Policy Making with Reputation Concerns*

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Abstract

We study the policy choice of an incumbent politician who is concerned with the public's perception of his capability. The politician decides whether to maintain the status quo or to conduct a risky reform. The success of the reform critically depends on the ability of the politician in office, which is privately known to the politician. The public observes both his policy choice and the outcome of the reform, and forms a posterior on the true ability of the politician. We show that politicians may engage in socially detrimental reform in order to be perceived as more capable. Conservative institutions that thwart reform may potentially improve social welfare.

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1 Introduction

> She (Emma) was not much deceived as to her own skill either as an artist or a musician, but she was not unwilling to have others deceived, or sorry to know her reputation for accomplishment often higher than it deserved.
>
> *Emma*, vol. 1, ch. 6, by Jane Austen

In making decisions and taking actions, we are often concerned about inferences that people draw about us from our choices and/or their consequences. Positive assessment from others not only generates psychological satisfaction and improves one's social status, but

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also could lead to various tangible gains such as opportunities in career development. To a large extent, our success, professional or otherwise, is determined by the inferences others made on our competence.

Reputation or career concerns form one important dimension of the informal incentives that motivate economic agents to carry out various activities. They loom large, perhaps more conspicuously, in the public sector or nonprofit organizations, where formal contracts based on explicit performance-based incentives are usually rare. Plenty of examples are available to illustrate the ubiquity of its nontrivial influence. A politician in office can be concerned about his chance of being reelected or about how the public evaluates his legacy when he steps down. The likelihood of a politician being re-elected could depend to a large extent on the public's perception of his capability. As an aftermath of the economic turmoil, commentators deemed Gordon Brown to have lost his "reputation for economic competence" "through a combination of appallingly bad luck and even worse misjudgment,"[1] which could immediately jeopardize his premiership. A bureaucrat in the Securities and Exchange Commission may seek a promotion or a lucrative job offer from private financial firms after his term of service.

As Irving Rein, Philip Kotler, and Martin Stoller [22] state, politics is an "image intensive sector," where "image building and transformation truly dominate." Due to the strength and prevalence of such informal incentives, it is a widespread phenomenon that decision makers take actions to enhance their reputation. For instance, Frederick Sheehan [24] comments that Alan Greenspan deliberately built his own reputation of his competence in designing monetary policy, and he went to a great length to protect his reputation.

In this paper, we identify one particular context in which such concerns affect individuals' behaviour – they may take on risky or innovative initiatives whose success depends on their capability, so as to improve the public's perception of their talent, even though they know they have low capability and hence a poor chance of success. As Tereza Capelos [4] states, "political actors often engage in controversial activities that challenge their reputation". She points out that politicians would risk losing their support "after showing instances, or wrong judgment." Our analysis predict that undertaking risky actions can be interpreted as the politician's attempt to protect his reputation from falling. Throughout our paper, we refer to the decision maker in our model as a "politician," though our analysis may encompass a variety of environments: a prosecutor who has to decide whether to file charges against a crime suspect or not, a supreme court judge decides whether to exercise his power to strike down law, a CEO who has to decide whether to implement an expansion plan or not, a doctoral candidate who decides whether to pursue a cutting-edge research project or not,

[1]Source: Fraser Neslon, Brown's "Reputation for Economic Competence Has Gone. The Tories Should Seize the Chance." http://www.spectator.co.uk, January 23rd, 2008.

etc.

In our model, a politician's competence is reflected by his ability to gather information and to make sensible decision in situations of uncertainty. The office-holding politician decides whether to drop the status quo policy in favour of a reform proposal. The ex post performance of the reform depends on two factors: the inherent value of the available reform proposal and its implementation by the politician. The value of the reform proposal follows a continuous distribution, which is observed before he decides to undertake the reform.[2] There exist two types of politicians with differing abilities. The ability of a politician in office can be either high or low and is privately known only to the politician himself.

If the status quo is retained, the performance of the politician does not vary across differing types, and it would not be subject to perturbation. Arguably, a continuing policy reduces uncertainty and allows the politician in office to gather reliable information from the past. By contrast, uncertain situations arise once the status quo is abandoned, and the politician has to manage the resulted uncertainty. He receives a private signal regarding the true state of the world, and has to choose his action in response to his conjectured underlying state of the world. The reform could succeed only if the politician ex post correctly responds to the state of the world, while it fails otherwise. For instance, a financial stimulus package could help rescure an economy out of recess, while its ultimate payoff depends on how its details are hammered out and how the rescue plan is exactly implemented. Alternatively, although HP's acquisition of Compaq has proven its merit over the years, it has been widely held that the fiasco of the company was caused by the flawed approach of Carly Florina (HP's former CEO) to managing the merger.

The outcome of a reform relies crucially on the ability of the politician. A high-type politician receives a more precise signal about the true state of the world, which enables him to choose responsive action and conduct socially beneficial reform given sufficiently promising reform proposal; while the ability of a low-type politician is inadequate for managing the uncertainty after the status quo is overthrown. He receives only a noisy signal, which causes him to make more mistakes, and inflicts damage to social welfare.[3]

The public observes the policy choice of the politician as well as the resulted performance, and forms a posterior on the type of the politician based on the two pieces of information. Two possibilities may lie beneath when status quo is maintained. First, a high-type politician may not reform if a rosy proposal is unavailable; Second, a low-type may abstain from reform even if considerably valuable proposal appears as he is afraid of failure. If a reform has been implemented, a politician is more likely to be regarded as being capable if the reform succeeds,

[2] We assume that the potential value of the available reform proposal is a piece of "hard" information and therefore is verifiable, while publicizing this information is in the discretion of the politician.

[3] We assume that the reform implemented by a low-type politician is ex ante socially inefficient regardless of the merit of the reform proposal.

while he suffers from a more pessimistic assessment if a miserable outcome results. Hence, reform function as a costly signal that conveys the politician's private information; while the posterior is formed based on not only the politician's action of reform (or no reform) but also his (random) performance.

We show that there exist a continuum of Perfect Bayesian equilibria in this game. Each equilibrium is characterized by a distinct cutoff, such that the high-type politician reforms if and only if the available reform proposal carries a potential value that exceeds the cutoff. We find that there exists no fully-separating equilibrium. We show that a high-type politician is always "eager" to reveal more information by undertaking reform: he reforms with probability one once the value of available proposal exceeds the cutoff of prevailing equilibrium. The low type mimics his high-type counterpart with a positive probability. Although the reform undertaken by a low type fails with a higher probability, his reputation concerns "force" him to do so, because he would otherwise suffer from more unfavourable assessment.

Our analysis allows us to make a number of interesting observations.

- **Pressure to prove oneself.** The probability of the low type undertaking reform strictly decreases with the public's assessment of the likelihood that the politician is capable. When the public holds a more pessimistic prior, the low-type politician would expect a greater gain if his reform turns out to succeed. Because of this effect, we predict that reform will be observed less often when the public holds a more favourable prior on the type of the politician, or a higher portion of high-type politicians exist in the population. Furthermore, though our model is static, this result points towards the following conjecture about the dynamic behaviour of a politician: a politician who has failed in the past is more likely to take radical action in the future. Past failure lowers his rating among the public, which therefore makes more lucrative an accidental success in the future.

- **Tough act to follow.** The higher is the capability differential between the high type and the low type, the less likely the low type undertakes reform. On the one hand, it could lead high type to reform more, which forces the low type to follow suit. On the other hand, it makes successful mimicry more difficult. We show that the latter effect always prevails and the low type in equilibrium must reform less often to avoid failure.

- **Thwarted good reforms.** We consider the design of optimal (welfare-maximizing) bureaucratic rule that restricts the discretion of the politician. Assume that a legislative body enforces a threshold rule – it rejects the politician's request for reform unless the value of available reform proposal exceeds a threshold. A higher, or more conservative, threshold has two competing effects. First, it discourages a low-capability politician from undertaking detrimental reform because the effect of reputation enhancement becomes less pronounced. However, it also prevents a high-capability politician from undertaking beneficial reform. We derive a fairly general conclusion about the socially optimal threshold, and we find that moderate "conservatism" is optimal in this context, despite that it must thwart *ex ante* beneficial reform. Our analysis thus lends its support to various bucreacratic rules that restricts the discretionary power of politicians or bureaucrats. It also sheds light on the debate on judicial restraint, which encourges judges to abstain from exercising their powers. These implications will be further elaborated upon at a later point of this paper.

- **Opportunities hurt and "optimism" requires more conservatism**. When favorable reform proposals are more likely to be available, does it necessarily lead to social gain? The answer is indefinite. On one hand, the society gains more from the efficient reform undertaken by the high-type. On the other hand, it "forces" the low type to reform more often – a no-reform outcome will more likely to be interpreted by the putlic as the politician's lack of competence, instead of the lack of opportunities. We show examples where a more favorable environment actually leads to further fall in social welfare. This observation compels us to study how the welfare-maximizing institutional rule responds to the change in environment. We find under plausible conditions that a more favorable environment always leads to more conservative bureucratic rule!

In the rest of this section, we discuss the link between our paper and the relevant literature. In Section 2, we set up the model. We carry out our analysis in Section 3, which establishes equilibria of the model and present comparative statics of relevant environmental factors. We discuss the welfare implications of our equilibrium results and the issue of institution design in Section 4. Section 5 provides a concluding remark.

Relation to Literature

The notion of career or reputation concerns can be traced back to the pathbreaking work of Bengt Holmstrom [11] and Mathias Dewtripont, Ian Jewitt, and Jean Tirole [6] [7]. An enormous amount of scholarly effort has been devoted to exploring the incentive effects of reputation or career concerns in a wide array of environments, including corporate decision making (e.g., Jeffery Zwiebel [27], Adam Brandenburger and Ben Polak [3], and Dominguez-Martinez, Swank, and Visser [8]), economic agents' effort supply (e.g. Bengt Holmstrom [11], and Alberto Alesina and Guido Tabellini [1]), and financial analysts' strategic stock (e.g. Marco Ottaviani and Peter Norman Sørensen [19]) recommondations.

Our model has two distinct features: first, the policy maker's capability is only relevant when he takes the reform, and the action of reform is observable; second, the politician knows his own type, so his action of reform serves as a signalling device.

The career concern literature reveals in various contexts that concerns on public or market perception distort managerial decision making, and leads managers to ignore their own useful information but take the decision ex ante favoured by the public or market. For instance, Adam Brandenburger and Ben Polak [3], Stephen Morris [18], David S. Scharfstein and Jeremy C. Stein [23], and Marco Ottaviani and Peter Norman Sørensen [19] all share this flavor.

Within this literature, our paper is similar in spirit to those of Andrea Prat [20] and Jeffrey Zwiebel [27]. He shows that the principal benefits from knowing the consequence of the agent's action, but not the agent's action itself, when the agent cares about his perceived ability. We abstract from the welfare consideration of revelation of the policy maker's ability, but we introduce a scenario where there are both observable (strategic) actions and unobservable (tactical) ones. This setup allows us to investigate the design of institution that governs the politician's scope of discretion. In addition, the agent's type is unknown to himself in the model of [20]. Zwiebel [27] also explores how reputation concerns moderate one's incentive to undertake innovative but risky action. He shows that, in a setup where the action of innovation is not observable, managers with intermediate capability may not want to innovate even if it is beneficial to the firm. The main difference between our model and his is that the action of reform is observable in our model. Hence, the setting of [27], as well as those in the managerial herding literature, does not involve costly signalling action on the part of the decision maker. We also arrive at the opposite conclusion that there can be *too much* reform when the politician cares about his reputation.[4]

A handful of studies include flavours from both the literature of signalling and that of career concerns, including Canice Prendergast and Lars Stole [21] and Wei Li [16] as notable examples. Kim-Sau Chung and Péter Esö [5] build a model in which a worker chooses a task to both signal to potential employers his capability and learn about his capability himself, as he only has imperfect knowledge about it. They assume that the more difficult task is a worse (less informative) device for assessing capability of the worker; while in our setting, the outcome of undertaking the more difficult task (reform) allows one to reveal more information. Gilat Levy [14] shows that in a committee of voters with career concerns, radical actions are more likely to be accepted when the committee voting process is transparent, and the public is able to infer a voter's ability by observed vote.

Both Sumon Majumdar and Sharun W. Mukand [17] and Guido Suurmond, Otto H. Swank, and Bauke Visser [25] study agents' incentives to experiment with risky public policies. Majumdar and Mukand[17] study governments' dynamic incentives of policy experimentation and persistence when the government's payoff is partially determined by voters'

[4] Robert A. J. Dur [9] and Peter Howitt and Ronald Wintrobe [12] also explore scenarios where there is too little change of policy.

perception of its ability. The government can be either too radical or too conservative in equilibrium. Suurmond, Swank, and Visser [25] find that the presence of career concerns can be socially beneficial as it could encourage a smart agent to expend more effort in gathering information. In general, our paper differs from those of [17] and [25] in two aspects. First, they both assume that a new project is either good or bad, and that a smart agent make better decision as he can find about its ex ante "suitability" more precisely. Second, the realized performance of a project takes either of two possible values, when it succeeds or fails. Our model, by contrast, lets the ability of the politician affect the ex post "suitability" of a project, while the potential value of a project is distributed continuously. Our setup complements those of [17] and [25], which allows us to study the issue of institution design concerning the proper level of tolerance for reform.

Our result that restrictions on change of status quot could be welfare-improving complements other justifications of institutional conservatism, for example, those offered by Li, Hao [15] and Young K. Kwon [13]. Our analysis suggests institutional barrier (bureaucracy) that limits the discretion the decision maker can exercise. Our paper echoes Jean Tirole [26] in this aspect.

2 Setup

A risk-neutral politician makes a policy choice between two alternatives: maintaining the status quo or implementing a reform. If the politician retains the status quo, the outcome of this polity, y, is deterministic, which we normalize to 0. By contrast, if the politician chooses to undertake the reform, uncertainty will arise that affect the outcome and the politician must take an action to address it. The outcome is given by

$$y = \theta - (a - \omega)^{2.}. \tag{1}$$

where θ measures the value of reform, ω is the true state of the world, and a is the action taken by the politician in response to his assessment of ω. The politician observes the value of reform, θ, before choosing whether to implement it. We assume that the signal θ is a piece of "hard" and verifiable information. It is common knowledge that θ is continuously distributed on $[\theta_l, \theta_h]$ with distribution function F and density function f, where $\theta_l < 0 < \theta_h$, and $|\theta_l|, \theta_h \in (1, 2)$. The state of the world, ω, may take two values, -1 or 1, each with probability 1/2. Neither the politician nor the public observe the true state. The action a is chosen from $\{-1, 1\}$. Thus, when a reform is implemented, the best outcome is achieved when the politician takes an action that turns out to match the state of the world.

The politician's talent, t, which affects the success of the reform, can be high ($t = H$) or low ($t = L$). The talent of the politician is his private information. A high-talent politician receives an informative signal $\sigma \in \{-1, 1\}$, which matches the true state with probability

$$q = \Pr(\sigma = \omega) > \frac{3}{4}.$$

By contrast, a low-talent politician's signal is completely uninformative.[5] Let α be the probability of $t = H$, which is commonly known. It should be noted that the assumption $q > \frac{3}{4}$ does not affect the strategic analysis. However, without this assumption, no reform can be ex ante socially beneficial.

The setup of this model differs from the existing literature. Here, we stress some essential features of our model. First, the distinction between policies (status quo or reform) and actions is important in our model. Policies are macro-level or "strategic" decisions such as whether to introduce a new product or whether to start a war. By contrast, actions are micro-level or "tactical" decisions such as which technology to use in the new product or how many troops to deploy in the war. Though there may be general agreement about how desirable a reform is (θ), there may well be disagreement over the optimal way to implement the reform (a). The true nature of the problem (ω) determines which action is ex post suitable for implementing the reform. Second, in contrast to most of existing studies, we assume that the outcome of a reform is measured by a continuous variable, instead of a binary indicator (e.g., success or failure). This setup enriches our analysis in two aspects. First, it enables an analysis of institution design. A more sophisticated trade-off is involvedin the determination of the level of conservatism of the institution. Second, a comparative static analysis may be performed on the probability distribution of the value of reform, which may provide the answer to questions like "should the institution become more or less conservative when the *ex ante* prospects of the reform improve?". In addition, the distribution of θ, as will be verified, affects the politician's behaviour, and allows our analysis to yield useful implications on social welfare.

We assume that the proportion of "good" politicians in the population is small:[6]

$$\alpha < \frac{1}{2}.$$

Upon receiving σ (either informative or uninformative), the politician takes an action.

[5]Though we do not model how the politician obtains his signal, one may interpret the politician's talent in our model as the ability to gather information from various sources. The US presidential historian, Erwin C. Hargrove, paints two completely different pictures of Franklin D. Roosevelt and Herbert Hoover with respect to information gathering. Roosevelt brought together experts who held a great variety of views and balanced them off against each other while Hoover did not enjoy critical advice from anyone. See [10], pp 70-73 and pp 114-116.

[6]This regularity assumption guarantees that the low type has an incentive to undertake reform and mimic the high type when the high type takes perfectly informed action when he implements reform (see the proof of Lemma 1).

The public observes the politician's policy choice (status quo or reform) and the final outcome.[7] Their updated belief, or the reputation of the politician, can be written as

$$\mu_i(y) \equiv \Pr(t = H|\, y, i)$$

by Baye's rule, where $i = 0$ indicates status quo and $i = 1$ indicates reform. We use μ_0 to denote the politician's reputation when no reform is implemented as the outcome is always zero. We also use $\mu_{1H}(\theta)$ and $\mu_{1L}(\theta)$ to denote the expected reputation payoff of the high type and the low type from choosing to reform when the value of the reform proposal is θ. Analogous to the vast career concern literature, we assume that the politician's payoff purely depends on his reputation. The politician therefore chooses the action that maximizes his reputation.

We adopt the concept of Perfect Bayesian Equilibrium to analyze the game.

3 The Analysis

First, we consider the outcome of reform. When the status quo is abandoned, and an action a is taken, the expected output of the reform is given by

$$E(y) = \theta - E_{\omega \in \{-1,1\}}(a - \omega)^2 \geq 0. \tag{2}$$

Since a low-type politician's signal is completely noisy, the outcome is the same regardless of his action. A high-type politician, however, would use his signal to maximize his probability of success.

In the first-best situation, a politician would adopt the reform if and only if the expected outcome $E(y)$ is nonnegative. A low-type politician should never reform regardless of θ as the expected loss from wrong actions always exceeds the benefit of reform, that is,

$$E(y) = \frac{1}{2}\theta + \frac{1}{2}(\theta - 4) \leq \theta_h - 2 < 0,$$

as the support of the value of reform $[\theta_l, \theta_h] \subset (1, 2)$. By contrast, the expected outcome for a high-type politician is given by

$$E(y) = \theta - 4(1 - q).$$

Thus, the high type should undertake reform if and only if the value of reform is sufficiently high:

$$\theta \geq 4(1 - q).$$

[7] In our setup, whether or not the public observe the action is inconsequential. Once the politician chooses reform, the belief of the public is determined only by whether the outcome is a "failure" or "success."

When the value of reform is below $4(1-q)$, reform is socially undesirable regardless of the type of the politician.

We now formally analyze the politician's policy choice. Let $\rho_t(\theta)$ be the probability with which a type-t politician chooses reform when its value is θ. We focus on *monotonic equilibria*, where the politician's probability of undertaking reform is nondecreasing in θ, the potential value of reform. Define $\overline{\theta}_t \equiv \inf\{\theta | \rho_t(\theta) > 0\}$. Thus, a type-$t$ politician undertakes reform with a positive probability only if the value θ exceeds a cutoff $\overline{\theta}_t$. To summarize, we consider equilibria that satisfy:

A type-t politician maintains the status quo when the value of reform is lower than $\bar{\theta}_t$ and adopts reform with probability $\rho_t(\theta)$ in state $\theta \geq \bar{\theta}_t$, where $\bar{\theta}_t \geq 4(1-q)$.

Given the politician's behaviour above, when the politician maintains the status quo, his reputation among the public will be

$$\mu_0 = \frac{\alpha F(\overline{\theta}_H) + \alpha \int_{\overline{\theta}_H}^{\theta_h} [1-\rho_H(\theta)] f(\theta) d\theta}{\left[\begin{array}{l} \alpha F(\overline{\theta}_H) + \alpha \int_{\overline{\theta}_H}^{\theta_h} [1-\rho_H(\theta)] f(\theta) d\theta \\ +(1-\alpha) F(\overline{\theta}_L) + (1-\alpha) \int_{\overline{\theta}_L}^{\theta_h} [1-\rho_L(\theta)] f(\theta) d\theta \end{array}\right]}. \tag{3}$$

Clearly, when no reform occurs, the politician's reputation does not depend on his talent, as the outcome is always zero.

When the politician implements a reform of value θ, his reputation will become

$$\mu_1(\theta) = \frac{\alpha q \rho_H(\theta) f(\theta)}{\alpha q \rho_H(\theta) f(\theta) + (1-\alpha)\frac{1}{2}\rho_L(\theta) f(\theta)}$$

when the reform succeeds and

$$\mu_1(\theta - 4) = \frac{\alpha q \rho_H(\theta) f(\theta)}{\alpha q \rho_H(\theta) f(\theta) + (1-\alpha)\frac{1}{2}\rho_L(\theta) f(\theta)}$$

when the reform fails.

Define

$$q_t = \begin{cases} q & \text{for } t = H; \\ \frac{1}{2} & \text{for } t = L. \end{cases}$$

If a type-t politician implements a reform with value θ, he receives an expected payoff

$$\mu_{1t}(\theta) = q_t \mu_1(\theta) + (1-q_t)\mu_1(\theta - 4).$$

In any equilibrium, the low type does not reform when the realized value of reform satisfies $\theta < \overline{\theta}_H$. If he did in equilibrium, since the high type does not reform for $\theta < \overline{\theta}_H$, the public must assign probability one to him being the low type regardless of success or failure, thereby leaving him worse off than if he does not reform. Hence, we must have $\overline{\theta}_L \geq \overline{\theta}_H$ in any equilibrium. In the following lemma, we show that their strategies follow the same cutoff $\overline{\theta} = \overline{\theta}_L = \overline{\theta}_H$.

Lemma 1 *In any equilibrium that involves a positive probability of reform, (1) the cutoffs for reform must be the same for the low type and the high type, i.e.,* $\overline{\theta}_L = \overline{\theta}_H = \overline{\theta}$*; and (2) the high-type politician plays a pure strategy* $\rho_H(\theta) = 1$ *for any* $\theta \in [\overline{\theta}, \theta_h]$*.*

Proof. See Appendix. ■

The above lemma states that there is no full separation of the two types regardless of the value of the reform proposal. The same cutoff level $\overline{\theta} = \overline{\theta}_L = \overline{\theta}_H$ applies to both types of the politician. Above this threshold, the high type always undertakes reform and the low type mixes between reform and no reform.

As Perfect Bayesian Equilibrium imposes little restriction on out-of-equilibrium beliefs, there exist multiple equilibria and any cutoff $\overline{\theta} \in [\theta_l, \theta_h]$ could prevail in the equilibrium. To tighten our analysis, we assume that the politician is subject to a minimum level of "accountability" constraint on his strategy space. He is not allowed to implement any reform with a value $\theta < 4(1-q)$. Clearly, when a reform with $\theta < 4(1-q)$ is undertaken, the reform is socially detrimental even if it is implemented by a high-talent politician. We then assume that any reform with $\theta < 4(1-q)$ is socially unacceptable, and that a politician in office is obliged not to carry out such obviously socially undesirable activities, even if success may improve the perception on his competence. It should be noted that in our setup, the assumption of $[\theta_l, \theta_h] \subset (1, 2)$ guarantees that the true value of θ can be correctly inferred by the public after the output y is realized.

We then focus on our attention on equilibria with $\overline{\theta} \geq 4(1-q)$*.* The following is obtained.

Theorem 1 *There exist a continuum of Perfect Bayesian Equilibria with cutoffs* $\bar{\theta} \in [4(1-q), \theta_h)$*. For any* $\overline{\theta}$*, there exists a unique equilibrium probability* $\rho^* \in (0, 1)$*, such that the low-type politician undertakes reform with the probability* ρ^* *whenever he receives a signal* $\theta \geq \overline{\theta}$*.*

Proof. See Appendix. ■

The equilililibrium probability ρ^* solves

$$\frac{1}{1+\lambda(\alpha)A} = \frac{1}{2} \cdot \frac{1}{1+\lambda(\alpha)B} + \frac{1}{2} \cdot \frac{1}{1+\lambda(\alpha)C}, \tag{4}$$

where

$$\lambda(\alpha) = \frac{1-\alpha}{\alpha},\ A = 1 + (1-\rho^*)\kappa(\bar{\theta}),\ \kappa(\bar{\theta}) = \frac{1-F(\bar{\theta})}{F(\bar{\theta})},\ B = \frac{\frac{1}{2}\rho^*}{q},\ C = \frac{\frac{1}{2}\rho^*}{1-q}.$$

In the case when the high-type politician receives a perfect signal, i.e. $\Pr(\sigma = \omega | \omega) = 1$. A closed-form solution to ρ^* can be obtained, which yields

$$\rho^* = \frac{1-\alpha[1+F(\overline{\theta})]}{1-\alpha}. \tag{5}$$

The high type reforms with probability one when the prospect of reform is good, and does not reform when it is not. The low type, by contrast, mimics the high type with a positive probability in the former case, and does not reform in the latter. Even though the probability of success is only 1/2, it is optimal for the low type to reform because the choice of reform is a signal of high talent.

Comparative Statics

We now examine how the policy maker's equilibrium behaviour varies with environment parameters. We examine how a change in α, the prior of the public, or the proportion of high-type politicians, affects the probability with which a low-type politician conducts reform.

The answer to this question is not straightforward. When α increases, as implied by the equilibrium condition (16), a low-type's reputation goes up regardless of his policy choice. Formal analysis leads to the following conclusion.

Theorem 2 *Fixing a cutoff for reform, $\bar{\theta}$, the probability of reform by the low type, ρ^*, is strictly decreasing in α, the probability of high type.*

Proof. See Appendix. ■

The theorem states that the less favourable the public's prior assessment, the more likely the low type conducts reform. The analysis that is laid out above reveals its logic. A favourable prior assessment makes it more desirable for the low-type politician to maintain the status than to takes reform: on the one hand, the public would more likely attribute his failure to reform to the lack of opportunities (when a lower θ is realized) rather than the lack of talent; on the other hand, his loss from a failed reform would increase, which consequently weakens his incentive to reform. By contrast, a less favourable prior would strengthen his incentive to take risk, because it implies a lesser loss from a failed reform but a larger gain from a successful one. We then interpret this as the "pressure to prove oneself" phenomenon.

The result of Theorem 2 allows us to investigate another property of the equilibrium. In this game, reform would take place with probability

$$\bar{\rho} = [1 - F(\bar{\theta})][\alpha + (1-\alpha)\rho^*]. \tag{6}$$

Using Theorem 2, we may investigate whether more reform or less reform takes place when the public has a more favourable assessment of the politician's talent (or there is a higher proportion of capable politicians. Note that

$$\frac{\partial \bar{\rho}}{\partial \alpha} = [1 - F(\bar{\theta})][1 - \rho^* + (1-\alpha)\frac{\partial \rho^*}{\partial \alpha}]. \tag{7}$$

Two competing forces come into play when α is higher. On the one hand, since the low type reforms with a lower probability than the high type, the overall probability of reform increases when there is a higher proportion of high type. On the other hand, Theorem 2 implies that the low type reforms less when α is higher, causing the overall probability of reform to decrease. Our next theorem states that the second effect dominates.

Theorem 3 *The overall likelihood of reform $\bar{\rho}(\overline{\theta};\alpha)$ strictly decreases with α.*

Proof. See Appendix. ■

The analysis shows that the overall likelihood of reform would be unambiguously reduced when α increases. Theorem 3 yields an empirically testable hypothesis, namely, when there is a smaller proportion of capable politicians in the population or when the public holds a more pessimistic prior, more reform is expected. This conclusion is drawn without knowing the true type of the politician in office (which is the politician's private information and cannot be verified).

Next, we investigate how the low type's frequency of reform varies with q, the ability measure of the high-type politician.

Theorem 4 *Fix any equilibrium with cutoff $\overline{\theta}$, the probability of reform by the low type, ρ^*, is strictly decreasing in q.*

Proof. See Appendix. ■

Theorem 4 states that a low-type politician would mimic his high-type counterpart less often when the latter becomes more capable. The logic of this result is as follows. As the high type becomes more capable, the public is more likely to attribute an unsuccessful reform to a low-type politician, which unambiguously reduces the expected payoff of the low type from reform. This logic can be verified by evaluating $\mu_{1L}(\theta)$ with respect to q for a fixed ρ. Define $\lambda(\alpha) = \frac{1-\alpha}{\alpha}$. It yields

$$\frac{\partial \mu_{1L}(\theta)}{\partial q} = \frac{1}{2}\lambda(\alpha)\rho[\frac{1}{q + \frac{1}{2}\lambda(\alpha)\rho} - \frac{1}{(1-q) + \frac{1}{2}\lambda(\alpha)\rho}]. \tag{8}$$

The first term $(\frac{1}{q+\frac{1}{2}\lambda(\alpha)\rho})$ stands for the increase in reputation when the reform succeeds and the second $(\frac{1}{(1-q)+\frac{1}{2}\lambda(\alpha)\rho})$ the decrease in reputation when it fails. The combined effect is negative because $q > 1 - q$. A greater ability differential makes it more difficult for a low type to mimic his high-type counterpart, and therefore leads to a lower ρ^*. We then interpret this result as the "tough action to follow" phenomenon.

As implied by the analysis laid out above, the distribution of the value of reform does not qualitatively alter the main prediction of our analysis. We now examine how it quantitatively affects the equilibrium probability of low type undertaking reform.

Theorem 5 *Let ρ and ρ' denote respectively the equilibrium probabilities of the low type undertaking reform associated with distributions $F(\cdot)$ and $G(\cdot)$. For a fixed $\overline{\theta}$, then, $\rho > \rho'$ if $F(\cdot)$ first order stochastically dominates $G(\cdot)$.*

Proof. See Appendix. ■

The intuition of the theorem is as follows: when the prospect of reform is more likely to be good, the public would then believe a no-reform outcome is more likely to be caused by the politician's lack of talent, instead of the lack of opportunities (a lower θ is realized). It therefore lowers the public's rating of the politician when they observe no reform, and induces the low type to reform more often.

Comparison across Equilibria

Analogous to standard signalling game, our analysis yields multiple equilibria, which are characterized by differing cutoffs. One may interpret a higher cutoff $\overline{\theta}$ in the prevailing equilibrium as a proxy for escalating conservatism or more resistance to reform. Then we first investigate how the equilibrium strategy of a low-type politician ρ^* would differ across differing equilibria, i.e., how it responds to different levels of "conservatism".

Theorem 6 *The equilibrium probability of reform by the low type, ρ^*, strictly decreases with the cutoff $\overline{\theta}$.*

Proof. See Appendix. ■

The intuition is in line with that of Theorem 5. A higher cutoff $\overline{\theta}$ increases the size of $F(\overline{\theta})$, which in turn increases the low type's reputation when he does not take reform. This makes reform less attractive to the low type when the prospect of reform is above the threshold $\overline{\theta}$.

Theorem 6 allows us to further explore a politician's preference for "conservatism". We are interested in the following question: Do politicians prefer equilibria with more reform or less reform?

The high-type politician can benefit from more reform, as it allows the public to infer his type more often from successful reform. However, because ρ^* decreases with $\overline{\theta}$, an equilibrium with a lower cutoff $\overline{\theta}$ encourages his low-type counterpart to conduct reform, which then makes his reform less informative and tends to offset the gain he may have by undertaking reform.

Theorem 7 *The low-type politician always prefers an equilibrium with a higher cutoff $\overline{\theta}$; while the high-type politician always benefits from an equilibrium with a lower $\overline{\theta}$.*

Proof. See Appendix. ■

Theorem 7 states that the low type always prefers more conservative equilibria, while the high type prefers equilibria with more reform. The low type's aversion to reform embodies the logic that explains Theorem 5. On one hand, when $\overline{\theta}$ increases, a no-reform outcome reveals less information to the public, which allows the low type to receive a higher payoff from maintaining status quo. On the other hand, when the low type reforms less often, the public would believe a reform is increasingly likely to be implemented by the high type, which further reduces the damage to the low type when an unsuccessful reform realizes. Both effects contribute to the result. By way of contrast, the high type always prefers to reform as much as possible! In an equilibrium with a lower cutoff $\overline{\theta}$, his true type is more likely to be revealed.

4 Institution Design

In our analysis so far, we have assumed that the politician in office is maximally empowered. He is subject to virtually no institutional constraint except the *Accountability Constraint*, which prevents the politician from undertaking any reform with a value less than $4(1-q)$. Hereby we consider an alternative context, and we investigate the optimal institution that governs the politician's scope of discretion in the organization.

We assume that there exists a legislative body whose goal is to maximize social welfare, which may include parliaments, senate, or board of directors, etc. The legislative body enforces a limit of authority by restricting the action space of the politician. The rule set by the legislative body can be also understood as organizational bureaucracies discussed (see Tirole [26]), which restrict the discretion of the decision maker. Institutional restrictions on a decision maker's discretionary actions are prevalent in various organizations. For instance, an office-holding politician usually can only exercise limited discretion. Military commanders have to honor "rule of engagement" when resorting to forces. A bureaucrat in EPA is often handcuffed in terms of his power in regulating businesses. An attorney general's ability of legal enforcement is bounded to a large extent. Alternatively, a mutual fund manager is subject to various restrictions on investment activities.

In particular, the institution we focus on in this setting resembles a "rule of engagement". The legislative body is assumed not to know the true type of the politician. However, the behavior of the politician is subject to the its ex post auditing. The legislative body sets a threshold $\overline{\theta}'$ and a politician is allowed to undertake a reform only if the potential value of his available reform proposal exceeds the cutoff $\overline{\theta}'$. As aforementioned, the assumption of $\theta_h < 2$ guarantees that the true value of θ can be correctly inferred once the output y of a reform is realized. There are two lines in which we can illustrate the implementation of the rule. First, one may assume that the politician would be held accountable and be subject to severe non-pecuniary punishment, e.g., termination of career, if the rule is breached and a reform with $\theta < \overline{\theta}'$ were attempted. Second, analogous to Tirole [26], one may assume that the politician can form a partially informative report on the realization of θ when he advocates a reform.[8] The rule is then characterized by $\overline{\theta}'$. A higher $\overline{\theta}'$ represents a more conservative rule that grants less authority to the politician; while a lower $\overline{\theta}'$ represents a more liberal rule that tolerates reform more.

The institutional authority granting rule is aimed at maximizing social welfare. For any equilibrium with a given equilibrium cutoff $\overline{\theta}$, the social welfare in equilibrium can be written as a function

$$W = \underbrace{\alpha \int_{\overline{\theta}}^{\theta_h} [\theta - 4(1-q)] f(\theta) d\theta}_{W_1} + \underbrace{(1-\alpha)\rho^* \int_{\overline{\theta}}^{\theta_h} (\theta - 2) f(\theta) d\theta}_{W_2}. \tag{9}$$

The term W_1, which is strictly positive, represents the expected net gain from reform undertaken by the high-type politician; while the term W_2, which is strictly negative, depicts the next loss that results from the inefficient reform undertaken by the low type. Hence, a trade-off is triggered when a more liberal or a more conservative rule is adopted. Less reform leads to lesser gain from W_1, but could also reduce the damage from W_2. The optimum must depend on the tension between the two forces.

Our subsequent analysis proceeds in two steps. First, to further tighten our analysis and sharpen our prediction, we employ a commonly adopted refinement technique to select plausible equilibria. When a threshold rule $\overline{\theta}'$ is in place, our equilibrium result implies that there exist a continuum of equilibria, as no additional restriction is imposed on out-of-equilibrium belief. In each of these equilibria, a politician reforms with positive probabability whenever θ exceeds an equilibrium cutoff $\overline{\theta} \geq \overline{\theta}'$. The multiplicity of equilibria thus prevents us from drawing conclusive predictions on the behavior of the politician when the prevailing authorization rule differs. We follow Jeffrey S. Banks and Joel Sobel [2] and apply the "Divinity Criterion" to strike out implausible equilibria. Second, we characterize the optimum based on the unique equilibrium prediction through our refinement.

4.1 Equilibrium Refinement

Analogous to other conventional refinement techniques for signalling games, the Divinity Criterion seeks to impose additional restrictions on out-of-equilibrium beliefs. When an

[8] In addition, it should be remarked that the legislative body does not use contigent monetary transfer to elicit desirable action. The performance of a decision maker can be non-contractible in a wide array of settings. Consider the examples of career politicians, supreme court justices, and district attorney, to name a few. (shall we put it here, or move to some other places, or simple throw it into a footnote?)

unexpected signal is received, the receiver has to form a conjecture about the type of sender who deviates from the equilibrium path. The criterion is built upon the notion that a sender is willing to deviate by sending unexpected signal only if she hopes for a payoff higher than that in the equilibrium. Consider two differing types of senders. If one type is more likely to benefit from a given deviation, then the receiver should believe the former type deviates at least no less often than the latter. The receiver must assign in her posterior more weight to the type that is more likely to gain from the given deviation. A formal definition of this refinement criteron is rendered in Appendix. Our analysis leads to the following.

Theorem 8 *When a threshold rule $\overline{\theta}'$ is implemented, there is a unique equilibrium satisfies Divinity Criterion. In this equilibrium, $\overline{\theta} = \overline{\theta}'$.*

Proof. See Appendix. ■

It states that only the most aggressive equilibrium satisfies Divinity Criterion. The politician always reforms as much as possible. The logic behind this result is straightforward. It is driven by the fact that the high-type politician always benefits from an equilibrium with more reform, as evidenced by Theorem 7. The refinement criterion simply requires the belief system to reflect the natural notion that a capable politician prefers to reform as much as possible. This result paves a foundation for our subsequent analysis on welfare-maximizing institution design.

4.2 Institution Design: Optimal "Rule of Engagement"

An authorization rule that specifies the minimum value of an acceptable reform $\overline{\theta}'$. By our refinement result, it must lead to an equilibrium with a cutoff $\overline{\theta} = \overline{\theta}'$ in the subsequent game. We now explore the optimal authorization rule that maximizes social welfare W.

To start our analysis, suppose a threshold $\overline{\theta}' \in [4(1-q), \theta_h]$ is enforced. If a reform proposal with a value $\theta \in [\overline{\theta}', \theta_h]$ is realized, then reform is undertaken with a probability $\alpha + (1-\alpha)\rho^*$, and it generates an ex ante expected output

$$E(y|\,\theta, \overline{\theta}') = \alpha[\theta - 4(1-q)] + (1-\alpha)\, \rho^*|_{\overline{\theta}=\overline{\theta}'}\, (\theta - 2).$$

Define define $\underline{\rho} \equiv \lim_{\overline{\theta}\uparrow\theta_h} \rho^*$. We have the following.

Lemma 2 *Suppose that an institutional rule $\widetilde{\theta} \in [4(1-q), \theta_h]$ is enforced.*

(a) Whenever $\frac{(1-\alpha)\underline{\rho}}{\alpha} < \frac{\theta_h - 4(1-q)}{2-\theta_h}$, there exists a unique $\widetilde{\theta} \in (4(1-q), \theta_h)$, which uniquely solves

$$E(y|\,\widetilde{\theta}, \widetilde{\theta}) = \alpha[\widetilde{\theta} - 4(1-q)] + (1-\alpha)\, \rho^*|_{\overline{\theta}=\widetilde{\theta}}\, (\widetilde{\theta} - 2) = 0.$$

(b) $\widetilde{\theta}$ exhibits the following property:

$$E(y|\,\overline{\theta}', \overline{\theta}') \gtreqless 0 \text{ if and only if } \overline{\theta}' \gtreqless \widetilde{\theta}. \tag{10}$$

Proof. See Appendix. ■

Suppose that $\widetilde{\theta}$ indeed exists and that the legislative body enforces a cutoff $\widetilde{\theta}$, that is, only reform with $\theta \geq \widetilde{\theta}$ is allowed to be implemented. Note that $E(y|\,\theta, \overline{\theta}')$ must strictly increase with θ for a fixed $\overline{\theta}'$. Hence, the property of $\widetilde{\theta}$ demonstrated by (10) yields interesting implications. "Bad" reform with negative ex ante expected output is completely ruled out, because all admitted reform proposals (with $\theta \geq \widetilde{\theta}$) yield nonnegative expected payoffs. Furthermore, any less conservative authorization rule (with $\overline{\theta}' < \widetilde{\theta}$) must admit "bad" reform (because $E(y|\,\overline{\theta}', \overline{\theta}') < 0$ if $\overline{\theta}' < \widetilde{\theta}$), while any more conservative rule must eliminate "good" reform, which otherwise yields positive expected output (because $E(y|\,\overline{\theta}', \overline{\theta}') > 0$ if $\overline{\theta}' > \widetilde{\theta}$). Is $\widetilde{\theta}$ the optimal cutoff $\overline{\theta}^*$ that maximizes social welfare? If not, then is the the optimal institution more conservative or less conservative, i.e., does the optimum require $\overline{\theta}'^* < \widetilde{\theta}$ or $\overline{\theta}'^* > \widetilde{\theta}$?

Our analysis yields the following.

Theorem 9 *The public prefers no reform, i.e.,* $\overline{\theta}^* = \theta_h$*, if and only if* $\frac{(1-\alpha)\rho}{\alpha} \geq \frac{\theta_h - 4(1-q)}{2-\theta_h}$*; While a unique socially optimal cutoff* $\overline{\theta}'^* \in (\widetilde{\theta}, \theta_h)$ *exists if and only if* $\frac{(1-\alpha)\rho}{\alpha} < \frac{\theta_h - 4(1-q)}{2-\theta_h}$.

Proof. See Appendix. ■

It states that the optimal threshold $\overline{\theta}'^*$ must exceed $\widetilde{\theta}$. The welfare maximizing institutional rule requires more conservatism than $\widetilde{\theta}$. To understand its logic, we now evaluat the marginal impact of an increase in $\overline{\theta}'$ on social welfare. Taking first order derivative of (9) with respect to $\overline{\theta}'$ yields

$$\frac{dW}{d\overline{\theta}'} = f(\overline{\theta}') \left\{ \begin{array}{l} -\alpha[\overline{\theta}' - 4(1-q)] - (1-\alpha)\rho^*(\overline{\theta}' - 2) \\ \qquad\qquad +(1-\alpha)\frac{d\rho^*|_{\overline{\theta}=\overline{\theta}'}/d\overline{\theta}'}{f(\overline{\theta}')} \int_{\overline{\theta}'}^{\theta_h} (\theta - 2) f(\theta) d\theta \end{array} \right\}. \tag{11}$$

An increase in $\overline{\theta}'$ affects W through three venues. First, it reduces the beneficial reform undertaken by the high type, and therefore decreases the gain from reform by the high-type politician. This loss is given by the term $-\alpha[\theta - 4(1-q)]$, which is obviously negative. Second, a higher cutoff $\overline{\theta}'$ (directly) reduces the ex ante inefficient reform undertaken by the low type. This (direct) effect is embodied through the term $-(1-\alpha)\rho^*(\overline{\theta}' - 2)$, which is unambiguously positive, because $\overline{\theta} < \theta_h < 2$. Third, it allows the low-type politician to refrain from reforming for any given $\theta \geq \overline{\theta}$, which further reduces the loss from the inefficient reform undertaken. This positive (indirect) effect is depicted by the term $(1-\alpha)\frac{d\rho^*|_{\overline{\theta}=\overline{\theta}'}}{d\overline{\theta}'} \int_{\overline{\theta}'}^{\theta_h} (\theta - 2) f(\theta) d\theta$.

The decomposition of $\frac{dW}{d\overline{\theta}'}$ unambiguously points out that $\widetilde{\theta}$ is never the optimum, despite that it does not lead to any ex ante inefficient reform, while it does not block away any ex ante efficient reform. When $\widetilde{\theta}$ is enforced, we must have $\left.\frac{dW}{d\overline{\theta}'}\right|_{\overline{\theta}=\widetilde{\theta}} > 0$, because the first two terms are equal to zero by the definition of $\widetilde{\theta}$, but the last term, $(1-\alpha)\left.\frac{d\rho^*|_{\overline{\theta}=\overline{\theta}'}}{d\overline{\theta}'}\right|_{\overline{\theta}'=\widetilde{\theta}} \int_{\widetilde{\theta}}^{\theta_h}(\theta-2)f(\theta)d\theta$, is positive. Hence, the optimal cutoff $\overline{\theta}'^*$ must exceed $\widetilde{\theta}$: although such a conservative cutoff would deter productive reform and decrease, it would also deter detrimental reform undertaken by the low type by decreasing ρ^*. We then learn that the optimum must require proper "conservatism" towards potential reform.

Reform can be socially desirable if and only if the condition $\frac{(1-\alpha)\underline{\rho}}{\alpha} \geq \frac{\theta_h-4(1-q)}{2-\theta_h}$ is met. Because $\underline{\rho}$ decreases with α (by Theorem 2), LHS must strictly decreases with α. Hence, this condition is more likely to be met with a larger α, i.e., a higher proportion of high-talent politicians. When the talent required for successful reform is very scarce, the public may prefer not to allow for any reform, as the gain from efficient reform undertaken by the high type cannot offset the loss from increased inefficient reform.

Similarly, the condition is more likely met with a larger q. That is, reform is socially beneficial only when the high type is sufficiently capable.

These arguments further lead to more general conclusions on the impact of α and q on the properties of $\overline{\theta}^* \in (\widetilde{\theta}, \theta_h)$.

Theorem 10 *The socially optimal cutoff $\overline{\theta}^*$ decreases with α and q.*

Proof. See Appendix. ■

Example: Uniform Distribution

In this subsection, to gain more insights on the optimal institution $\overline{\theta}^*$, we consider an example in which the value of reform follows a uniform distribution

$$F(\theta) = \frac{\theta - \theta_l}{\theta_h - \widehat{\theta}}$$

and the high-talent politician receives a perfect signal, i.e., $q = 1$. In any equilibrium with a given cutoff $\overline{\theta}$, the equilibrium strategy ρ^* is given by

$$\begin{aligned} \rho^* &= \frac{1-\alpha[1+F(\overline{\theta})]}{1-\alpha} \\ &= 1 - \frac{\alpha(\overline{\theta}-\theta_l)}{(1-\alpha)(\theta_h-\theta_l)}. \end{aligned} \tag{12}$$

Theorem 5 demonstrates that the equilibrium behaviour depends on the properties of the distribution of θ. We now discuss its impact on $\overline{\theta}^*$ in the case of the uniform distribution. We consider an increase in the upper bound, θ_h. It implies that the probability mass of the distribution is shifted upward, high-valued reform proposals are more likely, and more beneficial opportunities are possible. This has two effects. On the one hand, low-valued

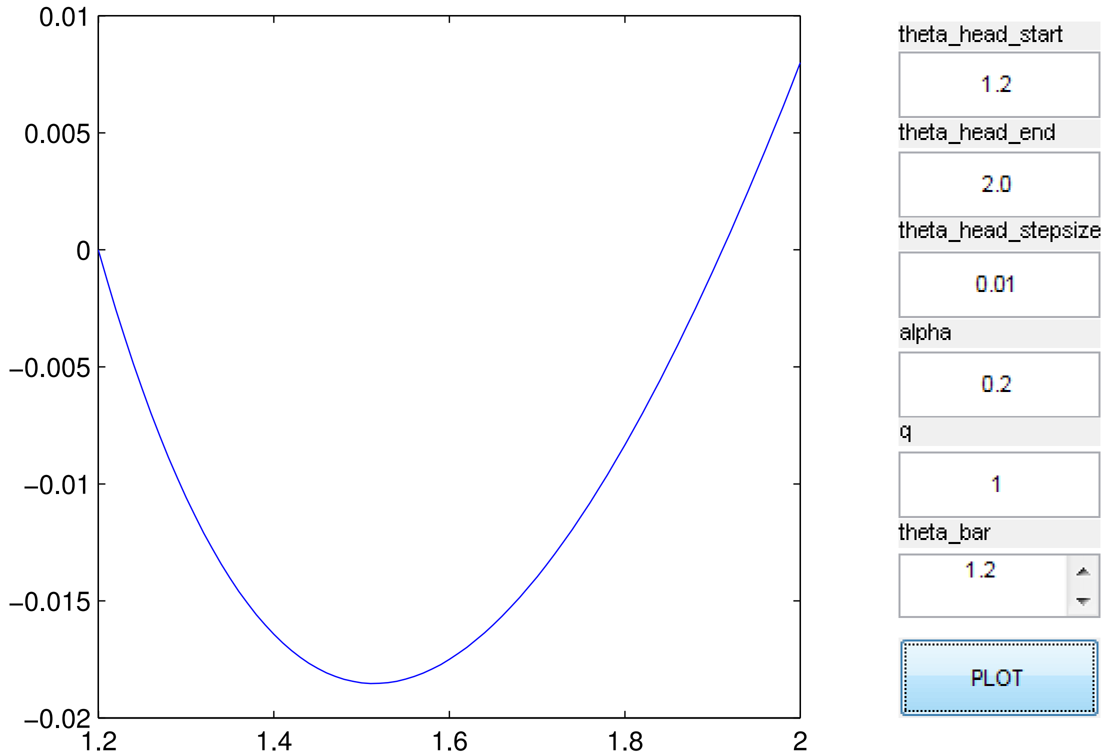

Figure 1: The Nonmonotonic Effect of $\widehat{\theta}$ on Social Welfare

reform proposals would emerge less often, and they cause less damage. It tends to cause the cutoff $\overline{\theta}^*$ to fall in order to realize the gain from the increased reform opportunities. On the other hand, for any given cutoff, the low type reforms more (see Theorem 5), which increases social loss and tends to lift $\overline{\theta}^*$. The overall effect remains obscure.

To illustrate this trade-off, let us consider the welfare implication of an increasing $\widehat{\theta}$ in an arbitrary equilibrium with a fixed $\overline{\theta}$. Figure 1 testifies to such nonmonotonicity and ambiguity, where θ is assumed to follow a uniform distribution.

The ambiguous welfare implication compels us to further look into its implications on the socially optimal institution. Should a more favorable numerical results thus compel us to address the following question: Would more opportunities imply a more conservative or less conservative rule? We then obtain the following.

Proposition 1 *The socially optimal cutoff point for reform, $\overline{\theta}^*$ strictly increases with θ_h.*

Proof. See Appendix. ■

Our comparative static analysis yields unambiguous results. We find that when the probability mass of the uniform distribution is shifted upward, i.e., when more opportunities of reform can be expected, it unambiguously lifts the optimal cutoff $\overline{\theta}^*$. A more conservative social optimum is then expected.

5 Concluding Remarks

In this paper, we study a politician's incentive to implement reform when his true ability is privately known but he is concerned about the public's perception of his ability. The politician then chooses his action to maximize his reputation payoff. We find that a high-type politician always attempts to reform as much as possible, which "forces" his low-type counterpart to mimic with positive probability. Socially inefficient reform therefore results. We further explore the socially optimal level of empowerment, and we find that both radicalism and conservatism may find their support depending on the specific parameterization.

Our paper sets forth a simple theoretical framework to investigate politician's incentive to undertake innovative but risky action when he has reputation concerns. Our paper leaves open plenty possibilities of extensions and variations. For instance, one may extend the model to allow a larger strategy space, or to allow the payoff of the politician to depend on realized outcome of his policy choice. Although we believe extensions in these directions would not yield predictions that fundamentally depart from those out of the current setting, these more comprehensive settings may still spawn richer comparative statics that further add to our understanding on this issue.

6 Appendix: Proofs

Proof of Lemma 1

Proof. First, observe that $q > 1/2$ implies that $\mu_1(\theta) > \mu_1(\theta - 4)$ as long as $\rho_H(\theta) > 0$ and $\rho_L(\theta) > 0$. But, this implies that $\mu_{1H}(\theta) > \mu_{1L}(\theta)$. Thus, whenever both types choose reform with a positive probability, the high type must choose it with probability one.

Second, we claim that whenever the high type chooses reform with a positive probability, the low type must do so as well. We have shown that whenever both types choose reform with positive probability, the high type's probability of reform is one and therefore at least as high as the low type's. Therefore, the overall probability for the low type to choose the status quo, P_{0L}, is weakly higher than that for the high type, P_{0H}. Thus, if the low type chooses the status quo, his reputation is $\mu_0 = \frac{\alpha P_{0H}}{\alpha P_{0H} + (1-\alpha) P_{0L}} \leq \alpha$.

However, if he deviates and undertakes reform, he is believed to be a high type with probability one if $q < 1$. If $q = 1$, his payoff depends on the public's off-equilibrium belief when reform fails. However, he succeeds with probability $\frac{1}{2}$, and the resulting expected payoff still exceeds α. Therefore, it cannot be that the low type always chooses the status quo when the high type chooses reform. This completes our proof. ■

Proof of Theorem 1

Proof. We now determine the low-type politician's probability of reform for a proposal with value θ, which we denote by $\rho(\theta)$ to economize on notation. By (3), if the politician maintains the status quo, his payoff is

$$\begin{aligned} \mu_0 &= \frac{\alpha F(\bar{\theta})}{\alpha F(\bar{\theta}) + (1-\alpha) F(\bar{\theta}) + (1-\alpha) \int_{\underline{\theta}}^{\widehat{\theta}} [1-\rho(\theta)] f(\theta) d\widehat{\theta}} \\ &= \frac{\alpha}{\alpha + (1-\alpha) \frac{F(\bar{\theta}) + \int_{\underline{\theta}}^{\widehat{\theta}} [1-\rho(\theta)] f(\theta) d\theta}{F(\bar{\theta})}}. \end{aligned} \tag{13}$$

Note that it does not depend on θ. On the other hand, if the low-type politician undertakes the reform, his payoff is given by

$$\begin{aligned} \mu_{1L}(\theta) &= \frac{1}{2} \cdot \frac{q\alpha f(\theta)}{q\alpha f(\theta) + \frac{1}{2}(1-\alpha)\rho(\theta) f(\theta)} + \frac{1}{2} \cdot \frac{(1-q)\alpha f(\theta)}{(1-q)\alpha f(\theta) + \frac{1}{2}(1-\alpha)\rho(\theta) f(\theta)} \\ &= \frac{1}{2} \cdot \frac{\alpha}{\alpha + \frac{\frac{1}{2}(1-\alpha)\rho(\theta)}{q}} + \frac{1}{2} \cdot \frac{\alpha}{\alpha + \frac{\frac{1}{2}(1-\alpha)\rho(\theta)}{1-q}}. \end{aligned} \tag{14}$$

If the low-type plays a completely mixed strategy, $\rho(\theta) \in (0, 1)$, we need to equate (13) and (14), which implies that $\rho(\theta)$ must be a constant ρ regardless of the value θ. Consequently, in equilibrium,

$$\frac{\alpha}{\alpha + (1-\alpha) \frac{F(\bar{\theta}) + (1-\rho^*)[1-F(\bar{\theta})]}{F(\bar{\theta})}} = \frac{1}{2} \cdot \frac{\alpha}{\alpha + (1-\alpha) \frac{\frac{1}{2}\rho^*}{q}} + \frac{1}{2} \cdot \frac{\alpha}{\alpha + (1-\alpha) \frac{\frac{1}{2}\rho^*}{1-q}}, \tag{15}$$

which we may rewrite as

$$\frac{1}{1+\lambda(\alpha) A} = \frac{1}{2} \cdot \frac{1}{1+\lambda(\alpha) B} + \frac{1}{2} \cdot \frac{1}{1+\lambda(\alpha) C}, \tag{16}$$

where

$$\lambda(\alpha) = \frac{1-\alpha}{\alpha},\ A = 1 + (1-\rho^*)\kappa(\bar{\theta}),\ \kappa(\bar{\theta}) = \frac{1-F(\bar{\theta})}{F(\bar{\theta})},\ B = \frac{\frac{1}{2}\rho^*}{q},\ C = \frac{\frac{1}{2}\rho^*}{1-q}.$$

The expression $\lambda(\alpha)$ is the likelihood ratio of the low type versus the high type, $\kappa(\bar{\theta})$ is the likelihood ratio of reform having good prospects versus bad prospects, and A, B, and C are respective the likely hood ratios of the low type not reforming, having a successful reform, and having a failed reform versus the high type obtaining each outcome. Consider the equilibrium condition (16). Note that its LHS is μ_0 and its RHS is μ_{1L}. When $\rho = 0$, $\mu_0 \leq \alpha$, while $\mu_{1L} = 1$ as $B = C = 0$. Therefore, $\mu_0 < \mu_{1L}$. By contrast, when $\rho = 1$, $\mu_0 = \alpha$ as $A = 1$, and $\mu_{1L} < \alpha$, which can be seen from the fact that when $\rho = 1$

$$\alpha\mu_{1H} + (1-\alpha)\mu_{1L} = \alpha,$$

while $\mu_{1L} < \mu_{1H}$. Therefore, $\mu_0 > \mu_{1L}$.

Both the RHS and LHS of (16) are continuous in ρ. Furthermore, it is straightforward to show that the LHS strictly increases with ρ, while the RHS strictly decreases with ρ. Hence, we conclude that there must exist a unique $\rho^* \in (0,1)$ that solves (16). ■

Proof of Theorem 2

Proof. Consider the equilibrium condition (16). We have shown above that the left hand side of (16) is increasing in ρ^* and the right hand side decreasing in ρ^*. Note that A, B, and C do not contain α in their expressions. Thus, we may write

$$\frac{\partial(LHS - RHS) \text{ of } (16)}{\partial\alpha} = -\frac{1}{\alpha^2}\left[-\frac{A}{(1+\lambda(\alpha)A)^2} + \frac{1}{2}\cdot\frac{B}{(1+\lambda(\alpha)B)^2} + \frac{1}{2}\cdot\frac{C}{(1+\lambda(\alpha)C)^2}\right].$$

We want to evaluate the above derivative at the value of ρ that satisfies (16). Observe that $0 < B < C$ as $q \geq 3/4$, we may conclude then $B < A < C$ based on (16). From (16), we can also see that $1 - \frac{A}{1+\lambda(\alpha)A} = 1 - [\frac{1}{2}\cdot\frac{B}{1+\lambda(\alpha)B} + \frac{1}{2}\cdot\frac{B}{1+\lambda(\alpha)C}] = 1 - [\frac{1}{2}\cdot\frac{B}{1+\lambda(\alpha)B} + \frac{1}{2}\cdot\frac{B}{1+\lambda(\alpha)C}]$, which yields

$$\frac{A}{1+\lambda(\alpha)A} = \frac{1}{2}\cdot\frac{B}{1+\lambda(\alpha)B} + \frac{1}{2}\cdot\frac{C}{1+\lambda(\alpha)C}.$$

Therefore,

$$\begin{aligned} & \frac{1}{2}\cdot\frac{B}{(1+\lambda(\alpha)B)^2} + \frac{1}{2}\cdot\frac{C}{(1+\lambda(\alpha)C)^2} \\ = \quad & \frac{A}{1+\lambda(\alpha)A}\left[\frac{\frac{B}{1+\lambda(\alpha)B}}{\frac{B}{1+\lambda(\alpha)B}+\frac{C}{1+\lambda(\alpha)C}}\cdot\frac{1}{1+\lambda(\alpha)B} + \frac{\frac{C}{1+\lambda(\alpha)C}}{\frac{B}{1+\lambda(\alpha)B}+\frac{C}{1+\lambda(\alpha)C}}\cdot\frac{1}{1+\lambda(\alpha)C}\right]. \end{aligned}$$

The expression in the brackets is a convex combination of $\frac{1}{1+\lambda(\alpha)B}$ and $\frac{1}{1+\lambda(\alpha)C}$. Since $0 < B < C$, the former is larger, but the coefficient on the former is smaller than $\frac{1}{2}$. Using (16), we have

$$\frac{1}{2}\cdot\frac{B}{(1+\lambda(\alpha)B)^2} + \frac{1}{2}\cdot\frac{C}{(1+\lambda(\alpha)C)^2} < \frac{A}{(1+\lambda(\alpha)A)^2}.$$

Hence, at the value of ρ that satisfies (16),

$$\frac{\partial(LHS - RHS) \text{ of } (16)}{\partial\alpha} > 0.$$

Thus, by the implicit function theorem, the probability of reform by the low type, ρ, is decreasing in α, the probability of high type. ■

Proof of Theorem 3

Proof. The equilibrium condition can be rewritten as

$$G(\rho^*, \alpha) \equiv [1 + (1-\rho^*)\kappa(\bar{\theta})] - \frac{\rho^*[\lambda(\alpha)\rho^* + 1]}{4q(1-q) + \lambda(\alpha)\rho} = 0. \tag{17}$$

We have

$$\frac{\partial G(\rho^*, \alpha)}{\partial \rho^*} = [\kappa(\bar{\theta}) + 1 + \frac{4q(1-q)[1-[4q(1-q)]^2]}{[4q(1-q) + \lambda(\alpha)\rho^*]^2}],$$

where $\kappa(\bar{\theta}) = \frac{1-F(\bar{\theta})}{F(\bar{\theta})}$, and

$$\frac{\partial G(\rho^*, \alpha)}{\partial \alpha} = -\frac{1}{\alpha^2} \cdot \frac{\rho^{*2}[1-4q(1-q)]}{[4q(1-q) + \lambda(\alpha)\rho^*]^2}.$$

Since $q \geq \frac{3}{4}$, $G(\rho^*, q)$ is decreasing with q. Further,

$$\frac{\partial G(\rho^*, q)}{\partial \rho^*} = -\left[\kappa(\bar{\theta}) + 1 + \frac{4q(1-q)[1-[4q(1-q)]^2]}{[4q(1-q) + \lambda\rho^*]^2}\right] < 0.$$

We then obtain $\frac{d\rho^*}{dq} = -\frac{\frac{\partial G(\rho^*,q)}{\partial q}}{\frac{\partial G(\rho^*,q)}{\partial \rho^*}} < 0$. ■

Proof of Theorem 4

Proof. Because $\frac{\partial \rho^*}{\partial \alpha} < 0$, we only need to show $\left|(1-\alpha)\frac{\partial \rho^*}{\partial \alpha}\right| + \rho^* > 1$. We have

$$\begin{aligned} & \left|(1-\alpha)\frac{\partial \rho^*}{\partial \alpha}\right| + \rho^* \\ = \quad & \frac{(1-\alpha)}{\alpha^2} \frac{\frac{\rho^{*2}[1-[4q(1-q)]}{[4q(1-q)+\lambda(\alpha)\rho^*]^2}}{[\kappa(\bar{\theta}) + 1 + \frac{4q(1-q)[1-[4q(1-q)]]}{[4q(1-q)+\lambda(\alpha)\rho^*]^2}]} + \rho^* \end{aligned}$$

By the equilibrium, $(1-\rho^*)\kappa = \frac{\rho^*(\lambda(\alpha)\rho^*+1)}{4q(1-q)+\lambda(\alpha)\rho^*} - 1 = \frac{\rho^*(\lambda(\alpha)\rho^*+1) - 4q(1-q) - \lambda(\alpha)\rho^*}{4q(1-q)+\lambda(\alpha)\rho^*} = \frac{\lambda(\alpha)\rho^{*2} + \rho^* - \lambda(\alpha)\rho^* - 4q(1-q)}{4q(1-q)+\lambda(\alpha)\rho^*}$, which yields

$$\kappa = \frac{\lambda(\alpha)\rho^{*2} + \rho^* - \lambda(\alpha)\rho^* - 4q(1-q)}{[4q(1-q) + \lambda(\alpha)\rho^*](1-\rho^*)}, \tag{18}$$

and therefore

$$\begin{aligned}\kappa(\bar{\theta})+1 &= \frac{\lambda(\alpha)\rho^{*2}+\rho^{*}-\lambda(\alpha)\rho^{*}-4q(1-q)+[4q(1-q)+\lambda(\alpha)\rho^{*}](1-\rho^{*})}{[4q(1-q)+\lambda(\alpha)\rho^{*}](1-\rho^{*})} \\ &= \frac{\rho^{*}[1-4q(1-q)]}{[4q(1-q)+\lambda(\alpha)\rho^{*}](1-\rho^{*})}. \qquad (19)\end{aligned}$$

Hence,

$$\begin{aligned}&[\kappa(\bar{\theta})+1+\frac{4q(1-q)[1-[4q(1-q)]}{[4q(1-q)+\lambda(\alpha)\rho^{*}]^2}] \\ =& \frac{\rho[1-4q(1-q)]}{[4q(1-q)+\lambda(\alpha)\rho^{*}](1-\rho^{*})}+\frac{4q(1-q)[1-[4q(1-q)]}{[4q(1-q)+\lambda(\alpha)\rho^{*}]^2} \\ =& \frac{1-4q(1-q)}{[4q(1-q)+\lambda(\alpha)\rho^{*}]^2(1-\rho^{*})}[4q(1-q)+\lambda(\alpha)\rho^{*2}]. \qquad (20)\end{aligned}$$

We then obtain

$$\begin{aligned}&\left|(1-\alpha)\frac{\partial\rho^{*}}{\partial\alpha}\right|+\rho^{*} \\ =& \frac{(1-\alpha)}{\alpha^2}\cdot\frac{\frac{\rho^{*2}[1-[4q(1-q)]}{[4q(1-q)+\lambda(\alpha)\rho^{*}]^2}}{\frac{1-4q(1-q)}{[4q(1-q)+\lambda(\alpha)\rho^{*}]^2(1-\rho^{*})}[4q(1-q)+\lambda(\alpha)\rho^{*2}]}+\rho^{*} \\ =& \frac{(1-\alpha)}{\alpha^2}\cdot\frac{(1-\rho^{*})\rho^{*2}}{[4q(1-q)+\lambda(\alpha)\rho^{*2}]}+\rho^{*}. \qquad (21)\end{aligned}$$

To our purpose, we only need to show $\frac{(1-\alpha)}{\alpha^2}\cdot\frac{\rho^{*2}}{[4q(1-q)+\lambda(\alpha)\rho^{*2}]}>1$. Rewrite it as $\frac{(1-\alpha)}{\alpha^2}\cdot\frac{\rho^{*2}}{[4q(1-q)+\lambda(\alpha)\rho^{*2}]}=\frac{1}{\alpha}\cdot\frac{\lambda(\alpha)\rho^{*2}}{[4q(1-q)+\lambda(\alpha)\rho^{*2}]}=\frac{1}{\alpha}\cdot\frac{1}{[\frac{4q(1-q)}{\lambda(\alpha)\rho^{*2}}+1]}$. Hence, it suffices to show $\frac{1}{[\frac{4q(1-q)}{\lambda(\alpha)\rho^{*2}}+1]}>\alpha$. We claim $\frac{1}{[\frac{4q(1-q)}{\lambda(\alpha)\rho^{*2}}+1]}>\frac{1}{2}>\alpha$, i.e., $4q(1-q)>\lambda(\alpha)\rho^{*2}$. To show that, recall the equilibrium condition $1+(1-\rho^{*})m]=\frac{\rho^{*}(\lambda(\alpha)\rho^{*}+1)}{4q(1-q)+\lambda(\alpha)\rho^{*}}$, which implies $\frac{\rho^{*}(\lambda(\alpha)\rho^{*}+1)}{4q(1-q)+\lambda(\alpha)\rho^{*}}>1\Leftrightarrow\rho^{*}(\lambda(\alpha)\rho^{*}+1)>4q(1-q)+\lambda(\alpha)\rho^{*}\Leftrightarrow\lambda(\alpha)\rho^{*2}+\rho^{*}>4q(1-q)+\lambda(\alpha)\rho^{*}$. Because $\lambda(\alpha)>1$, $\lambda(\alpha)\rho^{*2}>4q(1-q)$ must hold.

Q.E.D ■

Proof of Theorem 5

Proof. Consider the equilibrium condition (16). Since $F(\cdot)$ first order stochastically dominates $G(\cdot)$, we have $F(\overline{\theta})<G(\overline{\theta})$. This implies that for any given ρ, LHS of (16) for F is lower than that for G, since $\kappa(\overline{\theta})$ is larger for F than for G.

As we have shown above, LHS of (16) strictly increases with ρ, while RHS strictly decreases. Thus, only if $\rho>\rho'$ can (16) hold for both distributions. ■

Proof of Theorem 6

Proof. Recall the equilibrium condition (17). When $\overline{\theta}$ increases, $\kappa(\bar{\theta}) \equiv \frac{1-F(\bar{\theta})}{F(\bar{\theta})}$ must decrease, which causes $G(\rho^*, \overline{\theta})$ to decrease. Further, as we have shown in the proof for previous results, $G(\rho^*, \overline{\theta})$ strictly decreases with ρ^*. By the implicit function theorem, we establish that when $\overline{\theta}$ increases, ρ^* must decrease. ■

Proof of Theorem 7

Proof. Recall that the equilibrium is defined by the equation

$$\underbrace{\frac{\alpha}{1+\frac{(1-\alpha)(1-\rho^*)[1-F(\bar{\theta})]}{F(\bar{\theta})}}}_{\mu_0} = \frac{1}{2}[\underbrace{\frac{\alpha}{\alpha+(1-\alpha)\frac{\frac{1}{2}\rho^*}{q}}}_{\mu_1'} + \underbrace{\frac{\alpha}{\alpha+(1-\alpha)\frac{\frac{1}{2}\rho^*}{1-q}}}_{\mu_1''}].$$

The politician in office receives a payoff μ_0 when he maintains the status quo. He receives a payoff μ_1' when he successfully implements a reform and μ_1'' when he fails. In any equilibrium with a given $\bar{\theta}$, the type-t politician receives a payoff

$$u_t = \begin{cases} q_t\mu_1' + (1-q_t)\mu_1'', & \text{for } \theta \geq \overline{\theta}; \\ \mu_0 & \text{for } \theta < \overline{\theta} \end{cases}. \tag{22}$$

Hence, in this equilibrium, the expected payoff of a type-t politician is given by

$$E(u_t) = \mu_0 F(\bar{\theta}) + [q_t\mu_1' + (1-q_t)\mu_1''][1-F(\bar{\theta})]. \tag{23}$$

Taking its derivative with respect to $\overline{\theta}$ yields

$$\begin{aligned} \frac{dE(u_t)}{d\overline{\theta}} &= \mu_0 f(\overline{\theta}) - [q_t\mu_1' + (1-q)\mu_1'']f(\overline{\theta}) \\ &\quad +[d\mu_0/d\overline{\theta}]F(\overline{\theta}) + \{d[q_t\mu_1' + (1-q_t)\mu_1'']/d\overline{\theta}\}[1-F(\bar{\theta})]. \end{aligned}$$

First, we claim that when $\bar{\theta}$ increases, $E(u_H)$ and $E(u_L)$ change in opposite directions. Therefore, the first part of the theorem implies the second part. This claim is an implication of the fact $\alpha E(u_H) + (1-\alpha)E(u_L) = \alpha$, or

$$E(u_H) = 1 - \lambda(\alpha)E(u_L).$$

Now, we prove the first part of the theorem. For a low-type politician, $E(u_L) = \mu_0$ because $\mu_0 = \frac{1}{2}\mu_1' + \frac{1}{2}\mu_1''$. Hence, we need only verify $\frac{d\mu_0}{d\theta} > 0$. Define

$$H(\rho^*, \overline{\theta}) = \underbrace{\frac{\alpha}{1+\frac{(1-\alpha)(1-\rho^*)[1-F(\bar{\theta})]}{F(\bar{\theta})}}}_{\mu_0} - \frac{1}{2}[\underbrace{\frac{\alpha}{\alpha+(1-\alpha)\frac{\frac{1}{2}\rho^*}{q}}}_{\mu_1'} + \underbrace{\frac{\alpha}{\alpha+(1-\alpha)\frac{\frac{1}{2}\rho^*}{1-q}}}_{\mu_1''}].$$

We have

$$\frac{d\mu_0}{d\overline{\theta}} = \frac{\partial\mu_0}{\partial\overline{\theta}} + \frac{\partial\mu_0}{\partial\rho^*}\cdot\frac{\partial\rho^*}{\partial\overline{\theta}} = \frac{\partial\mu_0}{\partial\overline{\theta}} + \frac{\partial\mu_0}{\partial\rho^*}\cdot[-\frac{\partial H(\rho^*,\overline{\theta})}{\partial\overline{\theta}}\Big/\frac{\partial H(\rho^*,\overline{\theta})}{\partial\rho^*}].$$

Because $\frac{\partial H(\rho^*,\overline{\theta})}{\partial\overline{\theta}} = \frac{d\mu_0}{d\overline{\theta}}$, we then have $\frac{d\mu_0}{d\overline{\theta}} = \frac{\partial\mu_0}{\partial\overline{\theta}}[1-\frac{d\mu_0}{d\rho^*}\Big/\frac{\partial H(\overline{\theta},\rho^*)}{\partial\rho^*}]$. We must have $1-\frac{d\mu_0}{d\rho^*}\Big/\frac{\partial H(\overline{\theta},\rho^*)}{\partial\rho^*} > 0$ because $\frac{\partial H(\rho^*,\overline{\theta})}{\partial\rho^*} = \frac{\partial\mu_0}{\partial\rho^*} - (\frac{\partial\mu_1'}{\partial\rho^*}+\frac{\partial\mu_1''}{\partial\rho^*})$, while $\frac{\partial\mu_0}{\partial\rho^*} > 0$, $\frac{\partial\mu_1'}{\partial\rho^*}, \frac{\partial\mu_1''}{\partial\rho^*} < 0$. ■

Proof of Theorem 8

Proof. We First formally translate the notion of the Divinity Criterion into our context. Fix an equilibrium with a cutoff $\overline{\theta} > 4(1-q)$. Suppose that an unexpected reform takes place. The public infers from its outcome that the proposal has a value $\theta \in [\overline{\theta}', \overline{\theta})$. The public forms a set of beliefs $\phi_\theta \equiv \{\widetilde{\rho}_H(\theta), \widetilde{\rho}_L(\theta)\}$, where $\widetilde{\rho}_t(\theta)$ specifies the probability of a type-t politician to undertake this reform. Given this conjecture, a type-t politician, when deviating, has a payoff

$$\begin{aligned}\mu_t(\theta;\phi_\theta) \quad &= \quad q_t \times \frac{\alpha\widetilde{\rho}_H(\theta)q}{\alpha\widetilde{\rho}_H(\theta)q + \frac{1}{2}(1-\alpha)\widetilde{\rho}_L(\theta)} \\ &\quad +(1-q_t)\times\frac{\alpha\widetilde{\rho}_H(\theta)(1-q)}{\alpha\widetilde{\rho}_H(\theta)(1-q)+\frac{1}{2}(1-\alpha)\widetilde{\rho}_L(\theta)}. \qquad (24)\end{aligned}$$

Let μ_t^* denote the payoff of a type-t politician in the equilibrium. Further define $\Phi_\theta^t \equiv \{\phi_\theta |\, \mu_t(\theta;\phi_\theta) > \mu_t^*\}$. We then have the following. ■

Definition 1 *Divinity Criterion: the out-of-equilibrium belief ϕ_θ satisfies:*

$$\widetilde{\rho}_t(\theta) \geq \widetilde{\rho}_{t'}(\theta) \text{ if } \Phi_\theta^{t'} \subset \Phi_\theta^t, \text{ with } t \in \{H,L\} \text{ and } t \neq t'.$$

Proof. Consider an arbitrary equilibrium with a cutoff $\overline{\theta} > \overline{\theta}'$. Suppose that an unexpected reform is undertaken, and the public observes that the reform has a potential value $\theta \in [\overline{\theta}', \overline{\theta})$. Define $\epsilon \equiv \frac{\alpha\widetilde{\rho}_H(\theta)}{\alpha\widetilde{\rho}_H(\theta)+(1-\alpha)\widetilde{\rho}_L(\theta)}$. Hence, by taking this reform, the high type has an ex ante expected payoff

$$\begin{aligned}\mu_H(\theta;\epsilon) \quad &= \quad q\times\frac{\epsilon q}{\epsilon q+\frac{1}{2}(1-\epsilon)} + (1-q)\times\frac{\epsilon(1-q)}{\epsilon(1-q)+\frac{1}{2}(1-\epsilon)} \\ &= \quad q\times\frac{1}{1+\frac{1}{2\epsilon q}(1-\epsilon)} + (1-q)\times\frac{1}{1+\frac{1}{2\epsilon(1-q)}(1-\epsilon)}. \qquad (25)\end{aligned}$$

She has an incentive to deviate if and only if $\pi_H(\theta)-\mu_0 \geq 0$. The low type, by contrast, has an ex ante expected payoff

$$\mu_L(\theta;\epsilon) = \frac{1}{2}\times\frac{1}{1+\frac{1}{2\epsilon q}(1-\epsilon)} + \frac{1}{2}\times\frac{1}{1+\frac{1}{2\epsilon(1-q)}(1-\epsilon)}. \qquad (26)$$

She has an incentive to deviate if and only if $\pi_L(\theta) - \mu_0 \geq 0$. Because $\frac{1}{1+\frac{1}{2\epsilon q}(1-\epsilon)} > \frac{1}{1+\frac{1}{2\epsilon(1-q)}(1-\epsilon)}$, we see that $\mu_H(\theta) - \mu_0 > 0$ whenever $\mu_L(\theta) - \mu_0 \geq 0$. It implies that the high type is always more likely to deviate by undertake an expected reform than the low type. The out-of-equilibrium belief must require $\epsilon \geq \alpha$ to reflect this fact.

We now prove $\mu_H(\theta) > \alpha$. Given $\epsilon \geq \alpha$, we only need to show

$$\frac{q^2}{\epsilon q + \frac{1}{2}(1-\epsilon)} + \frac{(1-q)^2}{\epsilon(1-q) + \frac{1}{2}(1-\epsilon)} > 1. \tag{27}$$

Rewrite LHS as $\frac{\epsilon q^2(1-q)+\frac{1}{2}(1-\epsilon)q^2+\epsilon q(1-q)^2+\frac{1}{2}(1-\epsilon)(1-q)^2}{[\epsilon q+\frac{1}{2}(1-\epsilon)][\epsilon(1-q)+\frac{1}{2}(1-\epsilon)]} = \frac{\epsilon q(1-q)+\frac{1}{2}(1-\epsilon)q^2+\frac{1}{2}(1-\epsilon)(1-q)^2}{[\epsilon q+\frac{1}{2}(1-\epsilon)][\epsilon(1-q)+\frac{1}{2}(1-\epsilon)]}$. We then set out to show

$$\begin{aligned} & \epsilon q(1-q) + \frac{1}{2}(1-\epsilon)q^2 + \frac{1}{2}(1-\epsilon)(1-q)^2 \\ \geq\ & \epsilon^2 q(1-q) + \frac{1}{4}(1-\epsilon)^2 + \frac{1}{2}\epsilon(1-\epsilon). \end{aligned} \tag{28}$$

Comparing LHS with RHS yields

$$\begin{aligned} & LHS - RHS \\ =\ & \epsilon(1-\epsilon)q(1-q) + \frac{1}{2}(1-\epsilon)[q^2 + (1-q)^2 - \frac{1}{2}(1+\epsilon)] \\ =\ & \frac{1}{2}(1-\epsilon)[2\epsilon q(1-q) + q^2 + (1-q)^2 - \frac{1}{2}(1+\epsilon)] \\ =\ & \frac{1}{2}(1-\epsilon)[q^2 + (1-q)^2 + 2q(1-q) - 2(1-\epsilon)q(1-q) - \frac{1}{2}(1+\epsilon)] \\ =\ & \frac{1}{2}(1-\epsilon)[\frac{1}{2}(1-\epsilon) - 2(1-\epsilon)q(1-q)] \\ =\ & \frac{1}{4}(1-\epsilon)^2[1 - 4q(1-q)], \end{aligned} \tag{29}$$

which is apparently positive because $4q(1-q) < 4 \times \frac{3}{16} = \frac{3}{4}$.

Given such a belief, the high type must deviate when θ is realized, because his expected payoff $\mu_H(\theta) > \alpha > \mu_0$. ■

6.1 Proof of Lemma 2

Proof. Consider the value of $\alpha[\overline{\theta}' - 4(1-q)] + (1-\alpha)\ \rho^*|_{\overline{\theta}=\overline{\theta}'}\ (\overline{\theta}' - 2)$. When $\overline{\theta}' = 4(1-q)$, it must be negative. When $\overline{\theta}'$ approaches $\widehat{\theta}$, we have its value approach $\alpha[\widehat{\theta} - 4(1-q)] + (1-\alpha)\underline{\rho}(\widehat{\theta} - 2)$, which is positive if and only if $\frac{(1-\alpha)\underline{\rho}}{\alpha} < \frac{\widehat{\theta}-4(1-q)}{2-\widehat{\theta}}$. Further recall that $E(y|\,\theta, \overline{\theta}')$ strictly increases with both θ and $\overline{\theta}'$. There must exist a unique $\widetilde{\theta}$ that solves the equation. ■

Lemma 3 and Its Proof

Because $f(\overline{\theta}) > 0$ for all $\overline{\theta} \in [-\widehat{\theta}, \widehat{\theta}]$, the sign of (10) is the same as that of $\frac{dW(\overline{\theta})}{d\overline{\theta}} \big/ f(\overline{\theta})$. For our purpose, it suffices to explore $dW(\overline{\theta})/d\overline{\theta} \big/ f(\overline{\theta})$. We then establish the following.

Lemma 3 *The expression $dW(\overline{\theta})/d\overline{\theta} \big/ f(\overline{\theta})$ strictly decreases with $\overline{\theta}$.*

Proof. Recall the equilibrium condition

$$G(\rho^*, m) = [1 + (1-\rho^*)m] - \frac{\rho^*(\lambda\rho^* + 1)}{4q(1-q) + \lambda\rho^*} = 0,$$

where $m \equiv \frac{1-F(\overline{\theta})}{F(\overline{\theta})}$. Hence, we have $\frac{\partial G(\rho^*,m)}{\partial m} = \lambda(1-\rho^*)$. Because $\frac{\partial G(\rho^*,m)}{\partial \rho^*} = -[\kappa(\overline{\theta}) + 1 + \frac{4q(1-q)[1-[4q(1-q)]^2]}{[4q(1-q)+\lambda\rho]^2}] < 0$, we must have

$$\frac{d\rho^*}{dm} = \frac{1-\rho^*}{\kappa(\overline{\theta}) + 1 + \frac{4q(1-q)[1-[4q(1-q)]^2]}{[4q(1-q)+\lambda\rho^*]^2}}, \tag{30}$$

and therefore

$$\frac{d\rho^*}{d\overline{\theta}} \big/ f(\overline{\theta}) = -\frac{1-\rho^*}{[\kappa(\overline{\theta}) + 1 + \frac{4q(1-q)[1-[4q(1-q)]^2]}{[4q(1-q)+\lambda\rho^*]^2}][F(\overline{\theta})]^2}. \tag{31}$$

We now claim $-\frac{d\rho^*}{d\overline{\theta}} \big/ f(\overline{\theta})$ strictly decreases with $\overline{\theta}$. We have

$$\frac{d[-\frac{d\rho^*}{d\overline{\theta}} \big/ f(\overline{\theta})]}{d\overline{\theta}} = \frac{\begin{bmatrix} -\frac{d\rho^*}{d\overline{\theta}}[\kappa(\overline{\theta}) + 1 + \frac{4q(1-q)[1-[4q(1-q)]^2]}{[4q(1-q)+\lambda\rho^*]^2}][F(\overline{\theta})]^2 \\ -(1-\rho^*)\frac{d\{[\kappa(\overline{\theta})+1+\frac{4q(1-q)[1-[4q(1-q)]^2]}{[4q(1-q)+\lambda\rho^*]^2}][F(\overline{\theta})]^2\}}{d\overline{\theta}} \end{bmatrix}}{\{[\kappa(\overline{\theta}) + 1 + \frac{4q(1-q)[1-[4q(1-q)]^2]}{[4q(1-q)+\lambda\rho^*]^2}][F(\overline{\theta})]^2\}^2}. \tag{32}$$

Note that $-\frac{d\rho^*}{d\overline{\theta}}[\kappa(\overline{\theta}) + 1 + \frac{4q(1-q)[1-[4q(1-q)]^2]}{[4q(1-q)+\lambda\rho^*]^2}][F(\overline{\theta})]^2 = (1-\rho^*)f(\overline{\theta})$. We then only need to prove $\frac{d\{[\kappa(\overline{\theta})+1+\frac{4q(1-q)[1-[4q(1-q)]^2]}{[4q(1-q)+\lambda\rho^*]^2}][F(\overline{\theta})]^2\}}{d\overline{\theta}} > f(\overline{\theta})$. Rewrite $[\kappa(\overline{\theta})+1+\frac{4q(1-q)[1-[4q(1-q)]^2]}{[4q(1-q)+\lambda\rho^*]^2}][F(\overline{\theta})]^2$ as $F(\overline{\theta}) + \frac{4q(1-q)[1-[4q(1-q)]^2]}{[4q(1-q)+\lambda\rho^*]^2}[F(\overline{\theta})]^2$. When $\overline{\theta}$ increases, both $\frac{4q(1-q)[1-[4q(1-q)]^2]}{[4q(1-q)+\lambda\rho^*]^2}$ and $F(\overline{\theta})$ strictly increases. Hence, $\frac{d\{\frac{4q(1-q)[1-[4q(1-q)]^2]}{[4q(1-q)+\lambda\rho^*]^2}][F(\overline{\theta})]^2\}}{d\overline{\theta}} > 0$. Furthermore, $\frac{dF(\overline{\theta})}{d\overline{\theta}} = f(\overline{\theta})$. We then establish our claim.

Q.E.D. ■

Proof of Theorem 9

Proof. If $\frac{(1-\alpha)\rho}{\alpha} \geq \frac{\widehat{\theta}-4(1-q)}{2-\widehat{\theta}}$, then $\widetilde{\theta}$ does not exist. Any reform with a value $\theta < \widehat{\theta}$ must lead to negative expected output. Hence, no reform is ex ante beneficial, which implies $\overline{\theta}^* = \widehat{\theta}$. If $\frac{(1-\alpha)\rho}{\alpha} < \frac{\widehat{\theta}-4(1-q)}{2-\widehat{\theta}}$, then $\widetilde{\theta}$ exists. $\frac{dW(\overline{\theta})}{d\overline{\theta}} \big/ f(\overline{\theta})\Big|_{\overline{\theta}=\widetilde{\theta}} > 0$, but $\frac{dW(\overline{\theta})}{d\overline{\theta}} \big/ f(\overline{\theta})\Big|_{\overline{\theta}=\widehat{\theta}} < 0$ (because $\frac{(1-\alpha)\rho}{\alpha} < \frac{\widehat{\theta}-4(1-q)}{2-\widehat{\theta}}$), then there must exist a unique $\overline{\theta}^* \in (\widetilde{\theta}, \widehat{\theta})$ that solves $\frac{dW(\overline{\theta})}{d\overline{\theta}} \big/ f(\overline{\theta}) = 0$. ■

Proof of Theorem 10

Proof. Suppose that an interior optimum with $\overline{\theta}^* \in (0, \widehat{\theta})$ exists. Define $k \equiv [-\frac{d\rho^*}{d\overline{\theta}} \diagup f(\overline{\theta})]$. Then the optimal condition is

$$\upsilon(\overline{\theta}, \alpha) = \alpha[\overline{\theta} - 4(1-q)] + (1-\alpha)\rho(\overline{\theta})(\overline{\theta} - 2) - (1-\alpha)k \int_{\overline{\theta}}^{\widehat{\theta}} (2 - \overline{\theta}) f(\theta) d\theta = 0. \tag{33}$$

Apparently, $\frac{d\upsilon(\overline{\theta},\alpha)}{d\overline{\theta}} = -\frac{d\frac{\frac{dW(\overline{\theta})}{d\overline{\theta}}}{f(\overline{\theta})}}{d\overline{\theta}} > 0$. We now claim $\frac{d\upsilon(\overline{\theta},\alpha)}{d\alpha} > 0$. Taking first order derivative of $\upsilon(\overline{\theta}, \alpha)$ yields

$$\begin{aligned}
\frac{d\upsilon(\overline{\theta}, \alpha)}{d\alpha} &= [\overline{\theta} - 4(1-q)] - \rho^*(\overline{\theta} - 2) + (1-\alpha)\frac{d\rho^*}{d\alpha}(\overline{\theta} - 2) \\
&\quad + k \int_{\overline{\theta}}^{\widehat{\theta}} (2 - \overline{\theta}) f(\theta) d\theta - (1-\alpha)\frac{\partial k}{\partial \alpha} \int_{\overline{\theta}}^{\widehat{\theta}} (2 - \overline{\theta}) f(\theta) d\theta.
\end{aligned} \tag{34}$$

It suffices to show k strictly decreases with α and q. Recall by the proofs of previous results:

$$-\frac{d\rho^*}{d\alpha} = \frac{\frac{\rho^{*2}[1-[4q(1-q)]}{[4q(1-q)+\lambda\rho^*]^2}}{[\kappa(\overline{\theta}) + 1 + \frac{4q(1-q)[1-[4q(1-q)]^2]}{[4q(1-q)+\lambda\rho^*]^2}]} \cdot \left|\frac{d\lambda(\alpha)}{d\alpha}\right|. \tag{35}$$

Note $-\frac{d\frac{d\rho}{d\overline{\theta}}}{d\alpha} = -\frac{d\frac{d\rho}{d\alpha}}{d\overline{\theta}}$. Hence, we now evaluate $-\frac{d\rho^*}{d\alpha}$ with respect to $\overline{\theta}$. We first rearrange it as

$$\begin{aligned}
-\frac{d\rho^*}{d\alpha} &= \frac{\frac{\rho^{*2}[1-[4q(1-q)]}{[4q(1-q)+\lambda\rho^*]^2}}{[\kappa(\overline{\theta}) + 1 + \frac{4q(1-q)[1-[4q(1-q)]^2]}{[4q(1-q)+\lambda\rho^*]^2}]} \cdot \left|\frac{d\lambda(\alpha)}{d\alpha}\right| \\
&= \frac{(1-\rho^*)}{[\kappa(\overline{\theta}) + 1 + \frac{4q(1-q)[1-[4q(1-q)]^2]}{[4q(1-q)+\lambda\rho^*]^2}]} \cdot [1 - [4q(1-q)] \\
&\quad \cdot \frac{\rho^{*2}}{1-\rho^*} \cdot \frac{1}{[4q(1-q) + \lambda\rho^*]^2}.
\end{aligned} \tag{36}$$

We have established in the proof of Lemma 2 that $\frac{(1-\rho^*)}{[\kappa(\overline{\theta})+1+\frac{4q(1-q)[1-[4q(1-q)]^2]}{[4q(1-q)+\lambda\rho^*]^2}]}$ would strictly decrease with $\overline{\theta}$. So we only need to show $\frac{\rho^{*2}}{1-\rho^*} \cdot \frac{1}{[4q(1-q)+\lambda\rho^*]^2}$ decreases with $\overline{\theta}$ as well. Taking first order derivative of it with respect to $\overline{\theta}$ yields

$$\begin{aligned}
&\frac{\rho^*(2-\rho^*)\frac{d\rho^*}{d\overline{\theta}}}{(1-\rho^*)^2} \cdot \frac{1}{[4q(1-q) + \lambda\rho^*]^2} \\
&+ \frac{\rho^{*2}}{1-\rho^*} \cdot \frac{-2\lambda\frac{d\rho^*}{d\overline{\theta}}}{[4q(1-q) + \lambda\rho^*]^3}.
\end{aligned} \tag{37}$$

Because $\frac{d\rho}{d\overline{\theta}} < 0$, we need to show $(2-\rho^*)[4q(1-q) + \lambda\rho^*] - 2\lambda\rho^*(1-\rho^*) > 0$, which is obvious because $(2-\rho^*)[4q(1-q)+\lambda\rho^*]-2\lambda\rho^*(1-\rho^*) = (2-\rho^*)[4q(1-q)+\lambda\rho^*]-\lambda\rho^*(2-2\rho^*)$, and $2-\rho^* > 2-2\rho^*$. We further claim $\overline{\theta}^*$ decreases with q. To show that, we have to prove $\frac{d\upsilon(\overline{\theta},q)}{dq} > 0$. We have

$$\frac{d\upsilon(\overline{\theta},q)}{dq} = 4\alpha + (1-\alpha)\frac{d\rho^*}{dq}(\overline{\theta}-2) - (1-\alpha)\frac{dk}{dq}\int_{\overline{\theta}}^{\widehat{\theta}}(2-\overline{\theta})f(\theta)d\theta. \tag{38}$$

It would suffice to show $\frac{dk}{dq} < 0$. We use the same technique as above. We have

$$-\frac{d\rho^*}{dq} = \frac{\frac{4(2q-1)\rho^*(\lambda\rho^*+1)}{[4q(1-q)+\lambda\rho^*]^2}}{[\kappa(\overline{\theta}) + 1 + \frac{4q(1-q)[1-[4q(1-q)]^2]}{[4q(1-q)+\lambda\rho^*]^2}]}. \tag{39}$$

We then claim $-\frac{\partial^2\rho}{\partial q\partial\overline{\theta}} < 0$. Rewrite $-\frac{d\rho}{dq}$ as

$$-\frac{d\rho^*}{dq} = \frac{1-\rho^*}{[\kappa(\overline{\theta}) + 1 + \frac{4q(1-q)[1-[4q(1-q)]^2]}{[4q(1-q)+\lambda\rho^*]^2}]} \cdot \frac{1}{1-\rho^*} \cdot \frac{4(2q-1)\rho^*(\lambda\rho^*+1)}{[4q(1-q)+\lambda\rho^*]^2}. \tag{40}$$

Because $\frac{1-\rho^*}{[\kappa(\overline{\theta})+1+\frac{4q(1-q)[1-[4q(1-q)]^2]}{[4q(1-q)+\lambda\rho^*]^2}]}$ and $\frac{1}{1-\rho^*}$ decreases with $\overline{\theta}$, we only need to show $\frac{\rho^*(\lambda\rho^*+1)}{[4q(1-q)+\lambda\rho^*]^2}$ decreases with $\overline{\theta}$. Taking first order derivative of it with respect to $\overline{\theta}$ yields

$$\begin{aligned}
\frac{d\frac{\rho^*(\lambda\rho^*+1)}{[4q(1-q)+\lambda\rho^*]^2}}{d\overline{\theta}} &= \frac{\left[\begin{array}{c} (2\lambda\rho^*+1)\frac{d\rho^*}{d\overline{\theta}}[4q(1-q)+\lambda\rho^*]^2(1-\rho^*) \\ -2\rho^*(\lambda\rho^*+1)(1-\rho^*)[4q(1-q)+\lambda\rho^*]\lambda\frac{d\rho^*}{d\overline{\theta}} \\ +\rho^*(\lambda\rho^*+1)[4q(1-q)+\lambda\rho^*]^2\frac{d\rho^*}{d\overline{\theta}} \end{array}\right]}{(1-\rho^*)^2[4q(1-q)+\lambda\rho^*]^4} \\
&= \frac{\frac{d\rho^*}{d\overline{\theta}}}{[4q(1-q)+\lambda\rho^*]^3} \\
&\quad \times \left[\begin{array}{c} (2\lambda\rho^*+1)[4q(1-q)+\lambda\rho^*](1-\rho^*) - 2\lambda\rho^*(\lambda\rho^*+1)(1-\rho^*) \\ +\rho^*(\lambda\rho^*+1)[4q(1-q)+\lambda\rho^*] \end{array}\right]
\end{aligned} \tag{41}$$

The item in bracket is definitely positive because

$$\begin{aligned}
&\left[\begin{array}{c} (2\lambda\rho^*+1)[4q(1-q)+\lambda\rho^*](1-\rho^*) - 2\lambda\rho^*(\lambda\rho^*+1)(1-\rho^*) \\ +\rho^*(\lambda\rho^*+1)[4q(1-q)+\lambda\rho^*] \end{array}\right] \\
> \;& \lambda\rho^*\left[\begin{array}{c} (2\lambda\rho^*+1)(1-\rho^*) - 2(\lambda\rho^*+1)(1-\rho^*) \\ +\rho^*(\lambda\rho^*+1) \end{array}\right] \\
= \;& \lambda\rho^*[-\rho^* + \rho^*(\lambda\rho^*+1)] > 0.
\end{aligned} \tag{42}$$

Q.E.D. ■

Proof of Proposition 1

Proof. We examine how a higher upper support $\widehat{\theta}$ could affect $dW(\overline{\theta})/d\overline{\theta}$ for any given $\overline{\theta}$. When the high-type politician is perfectly informed, any positive θ would imply an efficient reform. The first-order derivative of the welfare function is as follows

$$\begin{aligned}\frac{dW(\overline{\theta})}{d\overline{\theta}'} &= \frac{1}{\theta_h-\theta_l}\left\{\begin{array}{l} -\alpha\overline{\theta}' - (1-\alpha)\rho^*(\overline{\theta}'-2) \\ +(1-\alpha)\frac{d\rho^*|_{\overline{\theta}=\overline{\theta}'}/d\overline{\theta}'}{f(\overline{\theta}')}\int_{\overline{\theta}'}^{\theta_h}(\theta-2)f(\theta)d\theta \end{array}\right\} \\ &= \frac{1}{\theta_h-\theta_l}\left\{\begin{array}{l} -\alpha\overline{\theta}' - (1-\alpha)[1-\frac{\alpha(\overline{\theta}'-\theta_l)}{(1-\alpha)(\theta_h-\theta_l)}](\overline{\theta}'-2) \\ +\frac{\alpha(\overline{\theta}-\theta_l)(\theta_h-\overline{\theta}')}{2(\theta_h-\theta_l)^2}[(\theta_h+\overline{\theta}')-4] \end{array}\right\}.\end{aligned}$$

We only need to look at the sign of the term w in the bracket learn the property of $\frac{dW(\overline{\theta})}{d\overline{\theta}}$. The optimal cutoff $\overline{\theta}^*$ is determined by the equation

$$w = -\alpha\overline{\theta}' - (1-\alpha)[1-\frac{\alpha(\overline{\theta}'-\theta_l)}{(1-\alpha)(\theta_h-\theta_l)}](\overline{\theta}'-2) + \frac{\alpha(\overline{\theta}'-\theta_l)(\theta_h-\overline{\theta}')}{2(\theta_h-\theta_l)^2}[(\theta_h+\overline{\theta}')-4] = 0$$

We only need to show $\frac{\partial w}{\partial\theta_h} > 0$. We have

$$\begin{aligned}\frac{\partial w}{\partial\theta_h} &= \frac{\alpha(\overline{\theta}'-\theta_l)(2-\overline{\theta}')}{(\theta_h-\theta_l)^2} + \frac{\alpha(\overline{\theta}'-\theta_l)(\theta_h-\overline{\theta}')}{2(\theta_h-\theta_l)^2} \\ &\quad +\alpha(\overline{\theta}'-\theta_l)[(\theta_h+\overline{\theta}')-4]\frac{(\theta_h-\theta_l)^2-2(\theta_h-\theta_l)(\theta_h-\overline{\theta}')}{2(\theta_h-\theta_l)^4} \\ &= \frac{\alpha(\overline{\theta}'-\theta_l)(2-\overline{\theta}')}{(\theta_h-\theta_l)^2} + \frac{\alpha(\overline{\theta}'-\theta_l)(\theta_h-\overline{\theta}')}{2(\theta_h-\theta_l)^2} \\ &\quad +\alpha(\overline{\theta}'-\theta_l)[(\theta_h+\overline{\theta}')-4]\frac{(\theta_h-\theta_l)-2(\theta_h-\overline{\theta}')}{2(\theta_h-\theta_l)^3} \\ &= \frac{\alpha(\overline{\theta}'-\theta_l)}{(\theta_h-\theta_l)^2}\left[(2-\overline{\theta}')+(\theta_h-\overline{\theta}')-(2-\frac{\theta_h+\overline{\theta}'}{2})\frac{(\theta_h-\theta_l)-2(\theta_h-\overline{\theta}')}{(\theta_h-\theta_l)}\right].\end{aligned}$$

If $(\theta_h-\theta_l)-2(\theta_h-\overline{\theta}') < 0$, then $\frac{\partial w}{\partial\theta_h} > 0$ is obvious. Assume $(\theta_h-\theta_l)-2(\theta_h-\overline{\theta}') > 0$. First, $(2-\overline{\theta}') > (2-\frac{\theta_h+\overline{\theta}'}{2}) > 0$. Second, we claim $\frac{(\theta_h-\theta_l)-2(\theta_h-\overline{\theta}')}{(\theta_h-\theta_l)} < 1$, which must hold because $(\theta_h-\theta_l)-2(\theta_h-\overline{\theta}') < (\theta_h-\theta_l)$. We then verify our claim. ■

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