Voters' desire to vote for the winner can deter incumbents from inefficient decisions

Huihui Ding [*] Cécile Aubert[†]

December 8, 2017

Abstract

We study the strategy of a re-election seeking incumbent in the presence of conformist voters. The incumbent has private information on both her ability and the adequate policy. A proportion of voters are partisans, who vote independently of policy outcomes. The others are independent voters who are conformists: They wish not only to vote for the better candidate but also to vote for the winner (i.e., like most others do). Policy choices affect voters' perception of the incumbent's ability, so that pandering (here, persistence of inefficient policies) emerges. Pandering depends on the extent to which independent voters wish to win. We contrast a socially efficient equilibrium (**S**) in which the incumbent uses her information in the social interest, and a pandering, pooling, equilibrium (**P**). We identify a 'conformity bonus' for the incumbent that arises jointly from incumbency advantage and conformity. Conformity determines in a non-monotonic way the conditions of occurrence of these equilibria: A strong desire to win (with a large 'conformity bonus') reduces and can even eliminate pandering, while weak conformity has the opposite effect. We derive implications for the impact of opinion polls and media coverage on policy persistence.

[*]THEMA, CNRS UMR 8184, Université de Cergy-Pontoise, UFR Economie et Gestion, 33, boulevard du Port, 95011 Cergy-Pontoise Cedex, France. Email: huihui.ding@u-cergy.fr.

[†]GREThA, Université de Bordeaux, and Toulouse School of Economics. Address: TSE, 21 allée de Brienne, 31042 Toulouse, France. Email: cecile.aubert@tse-fr.eu

JEL classification: D72, D82.

Keywords: Conformity; Bandwagon effect; Re-election seeking; Pandering; Incumbency advantage;

1 Introduction

Conformity exists when an individual in a group displays some behavior because it is what the individual has witnessed most frequently in others (Claidière and Whiten 2012). The desire to conform makes people wish to belong to the majority. Conformity as an emotional factor has been a central area of research in social psychology since the pioneering experiments in Asch (1951). Deutsch and Gerard (1955) distinguish between informational and normative conformity motivations. The former is based on the desire to form an accurate interpretation of reality and behave correctly, while the latter is based on the goal of obtaining social approval from others (Cialdini and Goldstein 2004).

An election is an important environment in which normative conformity manifests itself as the 'bandwagon effect'. The bandwagon effect refers to the notion that voters are more likely to vote for a candidate if they expect the candidate to win (Lee 2011; Panova 2015). Many authors have confirmed the bandwagon effect, both empirically (Hodgson and Maloney 2013; Kiss and Simonovits 2014) and experimentally (Bischoff and Egbert 2013; Morton, Muller, Page and Torgler 2015). Callander (2007) develops a model of sequential voting to argue that voters' desire to win (by voting like most others do, and thus belonging to the majority) is critical to the existence of the bandwagon. Callander (2008) analyzes simultaneous elections under the simple majority rule when voters, in addition to wanting the better candidate to be elected, care about winning.

We focus on the way in which conformity, or a desire to vote for the winner, as in the bandwagon effect, interacts with the policy choices of a privately informed politician motivated by re-election. Policy choices reveal information, especially choices to repeal or continue policies established during the mandate of the incumbent. The incumbent can privately obtain signals as to the effectiveness of the policies she has chosen at the beginning of her term. Repealing a policy signals to voters that it was a mistake, reducing the perceived ability of the incumbent in the eyes of voters. The voters' desire to win interacts with policies' signaling properties and the incumbent's advantage in determining re-election prospects. We find that the impact of the desire to be on the winning side on pandering is non-monotonous. While in Panova (2015), the bandwagon effect explains policy persistence, in our setup the reverse effect can arise: When the voters' desire to win is strong, it interacts with the incumbency advantage in such a way that the incumbent no longer finds it optimal to distort her policy choices to avoid signaling and ensure re-election. The desire for conformity thus limits strategic persistence of failing policies.

Our approach The incumbent[1] is appointed to choose some policy. Her abilities as a policymaker are unknown even after her initial policy choices.[2] Her actions while in office therefore affect voters' perceptions about her competence and influence her re-election chances. The incumbent responds to her anticipations of voters' decisions in order to maximize her chances of being re-elected (Harrington Jr 1993; Heidhues and Lagerlöf 2003; Laslier and Van der Straeten 2004; Gratton 2014). This can lead to pandering, when the incumbent chooses an inefficient policy (Heidhues and Lagerlöf 2003; Gratton 2014). In our set-up pandering takes the form of maintaining a failing policy in order not to reveal an initial mistake. Politicians typically are motivated by both choosing adequate policies and 'ego rents' from being in office (Canes-Wrone, Herron and Shotts 2001; Dur 2001; Maskin and Tirole 2004; Casamatta and De Donder 2005; Duggan and Fey 2005; Peress 2010) and have incentives to pander because of these rents (Canes-Wrone et al. 2001; Maskin and Tirole 2004).

We analyse how voters' desire to win affects the probability of pandering, when the incumbent benefits from an incumbency advantage. We consider pure strategy Perfect Bayesian Equilibria (PBE). Two polar cases emerge: One is the socially efficient strategy equilibrium (shortened to **S**), where the incumbent uses her information to promote the social interest efficiently. The other is the office-seeking, private-interest strategy equilibrium which entails pooling (shortened to **P**): the incumbent ignores her information and continues her policy independently of her private information on its success. The incumbent implements an inefficient decision in order to avoid revealing information on her capacities. We analyze the conditions under which each of these two equilibria emerge depending on the size of ego rents. Ego rents indeed measure the extent to which an elected politician can appropriate benefits from being in office ranging from status and

[1] For convenience, we refer to the incumbent as 'she' and each voter as 'he'.

[2] This can arise because the policy will take time for its effects to be observed by voters, or because it will affect voters only in certain circumstances or after the election date, as for defense or some education policies.

power to bribes. The larger the ego rents, the more likely will an incumbent be to sacrifice efficiency in policy-making to ensure re-election. Because voters' conformism affects re-election pressure, it influences the degree of pandering. We also discuss how the desire for conformity can lead to coordination on an inefficient equilibrium when there are multiple independent voters and can explain the impact of media coverage and opinion polls, with implications for inefficient policy persistence.

The policy choices of the incumbent will depend on the interaction between independent voters' desire to win, their updating based on policy choices, and the proportion of the incumbent's partisans. We will consider in particular the case of 'incumbency advantage', in which the incumbent's partisan outweigh the opponent's (Ashworth and De Mesquita 2008). Incumbency advantage is an important phenomenon in re-elections, and is well documented in the United States.[3]. that empicially appears as a critical determinant of success in re-elections(Levitt and Wolfram 1997; Trounstine 2011; Snyder, Folke and Hirano 2015). Partisan imbalance plays an important role in our model as it interacts with the voters' desire to pick the winner (what we call with some abuse of language 'conformity').

We consider two periods, an election taking place at the end of the first period, between the incumbent and an opponent. The competence of the incumbent and that of the future opponent are both independently determined by Nature. The incumbent designs and implements a policy at the beginning of the first period. During this first period (her office term), the incumbent gets a private, fully informative signal about the policy's effects. If the policy is a success, it is socially efficient to continue implementing it. Conversely, if the policy is a failure, it is socially efficient to terminate it to reduce the loss. Voters can observe the decision to continue or repeal the policy and update their beliefs as to the ability of

[3] Levitt and Wolfram (1997) report that incumbents can achieve re-election rates of around 90%. Holding office can provide resources to incumbents, for example, more media coverage for increasing their visibility among the public(Prior 2006) and additional financial support for their campaigns(Gerber 1998). A large literature has been devoted to the topic of incumbency advantage(Erikson 1971; Gelman and King 1990; Ansolabehere and Snyder Jr 2002; Ashworth and De Mesquita 2008; Lee 2008; Erikson and Titiunik 2015). Cox and Katz (2002) suggested that changes in redistricting since 1964 have contributed to an increased mismatch between challengers and incumbents, enhancing the incumbency advantage. Lee (2008) shows that in Congressional elections, a party which wins with a small number of additional votes, in a very close election (suggesting the electorate is very balanced between the party and its opponent), benefits from a 35% higher probability of winning the next election.

the incumbent. A high-ability incumbent is more likely to initially choose an efficient policy, and thus less likely to terminate policies. Hence the incentives of the incumbent to inefficiently persist to increase her re-election chances.

We analyse the conditions under which a social equilibrium (**S**) and a pooling equilibrium (**P**) emerge. Compared to the nonconformist case, when voters have a weak desire to win, the conditions on ego rents become more restricted in **S** and less restricted in **P**: Because the weak desire to win causes the incumbent to pander more, the incumbent's re-election pressure goes against social interest. This result contrasts strongly with the usual role attributed to re-election pressure in disciplining politicians and other elected officials. It is however in line with Dur (2001). To the contrary, when voters have a strong desire to win, the social equilibrium **S** exists, but not the pooling one **P**, no matter what the "ego rents" are. A strong desire to win thus fully eliminates the incumbent's pandering. In short, re-election pressure in our model damages social interest, via pandering, when independent voters have a weak desire to win, but not for strong 'conformism'. Incumbency advantage(Lee 2008)[4], measured as the chance to be re-elected thanks to partisans, influences conformist independent voters (while it would have no impact on non-conformist voters). Because of the incumbency advantage, conformist independent voters tend to prefer the incumbent, and this effect dominates when they have a strong desire to win. In that case, the incentive of the incumbent to distort policy choices in order to be re-elected disappear. However, when the desire to win is not so high, it only increases the probability that independent voters prefer the incumbent, without eliminating all uncertainty about the winner; The incumbent's strategy then depends on her type, incumbency advantage and 'ego rents'.

Related literature Our model relates most directly to the one proposed by Dur (2001). Dur (2001) considers a model in which repealing an implemented policy is a bad signal to uninformed voters about an incumbent's policy competence. The author characterizes the conditions under which the incumbent's optimal choice is always to continue her policy, even if it is a failure. Contrary to Dur (2001) we assume that the incumbent has private information on her own policy competence. Voters in Dur's model have common

[4] (Lee 2008) has introduced a method for estimating what is generally considered as the partisan incumbency advantage.

interests and are treated as a single representative independent voter, which is a standard assumption in the literature(Canes-Wrone et al. 2001). However, in the real world, partisans form a large share of voters (Swank 1995; Feddersen and Pesendorfer 1996, 1997; Bartels 2000, 2002; Brader and Tucker 2009; Klar 2014; Helland and Sørensen 2015). Feddersen and Pesendorfer (1996, 1997) distinguish between 'partisans' who always vote for the same alternative and 'independents' who want to select the best alternative. We thus assume that the incumbent faces three types of voters: the incumbent's partisans, the opponent's partisans, and the independent voters, who are conformist (Bartels 2000). This allows modeling the incumbency advantage that arises from a larger proportion of partisans for the incumbent. Independent voters may or may not make the election, depending on this incumbency advantage, and this has an impact on their vote given that they wish both to select the more able candidate and be on the winning side. This effect is at the core of the results we obtain.

Roadmap The remainder of the paper is organized as follows. In section 2, we present the model. Section 3 characterizes **S** and **P** in the benchmark case of no conformity desire. In section 4, we consider **S** and **P** with a conformist independent voter. We conduct a comparative analysis in section 5. Section 6 briefly discusses the impact of coordination and media coverage. We conclude in section 7. All proofs can be found in the appendix.

2 The model

2.1 Setup

An incumbent makes decisions in period 1, first about some policy to follow, then about whether to continue it or not. At the end of the period, the incumbent faces an opponent in an election under majority rule. The result of the initially chosen policy will be not observed by voters before the re-election closes. The winner of the election makes decisions in period 2. The two candidates have private information on their ability. The voters can infer information as to the ability of the incumbent based on whether the latter discontinue his first-period policy before the election or not. Discontinuing it signals that the incumbent learned the policy was a bad one; and more able politicians are less likely to pick up a bad policy in the first place.

The voters are divided into three different groups: incumbent's partisans, opponent's partisans and independent voters. The independent voters are modeled as a representative agent (we discuss this assumption in section 6).

The candidates Each candidate is privately informed on her type, which can be H (high ability) or L (low ability). A H-type candidate has a probability h that her policy is a success, while the corresponding probability for a L-type is l, where $1 > h > l > 0$.

The *prior* beliefs about a candidate having a high ability H is μ for the incumbent and μ_o for the opponent.

We assume that μ_o is randomly drawn from $[0,1]$ according to a c.d.f. $\mathbf{G}(\cdot)\colon [0,1] \to [0,1]$, and will focus on the uniform distribution over [0,1].

We assume that the identity of the challenger becomes known just before the re-election, as in Dur (2001). So μ_o is unknown to the incumbent at the time she makes her decision to continue or not her initial policy, but μ_o is known to voters when they vote.

- Candidates care about social welfare and have 'ego rents' X_t if they are in office in period t.

Policy choices In the first period, after policy implementation, the incumbent privately learns whether the policy is a 'success' or a 'failure' (voters will only learn this after the election has taken place). The incumbent can then choose whether to continue (C) or to repeal (R) her policy, $d \in \{C, R\}$.

- Repealing a policy during the first period nullifies all associated costs and benefits.
- If the period-t policy is a success and it is not repealed, it generates an expected social benefit b_t, where $b_1 > 0$ and $b_2 \equiv 1$ by normalization .
- If the period-t policy is a failure and it is not repealed, it generates an expected welfare loss $c_t > 0$.

In period 2, because of the absence of re-election concerns[5], a politician always con-

[5]Our results would also hold if re-election occurred also in period 2 but the type of abilities revealed by repealing or not the policy was no longer be a parameter of interest to voters at this time (e.g., because of a changing environment or of sufficient learning on abilities during period 2). The politician would then not have incentives to distort policy choices for signaling motives during period 2.

tinues her policy if it is a success and repeals it if it is a failure, no matter what her type is. Due to this feature, we focus on the incumbent's strategies in period 1. In the second period, a high ability (H-type) [resp. a low ability (L-type)] politician always generates an expected welfare of $hb_2 = h$ [resp. $lb_2 = l$]. This implies that the value of electing a high-ability rather than a low-ability candidate at the end of the first period is exactly equal to $h - l$.

Voters Each voter casts one vote for the incumbent or the opponent in the re-election and there is no abstention (Callander 2008). If there is a tie, the winner is the opponent. We assume that more than half of the voters are *partisans* who always vote for their preferred candidate, be it the incumbent or the opponent, independently of the incumbent's policy performance and other voters' actions. The other voters are *independent* voters who are assumed to be *'conformists'*, or more precisely, have a desire to 'win' and 'belong to the majority'(Ding 2017), in addition to wishing to select the most able candidate (that it, the one whose decisions will generate the highest expected welfare).

When the incumbent's decision d in period 1 is observed by independent voters, they revise their *prior* belief μ that she is H-type using Bayes' rule. We denote $\mu(d)$ the voter's revised belief when he observes decision d. The preferred candidate of a conformist voter depends not only on the comparison between the *a posteriori* probability $\mu(d)$ that the incumbent is H-type and the probability μ_o that the opponent is H-type, but also on his expectations about the winner of the re-election.

- It is common knowledge that the percentage of the opponent's partisans out of all voters is always less than $\frac{1}{2}$, so that the opponent can only win when when she is choosen by the independent voter.
- The probability that the incumbent's partisans are numerous enough (more than 1/2) to ensure the incumbent's victory independently of the independent voter's decision is p, $p \in (0,1)$.

Probability p (inversely) measures the importance of independent voters, and thus of policies as signaling devices, in the re-election. A lower value means more re-election pressure for the incumbent.

We denote ρ the probability that the incumbent gets re-elected: ρ, equals 1 when the independent voter prefers voting for the incumbent, and p otherwise. The decision for the independent voter to choose the incumbent is itself a function of beliefs $\mu(d)$ and μ^o and of the desire for being on the winning side, as will be detailed along the analysis.

The possibility that the incumbent's partisans are enough to guarantee victory, while the opponent's partisans never are, reflects incumbency advantage. Incumbency advantage is common to congressional elections and all state-wide offices (Erikson 1971; Cover 1977; Ansolabehere and Snyder Jr 2002). It depends on the exogenous electoral environment.[6]

2.2 Timeline

Table Timeline
Period 1
• t=1
Nature determines the (privately known) type of the incumbent,
who then implements a policy.
• The incumbent observes a fully informative signal about the effect of the policy,
and decides whether to continue or to repeal it.
• Nature draws the (privately known) type of an opponent for re-election.
• Re-election holds under majority rule and simultaneous voting.
When there is a tie, the opponent is elected.
Period 2
• The winner of the re-election implements her policy.
• The winner observes a fully informative signal about the effect of the policy,
and chooses (efficiently given that there is no re-election at this date) to continue
the policy if successful and repeal it otherwise.

[6] Incumbency advantage does not depend on the policymaking competence of the incumbent, but rather on the ability to communicate and campaign effectively to mobilize partisans(Schipper and Woo 2014). This assumption is consistent with the empirical political behavior literature (Cox and Morgenstern 1995) and the fact that partisans do not interpret government action objectively (Campbell 1980). People who identify with the governing party indeed perceive the results of economic policy more positively than subjects who identify with the opposition (Conover, Feldman and Knight 1986, 1987; Bartels 2002; Gerber and Huber 2009).

2.3 The utility of the incumbent in period 1

When the incumbent chooses policy d, $d \in \{C, R\}$ (continuing or repealing the policy), her expected utility is

$$E[u^I(d)] \equiv [V_1(d) + X_1] + E[V_2(d) + \rho(d)X_2].$$

Here $V_t(d)$ is the expected utility from the implemented policy outcome and X_t are ego rents in period t, and $\rho(d)$ is the probability that the incumbent wins in the re-election. The incumbent chooses d to maximize $E[u^I(d)]$. Her expected utility is $U^I \equiv \max_{d\in\{C,R\}} \left\{E[u^I(d)]\right\}$.

2.4 The utility of an independent voter

Independent voters are assumed to be risk-neutral, self-interested and conformists. They care both for policy outcomes and for voting for the winner. In order to avoid issues related to the relative size of the desire to win and the probability that each single independent voter is pivotal[7], we assume that independent voters are represented by a single, representative, independent voter, faced with partisan voters.

Because in period 2 both the incumbent and the opponent will, if elected, always continue only good policies (which yield a benefit $b_2 = 1$ instead of 0 for a bad policy that gets repealed), the difference between the two candidates lies in their expected policy competence in designing a successful policy. A H-type [resp. a L-type] politician generates a payoff $hb_2 \equiv h$ [resp. $lb_2 \equiv l$]. The benefit from electing an able politician rather than a low-ability one is thus exactly $h - l$. An independent voter gets an expected payoff from policy choices given by $\mu(d)h + (1 - \mu(d))l$ when the incumbent gets elected, and $\mu_o h + (1 - \mu_o)l$ otherwise.

Conformity provides an additional reward $W (W > 0)$ if the independent voter votes for the winner in the re-election. This reward is obtained for sure when he votes for the

[7] The desire to pick the winner should not systematically overrule the desire to achieve good policies. To avoid dealing with multiple conditions to ensure this for all configurations, we consider a representative voter. The literature on voter turnout has often used the concept of quasi-symmetric mixed-strategy Nash equilibrium in which the voters in favor of the same alternative use the same strategy. In our specific context, this reduces to considering a representative voter. Media coverage, opinion polls or political advertising can serve as coordination devices. Furthermore, Pivato (2017) considers the coordination as voter correlation amongst independent voters via a social network because of a culture.

incumbent ($\rho = 1$), but only with probability $1-p$ if he votes for the opponent ($\rho = p$). This is a crucial way in which conformity and incumbency advantage interact.

An independent voter's utility is $(h-l)\mu(d)+W$ when he votes for the incumbent and $(h-l)[p\mu(d)+(1-p)\mu_o]+(1-p)W$ when he votes for the opponent.

An independent voter thus re-elects the incumbent if and only if $(h-l)\mu(d)+W \geq (h-l)[p\mu(d)+(1-p)\mu_o]+W(1-p)$, that is:

$$\mu(d)+\frac{p}{(1-p)(h-l)}W \geq \mu_o.$$

It is as if the voter's beliefs about the ability of the incumbent were improved by a *'conformity bonus'* $\frac{p}{(1-p)(h-l)}W$ that increases with both incumbency advantage p and the strength of the desire to win, W, and decreases in the value of selecting a high-ability candidate, $h-l$.

2.5 Definition of equilibrium

The formal definition of a Perfect Bayesian Equilibrium in our game is given in the appendix.

The incumbent's socially efficient strategy entails continuing her policy if it is a success, and repealing it if it is a failure. Equilibrium **S** is characterized by $\{(d=C/\text{policy succeeds}),(d=R/\text{policy fails}),\mu(C),\mu(R),Vote(C),Vote(R)\}$, where $\mu(C)$ and $\mu(R)$ are the revised beliefs of an independent voter upon observing C and R respectively, and $Vote(C)$ and $Vote(R)$ are the voting decisions that maximizes the voter's utility given his beliefs. In this equilibrium the incumbent uses her private information optimally, which promotes social interest in period 1.

Conversely, in equilibrium **P**, the incumbent hides her information by always continuing the policy even though this is inefficient when the policy is a failure. **P** is characterized by $\{(d=C/\text{policy succeeds}),(d=C/\text{policy fails}),\mu(C),\mu(R),Vote(C),Vote(R)\}$ and is a pooling equilibrium. In this equilibrium inefficient policy persistence arises as the incumbent never repeals a failing policy before the election date.

3 A benchmark: No desire to vote for the winner

We first study the conditions under which **S** and **P** arise when voters do not benefit from picking the winner ($W = 0$). The condition that determines the winner, (2.4), is simplified to (1):

$$\mu(d) > \mu_o. \tag{1}$$

An independent voter indeed re-elects the incumbent in period 1 only when the *a posteriori* probability that the incumbent is H-type, $\mu(d)$, exceeds the *prior* probability that the opponent is H-type, μ_o.

3.1 The social equilibrium S

We suppose that the independent voter believes that the incumbent uses the **S** strategy. If the policy is continued, the *a posteriori* probability that the incumbent is H-type is:

$$\mu(C) = \frac{\mu h}{\mu h + (1-\mu) l}. \tag{2}$$

If the policy is repealed, the *a posteriori* probability that the policymaker is H-type is:

$$\mu(R) = \frac{\mu(1-h)}{\mu(1-h) + (1-\mu)(1-l)}. \tag{3}$$

Because $h > l$, it follows that $1 > \mu(C) > \mu > \mu(R) > 0$, i.e., continuing (repealing) the implemented policy increases (decreases) the voter's posterior belief that the incumbent is H-type. In the absence of desire for conformity, the beliefs of the voter about the incumbent are exactly the thresholds on μ_o, the beliefs about the opponent, that ensures that the voter prefers to vote for the incumbent. This will no longer be the case when voters are conformists.

We suppose that the incumbent in period 1 maximizes her utility function U^I, where ρ is decided by partisans and independent voters. Proposition 1 gives the conditions under which the incumbent follows the **S** strategy.

Proposition 1 *When $W = 0$, **S** appears if:*

$$X_2 < \Phi_0, \tag{4}$$

where

$$\Phi_0 \equiv \frac{c_1}{(1-p)[\mu(C)-\mu(R)]} - \frac{\mu(C)+\mu(R)}{2}(h+l) - (h-l).$$

When there is no conformity, the incumbent prefers to use her own information about the best policy in a socially efficient way when ego rents are sufficiently small compared with the cost of continuing a failing policy till re-election (weighted by the inverse of the change in beliefs this yields) and a term that reflects the probability that the efficient decision (yielding benefit $b_2 = 1$) is implemented in period 2. Because the incumbent cares for social welfare even when not in power, the condition incorporates the expected ability of the opponent given that he wins the election (details are in the appendix).[8]

3.2 The pandering equilibrium P

We now suppose that the independent voter believes that the incumbent continues her policy independently from her information on its success (**P** strategy). Continuing a policy is thus uninformative. **P** is a pooling equilibrium where the posterior belief about the incumbent type equals the prior μ.

The independent voters' beliefs if the incumbent repeals her policy (an out-of-equilibrium move) cannot be determined by Bayes' rule[9]. As Dur (2001), we assume that in that case the voter concludes that the policy has been a failure and updates the probability that the incumbent is H-type to $\mu(R)$ (as in (3)).

Proposition 2 *When $W = 0$, **P** appears if:*

$$X_2 > \Psi_0, \tag{5}$$

[8] If we had assumed that the incumbent cares for social welfare only when in power, the exact conditions would have been different, but the insights we obtain on the impact of incumbency advantage and conformity would hold.

[9] Because repealing the policy is of zero probability in a pooling equilibrium, we need to make assumptions on the out-of-equilibrium beliefs. We have chosen to assume that the voter believes the incumbent is playing according to a separating equilibrium, which implies that he believes her probability of being H given that she has repealed the policy is $\mu(R)$. While other assumptions could be made, including passive beliefs, this has a very minimal impact on our results.

where

$$\Psi_0 \equiv \frac{c_1}{(1-p)[\mu - \mu(R)]} - \frac{\mu + \mu(R)}{2}(h+l).$$

If the incumbent cares sufficiently about holding office relative to social welfare (measured again by the cost of a failing policy in period 1 and the probability that the efficient policy will be implemented in period 2 given the expected ability of the opponent), she never repeals her policy.

Our results in this benchmark case are in line with those in Dur (2001), in which there is no conformity, up to some differences due to our assumptions.[10]

4 Policy efficiency in equilibrium with conformist voters

Assume now that voters are 'conformists' who want to pick the winner: $W > 0$. We focus in this section on the conditions under which the efficient equilibrium **S** and the inefficient one **P** (characterized by excess policy persistence) exist.

Note that we have a natural continuity result: when W tends to 0, the threshold values on ego rents X_2 that guarantee the existence of the two P.B.E.s tend to the ones for the benchmark case of $W = 0$.

In a separating equilibrium updated beliefs after observing that the first-period policy is continued, or repealed, are given by the same expressions as before (respectively (2) and (3)). The condition for an independent voter to vote for the incumbent in a separating equilibrium is

$$\underline{\mu}^S(d) \equiv \mu(d) + \frac{p}{(1-p)(h-l)}W > \mu_o \tag{6}$$

As mentioned it is as if the beliefs about the ability of the incumbent were increased by a 'conformity bonus' $\frac{p}{(1-p)(h-l)}W$ so that the voting decision will not depend on beliefs $\mu(d)$ but on the augmented value $\underline{\mu}^S(d)$.

In a pandering, pooling, equilibrium the voter does not adjust his belief in response to the incumbent's decision to continue her policy. As in the benchmark case, if she repeals

[10] The differences between the two models come from different assumptions: First, we assume that the incumbent knows her own type. In Dur (2001) the incumbent and the voters have the same *prior* belief about the incumbent's ability. Second, we have partisan voters, and their proportion affects the probability p, which enters the conditions under which equilibria **S** and **P** exist.

her policy, we assume that the voter's out-of-equilibrium beliefs are given by $\mu(R)$. The condition for an independent voter to vote for the incumbent in a pooling equilibrium is

$$\underline{\mu}^P \equiv \mu + \frac{p}{(1-p)(h-l)} W > \mu_o. \tag{7}$$

Since $\mu(C) > \mu > \mu(R)$, we have $\underline{\mu}^S(C) > \underline{\mu}^P > \underline{\mu}^S(R)$ (the **S** strategy is more informative than the pooling one).

The thresholds on μ_o that ensure that the voter prefers to vote for the incumbent are now different from the revised beliefs (μ, $\mu(C)$ and $\mu(R)$) and are increasing in the gain from choosing the winner, W. Moreover the degree to which these thresholds increase with W is determined by the extent of the incumbency advantage as measured by p. Because the opponent only gets elected with probability $1-p$, voting for the opponent entails a risk of losing W, which acts as if the opponent's capabilities were lower, or equivalently as if the incumbent's capabilities were higher than they really are. This effect is at the core of the results we obtain on equilibrium existence and their implications for policy persistence.

4.1 The social equilibrium S with conformity

The conditions for the separating socially efficient equilibrium to emerge bear on the size of the ego rents compared with thresholds on the benefit b_1 of continuing a good policy and the cost c_1 of not repealing a bad one in the first period.

Proposition 3 *a)When* $W \geq [1-\mu(R)](h-l)\frac{1-p}{p}$, ***S*** *exists for* $\forall X_2 > 0$.
b)When $[1-\mu(R)](h-l)\frac{1-p}{p} > W > [1-\mu(C)](h-l)\frac{1-p}{p}$, ***S*** *exists if and only if*

$$\Phi_b^S < X_2 < \Phi_1^S, \tag{8}$$

where

$$\Phi_b^S \equiv \frac{-b_1}{(1-p)[1-\underline{\mu}^S(R)]} + \frac{1+\underline{\mu}^S(R)}{2}(h-l),$$

$$\Phi_1^S \equiv \frac{c_1}{(1-p)[1-\underline{\mu}^S(R)]} - \frac{1-\underline{\mu}^S(R)}{2}(h-l).$$

c)When $[1-\mu(C)](h-l)\frac{1-p}{p} \geq W > 0$*,* ***S*** *exists if and only if*

$$X_2 < \Phi_2^S, \tag{9}$$

where

$$\Phi_2^S \equiv \frac{c_1}{(1-p)[\underline{\mu}^S(C) - \underline{\mu}^S(R)]} - \frac{\underline{\mu}^S(C) + \underline{\mu}^S(R)}{2}(h+l) - (h-l).$$

Assuming $\Phi_2^S > \Phi_1^S$, the following figure 1 presents the equilibrium regions where the horizontal and vertical axes correspond to levels of independent voters' desire to win and the incumbent's ego rents. [11]

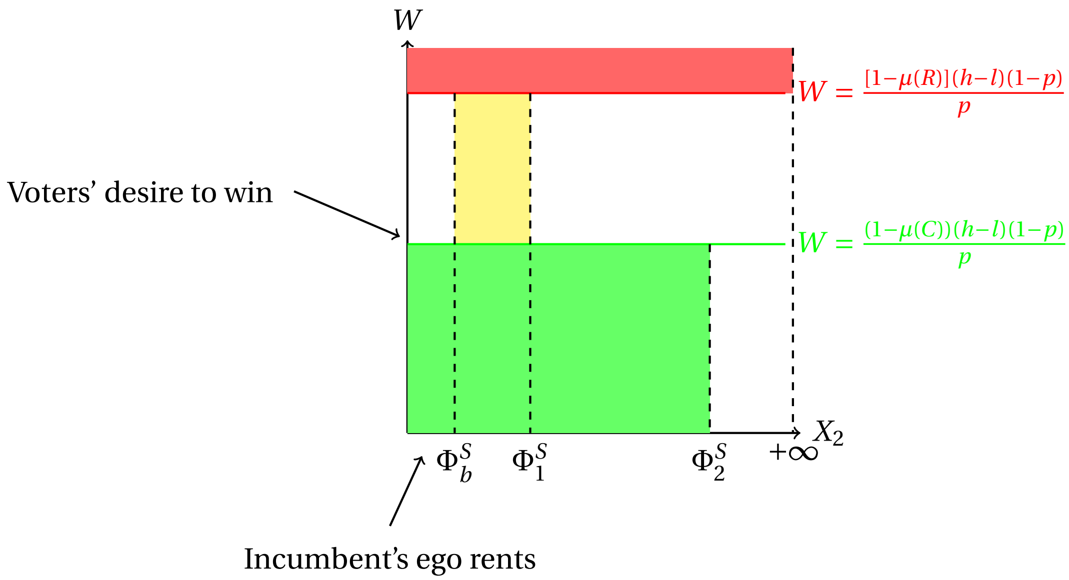

Figure 1: The equilibrium regions where $\Phi_2^S > \Phi_1^S > \Phi_b^S > 0$.

When the independent voter votes for the incumbent, she always wins, but when he votes for the opponent, the opponent may or not be the winner. Conformity thus creates a preference of independent voters for the incumbent (ρ becomes larger with conformity).

In case *a*), $W \geq [1-\mu(R)](h-l)\frac{1-p}{p}$, or equivalently the conformity bonus $\frac{p}{(1-p)(h-l)}W$ is larger than $1-\mu(R)$. This ensures that $\underline{\mu}^S(R) = \mu(R) + \frac{p}{(1-p)(h-l)}W$ is larger than 1: Because of the independent voter's strong desire to win, the incumbent gets re-elected even if she repeals her policy. Therefore, no matter what her ego rents X_2 are, she prefers the efficient decision.

[11] If $\Phi_2^S \leq \Phi_1^S$ or $\Phi_b^S \leq 0$, the corresponding figures are easy to draw. We omit them here.

In case b) where $[1-\mu(R)](h-l)\frac{1-p}{p} > W > [1-\mu(C)](h-l)\frac{1-p}{p}$, the incumbent gets re-elected for sure only if she continues her policy (the conformity bonus is such that $\underline{\mu}^S(C) > 1 > \underline{\mu}^S(R)$). Therefore **S** exists if and only if condition (8) is satisfied. This condition imposes that the incumbent's ego rents X_2 belong to some interval, which gets larger when incumbency advantage (measured by p) increases.

In case c) where $[1-\mu(C)](h-l)\frac{1-p}{p} \geq W > 0$, the incumbent loses the election with probability $1-p$ whatever her decision d (indeed the conformity bonus is small so that $\underline{\mu}^S(C) < 1$). Equilibrium **S** exists under condition (9). Comparing these conditions to the benchmark case where $W = 0$, we see that the desire to win (or 'conformity') affects the existence condition (9) *via* the 'conformity bonus' $\frac{p}{(1-p)(h-l)}W$: The characteristics of the equilibria are similar once one replaces the independent voter's posterior beliefs by their version augmented by the conformity bonus.

4.2 The pandering equilibrium P with conformity

Proposition 4 *a)When* $W \geq [1-\mu(R)](h-l)\frac{1-p}{p}$*,* ***P*** *does not exist.*

b)When $[1-\mu(R)](h-l)\frac{1-p}{p} > W > (1-\mu)(h-l)\frac{1-p}{p}$*,* ***P*** *exists if*

$$X_2 > \Psi_1^P, \tag{10}$$

where

$$\Psi_1^P \equiv \frac{c_1}{(1-p)[1-\underline{\mu}^S(R)]} + \frac{1+\underline{\mu}^S(R)}{2}(h-l).$$

c)When $(1-\mu)(h-l)\frac{1-p}{p} \geq W > 0$*,* ***P*** *exists if*

$$X_2 > \Psi_2^P, \tag{11}$$

where

$$\Psi_2^P \equiv \frac{c_1}{(1-p)[\underline{\mu}^P - \underline{\mu}^S(R)]} - \frac{\underline{\mu}^P + \underline{\mu}^S(R)}{2}(h+l).$$

We always have $\Psi_2^P < \Psi_1^P$ for identical thresholds $\underline{\mu}^S(R)$. For this ordering, figure 2 presents the equilibrium regions where the horizontal and vertical axes correspond to levels of independent voters' desire to win and the incumbent's ego rents.

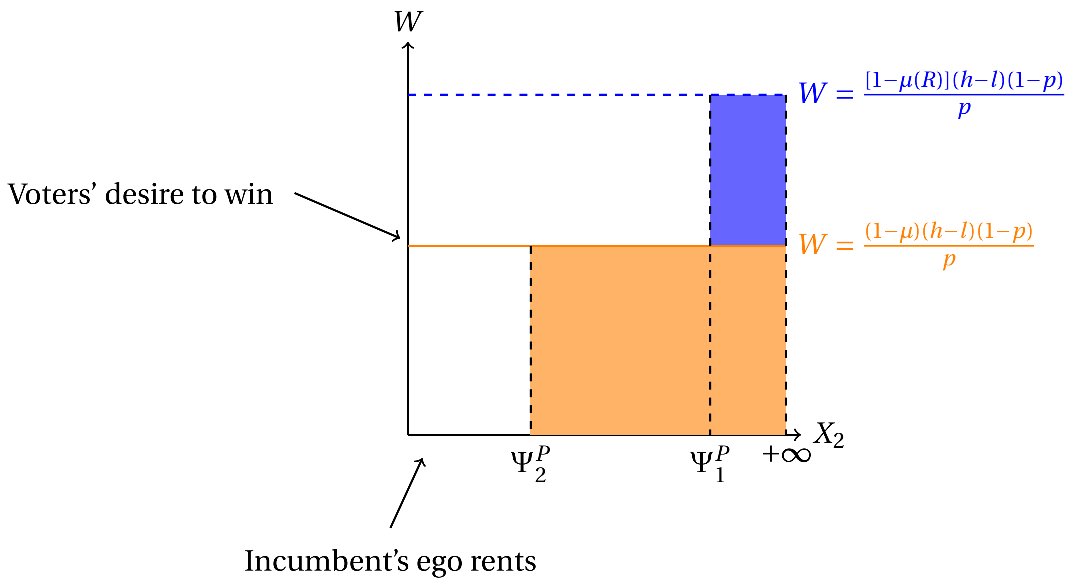

Figure 2: The equilibrium regions where $\Psi_2^P < \Psi_1^P$.

Conformity gives the independent voter an extra gain in choosing the incumbent. Thus, the incumbent a greater chance of winning, i.e., ρ increases with the conformity gain W. Furthermore, for the incumbent the probability of winning via pandering is amplified.

The thresholds determining the existence of the pandering equilibrium are the same as the ones for the socially efficient one. In particular, the **S** equilibrium always exists under the conditions for which **P** does not exist. In case *a*) where $W \geq [1-\mu(R)](h-l)\frac{1-p}{p}$, as we have seen in the analysis of **S**, the incumbent wins in the re-election even if she repeals the policy ($\underline{\mu}^S(R) > 1$ given the size of the conformity bonus). Therefore, she always repeals a failing policy to avoid cost c_1 and **P** does not exist.

In case *b*) where $[1-\mu(R)](h-l)\frac{1-p}{p} > W > (1-\mu)(h-l)\frac{1-p}{p}$, when independent voters believe that the incumbent follows **P** strategy, the incumbent definitely wins in the re-election only if she continues the policy ($\underline{\mu}^S(C) > 1 > \underline{\mu}^S(R)$). Therefore, **P** exists if the incumbent cares sufficiently about holding office relative to social welfare or has a higher degree of incumbency advantage.

In case *c*) where $(1-\mu)(h-l)\frac{1-p}{p} \geq W > 0$, the incumbent cannot ensure re-election with certainty through her decision d ($\underline{\mu}^S(C) < 1$).

Conformity affects the existence condition (11) entirely by changing the thresholds on posterior probabilities that ensure that the voter chooses the incumbent (i.e., $\underline{\mu}^S(C)$, $\underline{\mu}^S(R)$ and $\underline{\mu}^P$). The conformity bonus is thus the essential element that drives which type of equilibrium exists.

4.3 Discussion

To summarize, the condition on W that ensures that the socially efficient equilibrium always exists also guarantees that the pandering one never exists: This corresponds to the case in which the desire to be on the winning side (desire for conformity) is strong enough that, once augmented by the conformity bonus, the beliefs of the independent voter always lead him to choose the incumbent.

There are two other intervals for lower values of W, corresponding to cases *b*) (intermediate W) and *c*) (small W), in which equilibrium existence depends on the size of ego rents compared with expected politician ability and policies' costs and benefits.

The next section specifically studies how the desire for conformity enlarges or restricts the set of parameters compatible with the socially efficient and the pandering equilibria.

5 The effect of conformity on policy persistence

This section analyses whether 'conformity', understood as the desire to be on the winning side, makes it more likely that the socially efficient equilibrium **S** exists, and whether it reduces pandering **P**.

5.1 The socially efficient equilibrium S

Using proposition 3, we consider the impact of conformity on the socially efficient equilibrium for each of the three cases defined by the value of winning W.

Strong conformity value From Proposition 3 we know that for a strong desire for conformity (and contrary to the case of nonconformist voters), the socially efficient equilibrium **S** exists no matter what the incumbent's ego rents X_2 are.

When $W \geq [1-\mu(R)](h-l)\frac{1-p}{p}$, probabilities are such that $\underline{\mu}^S(d) \geq 1 \geq \mu_o (\forall d \in \{C, R\})$: The independent voter votes for the incumbent no matter what her decisions d are. Decision d is not be affected by re-election pressure and the socially efficient equilibrium **S** exists for $\forall X_2 > 0$. When $W = 0$, **S** exists only if the condition (4) is satisfied, because of re-election pressure.

Lemma 1 *A desire for conformity strong enough that* $W \geq [1-\mu(R)](h-l)\frac{1-p}{p}$ *increases the set of parameters for which the incumbent behaves efficiently, compared with no desire for conformity.*

Intermediate conformity value When $[1-\mu(R)](h-l)\frac{1-p}{p} > W > [1-\mu(C)](h-l)\frac{1-p}{p}$, $\underline{\mu}^S(C) > 1 > \underline{\mu}^S(R)$ and $\mathbf{G}(\underline{\mu}^S(C)) = 1 > \mathbf{G}(\underline{\mu}^S(R))$. This means that if the incumbent's decision is C, the probability that μ_o is smaller than $\underline{\mu}^S(C)$, is 1; and if the incumbent's decision is R, the probability that μ_o is smaller than $\underline{\mu}^S(R)$, is smaller than 1. If the incumbent chooses to continue the policy ($d = C$), it increases the independent voter's posterior belief that her type is H above the prior belief that the challenger's type is H. This is not the case for decision R. We see that the condition of **S** from the condition (4) is $X_2 \in (0, \Phi_0)$, and from (8) is $X_2 \in (\Phi_b^S, \Phi_1^S)$.

Conformity induces **S** if $[0, \Phi_0) \subseteq (\Phi_b^S, \Phi^S)$. This requires $\Phi_b^S \leq 0$, i.e., for condition (12) to be satisfied:

$$\frac{2b_1}{(1-p)(h-l)} \geq 1 - [\underline{\mu}^S(R)]^2. \tag{12}$$

When condition (12) is satisfied, continuing the successful policy is preferred to repealing it for a L-type incumbent (independently from X_2). This is an appealing assumption since a L-type incumbent would only want to repeal a successful policy in order to help the opponent win the election (in order to obtain the second period welfare benefits from a policy chosen by a more able politician). Assuming that the incumbent prefers to win the re-election even when she knows being of low ability appears quite in line with actual politics.

Consider now the condition for $\Phi_1^S > \Phi_0$. It writes:

$$\frac{1+\underline{\mu}^S(R)}{2}(h-l)+\frac{\mu(C)+\mu(R)}{2}(h+l)>\frac{c_1}{1-p}\{\frac{1}{\mu(C)-\mu(R)}-\frac{1}{1-\underline{\mu}^S(R)}\}, \tag{13}$$

When condition (13) is satisfied, the voter believes that the incumbent uses the **S** strategy, and uses Bayes's rule to update his belief about her type after observing her decision. If repealing the failing policy is preferred by the incumbent when voters are nonconformists, then it must also be preferred when independent voters are conformists (who vote more easily for the incumbent).

Conditions (12) and (13) ensure that $(0,\Phi_0)\subseteq(\Phi_b^S,\Phi_1^S)$. This implies that the conditions under which **S** arises are more easily satisfied under conformity than without conformity.

Lemma 2 *When* $[1-\mu(R)](h-l)\frac{1-p}{p}>W>[1-\mu(C)](h-l)\frac{1-p}{p}$, *if the conditions* (12) *and* (13) *are satisfied,* $(0,\Phi_0)\subseteq(\Phi_b^S,\Phi_1^S)$*: Conformity enlarges the set of parameters for which the socially efficient equilibrium* **S** *exists, but under these specific conditions.*

The case of an intermediate desire to vote for the winner, W, highlights the complex role played by this variable: Conformity may induce the efficient equilibrium for a larger set of parameters but only under two conditions.

Weak conformity value When $[1-\mu(C)](h-l)\frac{1-p}{p}\geq W>0$, $1\geq\mathbf{G}(\underline{\mu}^S(C))>\mathbf{G}(\underline{\mu}^S(R))$, i.e., if the incumbent's decision is C, the probability that μ_o is smaller than $\underline{\mu}^S(C)$, is no more than 1; and if the incumbent's decision is R, the probability that μ_o is smaller than $\underline{\mu}^S(R)$, is smaller than $\mathbf{G}(\underline{\mu}^S(C))$.

In this third case the incumbent's decision d may not ensure that the independent voter's posterior belief is higher than the belief about the opponent, μ_o.

Lemma 3 *Assume* $[1-\mu(C)](h-l)\frac{1-p}{p}\geq W>0$. *Then* $X_2\in(0,\Phi_2^S)$ *implies* $X_2\in(0,\Phi_0)$.

A weak desire for conformity (W small but above 0) reduces the set of parameters for which the efficient equilibrium **S** *exists, compared with no conformity.*

Because of the incumbency advantage, when the independent voter votes for the incumbent, the latter always wins the election; while when they vote for the opponent, the opponent may still not win. This provides an advantage to the incumbent for an independent voter who cares for conformity. For a weak desire for winning however, this advantage is not enough to ensure that an independent voter always prefer to vote for the incumbent whatever her expected ability. Continuing a policy increases the chance of winning, since winning is not guaranteed by the interplay of incumbency advantage and desire for conformity.

The condition under which **S** arises has become more restricted: it is less likely that an incumbent follows her information when deciding whether to repeal her policy in period 1. Weak conformity (a weak desire to win) tends to lead to more pandering and hurts social interest.

5.2 The pooling equilibrium P

Strong conformity value As we have seen, when $W \geq [1-\mu(R)](h-l)\frac{1-p}{p}$, an independent voter will vote for the incumbent no matter what her decision is. The incumbent always wins the election so her decision is not affected by signaling concerns. Because $b_1 > 0$ and $c_1 > 0$, **P** cannot arise, no matter what the incumbent's ego rent X_2 is.

Lemma 4 *When $W \geq [1-\mu(R)](h-l)\frac{1-p}{p}$, the pooling equilibrium **P** cannot arise, while it exists when $W = 0$ under condition* (5). *Strong conformity eliminates pandering.*

Intermediate conformity value When $[1-\mu(R)](h-l)\frac{1-p}{p} > W > (1-\mu)(h-l)\frac{1-p}{p}$, $\mathbf{G}(\underline{\mu}^P) = 1 > \mathbf{G}(\underline{\mu}^S(R))$, i.e., if the incumbent's decision is C, μ_o is always smaller than $\underline{\mu}^P$, while following decision R, μ_o is larger than $\underline{\mu}^S(R)$ with a non-zero probability. Decision C makes the independent voter believe she is more likely to be of type H than the opponent, but decision R does not. The conditions for the equilibrium to arise become (5): $X_2 \in (\Psi_0, +\infty)$ in the absence of conformity, and (10): $X_2 \in (\Psi_1^P, +\infty)$ for conformity.

The threshold for pandering is higher under conformity ($\Psi_1^P > \Psi_0$) if and only if

$$\frac{1}{2}[1+\underline{\mu}^S(R)](h-l) + \frac{\mu+\mu(R)}{2}(h+l) > \frac{c_1}{1-p}\Big[\frac{1}{\mu-\mu(R)} - \frac{1}{1-\underline{\mu}^S(R)}\Big]. \tag{14}$$

When condition (15) is satisfied and $[1-\mu(R)](h-l)\frac{1-p}{p} > W > (1-\mu)(h-l)\frac{1-p}{p}$, an independent voter believing that the incumbent uses the **P** strategy, uses Bayes's rule to update his belief about her type only after observing her out-of-equilibrium decision R, and retains his prior belief after observing her decision C. If repealing the failing policy is preferred for the H-type incumbent facing conformist independent voters, then it is so as well in the absence of conformism. The condition of the emergence of **P** with conformity has become more restricted than with $W = 0$: Pandering decreases with the independent voters' desire to win.

Lemma 5 *When* $\frac{[1-\mu(R)](h-l)(1-p)}{p} > W > \frac{(1-\mu)(h-l)(1-p)}{p}$*, if the condition* (15) *is satisfied, conformity makes* ***P*** *less likely, as*

$$(\Psi_1^P, +\infty) \subseteq (\Psi_0, +\infty).$$

Replacing $\underline{\mu}^S(R)$ by its expression $\mu(R) + \frac{p}{(h-l)(1-p)}W$, we can rewrite condition (15) as

$$\frac{1}{2}[h-l+(\mu(R)+\frac{p}{1-p}W]+\frac{\mu+\mu(R)}{2}(h+l) > \frac{c_1}{1-p}[\frac{1}{\mu-\mu(R)}-\frac{1}{1-(\mu(R)+\frac{p}{(1-p)(h-l)}W)}], \quad (15)$$

which is unambiguously easier to satisfy when W increases. In words, conformity is more likely to prevent the emergence of an equilibrium with pandering as one gets closer to the upper bound of the relevant interval for W.

Small conformity value When $(1-\mu)(h-l)\frac{1-p}{p} \geq W > 0$, the conformity term $\frac{p}{(h-l)(1-p)}W$ is lower than $1-\mu$ and is not large enough to ensure that the incumbent's decision leads to revised beliefs superior to μ_o. We have $1 \geq \mathbf{G}(\underline{\mu}^P) > \mathbf{G}(\underline{\mu}^S(R))$. The incumbent's decision (C or R) does not induce a posterior belief about her ability sufficiently high to always overcome the belief about the opponent.

Lemma 6 *When* $(1-\mu)(h-l)\frac{1-p}{p} \geq W > 0$,$(\Psi_0, +\infty) \subseteq (\Psi_2^P, +\infty)$. *Pandering emerges for a larger set of parameters under weak conformity than in the absence of conformity.*

Discussion The incumbent's pandering increases with the independent voters' desire to win, as long as this desire is weak enough. Conformity indeed makes independent voters prefer the incumbent to the opponent in our model. The desire to win amplifies any positive effect of pandering on the winning probability. Thus, the incentive to pander increases with conformity. This in turn increases the range of parameters for which the incumbent prefers continuing a failing policy in spite of her information. When the conformity bonus becomes large enough, the certainty of winning overrides this adverse effect of conformity, so that pandering emerges less often for high values of W.

Proposition 5 *A weak desire to be on the winning side, in the sense of a conformity bonus lower than* $1-\mu$*, increases the range of values of ego rents* X_2 *for which inefficient policy persistence arises in the first election term. Weak conformity degrades social welfare.*

A strong desire to be on the winning side, in the sense of a conformity bonus larger than $1-\mu(R)$*, increases the range of values of ego rents* X_2 *for which policies are efficiently continued or terminated in the first election term. Strong conformity improves social welfare.*

6 Multiple independent voters

In our model, independent voters have been modeled by a representative agent (as if independent voters could perfectly coordinate). This section discusses the case in which there are many independent conformist voters[12].

In the context of conformism, the coordination of votes with other independent voters is of value to each independent voter. That is because each voter may not have a weakly dominant strategy. In the absence of conformism, and because there is no cost to voting, a voter finds it weakly dominant to vote for his preferred alternative. This is no longer so with conformism since a voter may now prefer to vote for his less preferred alternative if he believes the latter to be preferred by a majority. Strategies are thus dependent on beliefs. Political advertising, biased media and opinion polls can all change equilibrium outcomes by changing the perceived probability that the incumbent wins the election.

6.1 An example of inefficient equilibrium due to conformism

Consider the situation in which i) independent voters would vote for the incumbent because his expected competence, $\mu(d)$, is higher than that of the opponent, μ_o, and ii) the incumbent's partisans are not numerous enough so that she cannot be elected without

[12] In addition, though Pivato (2013) focuses on voting rules in epistemic social choice theory, the author proposes that there are an objectively correct choice and many independent voters who separately receive 'noisy signals' about the correct choice.

several (at least two) votes from independent voters (incumbency advantage is small so $p < 1/2$).

Because of voters' desire to be on the winning side, they may coordinate on an inefficient equilibrium in which they vote for the opponent despite her lower ability. This is a more realistic outcome if media coverage or massive advertising affect the beliefs of the voters: they should change their vote after observing the campaign if they expect that other voters will change theirs. But media coverage and campaigns are not necessary for the inefficient equilibrium to arise. Indeed there exists an equilibrium in which each independent voter votes for the opponent even though she believes that the incumbent is more able:

Assume that a voter i believes all other independent voters vote for the opponent. Voting for the incumbent is useless (whatever the incumbent's ability) from the point of view of a single voter since she will not be elected: $\rho = 0$. And it is costly as it means losing the gain of being on the winning side, W.

The utility for voter i of voting for the incumbent is $\mu_o(h-l)$ (since the incumbent is not elected with a single vote), while the utility of voting for the opponent is $\mu_o(h-l)+W$. So even if the value of selecting the incumbent, $(\mu(d)-\mu_o)(h-l)$, is much larger than W, each independent voter prefers to vote for the opponent if he believes others do so – which turns out to be the case in equilibrium.

A similar logic clearly applies to the situation in which the opponent is more able than the incumbent, but the incumbent gets elected when only one independent voter does not vote for her.

Lemma 7 *With conformist voters, there exists an inefficient equilibrium in which the opponent is elected despite a lower expected ability when incumbency advantage is not sufficient for the incumbent to be elected with a single independent vote.*
The same result applies for an inefficient equilibrium in which the incumbent gets elected despite a lower expected ability when her incumbency advantage is sufficient to ensure reelection if only one independent voter votes for the opponent.

6.2 Media coverage, advertising and polls

Rational voters should, in general and in theory, not pay much attention to political advertising or to opinion polls. Polls for large-scale elections do not reveal much private information, as a voter is unlikely to have a different information than another, and each voter can be seen as atomistic so that strategic considerations should not matter (contrary to voting in committees where private information and strategic concerns both exist). Yet there is extensive evidence of an impact of media bias and exposure(e.g., DellaVigna and Kaplan, 2007, Enikolopov, Petrova and Zhuravskaya, 2011) and opinion polls are banned in some countries (like France) in the last days preceding an election, in order to avoid manipulation. Assuming conformism allows explaining why polls and media can have an impact on election outcomes. We stressed the coordination effects of polls and media above. They may also directly affect the number of partisans, as for persuasive advertising. And because of conformism, as we highlighted above, they may lead to a coordination of independent voters. If they affect only a proportion of independent voters, the voters affected behave as partisans in the sense that their decision no longer depends on the policy choice of the incumbent. Formally, we can model this as a change in the probability p that reflects the relative size of partisans among voters.

Because of the impact of incumbency advantage on the incumbent's policies, this implies, rather strikingly, that media, polls and political advertising affect the efficiency of political decisions, and especially inefficient policy persistence.

The expenses that the incumbent and the opponent can incur to increase their visibility will have an impact on the probability that coordination favors one or the other candidate. Under the conditions of a strong desire to win (large W), the incumbency advantage translates into the ability for the incumbent to make the efficient decision (continue or repel the first-period decision) without fear of losing the election. When the probability that the opponent is able to obtain more media exposure increases, it is as if the incumbency advantage p of the incumbent was decreasing. This has an impact, as we have shown, on the efficiency of the incumbent's decisions before the re-election. Expected media coverage of the opponent can thus induce more pandering and excess continuation of bad policies by the incumbent in the first period.

Lemma 8 *Assume that media coverage favors the opponent, so that p decreases. This increases the probability that the incumbent panders (chooses to play strategy* ***P****) in equilibrium for very conformist voters.*

In our model, media coverage favorable to the opponent leads to inefficient policy persistence while media coverage favorable to the incumbent (acting as an increase in the incumbency advantage) leads to less pandering. This is of course due to the type of policies we consider, and in no way implies that limiting the media coverage of opponents improves welfare in general.

7 Conclusion

Our analysis has shown how the signaling motives of an incumbent depend on the degree to which voters wish to be on the winning side. Those signaling motives may drive the incumbent to inefficiently continue failing policies. Because the incumbent benefits from an incumbency advantage, we consider a set-up in which more desire to be on the winning side makes it more likely that the incumbent gets re-elected. We have identified a 'conformity bonus' that benefits the incumbent, and arises from the interaction of incumbency advantage and conformity. This bonus is lessened when the cost of not selecting a high-ability politician increases. We have shown that the desire for 'conformity' plays a non-monotonic role on equilibrium existence: A weak desire for conformity tends to induce more pooling and inefficient persistence, while a strong desire for conformity reduces the re-election pressure felt by the incumbent, and leads to more efficiency and less persistence. These effects depend crucially on the existence of an incumbency advantage. To this extent, media coverage, opinion polls and political advertising all may modify the extent of incumbency advantage, with non-trivial consequences on policy persistence and efficiency. Future research should more closely investigate the interactions between these external determinants of incumbency advantage and policies.

References

Ansolabehere, Stephen and James M Snyder Jr, "The incumbency advantage in US elections: An analysis of state and federal offices, 1942-2000," *Election Law Journal*, 2002, *1* (3), 315–338.

Asch, Solomon E, *Effects of group pressure upon the modification and distortion of judgments*, In Harold Guetzkow(ed.),Groups, leadership, and men. Pittsburgh: Carnegie Press, 1951.

Ashworth, Scott and Ethan Bueno De Mesquita, "Electoral selection, strategic challenger entry, and the incumbency advantage," *The Journal of Politics*, 2008, *70* (4), 1006–1025.

Bartels, Larry M, "Partisanship and voting behavior, 1952-1996," *American Journal of Political Science*, 2000, *44* (1), 35–50.

__ , "Beyond the running tally: Partisan bias in political perceptions," *Political Behavior*, 2002, *24* (2), 117–150.

Bischoff, Ivo and Henrik Egbert, "Social information and bandwagon behavior in voting: An economic experiment," *Journal of Economic Psychology*, 2013, *34*, 270–284.

Brader, Ted A and Joshua A Tucker, "What's left behind when the party's over: survey experiments on the effects of partisan cues in Putin's Russia," *Politics & Policy*, 2009, *37* (4), 843–868.

Callander, Steven, "Bandwagons and momentum in sequential voting," *The Review of Economic Studies*, 2007, *74* (3), 653–684.

__ , "Majority rule when voters like to win," *Games and Economic Behavior*, 2008, *64* (2), 393–420.

Campbell, Angus, *The american voter*, University of Chicago Press, 1980.

Canes-Wrone, Brandice, Michael C Herron, and Kenneth W Shotts, "Leadership and pandering: A theory of executive policymaking," *American Journal of Political Science*, 2001, *45* (3), 532–550.

Casamatta, Georges and Philippe De Donder, "On the influence of extreme parties in electoral competition with policy-motivated candidates," *Social Choice and Welfare*, 2005, *25* (1), 1–29.

Cialdini, Robert B and Noah J Goldstein, "Social influence: Compliance and conformity," *Annual Reviews Psychology*, 2004, *55*, 591–621.

Claidière, Nicolas and Andrew Whiten, "Integrating the study of conformity and culture in humans and nonhuman animals," *Psychological bulletin*, 2012, *138* (1), 126–145.

Conover, Pamela Johnston, Stanley Feldman, and Kathleen Knight, "Judging inflation and unemployment: The origins of retrospective evaluations," *The Journal of Politics*, 1986, *48* (3), 565–588.

__ **, __ , and __** , "The personal and political underpinnings of economic forecasts," *American Journal of Political Science*, 1987, *31* (3), 559–583.

Cover, Albert D, "One good term deserves another: The advantage of incumbency in congressional elections," *American Journal of Political Science*, 1977, *21* (3), 523–541.

Cox, Gary W and Jonathan N Katz, *Elbridge Gerry's salamander: The electoral consequences of the reapportionment revolution*, Cambridge University Press, 2002.

__ **and Scott Morgenstern**, "The incumbency advantage in multimember districts: Evidence from the US States," *Legislative Studies Quarterly*, 1995, pp. 329–349.

Deutsch, Morton and Harold B Gerard, "A study of normative and informational social influences upon individual judgment," *The journal of abnormal and social psychology*, 1955, *51* (3), 629–636.

Ding, Huihui, "Conformity Preferences and Information Gathering Effort in Collective Decision Making," *The BE Journal of Theoretical Economics*, 2017.

Duggan, John and Mark Fey, "Electoral competition with policy-motivated candidates," *Games and Economic Behavior*, 2005, *51* (2), 490–522.

Dur, Robert AJ, "Why do policy makers stick to inefficient decisions?," *Public Choice*, 2001, *107* (3), 221–234.

Erikson, Robert and Rocio Titiunik, "Using regression discontinuity to uncover the personal incumbency advantage," *Quarterly Journal of Political Science*, 2015, *10* (1), 101–119.

Erikson, Robert S, "The advantage of incumbency in congressional elections," *Polity*, 1971, *3* (3), 395–405.

Feddersen, Timothy and Wolfgang Pesendorfer, "Voting behavior and information aggregation in elections with private information," *Econometrica: Journal of the Econometric Society*, 1997, pp. 1029–1058.

Feddersen, Timothy J and Wolfgang Pesendorfer, "The swing voter's curse," *The American economic review*, 1996, pp. 408–424.

Gelman, Andrew and Gary King, "Estimating incumbency advantage without bias," *American Journal of Political Science*, 1990, *34* (4), 1142–1164.

Gerber, Alan, "Estimating the effect of campaign spending on senate election outcomes using instrumental variables," *American Political Science Review*, 1998, *92* (02), 401–411.

Gerber, Alan S and Gregory A Huber, *Partisanship and ecdnomic behavior: do partisan differences in economic forecasts predict real economic behavior?*, Cambridge Univ Press, 2009.

Gratton, Gabriele, "Pandering and electoral competition," *Games and Economic Behavior*, 2014, *84*, 163–179.

Heidhues, Paul and Johan Lagerlöf, "Hiding information in electoral competition," *Games and Economic Behavior*, 2003, *42* (1), 48–74.

Helland, Leif and Rune J Sørensen, "Partisan bias, electoral volatility, and government efficiency," *Electoral Studies*, 2015, *39*, 117–128.

Hodgson, Robert and John Maloney, “Bandwagon effects in British elections, 1885–1910,” *Public Choice*, 2013, *157* (1), 73–90.

Jr, Joseph E Harrington, “Economic policy, economic performance, and elections,” *The American Economic Review*, 1993, *83* (1), 27–42.

Kiss, Áron and Gábor Simonovits, “Identifying the bandwagon effect in two-round elections,” *Public Choice*, 2014, *160* (3), 327–344.

Klar, Samara, “Partisanship in a social setting,” *American journal of political science*, 2014, *58* (3), 687–704.

Laslier, Jean-François and Karine Van der Straeten, “Electoral competition under imperfect information,” *Economic Theory*, 2004, *24* (2), 419–446.

Lee, David S, “Randomized experiments from non-random selection in US House elections,” *Journal of Econometrics*, 2008, *142* (2), 675–697.

Lee, Woojin, “Bandwagon, underdog, and political competition: the uni-dimensional case,” *Social Choice and Welfare*, 2011, *36* (3), 423–449.

Levitt, Steven D and Catherine D Wolfram, “Decomposing the sources of incumbency advantage in the US House,” *Legislative Studies Quarterly*, 1997, pp. 45–60.

Maskin, Eric and Jean Tirole, “The politician and the judge: Accountability in government,” *The American Economic Review*, 2004, *94* (4), 1034–1054.

Morton, Rebecca B, Daniel Muller, Lionel Page, and Benno Torgler, “Exit polls, turnout, and bandwagon voting: Evidence from a natural experiment,” *European Economic Review*, 2015, *77*, 65–81.

Panova, Elena, “A passion for voting,” *Games and Economic Behavior*, 2015, *90*, 44–65.

Peress, Michael, “The spatial model with non-policy factors: a theory of policy-motivated candidates,” *Social Choice and Welfare*, 2010, *34* (2), 265–294.

Pivato, Marcus, “Voting rules as statistical estimators,” *Social Choice and Welfare*, 2013, *40* (2), 581–630.

__ , “Epistemic democracy with correlated voters,” *Journal of Mathematical Economics*, 2017, *72* (7), 51–69.

Prior, Markus, “The incumbent in the living room: The rise of television and the incumbency advantage in US House elections,” *Journal of Politics*, 2006, *68* (3), 657–673.

Schipper, Burkhard C and Hee Yeul Woo, “Political awareness, microtargeting of voters, and negative electoral campaigning,” 2014.

Snyder, James M, Olle Folke, and Shigeo Hirano, “Partisan imbalance in regression discontinuity studies based on electoral thresholds,” *Political Science Research and Methods*, 2015, *3* (02), 169–186.

Swank, Otto H, "Rational voters in a partisanship model," *Social choice and welfare*, 1995, *12* (1), 13–27.

Trounstine, Jessica, "Evidence of a local incumbency advantage," *Legislative Studies Quarterly*, 2011, *36* (2), 255–280.

8 Appendix

Definition of an equilibrium

Let $\sigma_S \in [0,1]$ [resp. σ_F] be the probability that in period 1 the incumbent who observes that her policy is a success [resp. a failure] chooses to continue the policy.

Let $\eta_C \in [0,1]$ [resp. η_R] be the probability that the independent voter votes for the incumbent when he observes that her decision is to continue [resp. repeal] her policy in period 1.

A pure strategy profile $[(\sigma_S,\sigma_F),(\eta_C,\eta_R)]$ and a belief μ constitutes a pure Perfect Bayesian Equilibrium, if u^I and u^v are maximized by the strategy $[(\sigma_S,\sigma_F),(\eta_C,\eta_R)]$ when given μ and other players' strategies which are $[(\sigma_S,\sigma_F),(\eta_C,\eta_R)]$, and in terms of Bayesian updating μ is consistent with $[(\sigma_S,\sigma_F),(\eta_C,\eta_R)]$.

The incumbent's socially efficient policymaking strategy is $(\sigma_S = 1, \sigma_F = 0)$: she continues her policy if it is a success, and repeals it if it is a failure. Equilibrium **S** is characterized by $[(\sigma_S = 1,\sigma_F = 0),(\eta_C,\eta_R)]$, and the incumbent uses her private information optimally to promote social interest in period 1.

Conversely, in equilibrium **P**, the incumbent hides her information by always continuing the policy even though this is inefficient when the policy is a failure. **P** is characterized by $[(\sigma_S = 1,\sigma_F = 1),(\eta_C,\eta_R)]$ and is a pooling equilibrium.

Note that we do not specify the probabilities η_C and η_R in these equilibria at this stage as they a priori depend on the desire for being on the winning side.

Proof of proposition 1

Proof. Before proving proposition 1, we provide the following two notations.

Given the incumbent's decision d, $d \in \{C,R\}$, where she may lose the re-election (i.e., $1 > \mu(d) > 0$), the expected value of the *prior* probability that an opponent is H-type is updated by her as $\overline{\mu_d}$. Given $1 > \mu(d) > 0$ and $d \in \{C,R\}$,

$$\overline{\mu_d} \equiv E[\mu_o | \mu_o > \mu(d)] = \frac{\int_{\mu(d)}^{1} x g(x) \mathbf{d} x}{1-\mu(d)} = \frac{1+\mu(d)}{2}.$$

This matters to the incumbent since she cares for social welfare when not in power.

$\overline{\mu_d}$ will be used in the following proof about proposition 1.

When $W = 0$, given that independent voters believe that the incumbent uses **S** strategy, when they observe her decision d, they update their belief about her type using Bayes' rule.

1. If the incumbent has observed that her policy is a success, continuing the policy is preferred to repealing the policy for H-type incumbent if and only if:

$$X_1 + b_1 + p(X_2+h) + (1-p)\{\mathbf{G}(\mu(C))(X_2+h) + [1-\mathbf{G}(\mu(C))][\overline{\mu_C} h + (1-\overline{\mu_C}) l]\}$$

$$>$$

$$X_1 + 0 + p(X_2+h) + (1-p)\{\mathbf{G}(\mu(R))(X_2+h) + [1-\mathbf{G}(\mu(R))][\overline{\mu_R} h + (1-\overline{\mu_R}) l]\}$$

$$\Leftrightarrow$$

$$b_1 + (1-p)[\mu(C)-\mu(R)][X_2 + \frac{\mu(C)+\mu(R)}{2}(h+l) + (h-l)] > 0. \tag{16}$$

The first term in (16) represents the effect of continuing the successful welfare policy, which is obviously positive. The second term in (16) represents the effect of the H-type incumbent's decision on her probability of re-election, and thus on her expected utility after the re-election. We recall that $\mu(C) > \mu(R)$. Thus, provided that the incumbent is H-type, the second term in (16) is obviously positive. Hence the function (16) is obviously positive. Suppose each independent voter believes that the incumbent uses **S** strategy and uses Bayes' rule to update his belief about her type after observing her decision, the H-type incumbent will continue her successful policy.

2. When the incumbent has observed that her policy is a success, continuing the policy is preferred to repealing the policy for the L-type incumbent if and only if:

$$X_1 + b_1 + p(X_2 + l) + (1-p)\{\mathbf{G}(\mu(C))(X_2 + l) + [1 - \mathbf{G}(\mu(C))][\overline{\mu_C} h + (1 - \overline{\mu_C}) l]\}$$

$$>$$

$$X_1 + 0 + p(X_2 + l) + (1-p)\{\mathbf{G}(\mu(R))(X_2 + l) + [1 - \mathbf{G}(\mu(R))][\overline{\mu_R} h + (1 - \overline{\mu_R}) l]\}$$

$$\Leftrightarrow$$

$$b_1 + (1-p)[\mu(C) - \mu(R)][X_2 + \frac{\mu(C) + \mu(R)}{2}(h + l)] > 0. \tag{17}$$

Similarly to (16), it is clear that the condition (17) is satisfied. Its intuition is that supposing each independent voter believes that the incumbent uses **S** strategy and uses Bayes's rule to update his belief about her type after observing her decision, the L-type incumbent prefers to continue her successful policy.

3. When the incumbent has observed that her policy is a failure, repealing the policy is optimal for the H-type if and only if:

$$X_1 + 0 + p(X_2 + h) + (1-p)\{\mathbf{G}(\mu(R))(X_2 + h) + [1 - \mathbf{G}(\mu(R))][\overline{\mu_R} h + (1 - \overline{\mu_R}) l]\}$$

$$>$$

$$X_1 + (-c_1) + p(X_2 + h) + (1-p)\{\mathbf{G}(\mu(C))(X_2 + h) + [1 - \mathbf{G}(\mu(C))][\overline{\mu_C} h + (1 - \overline{\mu_C}) l]\}$$

$$\Leftrightarrow$$

$$c_1 + (1-p)[\mu(R) - \mu(C)][X_2 + \frac{\mu(R) + \mu(C)}{2}(h + l) + (h - l)] > 0. \tag{18}$$

The first term in (18) represents the benefit of repealing the failing policy, which is positive. The second term in (18) is the effect of the H-type incumbent's decision on her re-election chances, and thus on her welfare after re-election. Repealing the policy hurts the reputation of the H-type incumbent, i.e., $\mu(R) - \mu(C) < 0$. Thus, the second term in (18) is negative. Furthermore, if the benefit of repealing the failing policy c_1 is sufficiently small, the condition (18) is violated. Therefore, the condition (18) is satisfied if and only if

$$X_2 < \frac{c_1}{(1-p)[\mu(C) - \mu(R)]} - \frac{\mu(C) + \mu(R)}{2}(h + l) - (h - l).$$

4. When the incumbent has observed that her policy is a failure, repealing the failing policy is preferred to continuing the policy for the L-type incumbent if and only if:

$$X_1 + 0 + p(X_2 + l) + (1-p)\{\mathbf{G}(\mu(R))(X_2 + l) + [1 - \mathbf{G}(\mu(R))][\overline{\mu_R}h + (1-\overline{\mu_R})l]\}$$

$$>$$

$$X_1 + (-c_1) + p(X_2 + l) + (1-p)\{\mathbf{G}(\mu(C))(X_2 + l) + [1 - \mathbf{G}(\mu(C))][\overline{\mu_C}h + (1-\overline{\mu_C})l]\}$$

$$\Leftrightarrow$$

$$c_1 + (1-p)\{[\mu(R) - \mu(C)][X_2 + \frac{\mu(R) + \mu(C)}{2}(h+l)]\} > 0. \tag{19}$$

In a similar analysis to the above case, the condition (19) is satisfied if and only if

$$X_2 < \frac{c_1}{(1-p)[\mu(C) - \mu(R)]} - \frac{\mu(C) + \mu(R)}{2}(h+l).$$

In summary, when independent voters believe that the incumbent follows **S** strategy and the incumbent has observed her private informative signal about the policy she has implemented, the optimal decision of both types of incumbent is to continue the successful policy, but the optimal decision of both types of incumbent is to repeal the failing policy if and only if the two conditions (18) and (19) are satisfied:

$$X_2 < \Phi_0,$$

$$\Phi_0 \equiv \frac{c_1}{(1-p)[\mu(C) - \mu(R)]} - \frac{\mu(C) + \mu(R)}{2}(h+l) - (h-l),$$

This proves proposition 1. ■

Proof of proposition 2

Proof. Thus, being similar to $\overline{\mu_d}$, when $1 > \mu > 0$ and the incumbent's decision is $d = C$, the expected value of the *prior* probability that an opponent is H-type is updated by the incumbent herself as $\overline{\mu}$ and

$$\overline{\mu} \equiv E[\mu_o | \mu_o > \mu] = \frac{\int_{\mu}^{1} x g(x) \mathbf{d}x}{1-\mu} = \frac{1+\mu}{2}.$$

$\overline{\mu}$ will be used in the following proof about proposition 2.

When $W = 0$, we assume that independent voters believe that the incumbent uses **P** strategy. Thus, when they observe that her decision d is R, they update their belief about her type using Bayes' rule. Otherwise, they do not adjust their belief about her type.

1. Continuing a policy after observing that it is a success is optimal for the H-type incumbent if and only if:

$$X_1 + b_1 + p(X_2 + h) + (1-p)\{\mathbf{G}(\mu)(X_2 + h) + [1 - \mathbf{G}(\mu)][\overline{\mu}h + (1-\overline{\mu})l]\}$$

$$>$$

$$X_1 + 0 + p(X_2 + h) + (1-p)\{\mathbf{G}(\mu(R))(X_2 + h) + [1 - \mathbf{G}(\mu(R))][\overline{\mu_R}h + (1-\overline{\mu_R})l]\}$$

$$b_1 + (1-p)[\mu - \mu(R)][X_2 + \frac{\mu + \mu(R)}{2}(h+l) + (h-l)] > 0. \tag{20}$$

The condition (20) is clearly satisfied. Its explanation is similar to (16). Its intuition is that if each independent voter believes that the incumbent uses **P** strategy, and uses Bayes' rule to update his belief about the incumbent's type only after observing that her decision is R, the H-type incumbent will always continue her successful policy.

2. Similarly, continuing the successful policy is preferred to repealing it for the L-type incumbent if and only if:

$$b_1 + (1-p)[\mu - \mu(R)][X_2 + \frac{\mu + \mu(R)}{2}(h+l)] > 0. \tag{21}$$

The condition (21) is obviously satisfied.

3. When the incumbent has observed that her policy is a failure, continuing the policy is optimal for the H-type incumbent if and only if:

$$-c_1 + (1-p)[\mu - \mu(R)][X_2 + \frac{\mu + \mu(R)}{2}(h+l) + (h-l)] > 0. \tag{22}$$

This shows that although the H-type incumbent incurs the cost of continuing the failing policy, she avoids facing a lower probability of re-election stemming from the decision to repeal the policy. The condition (22) holds if and only if the H-type incumbent has sufficiently high "ego rents X_2" and the policy outcome benefit from repealing the faithful policy c_1 is sufficiently small, i.e.,

$$X_2 > \frac{c_1}{(1-p)[\mu - \mu(R)]} - \frac{\mu + \mu(R)}{2}(h+l) - (h-l).$$

Supposing each independent voter believes that the incumbent uses **P** strategy, and uses Bayes' rule to update his belief about the incumbent's type only after observing that her decision is R, the H-type incumbent who has higher ego rents X_2 would never repeal her failing policy, when the policy outcome benefit from repealing the faithful policy is sufficiently small.

4. Similarly, continuing the failing policy is preferred to repealing it for the L-type incumbent if and only if:

$$-c_1 + (1-p)\{[\mu - \mu(R)][X_2 + \frac{\mu + \mu(R)}{2}(h+l)]\} > 0, \tag{23}$$

i.e,

$$X_2 > \frac{c_1}{(1-p)[\mu - \mu(R)]} - \frac{\mu + \mu(R)}{2}(h+l).$$

In conclusion, there is **P** if and only if conditions (22) and (23) are satisfied:

$$X_2 > \Psi_0,$$

$$\Psi_0 \equiv \frac{c_1}{(1-p)[\mu-\mu(R)]} - \frac{\mu+\mu(R)}{2}(h+l)$$

This proves proposition 2. ■

Proof of proposition 3

Proof.

When the incumbent's decision is d and $1 > \underline{\mu}^S(d) > 0$, she updates the expected value of the *prior* probability that a challenger is H-type as $\overline{\underline{\mu}^S_d}$ and

$$\overline{\underline{\mu}^S_d} \equiv E[\mu_o|\mu_o > \underline{\mu}^S(d)] = \frac{\int_{\underline{\mu}^S(d)}^1 xg(x)\mathbf{d}x}{1-\underline{\mu}^S(d)} = \frac{1+\underline{\mu}^S(d)}{2}.$$

If $\underline{\mu}^S(d) \geq 1$, because of $\mu_o \leq 1$, then

$$\overline{\underline{\mu}^S_d} \equiv 0.$$

(a)When $W \geq \frac{[1-\mu(R)](h-l)(1-p)}{p}$, we have $\underline{\mu}^S(C) > \underline{\mu}^S(R) \geq 1$ and $\mathbf{G}(\underline{\mu}^S(C)) = \mathbf{G}(\underline{\mu}^S(R)) = 1$. This means that the incumbent is sure to win in the re-election even if she repeals her policy. We continue to analyze **S** as in proposition 1.

1. If the incumbent has observed that her policy is a success, continuing the policy is preferred to repealing it for the H-type incumbent if and only if:

$$X_1 + b_1 + p(X_2+h) + (1-p)\mathbf{G}(\underline{\mu}^S(C))(X_2+h)$$
$$>$$
$$X_1 + 0 + p(X_2+h) + (1-p)\mathbf{G}(\underline{\mu}^S(R))(X_2+h)$$

$$\Leftrightarrow \quad b_1 > 0.$$

b_1 represents the effect of continuing the successful welfare policy in period 1, which is obviously positive. The H-type incumbent then prefers to continue the successful policy when she is certain to win the re-election.

2. Similarly, continuing the successful policy is preferred to repealing it for the L-type incumbent if and only if:

$$X_1 + b_1 + p(X_2+l) + (1-p)\mathbf{G}(\underline{\mu}^S(C))(X_2+l)$$
$$>$$
$$X_1 + 0 + p(X_2+l) + (1-p)\mathbf{G}(\underline{\mu}^S(R))(X_2+l)$$

$$\Leftrightarrow \quad b_1 > 0.$$

The above condition is obviously satisfied.The L-type incumbent prefers to continue the successful policy when she is certain to win the re-election.

3. When the incumbent has observed that her policy is a failure, repealing the policy is optimal for the H-type if and only if:

$$X_1 + 0 + p(X_2 + h) + (1-p)\mathbf{G}(\underline{\mu}^S(R))(X_2 + h)$$

$$>$$

$$X_1 + (-c_1) + p(X_2 + h) + (1-p)\mathbf{G}(\underline{\mu}^S(C))(X_2 + h)$$

$$\Leftrightarrow \quad c_1 > 0.$$

c_1 represents the benefit of repealing the failing policy, which is positive. Therefore, the H-type incumbent prefers to repeal her failing policy when she is certain to win the re-election.

4. Similarly, repealing the failing policy is preferred to continuing it for the L-type incumbent if and only if:

$$X_1 + 0 + p(X_2 + l) + (1-p)\mathbf{G}(\underline{\mu}^S(R))(X_2 + l)$$

$$>$$

$$X_1 + (-c_1) + p(X_2 + l) + (1-p)\mathbf{G}(\underline{\mu}^S(C))(X_2 + l)$$

$$\Leftrightarrow \quad c_1 > 0.$$

The above condition obviously holds. Therefore, the L-type incumbent also prefers to repeal her failing policy when she is certain to win the re-election.

In summary, when $W \geq \frac{[1-\mu(R)](h-l)(1-p)}{p}$, **S** exists.

(b)When $\frac{[1-\mu(R)](h-l)(1-p)}{p} > W > \frac{[1-\mu(C)](h-l)(1-p)}{p}$, $\underline{\mu}^S(C) > 1 > \underline{\mu}^S(R)$, $\mathbf{G}(\underline{\mu}^S(C)) = 1 > \mathbf{G}(\underline{\mu}^S(R))$. This means that the incumbent is certain to win in the re-election only if she continues the policy. We continue to consider the conditions of **S**.

1. If the incumbent has observed that her policy is a success, continuing the policy is preferred to repealing it for H-type incumbent if and only if:

$$X_1 + b_1 + p(X_2 + h) + (1-p)\mathbf{G}(\underline{\mu}^S(C))(X_2 + h)$$

$$>$$

$$X_1 + 0 + p(X_2 + h) + (1-p)\{\mathbf{G}(\underline{\mu}^S(R))(X_2 + h) + [1 - \mathbf{G}(\underline{\mu}^S(R))][\overline{\mu_R} h + (1 - \overline{\mu_R})l]\}$$

$$\Leftrightarrow$$

$$b_1 + (1-p)(1 - \underline{\mu}^S(R))[X_2 + \frac{1 - \underline{\mu}^S(R)}{2}(h - l)] > 0. \tag{24}$$

The first term in (24) represents the effect of continuing the successful welfare policy in period 1, which is obviously positive. The second term in (24) represents the effect of the H-type incumbent's decision on her probability of re-election, and thus on her expected utility after the re-election. We recall that $1 > \underline{\mu}^S(R)$. Thus the second term in (24) is obviously positive. Hence the condition (24) is obviously positive.

2. Similarly, continuing the successful policy is preferred to repealing it for the L-type incumbent if and only if:

$$X_1 + b_1 + p(X_2 + l) + (1-p)\mathbf{G}(\underline{\mu}^S(C))(X_2 + l)$$

$$>$$

$$X_1 + 0 + p(X_2 + l) + (1-p)\{\mathbf{G}(\underline{\mu}^S(R))(X_2 + l) + [1 - \mathbf{G}(\underline{\mu}^S(R))][\overline{\mu_R}h + (1-\overline{\mu_R})l]\}$$

$$\Leftrightarrow$$

$$b_1 + (1-p)(1-\underline{\mu}^S(R))\left\{X_2 - \frac{1+\underline{\mu}^S(R)}{2}(h-l)\right\} > 0. \tag{25}$$

The first term in (25) is obviously positive. We recall the fact that $1 > \underline{\mu}^S(R) > 0$. Provided that the L-type incumbent does not care about "ego rents X_2", the second term in (25) is negative. If the welfare from continuing the successful policy b_1 is sufficiently small, (25) is violated. Then the condition (25) holds if and only if:

$$X_2 > \frac{-b_1}{(1-p)(1-\underline{\mu}^S(R))} + \frac{1+\underline{\mu}^S(R)}{2}(h-l).$$

3. When the incumbent has observed that her policy is a failure, repealing the policy is optimal for the H-type if and only if:

$$X_1 + 0 + p(X_2 + hb_2) + (1-p)\{\mathbf{G}(\underline{\mu}^S(R))(X_2 + h) + [1 - \mathbf{G}(\underline{\mu}^S(R))][\overline{\mu_R}h + (1-\overline{\mu_R})l]\}$$

$$>$$

$$X_1 + (-c_1) + p(X_2 + h) + (1-p)\mathbf{G}(\underline{\mu}^S(C))(X_2 + h)$$

$$\Leftrightarrow$$

$$c_1 + (1-p)(\underline{\mu}^S(R) - 1)[X_2 + \frac{1-\underline{\mu}^S(R)}{2}(h-l)] > 0. \tag{26}$$

The first term in (26) represents the benefit of repealing the failing policy, which is positive. The second term in (26) is the effect of the H-type incumbent's decision on her re-election chances, and thus on her welfare after re-election. We recall that $1 > \underline{\mu}^S(C)$. The second term in (26) is negative. If the benefit of repealing a failing policy c_1 is sufficiently small and the incumbent's ego rent X_2 is sufficiently high, the condition (26) is violated. Therefore, the H-type incumbent prefers to repeal the failing policy if and only if the function (26) is positive, i.e.,

$$X_2 < \frac{c_1}{(1-p)[1-\underline{\mu}^S(R)]} - \frac{1-\underline{\mu}^S(R)}{2}(h-l).$$

4. Similarly, repealing the failing policy is preferred to continuing it for the L-type incumbent if and only if:

$$X_1 + 0 + p(X_2 + l) + (1-p)\{\mathbf{G}(\underline{\mu}^S(R))(X_2 + l) + [1 - \mathbf{G}(\underline{\mu}^S(R))][\overline{\mu_R}h + (1-\overline{\mu_R})l]\}$$

$$>$$

$$X_1 + (-c_1) + p(X_2 + l) + (1-p)\mathbf{G}(\underline{\mu}^S(C))(X_2 + l)$$

$$\Leftrightarrow$$

$$c_1 + (1-p)[\underline{\mu}^S(R) - 1][X_2 - \frac{1 + \underline{\mu}^S(R)}{2}(h-l)] > 0. \tag{27}$$

The first term in (27) is positive. We recall that $1 > \mu(R)$. Supposing that the L-type incumbent has a high enough "ego rent X_2", the second term in (27) is negative. If the benefit of repealing a failing policy c_1 is sufficiently small, the condition (27) is violated. Therefore, the incumbent prefers to repeal her failing policy if and only if the condition (27) holds, i.e.,

$$X_2 < \frac{c_1}{(1-p)[1-\underline{\mu}^S(R)]} + \frac{1 + \underline{\mu}^S(R)}{2}(h-l).$$

In summary, **S** exists if and only if the conditions (25), (26) and (27) hold at the same time, i.e.,

$$\frac{-b_1}{(1-p)[1-\underline{\mu}^S(R)]} + \frac{h-l}{2}[1 + \underline{\mu}^S(R)] < X_2 < \Phi_1^S, \tag{28}$$

$$\Phi_1^S \equiv \frac{c_1}{(1-p)[1-\underline{\mu}^S(R)]} - \frac{h-l}{2}[1 - \underline{\mu}^S(R)],$$

(c)When $\frac{[1-\mu(C)](h-l)(1-p)}{p} \geq W > 0$, $1 > \underline{\mu}^S(C) > \underline{\mu}^S(R)$, $1 > \mathbf{G}(\underline{\mu}^S(C)) > \mathbf{G}(\underline{\mu}^S(R))$. This means that the incumbent cannot definitely win the re-election through her decision. In this case, we consider **S** as in proposition 1.

1. If the incumbent has observed that her policy is a success, continuing the policy is preferred to repealing the policy for the H-type incumbent if and only if:

$$X_1 + b_1 + p(X_2 + h) + (1-p)\{\mathbf{G}(\underline{\mu}^S(C))(X_2 + h) + [1 - \mathbf{G}(\underline{\mu}^S(C))][\overline{\mu_C}h + (1-\overline{\mu_C})l]\}$$

$$>$$

$$X_1 + 0 + p(X_2 + h) + (1-p)\{\mathbf{G}(\underline{\mu}^S(R))(X_2 + h) + [1 - \mathbf{G}(\underline{\mu}^S(R))][\overline{\mu_R}h + (1-\overline{\mu_R})l]\}$$

$$\Leftrightarrow$$

$$b_1 + (1-p)[\underline{\mu}^S(C) - \underline{\mu}^S(R)][X_2 + \frac{\underline{\mu}^S(C) + \underline{\mu}^S(R)}{2}(h+l) + (h-l)] > 0.$$

We recall that $\underline{\mu}^S(C) > \underline{\mu}^S(R)$. Being similar to the condition (16), this condition is obviously positive.

2. Similarly, continuing the successful policy is preferred to repealing it for the L-type incumbent if and only if:

$$X_1 + b_1 + p(X_2 + l) + (1-p)\{\mathbf{G}(\underline{\mu}^S(C))(X_2 + l) + [1 - \mathbf{G}(\underline{\mu}^S(C))][\overline{\mu_C} h + (1 - \overline{\mu_C}) l]\}$$

$$>$$

$$X_1 + 0 + p(X_2 + l) + (1-p)\{\mathbf{G}(\underline{\mu}^S(R))(X_2 + l) + [1 - \mathbf{G}(\underline{\mu}^S(R))][\overline{\mu_R} h + (1 - \overline{\mu_R}) l]\}$$

$$\Leftrightarrow$$

$$b_1 + (1-p)[\underline{\mu}^S(C) - \underline{\mu}^S(R)][X_2 + \frac{\underline{\mu}^S(C) + \underline{\mu}^S(R)}{2}(h + l)] > 0.$$

This condition is always satisfied.

3. When the incumbent has observed that her policy is a failure, repealing the failing policy is optimal for the H-type if and only if:

$$X_1 + 0 + p(X_2 + h) + (1-p)\{\mathbf{G}(\underline{\mu}^S(R))(X_2 + h) + [1 - \mathbf{G}(\underline{\mu}^S(R))][\overline{\mu_R} h + (1 - \overline{\mu_R}) l]\}$$

$$>$$

$$X_1 + (-c_1) + p(X_2 + h) + (1-p)\{\mathbf{G}(\underline{\mu}^S(C))(X_2 + h) + [1 - \mathbf{G}(\underline{\mu}^S(C))][\overline{\mu_C} h + (1 - \overline{\mu_C}) l]\}$$

$$\Leftrightarrow$$

$$c_1 + (1-p)[\underline{\mu}^S(R) - \underline{\mu}^S(C)][X_2 + \frac{\underline{\mu}^S(R) + \underline{\mu}^S(C)}{2}(h + l) + (h - l)] > 0. \tag{29}$$

The condition (29) is not always satisfied. The first term in (29) represents the benefit of repealing the failing policy. It is positive. The second term in (29) is the effect of the H-type incumbent's decision on her re-election chances, and thus on her welfare after re-election. Repealing the policy hurts the reputation of the H-type incumbent, i.e., $\underline{\mu}^S(R) - \underline{\mu}^S(C) < 0$. The second term in (29) is negative. Furthermore, if the benefit of repealing a failing policy c_1 is sufficiently small, the condition (29) is violated. Therefore, the condition (29) holds if and only if

$$X_2 < \frac{c_1}{(1-p)[\underline{\mu}^S(C) - \underline{\mu}^S(R)]} - \frac{\underline{\mu}^S(C) + \underline{\mu}^S(R)}{2}(h + l) - (h - l).$$

4. Similarly, repealing the failing policy is preferred to continuing it for the L-type incumbent if and only if:

$$X_1 + 0 + p(X_2 + l) + (1-p)\{\mathbf{G}(\underline{\mu}^S(R))(X_2 + l) + [1 - \mathbf{G}(\underline{\mu}^S(R))][\overline{\mu_R} h + (1 - \overline{\mu_R}) l]\}$$

$$>$$

$$X_1 + (-c_1) + p(X_2 + l) + (1-p)\{\mathbf{G}(\underline{\mu}^S(C))(X_2 + l) + [1 - \mathbf{G}(\underline{\mu}^S(C))][\overline{\mu_C} h + (1 - \overline{\mu_C}) l]\}$$

$$\Leftrightarrow$$

$$c_1 + (1-p)[\underline{\mu}^S(R) - \underline{\mu}^S(C)][X_2 + \frac{\underline{\mu}^S(C) + \underline{\mu}^S(R)}{2}(h+l)] > 0. \tag{30}$$

Therefore, the condition (30) is satisfied if and only if

$$X_2 < \frac{c_1}{(1-p)[\underline{\mu}^S(C) - \underline{\mu}^S(R)]} - \frac{\underline{\mu}^S(C) + \underline{\mu}^S(R)}{2}(h+l).$$

In summary, when independent voters believe that the incumbent follows the **S** strategy and the incumbent has observed her private informative signal about her implemented policy in the first period, the optimal decision by both types of incumbent is to continue the successful policy, but the optimal decision by both types of incumbent is to repeal the failing policy if and only if the two conditions (29) and (30) hold:

i.e.,

$$X_2 < \Phi_2^S, \tag{31}$$

$$\Phi_2^S \equiv \frac{c_1}{(1-p)[\underline{\mu}^S(C) - \underline{\mu}^S(R)]} - \frac{\underline{\mu}^S(C) + \underline{\mu}^S(R)}{2}(h+l) - (h-l),$$

This proves proposition 3. ■

Proof of proposition 4

Proof. Similarly, we give $\overline{\underline{\mu}^P}$, i.e., given $1 > \underline{\mu}^P > 0$,

$$\overline{\underline{\mu}^P} \equiv E[\mu_o | \mu_o > \underline{\mu}^P] = \frac{\int_{\underline{\mu}^P}^1 x g(x) \mathbf{d}x}{1 - \underline{\mu}^P} = \frac{1 + \underline{\mu}^P}{2};$$

given $\underline{\mu}^P \geq 1$,

$$\overline{\underline{\mu}^P} \equiv 0.$$

(a)When $W \geq \frac{[1-\mu(R)](h-l)(1-p)}{p}$, $\underline{\mu}^P > \underline{\mu}^S(R) \geq 1$, and $\mathbf{G}(\underline{\mu}^P) = \mathbf{G}(\underline{\mu}^S(R)) = 1$. This means that the incumbent definitely wins the re-election even if she repeals her policy.

Therefore, supposing that the incumbent has observed that her policy is a failure, continuing the policy is optimal for the H-type incumbent if and only if:

$$X_1 + (-c_1) + p(X_2 + h) + (1-p)\mathbf{G}(\underline{\mu}^P)(X_2 + h)$$
$$>$$
$$X_1 + 0 + p(X_2 + h) + (1-p)\{\mathbf{G}(\underline{\mu}^S(R))(X_2 + h) + [1 - G(\underline{\mu}^S(R))][\overline{\mu_R} h + (1 - \overline{\mu_R}) l]\}$$

$$\Leftrightarrow \quad -c_1 > 0.$$

This condition cannot hold. Supposing each independent voter believes that the incumbent uses the strategy **P** and uses Bayes' rule to update his belief about the incumbent's type only after observing that her decision is R, the H-type incumbent would never repeal her failing policy. Therefore, **P** does not exist.

(b)When $\frac{[1-\mu(R)](h-l)(1-p)}{p} > W > \frac{(1-\mu)(h-l)(1-p)}{p}$, $\underline{\mu}^P \geq 1 > \underline{\mu}^S(R)$, $\mathbf{G}(\underline{\mu}^P) = 1 > \mathbf{G}(\underline{\mu}^S(R))$. This means that the incumbent definitely wins the re-election only if she continues her policy. We continue to consider the conditions of **P**.

1. Continuing a policy after observing that the policy is a success is optimal for the H-type incumbent if and only if:

$$X_1 + b_1 + p(X_2 + h) + (1-p)\mathbf{G}(\underline{\mu}^P)(X_2 + h)$$

$$>$$

$$X_1 + 0 + p(X_2 + h) + (1-p)\{\mathbf{G}(\underline{\mu}^S(R))(X_2 + h) + [1 - \mathbf{G}(\underline{\mu}^S(R))][\overline{\mu_R}h + (1 - \overline{\mu_R})l]\}$$

$$\Leftrightarrow$$

$$b_1 + (1-p)[1 - \underline{\mu}^S(R)][X_2 + \frac{1 - \underline{\mu}^S(R)}{2}(h - l)] > 0.$$

   This condition obviously holds. Its intuition is that supposing each independent voter believes that the incumbent uses the **P** strategy and uses Bayes' rule to update his belief about the incumbent's type only after observing that her decision is R, the H-type incumbent will always continue her successful policy.

2. Similarly, continuing the successful policy is preferred to repealing it for the L-type incumbent if and only if:

$$X_1 + b_1 + p(X_2 + l) + (1-p)\mathbf{G}(\underline{\mu}^P)(X_2 + l)$$

$$>$$

$$X_1 + 0 + p(X_2 + l) + (1-p)\{\mathbf{G}(\underline{\mu}^S(R))(X_2 + l) + [1 - \mathbf{G}(\underline{\mu}^S(R))][\overline{\mu_R}h + (1 - \overline{\mu_R})l]\}$$

$$b_1 + (1-p)[1 - \underline{\mu}^S(R)][X_2 - \frac{1 + \underline{\mu}^S(R)}{2}(h - l)] > 0. \tag{32}$$

   The first term in (32) is obviously positive. The second term in (32) represents the effect of the L-type incumbent's decision on her probability of re-election, and thus on her expected utility after the re-election. We recall the fact that $1 > \underline{\mu}^S(R) > 0$. Provided that the L-type incumbent does not care about "ego rents X_2", the second term in (32) is negative. Furthermore, if the welfare from continuing the successful policy b_1 is sufficiently small, the condition (32) is violated. Overall, the condition (32) holds if and only if

$$X_2 > \frac{-b_1}{(1-p)[1 - \underline{\mu}^S(R)]} + \frac{1 + \underline{\mu}^S(R)}{2}(h - l).$$

3. When the incumbent has observed that her policy is a failure, continuing the failing policy is optimal for the H-type incumbent if and only if:

$$X_1 + (-c_1) + p(X_2 + h) + (1-p)\mathbf{G}(\underline{\mu}^P)(X_2 + h)$$

$$>$$

$$X_1 + 0 + p(X_2 + h) + (1-p)\{\mathbf{G}(\underline{\mu}^S(R))(X_2 + h) + [1 - \mathbf{G}(\underline{\mu}^S(R))][\overline{\mu_R}h + (1 - \overline{\mu_R})l]\}$$

$$-c_1+(1-p)[1-\underline{\mu}^S(R)][X_2+\frac{1-\underline{\mu}^S(R)}{2}(h-l)]>0. \tag{33}$$

Hence (33) holds if the H-type incumbent has a sufficiently high ego rent X_2 and the policy outcome benefit from repealing the failing policy c_1 is sufficiently small, i.e.,

$$X_2>\frac{c_1}{(1-p)[1-\underline{\mu}^S(R)]}-\frac{1-\underline{\mu}^S(R)}{2}(h-l).$$

This shows although the H-type incumbent incurs the cost of continuing the failing policy, she avoids facing a lower probability of re-election which stems from the decision to repeal the policy. Its intuition is that supposing each independent voter believes that the incumbent uses strategy **P** and uses Bayes' rule to update his belief about the incumbent's type only after observing that her decision is R, the H-type incumbent who has a higher "ego rent X_2" would never repeal her failing policy.

4. Similarly, continuing the failing policy is preferred to repealing the policy for the L-type incumbent if and only if:

$$X_1+(-c_1)+p(X_2+l)+(1-p)\mathbf{G}(\underline{\mu}^P)(X_2+l)$$

$$>$$

$$X_1+0+p(X_2+l)+(1-p)\{\mathbf{G}(\underline{\mu}^S(R))(X_2+l)+[1-\mathbf{G}(\underline{\mu}^S(R))][\overline{\mu_R}h+(1-\overline{\mu_R})l]\}$$

$$-c_1+(1-p)[1-\underline{\mu}^S(R)][X_2-\frac{1+\underline{\mu}^S(R)}{2}(h-l)]>0. \tag{34}$$

Condition (34) holds if and only if

$$X_2>\frac{c_1}{(1-p)[1-\underline{\mu}^S(R)]}+\frac{1+\underline{\mu}^S(R)}{2}(h-l).$$

In conclusion, **P** exists, if and only if conditions (32), (33) and (34) are satisfied at the same time. Because $b_1>0>-c_1$, if the condition (34) is satisfied, the condition (32) is satisfied. To sum up,

$$X_2>\Psi_1^P, \tag{35}$$

$$\Psi_1^P\equiv\frac{c_1}{(1-p)[1-\underline{\mu}^S(R)]}+\frac{1+\underline{\mu}^S(R)}{2}(h-l).$$

(c)When $\frac{(1-\mu)(h-l)(1-p)}{p}\geq W>0$, $1>\underline{\mu}^P>\underline{\mu}^S(R)$, $1>\mathbf{G}(\underline{\mu}^P)>\mathbf{G}(\underline{\mu}^S(R))$. This means that the incumbent cannot definitely win the re-election through her decisions. The following proof is similar to the proof of proposition 2.

1. Continuing a policy after observing that the policy is a success is optimal for the H-type incumbent if and only if:

$$b_1+(1-p)\{[\underline{\mu}^P-\underline{\mu}^S(R)][X_2+\frac{\underline{\mu}^P+\underline{\mu}^S(R)}{2}(h+l)+(h-l)]\}>0.$$

This condition obviously holds, and its explanation is similar to (20).

2. Similarly, continuing the successful policy is preferred to repealing it for the L-type incumbent if and only if:

$$b_1 + (1-p)[\underline{\mu}^P - \underline{\mu}^S(R)][X_2 + \frac{\underline{\mu}^P + \underline{\mu}^S(R)}{2}(h+l)] > 0.$$

   This condition is always satisfied.

3. When the incumbent has observed that her policy is a failure, continuing the failing policy is optimal for the H-type incumbent if and only if:

$$-c_1 + (1-p)[\underline{\mu}^P - \underline{\mu}^S(R)][X_2 + \frac{\underline{\mu}^P + \underline{\mu}^S(R)}{2}(h+l) + (h-l)] > 0. \tag{36}$$

   This shows that although the H-type incumbent incurs the cost of continuing the failing policy, she avoids facing a lower probability of re-election which stems from the decision to repeal the policy. Hence the condition (36) holds if the H-type incumbent has a sufficiently high ego rent X_2 and the policy outcome benefit from repealing the faithful policy c_1 is sufficiently small, i.e.,

$$X_2 > \frac{c_1}{(1-p)[\underline{\mu}^P - \underline{\mu}^S(R)]} - \frac{\underline{\mu}^P + \underline{\mu}^S(R)}{2}(h+l) - (h-l).$$

4. Similarly, continuing the failing policy is preferred to repealing it for the L-type incumbent if and only if:

$$-c_1 + (1-p)[\underline{\mu}^P - \underline{\mu}^S(R)][X_2 + \frac{\underline{\mu}^P + \underline{\mu}^S(R)}{2}(h+l)] > 0. \tag{37}$$

   The condition (37) holds if and only if

$$X_2 > \frac{c_1}{(1-p)[\underline{\mu}^P - \underline{\mu}^S(R)]} - \frac{\underline{\mu}^P + \underline{\mu}^S(R)}{2}(h+l).$$

To sum up, **P** exists if and only if functions (36) and (37) are satisfied at the same time, i.e.,

$$X_2 > \Psi^P, \tag{38}$$

$$\Psi^P \equiv \frac{c_1}{(1-p)[\underline{\mu}^P - \underline{\mu}^S(R)]} - \frac{\underline{\mu}^P + \underline{\mu}^S(R)}{2}(h+l).$$

■

Proof of Lemma 3

Proof. Because of $\frac{[1-\mu(C)](h-l)(1-p)}{p} \geq W > 0$,

$$1 \geq \underline{\mu}^S(C) > \underline{\mu}^S(R).$$

Because $h > l$,

$$1 \geq \underline{\mu}^S(C) - \underline{\mu}^S(R) = \mu(C) - \mu(R) > 0. \tag{39}$$

Because of (4), (9) and $\underline{\mu}^S(d) \equiv \mu(d) + \frac{p}{(1-p)(h-l)} W$, we have that

$$\Phi_2^S < \Phi_0$$

Therefore,

$$(0, \Phi_2^S) \subset (0, \Phi_0).$$

This proves Lemma 3.

■

Proof of Lemma 6

Proof. Because of $\frac{(1-\mu)(h-l)(1-p)}{p} \geq W > 0$,

$$1 \geq \underline{\mu}^P > \underline{\mu}^S(R).$$

Because $h > l$,

$$1 > \underline{\mu}^P - \underline{\mu}^S(R) = \mu - \mu(R) > 0. \tag{40}$$

Inspired by (5), (11), $\underline{\mu}^P \equiv \mu + \frac{p}{(1-p)(h-l)} W$ and $\underline{\mu}^S(R) \equiv \mu(R) + \frac{p}{(1-p)(h-l)} W$,

thus, $\Psi_2^P < \Psi_0$.

It means $(\Psi_0, +\infty) \subseteq (\Psi_2^P, +\infty)$. This proves Lemma 6. ■