Authoritarian Governance with Public Communication∗

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Abstract

Why would an authoritarian regime allow citizens to complain publicly if, as is often presumed, exchange of information among citizens invites social instability? This paper studies how an authoritarian regime allows citizens to publicly express preferences to strengthen its rule. We argue that public communication has two functions. First, it disorganizes the citizens or strengthens their disagreement if, through communication, they find themselves split over government policies. Second, if communication reveals that citizens share a high level of dissatisfaction, the government identifies the danger and improves the policies accordingly. We show that the government allows public communication if and only if it perceives sufficient heterogeneity among citizens. The model also illustrates that public communication could serve as a commitment device that ensures government responsiveness when it faces high dissatisfaction, which in turn makes the government better off than with private polling.

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To silence the populace is as grim a task as preventing flood. A blocked river would eventually inundate and cause great catastrophe; the same can be said of a stifled people. It is therefore wise to dredge the river to let it run free, and to enable the people to speak its mind.

——Discourses of the States (Guo Yu), around 500 BC

1 Introduction

In order to maintain social stability and stay in power, an authoritarian incumbent has to find a way to please and/or repress citizens under its rule (Svolik 2012). Sophisticated authoritarian rulers provide citizens with economic benefits, and prevent them from coordinating with each other against the government (Bueno de Mesquita and Downs 2005). Some argue that an authoritarian regime must severely limit citizens’ freedom to criticize the government (Levitsky and Way 2002), and dislikes information exchange among the citizens (Hollyer, Rosendorff and Vreeland 2011, 2013).

In reality, however, scholars find that citizens in authoritarian countries regularly complain to the authorities about poor government services and officials’ misconduct (Botero, Ponce and Shleifer 2013). Particularly, in China, the world’s most populated authoritarian country, a non-trivial proportion of citizens in both urban and rural areas publicly complain about the local government (Lorentzen 2013; Tsai and Xu 2013). These findings echo scholars’ earlier claim that the Chinese state sets up institutions that aim to solicit information from the citizens in an orderly and peaceful manner (Oi 2003; Nathan 2003; Lorentzen 2013).

In addition to the benefit of learning from citizens, we argue that allowing public communication could reveal or even strengthen citizens’ disagreement. When
they find themselves split over government policies, the reform-oriented citizens are more likely to blame the failure of the reform on their fellow citizens instead of the government. By allowing different groups to voice various preferences and opinions, some of which signify their support for the government, an authoritarian government takes advantage of its support and isolates those with opposite preferences (Gandhi 2008).

For example, in 2009, a national-wide discussion over the policy of college entrance exam was initiated in China. The household registration system (hukou) in China prevents students from taking college entrance examinations outside of their jurisdiction. It is widely perceived that other things being equal, students with hukou in Beijing and Shanghai are more likely to be admitted by better universities.¹ Even (domestic) migrant children studying in the city whose parents temporarily work there must take the entrance exam in their hukou hometowns (Lan 2014). As a result, people outside of Beijing and Shanghai wished to reform the system and relax the hukou-based restriction. Nevertheless during the discussion, according to media and internet reports, lots of people from Beijing and Shanghai launched several petitions to show their strong dissatisfaction with such a reform.² Several popular websites conducted public opinion polls online, which

¹It is perceived that top universities allocate a larger quota (scaled by population) for students from Beijing and Shanghai.

revealed a split of preferences for this policy reform, with evidence of the objection from urban residents with hukou in Beijing and Shanghai.\(^3\) The reform-oriented citizens thus realized it is impossible to get support from those with opposite preferences. In this example, permitting public communication made it possible for the government to take advantage of its support. Nevertheless, in reality, citizens’ public communication does not always benefit the government, especially when it faces uncertainty about their opinions and preferences.

To better understand under what conditions an authoritarian is willing to allow public communication, we develop a game theoretic model. In the benchmark, we assume that citizens are not fully aware of how their preferences are correlated, and the government, though not fully informed about their preferences, has an additional private signal of the overall level of citizen dissatisfaction against the status quo policy. Public communication is a process by which citizens publicly express their preferences or opinions over government policies. Unlike in democracies, whether to allow citizens to speak out their preferences is a strategic choice of the government. If permitted, each citizen sends a message at no cost (i.e., cheap-talk). These messages are public information. The government then chooses a policy. After viewing the policy, the citizens simultaneously decide whether to participate in collective action demanding their desired policy. For simplicity, in the benchmark, we focus on the situation when the government has limited capacity to adjust policy. In other words, even if it makes an effort trying to change a policy, there is a chance that the reform could fail.\(^4\)


\(^4\)In the Appendix, we also characterize the equilibrium when the capacity to adjust policy is relatively large.
We emphasize that communication generates not only vertical information flows from the citizens to the government, but also horizontal information across the citizens.\footnote{This paper shares a similar insight as Farrell and Gibbons (1989), who investigate “cheap talk with two audiences.” A key difference is that in this paper, the two receivers (the government and the other citizen) take action sequentially rather than simultaneously. Our model can also be understood as a veto bargaining game with pre-bargaining communication. The proposer is able to control the information inflow while the two citizens need to coordinate on exercising the “veto power.”} Horizontal revelation, by making private information about individual preferences public, can either coordinate or discourage citizens in collective action. We call these the coordination effect and the discouragement effect, respectively.

As horizontal information flow takes place, vertical information flow, on the other hand, enables the government to respond to the fluctuating public opinion and to reduce the risk of citizens’ collective action by meeting their policy wishes. By allowing the government to condition policy on the vertical information flows, public communication allows the government to preempt the protests that are caused by horizontal learning. Thus, the strategic response to vertical information flows mitigates the cost of horizontal learning. This sometimes tilts the cost and benefit of citizens’ communication in favor of openness. The value of vertical information flow offers a direct justification for the wisdom in *Guo Yu* in our epigraph: a stifled people is like a blocked river; it is extremely dangerous if the ruler does not know that they are angry because they are not allowed to speak.

Thus we demonstrate that the government’s net gain from opening public deliberation can be decomposed into three driving forces. The first is the policy-adjustment effect through vertical learning, which is positive, since the government can always make good use of the citizens’ private information without its constraint being tightened. The second is the discouragement effect through hori-
izontal information flows, which is positive. The third one is the coordination effect in horizontal communication, which is negative.

Based on the interaction of the three driving forces, we characterize the government’s equilibrium strategy, and show that it permits public communication if and only if it perceives sufficient heterogeneity among citizens. Because in the baseline model we assume that the government has limited capacity to adjust policy, it mainly makes a trade-off between the coordination effect and the discouragement effect, although the policy-adjustment effect still exists. This result illustrates how government’s incentive of allowing public communication is affected by its perception about the chance of collective action. It is consistent with recent evidence that the Chinese government allows citizens to express their opinions with much freedom, but actively censors information that can potentially spur collective action (King, Pan and Roberts 2013). Furthermore, this also suggests that even when the policy-adjustment effect is small, the government may still allow public communication in order to take advantage of the discouragement effect. Thus, the existence of public communication does not necessarily lead to policy change.

Quite paradoxically, due to the presence of the discouragement effect, we show that the government may strictly prefer public communication to private polling, in which each citizen privately communicates her preference to the government. Specifically when the government knows that citizens are very likely to share opposite policy preferences, public deliberation makes it better off. This is because public deliberation serves as a commitment device, ensuring that the government fully responds to problems that spur popular anger, which in turn benefits the government. Under public communication, because citizens’ preferences are publicly revealed, they are discouraged from joining a protest when they find themselves split over the policies. With private polling, however, when a dissatisfied citizen
fails to see any policy changes, she is likely to over-estimate the probability that others are as equally dissatisfied with the government policies as she is. The chances of collective action are therefore higher than under public deliberation.\(^6\)

As an extension, we also consider the situation when citizens can privately communicate with each other without the government’s permission. Specifically, in the case where there could be private and effective horizontal communication across citizens without the platform provided by the government, we show that even a tiny possibility like this could push the government to become more open.\(^7\)

The main results of the paper are closely related to work that investigates the government control of information and citizens’ collective action (e.g., Casper and Tyson 2014; Dimitrov 2014; Edmond 2013; Egorov and Sonin 2012; Gehlbach and Sonin 2008; Landa and Tyson 2014; Little 2012, 2013, 2014; Lorentzen 2014; Shadmehr and Bernhardt 2011, 2012; Smith and Tyson 2014). For example, Magaloni (2006, 2010), Gandhi and Lust-Okar (2009), Little (2012, 2014) and Egorov and Sonin (2012) study how an authoritarian incumbent can use controlled elections to signal its strength and deter collective action.\(^8\) Little (2013) further argues that the

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\(^6\)We also characterize a condition under which the government strictly prefers private polling to public communication. This is when citizens do not fully realize their homogeneity and the government is fully aware of it. In this case, the government is strictly better off by using private polling to prevent dissatisfaction from spreading.

\(^7\)In the Appendix, we conduct various other extensions of the benchmark model that reinforce and complement our main argument.

\(^8\)A by-product result of the benchmark model is consistent with the signaling effect in the literature. Specifically, under the assumption that the government has additional private information, we show that whenever the discussion of a certain issue is shut down, discontent citizens tend to believe that more people demand the policy change than in the case when it is not shut down.
benefit of signaling strength in elections does not prevent the incumbent from learning from voters and making compromises accordingly. Lorentzen (2014) shows that a regime could permit traditional and online media, and thus gain some advantages of vertical information flow by improving monitoring of bureaucrats without being endangered by the horizontal information flows.

In line with Lorentzen (2014), our model incorporates the trade-off between the benefit of vertical information flows and the cost of horizontal information that may coordinate citizens. Slightly different from Egorov and Sonin (2012) and Lorentzen (2014), we assume that the value of vertical information flow is for policy adjustment rather than for bureaucratic monitoring. More importantly, we demonstrate that even without the policy adjustment effect, the authoritarian government may benefit from horizontal information flow because of the discouragement effect, and public communication as a commitment device could make the government strictly better off than private polling.

The benefit of horizontal information flows has not been sufficiently emphasized in the literature of comparative politics and positive political theory. In common-value models of collective action, Shadmehr and Bernhardt (2011) and Little (2012) show that allowing citizens to know more information (including the other citizens’ information) does not necessarily increase their incentive to protest. Different from theirs, our model allows private values. It is exactly the possibility of heterogeneous interests among citizens that makes the discouragement effect work. Furthermore, our model also illustrates a subtle interaction between vertical and horizontal information flows by establishing a private-value model with heterogeneous policy demands.

The arrangement of the paper is as follows. Section 2 introduces the basic framework and characterizes the equilibria. Section 3 compares public communic-
ation with private polling from the perspective of the authoritarian government. Section 4 considers an extension when citizens can privately communicate with each other without the government’s permission. Section 5 concludes.

2 Model

In this section, we introduce the basic framework and explain the mechanics of communication with a simple benchmark model. The Appendix presents the proofs for a generalized model.

2.1 Setup

Players and policy preferences. There are three players: a government, citizen 1 and citizen 2. The government has two policy options to choose from, \( x \in \{Q, R\} \). We call \( Q \) the status quo policy and \( R \) the reform policy. The government strictly prefers the status quo to reform, as if it is costly to implement the reform policy. Its preference over policy \( x \) is written as

\[
 u_G(x) = \begin{cases} 
 0 & \text{if } x = Q \\
 -\mu & \text{if } x = R
\end{cases}.
\]  

The two citizens can be one of two types, an anti-reform type, who prefers the status quo to reform, or a pro-reform type, who strictly prefers reform to the status quo. Citizen \( i \)'s type is denoted as \( \omega_i \in \{\omega, \overline{\omega}\} \), with \( \omega \) and \( \overline{\omega} \) representing an anti-reform type and a pro-reform type, respectively. We normalize a citizen’s

\textsuperscript{9}We can also interpret them as two groups of citizens.
policy gain from the status quo to zero, no matter what type she is, i.e.,

\[ u_i(Q; \omega_i) = 0, \quad i = 1, 2. \tag{2} \]

A citizen with an anti-reform preference likes the status quo better than reform:

\[ u_i(R; \omega_i = \omega) = -L < 0, \quad i = 1, 2. \tag{3} \]

A pro-reform citizen gets a strictly positive payoff from the reform policy:

\[ u_i(R; \omega_i = \overline{\omega}) = L, \quad i = 1, 2, \tag{4} \]

where \( L \) is common knowledge. We say reform policy \( R \) is the desired policy of the pro-reform type, and the status quo is the desired policy of the anti-reform type.

**Information.** Since the level of citizen dissatisfaction fluctuates over time, the citizens’ types \( \omega_1 \) and \( \omega_2 \) are unknown to the government and each other. However, both the government and the citizens share a common prior that a citizen prefers reform with probability one-half: \( p = \frac{1}{2}, \quad i = 1, 2. \tag{5} \)

The two citizens’ preferences (i.e., types) are (potentially) correlated. If one of

\[ \Pr(\omega_i = \overline{\omega}) = p = \frac{1}{2}, \quad i = 1, 2. \tag{5} \]

\[^{10}\]In the generalized model of the Appendix, we consider a more general preference \( u_i(R; \omega_i = \omega) = -L \leq 0, \) where \( L \) can be different from \( L. \)

\[^{11}\]In the Appendix, we characterize the equilibrium for an arbitrary prior \( p. \)
the citizens is pro-reform, with probability $\gamma$, the other one is also pro-reform, i.e.,

$$
\omega_j|\omega_i = \omega = \begin{cases} 
\bar{\omega} & \text{with probability } \gamma, \\
\omega & \text{with probability } 1 - \gamma 
\end{cases}, \quad i, j \in \{1, 2\}, \ i \neq j.
$$

(6)

$\gamma$ represents citizens’ preference correlation.\(^\text{12}\) Citizens face uncertainty about the distribution of public opinion, and only know that $\gamma$ follows a distribution on $[0, 1]$ according to a cumulative distribution function $G(\cdot)$. Therefore, citizens merely have a rough estimation about it, i.e., the expected correlation $\bar{\gamma} = E(\gamma)$. The government faces uncertainty about the realization of citizens’ preferences, yet gets a private signal about their distribution $\gamma$. For simplicity, we assume that the government directly observes the preference correlation $\gamma$.\(^\text{13}\)

The probability $p$ measures the extent to which citizens and the government have a conflict of interest. $\gamma$ captures the homogeneity of citizens. Lower preference correlation $\gamma$ implies that citizens are more heterogeneous.

**Policy adjustment.** The government can choose an effort $e \in [0, 1]$ to adjust the policy. With probability $e\sigma$, the reform policy $R$ will be implemented; otherwise, the status quo $Q$ will be kept. $\sigma \in [0, 1]$ is exogenous and measures the state capacity to adjust the policy. The main results are established when the capacity

\(^{12}\)The distribution of $\omega_j|\omega_i = \omega$ is characterized in Equation (A2) in the Appendix. Under the assumption that $p = \frac{1}{2}$, $\Pr(\omega_j = \bar{\omega}|\omega_i = \omega) = \gamma$.

\(^{13}\)When the government does not directly observe the preference correlation $\gamma$, the results will be exactly the same, as long as it gets a private signal $\tilde{t}$ with $E(\gamma|t)$ strictly increasing, continuously differentiable in the signal realization $t$, and

\[ \lim_{t \rightarrow \frac{1}{2}} E(\gamma|t) = \max\{0, 1 - \frac{1 - \bar{E}}{p}\}, \lim_{t \rightarrow \tilde{t}} E(\gamma|t) = 1, \]

where $[\underline{t}, \tilde{t}]$ is the support of the marginal distribution of $\tilde{t}$. In the Supplementary Appendix, we investigate an extension when the government does not have more information than the citizens. We make a relevant discussion and comparison with the benchmark model.
of adjustment in this particular policy domain is limited (i.e., $\sigma$ is small\textsuperscript{14}). The equilibrium when the capacity is large is also characterized in the Appendix.

The citizens observe only the policy outcome $x$, but do not observe the government’s effort $e$.

**Timing and actions.** The timing of actions is as follows.

Period (0) *Institutional design.* The government chooses whether or not to open public deliberative platforms to let citizens speak, $\alpha \in \{0, 1\}$. When $\alpha = 0$, a citizen’s voice will not be heard by the government or her fellow citizen. On the contrary, when $\alpha = 1$, citizens are allowed to send messages and their messages will be heard by both the government and the other citizen.

Period (1) *Public communication.* If allowed (i.e., $\alpha = 1$), each citizen sends a message $m_i \in \{0, 1\}$ to the government at no cost. The message is publicly observable. We interpret $m_i = 1$ as complaining and $m_i = 0$ as abstaining. If $\alpha = 0$, this period is skipped.

Period (2) *Policy adjustment.* The government chooses how to adjust the policy $e \in [0, 1]$. The citizens observe only the policy outcome $x$, but do not observe the government’s effort $e$.

Period (3) *Collective action.* Each citizen simultaneously decides whether to participate in a popular protest ($a_i = 1$) or not ($a_i = 0$).

**Collective action and payoffs.** Each player’s payoff consists of two parts: a payoff at the policy-adjustment stage, and a payoff at the collective-action stage. We denote them as the “policy payoff” and the “collective-action payoff,” respectively, although the latter can also be seen as policy driven. For simplicity, we assign

\textsuperscript{14}This assumption is consistent with the fact that policy adjustment in China is limited to smaller-scale, incremental changes (Tsai and Xu 2013).
equal weight to the two payoffs.\footnote{The results are qualitatively the same if we assign different weights.}

Successful collective action requires both citizens to participate. In this case, a new policy $y \neq x$ gets implemented and the government suffers $\rho_2 > 0$.\footnote{Depending on the magnitude of $\rho_2$, we can interpret collective action in different ways. It can be a small-scale protest demanding that the government change a particular policy or punish a misbehaved local official, as often happens in China. It can also be a social movement aiming at a regime change, after which citizens or a new government implement the reform policy.} If only one of the citizens participates, the government suffers a cost $\rho_1 > 0$. Throughout the paper we assume $\rho_2 > \mu > \rho_1$. Moreover, with probability $\lambda \in (0, \min\{\frac{1}{2}, \frac{1}{L}\})$, the individual protest is successful and the new policy $y \neq x$ is implemented; with probability $(1 - \lambda)$, it is not successful and the original policy $x$ remains unchanged. If neither citizen participates, no policy change happens and the government suffers no cost. Citizen $i$’s collective-action payoff is represented by:

\[
\begin{array}{c|cc}
\text{participate (i)} & \text{participate (j)} & \text{abstain (j)} \\
\hline
\text{participate (i)} & u_i(y; \omega_i) - k_i & \lambda u_i(y; \omega_i) + (1 - \lambda)u_i(x; \omega_i) - k_i \\
\text{abstain (i)} & \lambda u_i(y; \omega_i) + (1 - \lambda)u_i(x; \omega_i) & u_i(x; \omega_i) \\
\end{array}
\]

where $k_i$ is citizen $i$’s cost of participating in collective action. $k_i$ is $i$’s private information and is only known to her after she observes the government’s policy $x$.\footnote{We can show that, even if the citizens know their private costs of collective action in the deliberation stage, the outcome induced in any symmetric cut-point equilibrium will be the same as they do not know the costs. The intuition is that a citizen with a high collective-action cost always has an incentive to pretend to be of low cost so as to persuade the other citizen to join the protest. As a result, in any symmetric cut-point equilibrium, cheap-talk produces no information of the collective-action cost that would change the equilibrium outcome.} $k_i$ is assumed to be independent and identically distributed between 0 and 1 with a cumulative distribution function $F(\cdot)$. We assume $F(\cdot)$ is weakly concave;
and \( f(k) = F'(k) > 0, \forall k \in [0, 1] \). The distribution of the cost of participating in collective action captures the repression technology of the government.

The government’s total payoff also consists of two parts: a policy implementation cost \(-e\sigma\mu\) and a cost from collective action, which we summarize as follows:

<table>
<thead>
<tr>
<th>Participate ((i))</th>
<th>Participate ((j))</th>
<th>Abstain ((i))</th>
<th>Abstain ((j))</th>
</tr>
</thead>
<tbody>
<tr>
<td>-(\rho_2)</td>
<td>-(\rho_1)</td>
<td>-(\rho_1)</td>
<td>-(\mu)</td>
</tr>
</tbody>
</table>

Denote \( A \equiv (1-\lambda)L \), which is the payoff gain of joining a protest (excluding the protest cost) provided that the other citizen also participates. Similarly, \( B \equiv \lambda L \), is the payoff gain when the other citizen does not participate. Hence, we have \( 0 < B < \min\{1, A\} \).

The equilibrium notion is Perfect Bayesian Equilibrium. Because multiple equilibria may exist as in other cheap-talk/signaling games, we focus on equilibria in which citizens truthfully reveal their types (preferences) when allowed. Such equilibria involve the following requirements:

(i) \( \alpha^*(\gamma) \) as the probability of allowing public communication, maximizes the government’s expected payoff given the citizens’ equilibrium strategies, beliefs, and the government equilibrium policy-adjustment strategies;

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18We can verify that the uniform distribution and any distribution with a cumulative distribution function \( F(k) = k^\delta \) \((0 < \delta < 1)\) satisfy this property. The concavity of the distribution is used merely to guarantee the unique prediction in the collective-action stage. Without this assumption, we may need to deal with the problem of multiple equilibria, although the properties in the equilibrium we focus on are still valid.

19The condition \( A > B \) captures an important feature of authoritarian regimes: complementarity in collective action, that is, when knowing that others are less likely to join the collective action, one’s incentive to join it also decreases.
(ii) when public communication is (not) allowed, \( \alpha = 1 (\alpha = 0) \), \( e_1^\ast(\gamma, m_1, m_2) \) (\( e_0^\ast(\gamma) \)) as the probability of making an effort to adjust the policy, maximizes its expected payoff given the citizens’ equilibrium strategies and beliefs;

(iii) \( \hat{\gamma}_x^\ast \) as the citizens’ belief about their homogeneity \( \gamma \) when the finalized policy is \( x \) and public communication is not allowed (\( \alpha = 0 \)), is formed by Bayes’ rule given the government’s equilibrium strategies, for \( x \) that takes place with positive probability in equilibrium;\(^{20}\)

(iv) each citizen’s strategy in the collective-action stage maximizes her own welfare, given the equilibrium belief about social homogeneity \( \gamma \) and the other one’s equilibrium strategy.

We first pin down the equilibrium features at the collective-action stage based on the conjecture that such a citizen-truth-telling equilibrium exists. Then, we use those properties to check the incentive compatibility (IC) constraints of the citizens at the communication stage. In the end, we investigate the government’s optimal choice of whether to open public communication.

2.2 Equilibrium Characterization

The collective-action stage.

The following lemma (as well as a more technical version of it, Lemma 4 in the Appendix) shows that in any (citizen-truth-telling) equilibrium, the citizens’ strategy at the collective-action stage is uniquely determined.\(^{21}\) Specifically, if her

\(^{20}\)When public communication is allowed, because we focus on the citizen-truth-telling equilibrium, citizens directly observe each other’s preference.

\(^{21}\)Without the standard common-value global games setup, we still get the uniqueness feature at the collective-action stage. As implied by Morris and Shin (2006), whether the prediction for collective action in both common value and private value games is unique depends on how we
desired policy is implemented, a citizen never protests; otherwise she protests if and only if her realized cost of joining the protest is relatively small.

Since neither the government nor the other citizen observes a citizen’s cost of collective action, both can only gauge her probability of participation based on the prior of her cost of collective action and the equilibrium cut-point, which is characterized by Lemma 4 in the Appendix. Equation A18 in the Appendix defines \( p_0(\hat{\gamma}) \) as the endogenous probability that a discontent citizen protests, where \( \hat{\gamma} \) is the probability with which she believes that the other citizen is of the same type.

**Lemma 1 (Characterizing the collective-action stage)** In any equilibrium in which both citizens truthfully reveal their types when they are allowed to speak, each citizen uses a cut-point strategy characterized in Lemma 4 in the Appendix. Specifically, (1) a citizen never protests if her desired policy is implemented; (2) otherwise, the probability that she protests equals \( p_0(\hat{\gamma}) \), where \( \hat{\gamma} \) is her perception whether the other citizen shares the same preference; and (3) \( p_0(\hat{\gamma}) \) is an increasing function characterized by Equation A18 in the Appendix.

With public communication, when the other citizen also claims to be dissatisfied by disclosing the same preference, a dissatisfied citizen joins a protest with the highest possible probability \( p_0(1) \) since she knows that the other one has a similar incentive, and the collective action is likely to be successful. If a dissatisfied citizen infers that the other one is satisfied, she then chooses to join a protest with probability \( p_0(0) \). However, if public communication is not allowed, a dissatisfied citizen can only condition her behavior on her perception of the social

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technically parameterize the payoffs and the uncertainty, both of which capture assumptions of common knowledge. The technical approach we use, i.e., incorporating private costs, is similar to Palfrey and Rosenthal (1985), that Morris and Shin (2006) call a *private-value interaction/global game*. 

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homogeneity $\hat{\gamma}$ (which could depend on the finalized policy $x$). The probability of her joining a protest is therefore $p_0(\hat{\gamma})$. Lemma 1 helps us understand the role of horizontal communication in facilitating or impeding collective action. Compared with no communication, with public communication, a dissatisfied citizen increases her probability of joining a protest from $p_0(\hat{\gamma})$ to $p_0(1)$, when she finds the other one is also dissatisfied and decreases her probability of protest from $p_0(\hat{\gamma})$ to $p_0(0)$ when she finds that the other citizen is satisfied. We illustrate the two possibilities in Figure 1.

![Figure 1. Horizontal communication and participation in collective action](image)

**The government’s decision to open public communication.**

Suppose $G_1(e, \omega_1, \omega_2)$ is the government’s payoff in every possible situation $(\omega_1, \omega_2)$ when it allows public communication and it chooses an effort $e \in [0, 1]$; $G_0(e, \omega_1, \omega_2)$ is its payoff in every possible situation $(\omega_1, \omega_2)$ when it forbids communication and chooses an effort $e \in [0, 1]$. 
If both citizens are pro-reform types, i.e., $\omega_1 = \omega_2 = \overline{\omega}$, with public communication they know each other’s type and each independently protests against the status quo policy with probability $p_0(1)$. The government’s payoff therefore is:

$$G_1(e, \omega_1, \omega_2) \big|_{\omega_1 = \omega_2 = \overline{\omega}} = -(1 - e\sigma)W(p_0(1)) - e\sigma\mu, \quad (7)$$

where

$$W(x) = \rho_2 x^2 + 2\rho_1 x(1 - x). \quad (8)$$

Without public communication, the only difference is in the citizens’ belief about each other. Hence without public communication the government’s payoff is

$$G_0(e, \omega_1, \omega_2) \big|_{\omega_1 = \omega_2 = \overline{\omega}} = -(1 - e\sigma)W(p_0(\hat{\gamma}_0^*)) - e\sigma\mu. \quad (9)$$

If both citizens are anti-reform types, i.e., $\omega_1 = \omega_2 = \underline{\omega}$, they do not protest against the status quo policy. If reform is launched, under public communication, each of them independently protests with probability $p_0(1)$. The government’s payoff is:

$$G_1(e, \omega_1, \omega_2) \big|_{\omega_1 = \omega_2 = \underline{\omega}} = -e\sigma[\mu + W(p_0(1))]. \quad (10)$$

Similarly, without public communication, the government’s payoff is

$$G_0(e, \omega_1, \omega_2) \big|_{\omega_1 = \omega_2 = \underline{\omega}} = -e\sigma[\mu + W(p_0(\hat{\gamma}_1^*))], \quad (11)$$

where the only difference from the payoff under communication is the dissatisfied citizens’ perception that the other citizen is of the same type.

If there is one pro-reform type and one anti-reform type, i.e., $\omega_1 \neq \omega_2$, with communication, whoever is dissatisfied protests with probability $p_0(0)$. Hence, the
The government’s payoff is:

\[ G_1(e, \omega_1, \omega_2) \mid \omega_1 \neq \omega_2 = -(1 - e \sigma) p_0(0) - e \sigma (\mu + \rho_1 p_0(0)). \] (12)

Similarly when public communication is not allowed, the government gets

\[ G_0(e, \omega_1, \omega_2) \mid \omega_1 \neq \omega_2 = -(1 - e \sigma) p_0(\tilde{\gamma}^*_0) - e \sigma (\mu + \rho_1 p_0(\tilde{\gamma}^*_1)). \] (13)

We summarize the government’s payoffs in each of the three cases under the two circumstances (\( \alpha = 0 \) and \( \alpha = 1 \)) and their differences in Table 1.\(^{22}\)

Without considering the learning effect of its own, the government benefits from deliberation when the two citizens are of different types, and loses from deliberation when both citizens share the same interests. In other words, public communication might be beneficial to government even if it does not adjust policies according to what it learns from the citizens.

Table 1. Net Gain from Opening Public Communication Holding Government’s Effort Constant

<table>
<thead>
<tr>
<th>( \omega_1 = \omega_2 = \omega )</th>
<th>( \omega_1 = \omega_2 = \tilde{\omega} )</th>
<th>( \omega_1 \neq \omega_2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \alpha = 1 )</td>
<td>(-e \sigma [\mu + W(p_0(1))])</td>
<td>(-(1 - e \sigma) W(p_0(1)) - e \sigma \mu)</td>
</tr>
<tr>
<td>( \alpha = 0 )</td>
<td>(-e \sigma [\mu + W(p_0(\tilde{\gamma}^*_1))])</td>
<td>(-(1 - e \sigma) W(p_0(\tilde{\gamma}^*_0)) - e \sigma \mu)</td>
</tr>
</tbody>
</table>

\[ G_1 - G_0 \leq 0 \quad -[1 - e \sigma] Z(\tilde{\gamma}^*_1) \leq 0 \quad (1 - e \sigma) \rho_1 [p_0(\tilde{\gamma}^*_0) - p_0(0)] > 0 \]

\[ e \sigma \rho_1 [p_0(\tilde{\gamma}^*_1) - p_0(0)] > 0 \]

Note: \( Z(x) \triangleq [W(p_0(1)) - W(p_0(x))] \). Equivalent expressions of the government payoffs are Equations A19 and A20 in the Appendix.

\(^{22}\)For the moment, we use the same notation \( e \) for the policy adjustments when the public communication is allowed or not allowed, implicitly assuming that the government efforts under the two circumstances are the same.
**Horizontal communication** has two possible effects on the government’s net gain from opening deliberation: the *coordination* effect, when the citizens find out that they share the same preference, i.e., \( \omega_1 = \omega_2 \), and the *discouragement* effect, when the citizens realize that they are of different types, i.e., \( \omega_1 \neq \omega_2 \).

Suppose \( e_0^*(\gamma) \) is the government’s optimal policy choice when public communication is not allowed, i.e., \( e_0^*(\gamma) \in \arg \max_e \mathbb{E}[G_0(e, \omega_1, \omega_2) | \gamma] \). The coordination effect is formally defined as the government’s net gain from citizens’ horizontal learning when they are of the same type, assuming the government sticks to \( e_0^*(\gamma) \), i.e.,

\[
\sum_{\omega_1 = \omega_2} \Pr(\omega_1, \omega_2 | \gamma) [G_1(e_0^*, \omega_1, \omega_2) - G_0(e_0^*, \omega_1, \omega_2)],
\]

which equals \(-\frac{1}{2}\gamma e_0^*(\gamma) \sigma [W(p_0(1)) - W(p_0(\hat{\gamma}_0))] + (1 - e_0^*(\gamma) \sigma) [W(p_0(1)) - W(p_0(\hat{\gamma}_0^*))]\) after simplification and is always non-positive.

Similarly, the discouragement effect is formally defined as a net gain from horizontal learning when citizens are different types, assuming the government sticks to \( e_0^*(\gamma) \), i.e.,

\[
\sum_{\omega_1 \neq \omega_2} \Pr(\omega_1, \omega_2 | \gamma) [G_1(e_0^*, \omega_1, \omega_2) - G_0(e_0^*, \omega_1, \omega_2)],
\]

which equals \((1 - \gamma)\rho_1 [(1 - e_0^*(\gamma) \sigma) (p_0(\hat{\gamma}_0^*) - p_0(0)) + e_0^*(\gamma) \sigma (p_0(\hat{\gamma}_1^*) - p_0(0))]\) after simplification and is always non-negative.

**Vertical communication** affects the government’s payoff through a direct learning effect. The government may also gain from opening deliberation since it learns the citizens’ preferences and adjusts policy when it finds that the citizens pose a real threat to its rule. The *policy-adjustment* effect from vertical communication is formally defined as the government’s net gain from learning the citizens’ preferences through deliberation, assuming that the citizens already know each other’s
preference, i.e.,
\[
E[\max_e G_1(e, \omega_1, w_2) - G_1(e_0^s(\gamma), \omega_1, \omega_2)|\gamma], \tag{16}
\]
which is always non-negative because there is no loss to obtain additional information that does not change the government’s constraints.

Hence we get the following **Hierarchical Communication Identity**, that shows that the government’s payoff difference between allowing and forbidding deliberation can be decomposed into the above three driving forces, i.e.,
\[
\begin{align*}
E[\max_e G_1(e, \omega_1, \omega_2) - G_0(e_0^s(\gamma), \omega_1, \omega_2)|\gamma] \\
= E[\max_e G_1(e, \omega_1, w_2) - G_1(e_0^s(\gamma), \omega_1, \omega_2)|\gamma] + \\
\sum_{\omega_1 = \omega_2} \Pr(\omega_1, \omega_2)[G_1(e_0^s(\gamma), \omega_1, \omega_2) - G_0(e_0^s(\gamma), \omega_1, \omega_2)|\gamma] + \\
\sum_{\omega_1 \neq \omega_2} \Pr(\omega_1, \omega_2)[G_1(e_0^s(\gamma), \omega_1, \omega_2) - G_0(e_0^s(\gamma), \omega_1, \omega_2)|\gamma]
\end{align*}
\tag{17}
\]
We summarize the above results in the following lemma.

**Lemma 2 (The Hierarchical Communication Identity)** The government’s net gain from opening public communication can be decomposed into three driving forces: (1) the policy-adjustment effect (a direct informational gain from vertical communication, provided that the citizens already know each other’s type) that is non-negative; (2) the coordination effect (a net gain from horizontal communication when the citizens are of the same type, provided that the government sticks to the effort without communication) that is non-positive; and (3) the discouragement effect (a net gain from horizontal communication when citizens are of different types, provided that the government sticks to the effort without communication)
that is non-negative.

Provided that the government has limited benefit from the vertical policy-adjustment effect, the trade-off is mainly in terms of the chances of the coordination event and discouragement event. As it perceives the citizens to be more heterogeneous, it will have a higher incentive to allow public communication, as the discouragement effect is more likely to take place. To verify this insight, we need to write down the difference in the government’s payoff between allowing and forbidding deliberation. The following observation is helpful to simplify the expression.

**Lemma 3 (No effort without public communication)** In any equilibrium, the government chooses not to make any effort to adjust policy when public communication is not allowed, i.e., $e^*_0(\gamma) \equiv 0$.

(See the proof of the generalized version Lemma 5 in the Appendix.)

Since the government does not make any effort without public communication, the policy-adjustment stage will not disclose more private information of the government. Thus, when public communication is not allowed, the government gets $-M(\gamma, p_0(\hat{\gamma}^*_0))$, where $\hat{\gamma}^*_0 = E(\gamma|\alpha = 0; \alpha^*(\cdot))$ is the citizens’ equilibrium belief about social homogeneity when public communication is not allowed, and

$$M(\gamma, x) = p\gamma x^2 \rho_2 + 2px(1 - \gamma x) \quad (18)$$

is the government’s expected loss from pro-reform citizens’ collective action with each of them protesting with probability $x$. When deliberation is allowed, the government gets $\max\{-W(p_0(1)), -\sigma \mu - (1 - \sigma)W(p_0(1))\}$ if it sees two pro-reform citizens. The maximum function represents the government’s choice whether to make an effort. It makes no effort and gets $-p_0(0)\rho_1$ if it sees only one pro-reform
citizen as making an effort brings a higher cost $\sigma(\mu + p_0(0)\rho_1) + (1 - \sigma)p_0(0)\rho_1$. The government makes no effort and gets 0 if the two citizens are anti-reform. The difference in the government’s payoff therefore is:

$$G_{\text{diff}}(\gamma, \hat{\gamma}_0^*) = M(\gamma, p_0(\hat{\gamma}_0^*)) - \frac{1}{2} \gamma \max\{W(p_0(1)), \sigma \mu + (1 - \sigma)W(p_0(1))\} - (1 - \gamma)p_0(0)\rho_1,$$

(19)

which is a function of its private information about social homogeneity $\gamma$. The following existence result characterizes the government’s equilibrium decision of opening deliberation, when the value of vertical information flows is limited, i.e., $W(p_0(1)) \leq \mu$, or $\sigma$ is sufficiently small. When $W(p_0(1)) \leq \mu$, the government does not benefit by improving the policy upon two pro-reform citizens even it has the capacity to do so. When $\sigma$ is sufficiently small, the government’s capacity to adjust the policy is limited, so that a high effort will not result in a significant policy improvement. Under these situations, the government mainly makes the trade-off between the driving forces of coordination and discouragement. As the private signal of the government indicates that the discouragement is more likely to take place, that is when the $\gamma$ is low, the government understands that the benefit will dominate in public communication, hence it will open public deliberation.\footnote{In Proposition 10 in the Appendix, we also characterize the equilibria when the government has a high capacity and willingness to adjust the policy. In that case, the government’s decision is driven by the value of vertical learning. As a private signal indicates a higher social heterogeneity, the horizontal risk of citizens’ coordination is smaller, hence the government becomes less willing to listen to citizens. Therefore, the government will allow public communication if and only if the private signal of the government indicates a high social homogeneity.}

We characterize the equilibrium as follows.

**Proposition 1 (Equilibrium characterization)** Provided $W(p_0(1)) \leq \mu$, or $\sigma$
is sufficiently small, (1) in any equilibrium, the government allows public communication if and only if its private signal indicates that citizens are sufficiently heterogeneous, i.e.,

\[
\alpha^* = \begin{cases} 
1 & \text{if } \gamma < \gamma^* \\
0 & \text{if } \gamma \geq \gamma^* 
\end{cases},
\]

(20)

where \( \gamma^* \in (0, 1] \);

(2) when the public communication is shut down, citizens will think that they are more homogeneous than in the case when public communication is allowed, i.e.,

\[
E(\gamma|\alpha = 0) > E(\gamma|\alpha = 1); \quad \text{and}
\]

(3) if \( \min_x G_{\text{diff}}(x, E(\gamma|\gamma \geq x)) < 0 \), there exists an equilibrium with interior cut-point equilibrium \( \gamma^* \in (0, 1) \).

(See the proof of the generalized version Proposition 4 in the Appendix.)

Government’s private signal of the social homogeneity \( \gamma \) serves as a measurement for the likelihood of collective action. It allows public communication if and only if the likelihood of collective action is small. This result helps to explain recent evidence that the Chinese government allows citizens’ free talk online provided that there is a low likelihood of collective action, but actively censors information that arouses public anger and that can potentially spur collective action (King, Pan and Roberts 2013). Because of the discouragement effect, the presence of public discussion over policies does not necessarily lead to a policy change.

The second part of the proposition suggests that whenever the discussion of a certain issue is shut down, discontent citizens tend to believe that more people demand the policy change than in the case when it is not shut down. This is

\footnote{An equilibrium with \( \gamma^* = 1 \) always exists. In this equilibrium, whenever the government shuts down the platform of public communication, citizens believe that they are perfectly correlated.}
consistent with the argument that an authoritarian incumbent can use publicly observable action to signal its strength (Little 2013; Egorov and Sonin 2012).

As multiple equilibria may exist, the following proposition helps to select the unique equilibrium that maximizes the government’s welfare, which also minimizes openness, i.e., \( \Pr(\gamma : \alpha^*(\gamma) = 1) \).

**Proposition 2 (Equilibrium selection) Provided conditions in Proposition 1, there exists a unique equilibrium \( \gamma^{**} \) that maximizes the government’s welfare.**

\[
\gamma^{**} = \inf_{\gamma^* \text{ is an equilibrium } \gamma^* > 0} \gamma^*
\]

also has the minimum level of openness among all equilibria.

*(See the Appendix for the proof.)*

The proposition suggests that the government needs to keep the openness in terms of letting people speak at the minimum level in order to maximize its own welfare. In other words, the existence of government’s effort to minimize social openness and citizens’ communication is not exclusive to the fact that it still keeps a certain level of openness. This observation and the possibility of multiple equilibria provides an alternative explanation for the empirical finding of mixed signals about the limits of the permissible speak in authoritarian politics (Stern and OBrien 2012). This also reflects the empirical pattern reported by scholars that complaint-making to the Chinese state is limited and kept at the minimum possible level (e.g., Shi 1997; Tsai and Xu 2013).

In the following we will focus on this particular equilibrium.

### 3 Private Polling

To prevent citizens from coordinating with each other in the public space, the government can shut down deliberative platforms, privately elicit information from
individuals (say, by conducting private polls), and then can decide how to respond to citizens’ policy demands. In the private polling setup, citizens’ messages are directly seen by the government. Is private polling a better option than deliberation for an authoritarian government? In this section, we will compare the government’s welfare in this private polling game and in the benchmark model where it chooses only between public communication and no communication.

The intuition is straightforward. Under public communication, because citizens directly observe each other’s preference, there is a chance for a pro-reform citizen to realize that the lack of reform is a result of the lack of support from her fellow citizen. Under private polling, they cannot directly observe each other’s preference. When the government understands they are heterogeneous, it is better for the government to let the citizens discover their heterogeneity themselves through public communication. In the opposite situation, when citizens do not realize their homogeneity, the government does not want them to find this out and interact, so private polling is preferred.

When the government conducts private polls, the citizens only learn each other’s preference based on observed government policies. When the government faces one or no pro-reform citizen, there is no need to make an effort for reform. We denote \( \varepsilon^* \) as the equilibrium effort of trying to reform when the government faces two pro-reform citizens. Under the status quo policy, a pro-reform citizen believes that the other citizen shares the same preference with probability \( q \); \( q \) is determined by \( \varepsilon^* \) and \( \gamma \), the publicly perceived social homogeneity:

\[
q(\varepsilon^*) = \Pr(w_j = \varnothing | w_i = \varnothing, x = Q) = \frac{\gamma(1 - \sigma \varepsilon^*)}{\gamma(1 - \sigma \varepsilon^*) + (1 - \gamma)}.
\]

\[
q(0) = \gamma, \quad q(1) = \frac{\gamma(1 - \gamma)}{1 - \gamma}, \quad q'(\varepsilon^*) = -\sigma \gamma (1 - \gamma) \left(1 - \gamma \sigma \varepsilon^*\right)^{-2} < 0, \quad \text{so that} \quad q(\varepsilon^*) \quad \text{is strictly decreasing in} \quad \varepsilon^*.
\]

By Lemma 1, a pro-reform citizen protests against the
status quo policy with probability \( p_0(q) \), which is also decreasing in \( \varepsilon^* \). This means that when a pro-reform citizen believes that the government makes a higher effort, she is more likely to think that the lack of reform is a result of the lack of support from her fellow citizen. Her incentive to join a protest therefore decreases.

We leave the characterization of equilibrium in the private polling game to the Appendix, and summarize the result here as follows.

**Proposition 3 (Public communication vs. private polling)** Provided conditions in Proposition 1,

(1) when the government’s private signal indicates that citizens are relatively heterogeneous (i.e., there exists an \( \hat{\gamma} > 0 \), whenever \( \gamma < \hat{\gamma} \)), it strictly prefers public communication to private polling; and

(2) when the government’s private signal indicates that they are relatively homogeneous (\( \gamma \geq \gamma^{**} \)) and knows that the citizens believe they are heterogeneous (\( W(p_0(\overline{\gamma})) \leq \mu \)), it strictly prefers private polling to public communication (and the outcome with no communication in the benchmark game).

(See the Appendix for the proof.)

4 Private channels of horizontal interaction

In practice, even without the permission of the authoritarian government, citizens could sometimes have their private channel of communication. For example, people can text each other; the neighborhoods may directly speak with each other without the platform of public communication. Proposition 7 in the Appendix investigates how such a possibility affects the government’s incentive to open the platform of public communication. We show that even a tiny possibility of citizens’ horizontal private communication will push the government to become more open. In other
words, when citizens can privately communicate with each other, the government would rather make this conversation public.

Specifically we model the private channel of citizens’ horizontal communication in the following way. When public communication is not allowed, with probability $h$, through certain private channels of communication, citizens can directly learn each other’s preference; with probability $1 - h$, their communication is not successful so that they still do not know each other’s preference. Thus $h$ captures the effectiveness of citizens’ horizontal interaction without the government’s communication platform. Proposition 7 shows that such a possibility will push the government to become more open and more willing to allow public communication.

5 Conclusions

By introducing both vertical and horizontal communication into a collective-veto bargaining structure, this paper develops a tractable model to illustrate how an authoritarian state uses public communication to strengthen its rule. Public communication in authoritarian regimes enables the citizens to publicly express their opinions and communicate policy preferences. We show that the government can gain from vertical communication as it learns citizens’ policy preferences and adjusts policies accordingly. Meanwhile, the government can either gain or lose from horizontal information flows, depending on whether it impedes or encourages citizens’ collective action by informing them of one another’s preference.

In general, a sophisticated authoritarian government opens public communication when the coordination effect from horizontal communication is dominated by the discouragement effect from horizontal communication (and the policy-adjustment effect from vertical communication). The model suggests that the
government is more likely to open public communication when it perceives a low likelihood of collective action, or when the citizens are more likely to have private communication or other forms of horizontal interaction. The model also shows that the existence of government’s effort to minimize citizens’ communication is not exclusive to the fact that it still keeps a certain level of openness.

Since public communication helps reshape citizens’ beliefs of each other’s policy preference, we show that the government prefers public communication to private polling when its private signal indicates that citizens are sufficiently heterogeneous. This is because with private polls, the government loses a chance for the discontent citizens to observe the objection from their fellow citizens and therefore blame the failure of the reform on them. When citizens are homogeneous and not fully aware of it, the government prefers private polling so as to prevent dissatisfaction from spreading.

Nathan (2003) observes that the availability of new information and communication technology is not likely to lead to a regime change in China because routinized protests cannot send strong enough signals to trigger a large mass movement that is needed for a fundamental change. This paper offers an alternative explanation for the lack of a regime change. Citizens’ public communication through the deliberative platforms not only enables the government to learn from the citizens effectively and change policies that spur popular anger, but this communication also informs the citizens about their own divergent interests and discourages them from coordinating when they are divided over government policies.
References


Appendix

The model

In the Appendix, most of the results are proved in a more generalized model. The model in the main part of the paper is a special case of it. First, we present the model.

The two citizens’ policy preferences in the policy-adjustment stage are $u_i(x, \omega_i, \omega_j), i = 1, 2$.

$$\Pr(\omega_i = \omega) = p, i = 1, 2$$

$$\omega_j|\omega_i=\omega = \begin{cases} \omega & \text{with probability } \gamma, \ i \neq j, \\ \omega & \text{with probability } 1 - \gamma \end{cases} \quad (A1)$$

where $\gamma \in (\max\{0, 1 - \frac{1-p}{p}\}, 1)$, and

$$\omega_j|\omega_i=\omega = \begin{cases} \omega & \text{with probability } \frac{p}{1-p}(1 - \gamma), \ i \neq j. \\ \omega & \text{with probability } 1 - \frac{p}{1-p}(1 - \gamma) \end{cases} \quad (A2)$$

Throughout the paper we assume $\mu > 2p\rho_1$.

Collective-action payoff is characterized by:

<table>
<thead>
<tr>
<th>participate (i)</th>
<th>participate (j)</th>
<th>abstain (j)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_i^{11}(x; \omega_i, \omega_j) - k_i$</td>
<td>$V_i^{10}(x; \omega_i) - k_i$</td>
<td></td>
</tr>
<tr>
<td>$V_i^{01}(x; \omega_i, \omega_j)$</td>
<td>$V_i^{00}(x; \omega_i)$</td>
<td></td>
</tr>
</tbody>
</table>

where $k_i$ is the private cost of participating in collective action, which is private information. $k_i$ is independently and identically distributed with a cumulative distribution function $F(\cdot)$ and support $[k, \bar{k}]$. $k_i$ is only observed by citizen $i$ after she observes government policy $x$. We also define
\[ A_i(x; \omega_i, \omega_j) = V_i^{11}(x; \omega_i, \omega_j) - V_i^{01}(x; \omega_i, \omega_j); \quad (A3) \]

\[ B_i(x; \omega_i) = V_i^{10}(x; \omega_i) - V_i^{00}(x; \omega_i). \quad (A4) \]

We say \( D(\omega_i) \) is the desired policy of the type \( \omega_i \) and denote \( D(\omega) = Q, D(\bar{\omega}) = R. \)

We can be verify that assumptions in the benchmark model are special cases of the following assumptions.

**Assumption 1** \( F(\cdot) \) is weakly concave; \( f(k) = F'(k) > 0, \forall k \in [\bar{k}, \overline{k}]. \)

**Assumption 2** Whenever the desired policy is chosen by the government, the type \( \omega_i \) never has an incentive to protest, that is, \( \max\{A_i(D(\omega_i); \omega_i, \omega_j), B_i(D(\omega_i), \omega_i)\} \leq k, \forall \omega_j \in \{\omega, \bar{\omega}\}. \)

**Assumption 3** If \( x \neq D(\omega_i) \), \( A(\omega_i) \triangleq A_i(x; \omega_i = \omega_j), B(\omega_i) \triangleq B_i(x; \omega_i) \) do not depend on \( i \). \( \min\{A(\bar{\omega}), \overline{k}\} > B(\bar{\omega}) > k; \) for the type \( \omega \), we either have \( \min\{A(\omega), \overline{k}\} > B(\omega) > k \) or \( A(\omega) = B(\omega) = k. \)

Under the assumptions that \( u_i(R; \omega_i = \bar{\omega}) = L, u_i(R; \omega_i = \omega) = -L \leq 0, \quad i = 1, 2, \) we have

\[ A(\bar{\omega}) = (1 - 2\lambda)L, B(\bar{\omega}) = \lambda L, A(\omega) = (1 - 2\lambda)L, B(\omega) = \lambda L. \]

**Lemma 4** (Characterizing the equilibrium in above collective-action game)

(1) Whenever the government implements its desired policy \( D(\omega_i) \), the type \( \omega_i \) never joins the collective action;

\[ \text{A-2} \]
(2) if \( x \neq D(\omega_i) \), the type \( \omega_i \) protests according to a cut-point strategy:

\[
a_i(\omega_0) = \begin{cases} 
1 & \text{if } k_i \leq k^* \\
0 & \text{if } k_i > k^*
\end{cases}
\]  \hspace{1cm} (A5)

\( k^* = T_0(\gamma; \omega_i) \), where \( \gamma \) is the probability with which she believes that the other player is of the same type; \( T_0(\gamma; \omega_i) \) is uniquely and well defined by \( T_0 = \min\{\gamma(\gamma(A(\omega_i) - B(\omega_i))F(T_0) + B(\omega_i), \overline{k})\} \); and \( T_0(\gamma; \omega_i) \) is weakly increasing, and it is strictly increasing whenever \( \gamma \leq \min\{\gamma_0, 1\} \), where \( \gamma_0 = \frac{\overline{k} - B(\omega_i)}{A(\omega_i) - B(\omega_i)} \). Hence \( p_0(\gamma; \omega_i) = F(T_0(\gamma; \omega_i)) \) is the probability with which a citizen protests if her desired policy is not implemented.

**Proof of Lemma 4**

Without loss of generality, suppose \( \omega_0 \) is the dissatisfied type and her desired policy is not implemented. Define \( A = A(\omega_0), B = B(\omega_0) \).

(a) Assumption 2 implies that it is a dominant strategy for the type \( \omega_i \neq \omega_0 \) not to protest.

(b) Thus the only uncertainty is to what extent a citizen with the type \( \omega_0 \) will join the protest.

(b.1) We first claim that in equilibrium citizen \( i \) with the type \( \omega_0 \) uses a cut-point strategy

\[
a_i(\omega_0) = \begin{cases} 
1 & \text{if } k_i \leq k^* \\
0 & \text{if } k_i > k^*
\end{cases}
\]  \hspace{1cm} (A6)

because her payoff gain in protest is: \( \gamma \Pr(j \text{ protest}\mid \omega_i = \omega_0)A + (1 - \gamma)\Pr(j \text{ protest}\mid \omega_i = \omega_0))B - k_i \). Now suppose \( i \)'s cut-point is \( k^*_i, i = 1, 2 \).

(b.2) According to (b.1) the payoff gain of player \( i \) is therefore \( \gamma F(k^*_i)(A - B) + \)
It then can be verified that the equilibrium condition is equivalent to

\[ k_1^* = \min \{ \hat{\gamma} F(k_2^*) (A - B) + B, \overline{k} \}, \quad (A7) \]

\[ k_2^* = \min \{ \hat{\gamma} F(k_1^*) (A - B) + B, \overline{k} \}. \quad (A8) \]

(b.3) Suppose \( \gamma_0 = \frac{k - B}{A - B} < 1 \), and focus on the situation where \( \hat{\gamma} \geq \frac{k - B}{A - B} \).

We claim that the unique solution to Equation (A7) and Equation (A8) is \( k_1^* = k_2^* = \overline{k} \). We can easily verify that \( k_1^* = k_2^* = \overline{k} \) is a solution to the above equations and hence is an equilibrium. We need to check the other two possibilities.

Possibility 1: If at least one cut-point \( k_i^* = \overline{k} \), then according to Equation (A7) and Equation (A8), the other cut-point automatically becomes the corner solution \( \overline{k} \).

Possibility 2: Both cut-points are interior \( k_1^*, k_2^* \in [B, \overline{k}) \). Without loss of generality, let’s assume \( k_1^* \leq k_2^* \), so we get

\[ \hat{\gamma} F(k_2^*) (A - B) + B \leq \hat{\gamma} F(k_1^*) (A - B) + B, \quad (A9) \]

therefore \( k_1^* \geq k_2^* \) so that \( k_1^* = k_2^* \in [B, \overline{k}) \). Let’s denote them as \( k^* \), we then have:

\[ k^* = \hat{\gamma} F(k^*) (A - B) + B. \quad (A10) \]

Because of Assumption 1, \( \psi(x) \triangleq \hat{\gamma} F(x) (A - B) + B - x \) is also weakly concave. In addition we have \( \psi(k) = B - k > 0, \psi(\overline{k}) \geq 0 \).

\( \forall k \in (\underline{k}, \overline{k}) \) can be represented by \( k = \theta \underline{k} + (1 - \theta) \overline{k} \) for some \( \theta \in (0, 1) \). So \( \psi(k) \geq \theta \psi(\underline{k}) + (1 - \theta) \psi(\overline{k}) > 0 \). As a result, \( k_1^* = k_2^* = \overline{k} \) is the unique equilibrium.

(b.4) When \( 0 < \hat{\gamma} < \min \{ \frac{\overline{k} - B}{\overline{A} - B}, 1 \} \), we first claim that any equilibrium \( k_1^*, k_2^* \in \)
for some $i$. However the right-hand side $\min\{\hat{\gamma}F(k_i^*) (A - B) + B, \bar{k}\} = \hat{\gamma}F(k_i^*) (A - B) + B < \bar{k}$ because $\hat{\gamma} < \min\{\frac{\bar{k} - B}{A - B}, 1\}$. So we get a contradiction. Hence, $k_1^*, k_2^* \in [B, \bar{k})$. Similarly as in (b.3), without loss of generality, let’s assume $k_1^* \leq k_2^*$, so we get:

$$\hat{\gamma}F(k_2^*) (A - B) + B \leq \hat{\gamma}F(k_1^*) (A - B) + B, \quad (A12)$$

therefore $k_1^* \geq k_2^*$ so that $k_1^* = k_2^* \in [B, \bar{k})$. Let’s denote them as $k^*$, we then have:

$$k^* = \widehat{\gamma}F(k^*) (A - B) + B. \quad (A13)$$

Because of Assumption 1 $\psi(x) \triangleq \hat{\gamma}F(x) (A - B) + B - x$ is also weakly concave.

In addition we have $\psi(k) = B - \bar{k} > 0$, $\psi(\bar{k}) = \gamma (A - B) - (\bar{k} - B) < 0$.

Because of continuity of $\psi(x)$, $\exists$ a solution $k^* \in (k, \bar{k})$ such that $k^* = \hat{\gamma}F(k^*) (A - B) + B$.

Because of concavity of $\psi(x)$, applying the same logic in (b.3), $\forall k \in (k, k^*)$, $\psi(k) > 0$ and $\forall k \in (k^*, \bar{k})$, $\psi(k) < 0$. As a result, $k^*$ is the unique cut-point equilibrium.

(b.5) Therefore the equilibrium cut-point of type $\omega_i = \omega_0$ is uniquely determined by $k^* \triangleq T_0(\hat{\gamma})$, where $T_0(\hat{\gamma})$ is uniquely and well defined by

$$T_0(\hat{\gamma}) = \min\{\hat{\gamma}F(T_0(\hat{\gamma})) (A - B) + B, \bar{k}\}. \quad (A14)$$

(c) When $\gamma_0 = \frac{\bar{k} - B}{A - B} < 1$ and $\hat{\gamma} \geq \frac{\bar{k} - B}{A - B}$, $T_0(\gamma) = \bar{k}$. When $\gamma < \min\{\frac{\bar{k} - B}{A - B}, 1\}$, $T_0(\hat{\gamma})$
is uniquely and well defined by Equation (A13). To rewrite the above equation, we get:

\[ \hat{\gamma} = \frac{T_0 - B}{(A - B)F(T_0)}. \quad \text{(A15)} \]

To show that \( T_0(\hat{\gamma}) \) is strictly increasing when \( \hat{\gamma} < \min\{\frac{T - B}{A - B}, 1\} \), we only need to show that above well-defined function is strictly increasing in \( T_0 \) when \( T_0 \geq B \). It is obvious that \( \frac{T_0 - B}{(A - B)F(T_0)} \) is differentiable, thus we have:

\[ \frac{d \frac{T_0 - B}{(A - B)F(T_0)}}{dT_0} = \frac{F(T_0) - (T_0 - B)f(T_0)}{(A - B)(F(T_0))^2}. \quad \text{(A16)} \]

We only need to show \( F(T_0) - (T_0 - B)f(T_0) > 0 \). Because \( F(T_0) \) is differentiable, \( \exists \xi \in [k, T_0] \) s.t. \( F(T_0) = F(k) + f(\xi)(T_0 - k) > f(\xi)(T_0 - B) \geq (T_0 - B)f(T_0) \). The last inequality comes from concavity. 

According to the above lemma, in our benchmark model, \( T_0(\hat{\gamma}; \omega_i) \) is uniquely and well defined by

\[ T_0 = \min\{\hat{\gamma}(1 - 2\lambda)ZF(T_0) + \lambda Z, 1\} \text{ and } \gamma_0 = \frac{1 - \lambda Z}{(1 - 2\lambda)Z}, \]

where

\[ Z = \begin{cases} L & \text{if } \omega_i = \omega, \\ L & \text{if } \omega_i = \overline{\omega}. \end{cases} \quad \text{(A17)} \]

Therefore \( p_0(\hat{\gamma}; \omega_i) = F(T_0(\hat{\gamma}; \omega_i)) \) is determined by

\[ F^{-1}(p_0) = \min\{\hat{\gamma}(1 - 2\lambda)Zp_0 + \lambda Z, 1\}. \quad \text{(A18)} \]

The government’s payoffs in equations
\[
G_1(e, \omega_1, \omega_2) = \begin{cases} 
-e\sigma[\mu + W(p_0(1, \omega))] & \text{if } \omega_1 = \omega_2 = \omega \\
-(1 - e\sigma)W(p_0(1, \overline{\omega})) - e\sigma \mu & \text{if } \omega_1 = \omega_2 = \overline{\omega} \\
-(1 - e\sigma)p_1p_0(0, \overline{\omega}) - e\sigma(\mu + \rho_1p_0(0, \omega)) & \text{if } \omega_1 = \omega, \omega_2 = \overline{\omega} \\
-(1 - e\sigma)p_1p_0(0, \overline{\omega}) - e\sigma(\mu + \rho_1p_0(0, \omega)) & \text{if } \omega_1 = \overline{\omega}, \omega_2 = \omega 
\end{cases}
\]  

\[\frac{\partial}{\partial \omega} \rightarrow (A19)\]

where

\[
\bar{\gamma}_1^* = 1 - \frac{p}{1 - p}(1 - \widetilde{\gamma}_1^*). 
\]  

\[\frac{\partial}{\partial \omega} \rightarrow (A21)\]

**Lemma 5 (No effort without public communication)** Provided one of the following conditions,

(a) \( \rho_2 \geq 2\rho_1, A(\overline{\omega}) = A(\omega), B(\overline{\omega}) = B(\omega), p \leq \frac{1}{2} \),

or (b) \( \rho_2 \geq 2\rho_1, pp_0(1; \overline{\omega})(\rho_2 - 2\rho_1) + 2pp_1p_0(1; \overline{\omega}) \leq \mu \),

or (c) \( \rho_2 \leq 2\rho_1 \),

in any equilibrium, the government chooses not to make any effort to adjust the policy when public communication is not allowed, i.e., \( e_0^* (\gamma) \equiv 0 \).

**Proof of Lemma 5**

When \( \sigma = 0 \), any equilibrium is equivalent to the case with no effort. Without
loss of generality assume $\sigma > 0$.

$$e^*_0(\gamma) \in \arg \min_{e} [(1 - e\sigma)M(\gamma, p_0(\hat{\gamma}_0, \omega)) + e\sigma(\mu + M(\gamma, p_0(\hat{\gamma}_0, \omega))],$$  \hspace{1cm} (A22)

where $M(\gamma, x)$ is defined by Equation 18, and

$$M(\gamma, p_0(\hat{\gamma}_0)) = (1 - 2p + p\gamma)p_0(\hat{\gamma}_0, \omega)^2(\rho_2 - 2\rho_1) + 2(1 - p)\rho_1p_0(\hat{\gamma}_1, \omega),$$ \hspace{1cm} (A23)

where

$$\hat{\gamma}_1 = 1 - \frac{p}{1 - p}(1 - \hat{\gamma}_1).$$ \hspace{1cm} (A24)

Notice that the payoff gain $M(\gamma, p_0(\hat{\gamma}_0, \omega)) - M(\gamma, p_0(\hat{\gamma}_1, \omega)) - \mu$ is linear in $\gamma$, hence, $e^*_0(\gamma)$ must follow a cut-point rule.

(a) Since $A(\omega) = A(\omega)$, $B(\omega) = B(\omega)$, $p_0(x, \omega) = p_0(x, \omega)$ for any $x$.

The slope of $\gamma$ in the payoff gain is $pp_0(\hat{\gamma}_0, \omega)^2(\rho_2 - 2\rho_1) - pp_0(\hat{\gamma}_1, \omega)^2(\rho_2 - 2\rho_1)$.

Suppose $\hat{\gamma}_0 > \hat{\gamma}_1$, the payoff gain is strictly increasing in $\gamma$. So the government makes an effort only if $\gamma$ is higher. Therefore $\hat{\gamma}_1 > \hat{\gamma}_0$, so that $\hat{\gamma}_1 \geq \hat{\gamma}_1 > \hat{\gamma}_0$. It is a contradiction.

So we must have $\hat{\gamma}_0 \leq \hat{\gamma}_1$ and the payoff gain is strictly decreasing in $\gamma$.

The payoff gain at $\gamma = 0$ equals $2pp_0(\hat{\gamma}_0, \omega)\rho_1 - 2(1 - p)\rho_1p_0(\hat{\gamma}_1, \omega) - (1 - 2p)p_0(\hat{\gamma}_1, \omega)^2(\rho_2 - 2\rho_1) - \mu < 0$. It is a contradiction with the fact that the payoff gain is decreasing and $e^*_0(\gamma)$ follows a strictly interior cut-point rule.

As a result, we can only have either $e^*_0(\gamma) \equiv 0$ or $e^*_0(\gamma) \equiv 1$. Because $M(\gamma, p_0(\hat{\gamma}_1, \omega)) \leq M(\gamma, p_0(\hat{\gamma}_1, \omega))$, $e^*_0(\gamma) \equiv 1$ is ruled out, and $e^*_0(\gamma) \equiv 0$ is the only possible equilibrium strategy. As long as off-the-equilibrium-path citizens believe they are weakly more homogeneous than in the case without reform, the government never has an incentive to deviate from this pooling strategy.
(b) \( M(\gamma, p_0(\tilde{\gamma}_0^*, \overline{\omega})) < M(1, p_0(1, \overline{\omega})) \leq \mu \), thus it is the strictly dominant strategy not to make any effort.

(c) Similarly \( M(\gamma, p_0(\tilde{\gamma}_0^*, \overline{\omega})) < 2p\rho_1 p_0(\tilde{\gamma}_0^*, \overline{\omega}) \leq \mu \), thus it is the strictly dominant strategy not to make any effort. ■

**Proposition 4** Provided \( \sigma < \frac{2p_1 [p_0(1, \overline{\omega}) - p_0(0, \overline{\omega})]}{\max\{W(p_0(1, \overline{\omega})) - \mu, 0\}} \), (1) in any equilibrium, the government allows public communication if and only if its private signal indicates that citizens are sufficiently heterogeneous, i.e.,

\[
\alpha^* = \begin{cases} 
1 & \text{if } \gamma < \gamma^* \\
0 & \text{if } \gamma \geq \gamma^* 
\end{cases}, \tag{A25}
\]

where \( \gamma^* \in [0, 1] \); when \( p \leq \frac{1}{2}, \gamma^* > 0 \);

(2) when the public communication is shut down, citizens will think that they are more homogeneous than in the case when public communication is allowed, i.e.,

\( E(\gamma|\alpha = 0) > E(\gamma|\alpha = 1) \);

(3) if \( \min_x G_{diff}(x, E(\gamma|\gamma \geq x)) < 0 \), an equilibrium exists with interior cut-point equilibrium \( \gamma^* \in (0, 1) \),

(4) if one of the following conditions is satisfied, for sufficiently small \( \sigma \), we have \( \min_x G_{diff}(x, E(\gamma|\gamma \geq x)) < 0 \):

(4.a) \( p_0(E(\gamma), \overline{\omega}) < 1 \), and \( \frac{p_2}{p_1} \) is sufficiently large,

(4.b) \( p_2 \geq 2p_1, \exists \gamma'_0 \in (\max\{0, 1 - \frac{1-p}{p}\}, 1) \) such that \( p_0(E(\gamma|\gamma \geq \gamma'_0), \overline{\omega}) \leq \gamma'_0 p_0(1, \overline{\omega}) + (1 - \gamma'_0)p_0(0, \overline{\omega}) \).

**Proof of Proposition 4**

\(^1\)An equilibrium with \( \gamma^* = 1 \) always exists. In this equilibrium, whenever the government shuts down the platform of public communication, citizens believe that they are perfectly correlated.

A-9
The difference in the government’s payoff is:

\[ G_{diff}(\gamma, \hat{\gamma}_0^*) = M(\gamma, p_0(\hat{\gamma}_0^*, \overline{w})) - p\gamma \min\{W(p_0(1, \overline{w})), \sigma\mu + (1 - \sigma)W(p_0(1, \overline{w}))\} - 2p(1 - \gamma)p_0(0, \overline{w})\rho_1, \]

\[ \text{(A26)} \]

From the above expression we know that the payoff gain is piecewise linear.

(1) Suppose \( W(p_0(1)) \leq \mu \), the government never wants to make an effort, hence the vertical learning effect is 0, and the slope of \( \gamma \) is

\[ pp_0(\hat{\gamma}_0^*, \overline{w})^2(\rho_2 - 2\rho_1) - pW(p_0(1, \overline{w})) + 2pp_0(0)\rho_1 \]
\[ < pp_0(\hat{\gamma}_0^*, \overline{w})^2(\rho_2 - 2\rho_1) - pp_0(1, \overline{w})^2(\rho_2 - 2\rho_1) \leq 0. \]

Suppose \( W(p_0(1)) > \mu \), the slope of \( \gamma \) is

\[ pp_0(\hat{\gamma}_0^*, \overline{w})^2(\rho_2 - 2\rho_1) - [\sigma\mu + (1 - \sigma)W(p_0(1, \overline{w}))]p + 2pp_0(0)\rho_1 \]
\[ < pp_0(1, \overline{w})^2(\rho_2 - 2\rho_1) - [\sigma\mu + (1 - \sigma)W(p_0(1, \overline{w}))]p + 2pp_0(0)\rho_1 \]

which is negative if and only if \( \sigma < \frac{2p_1[p_0(1, \overline{w}) - p_0(0, \overline{w})]}{W(p_0(1, \overline{w})) - \mu} \).

As a result, the payoff gain is always decreasing in \( \gamma \), so that in any equilibrium we must have

\[ \alpha^* = \begin{cases} 
1 & \text{if } \gamma < \gamma^*, \\
0 & \text{if } \gamma \geq \gamma^* 
\end{cases} \]

\[ \text{(A27)} \]

where \( \gamma^* \in [0, 1] \).

Suppose a pooling equilibrium exists with \( \gamma^* = 0 \), the citizens’ equilibrium belief \( \hat{\gamma}_0^* = E(\gamma) > 0 \).

The payoff gain at \( \gamma = 0 \) equals \( 2p\rho_1(p_0(E(\gamma), \overline{w}) - p_0(0, \overline{w})) > 0 \), which is a contradiction. Therefore, in any equilibrium under the assumption that \( p \leq \frac{1}{2} \), \( \gamma^* > 0 \).

(2) When the citizens observe \( \alpha = 0 \), their belief toward the social homogeneity is \( E(\gamma | \gamma \geq \gamma^*) \).

When the citizens observe \( \alpha = 0 \), their belief toward the social homogeneity is
It is obvious that $E(\gamma|\gamma \geq \gamma^*) > E(\gamma|\gamma < \gamma^*)$.

(3) $E(\gamma|\gamma \geq x) = \int_{\gamma \geq x} \gamma d\frac{G(\gamma)-G(x)}{1-G(x)} = \int_{\gamma \geq x} \gamma dG(\gamma) \frac{1}{1-G(x)}$ is continuous in $x$, so that $G_{\text{diff}}(x, E(\gamma|\gamma \geq x))$ is continuous in $x$.

$G_{\text{diff}}(x, E(\gamma|\gamma \geq x))|_{x=0} = 2p\rho_1(p_0(E(\gamma), \overline{\omega}) - p_0(0, \overline{\omega})) > 0$, thus as long as $\min_x G_{\text{diff}}(x, E(\gamma|\gamma \geq x)) < 0$, there always exists a fixed point $\gamma^* \in (0, 1)$ such that $G_{\text{diff}}(\gamma, E(\gamma|\gamma \geq \gamma^*)) \geq 0$ with $\gamma \leq \gamma^*$, and $G_{\text{diff}}(\gamma, E(\gamma|\gamma \geq \gamma^*)) \leq 0$ with $\gamma > \gamma^*$.

(4) Assume $\sigma = 0$ and fix a $\gamma$ close to the lower bound, the payoff gain is $G_{\text{diff}}(\gamma, \check{\gamma}_0^*) = M(\gamma, p_0(\check{\gamma}_0^*, \overline{\omega})) - p\gamma W(p_0(1, \overline{\omega})) - 2p(1 - \gamma)p_0(0, \overline{\omega})\rho_1$

$= p\gamma p_0(\check{\gamma}_0^*, \overline{\omega})^2(\rho_2 - 2\rho_1) + 2pp_0(\check{\gamma}_0^*, \overline{\omega})\rho_1 - p\gamma[p_0(1, \overline{\omega})^2(\rho_2 - 2\rho_1) + 2p_0(1, \overline{\omega})\rho_1] - 2p(1 - \gamma)p_0(0, \overline{\omega})\rho_1$

$= -p\gamma[p_0(1, \overline{\omega})^2 - p_0(\check{\gamma}_0^*, \overline{\omega})^2](\rho_2 - 2\rho_1) + 2pp_0(\check{\gamma}_0^*, \overline{\omega}) - \gamma p_0(1, \overline{\omega}) - (1 - \gamma)p_0(0, \overline{\omega})]$

(4.a) As $\frac{\rho_2}{\rho_1}$ goes to infinity, the payoff gain is close to $p\gamma p_0^2(\check{\gamma}_0^*, \overline{\omega})\rho_2 - p\gamma p_0^2(1, \overline{\omega})\rho_2 < 0$.

(4.b) When $\rho_2 \geq 2\rho_1$ and a $\gamma$ exists such that $p_0(\check{\gamma}_0^*, \overline{\omega}) - \gamma p_0(1, \overline{\omega}) - (1 - \gamma)p_0(0, \overline{\omega}) \leq 0$, the payoff gain is also negative at this $\gamma$.

When we let $\sigma$ get close to 0, we will therefore always find an $x$ such that $G_{\text{diff}}(x, E(\gamma|\gamma \geq x)) < 0$.

(5) Finally to complete the proof we also need to check the IC conditions of the citizens so that they have incentives to fully reveal their preferences when public communication is allowed. The IC conditions are checked in the following lemma.

**Lemma 6** Provided the conditions below, citizens’ truth-telling incentives are satisfied:
(I) sufficient conditions for incentive compatibility of the type ω:

\[ u_i(R, ω) \leq u_i(Q, ω), V_i^{01}(Q, ω, ω) \geq \max\{V_i^{00}(R, ω), V_i^{10}(R, ω)\}, V_i^{00}(Q, ω) \geq \max\{V_i^{00}(R, ω), V_i^{10}(R, ω), V_i^{01}(Q, ω, ω)\}; \]

and

(II) sufficient conditions for incentive compatibility of the type ω:

\[ V_i^{00}(R, ω) \geq \max\{V_i^{00}(x, ω), V_i^{10}(x, ω), V_i^{00}(x, ω, ω), V_i^{01}(x, ω, ω)\}, \forall x \in \{R, Q\}; u_i(R, ω) \geq u_i(Q, ω), \]

\[ V_i^{11}(Q, ω, ω) \geq V_i^{10}(Q, ω), V_i^{01}(Q, ω, ω) \geq V_i^{00}(Q, ω). \]

Proof of Lemma 6

(a) Denote \( q_t \) as the probability that reform will be implemented when the government observes \( t \) number of pro-reform citizens.

First notice that in any citizen truth-telling equilibrium, \( q_2 \geq q_1 = q_0 = 0 \).

(b) We check the payoff gain of the ω type between claiming ω and ω.

When \( ω_j = ω \), by claiming ω she gets \( u_i(Q, ω) + V_i^{00}(Q, ω) \),

by claiming ω she gets \( u_i(Q, ω) + V_i^{00}(Q, ω) \), which makes her weakly better than claiming ω.

When \( ω_j = ω \), by claiming ω she gets \( q_2[u_i(R, ω) + \max\{V_i^{00}(R, ω), V_i^{10}(R, ω) - k_i\}] + (1 - q_2)[u_i(Q, ω) + δ_j V_i^{01}(Q, ω, ω) + (1 - δ_j) V_i^{00}(Q, ω)] \);

by claiming ω, she gets \( u_i(Q, ω) + δ_j V_i^{01}(Q, ω, ω) + (1 - δ_j) V_i^{00}(Q, ω, ω) \), where \( δ_j \leq δ_j \) according to Lemma 4.

As \( V_i^{01}(Q, ω, ω) \geq \max\{V_i^{00}(R, ω), V_i^{10}(R, ω)\} \), \( V_i^{00}(Q, ω) \geq \max\{V_i^{00}(R, ω), V_i^{10}(R, ω), V_i^{01}(Q, ω, ω) \)

claiming ω does not provide a profitable deviation.

(c) We check the payoff gain of the ω type between claiming ω and ω. When \( ω_j = ω \), the policy will never be changed so that the other person will never protest.

Thus, the ω type is indifferent between claiming ω and ω.

When \( ω_j = ω \), by claiming ω, she gets \( q_2[u_i(R, ω) + V_i^{00}(R, ω)] + (1 - q_2)[u_i(Q, ω) + VV] \),

where \( VV = \max\{δV_i^{11}(Q, ω, ω) + (1 - δ)V_i^{10}(Q, ω) - k_i, δV_i^{01}(Q, ω, ω) + (1 -
\[ \delta' V_i^{00}(Q, \varnothing) \] ;

By claiming \( \omega \), she gets \([u_i(Q, \varnothing) + ZZ] \), where \( ZZ = \max \{ \delta' V_i^{11}(Q, \varnothing, \omega) + (1 - \delta') V_i^{10}(Q, \varnothing) - k_i, \delta' V_i^{01}(Q, \varnothing, \omega) + (1 - \delta') V_i^{00}(Q, \varnothing) \} \), \( \delta' \leq \delta' \) according to Lemma 4.

Because \( V_i^{11}(Q, \varnothing, \omega) \geq V_i^{10}(Q, \varnothing) \), \( V_i^{01}(Q, \varnothing, \omega) \geq V_i^{00}(Q, \varnothing) \), we have

\[ \delta' V_i^{11}(Q, \varnothing, \omega) + (1 - \delta') V_i^{10}(Q, \varnothing) \geq \delta' V_i^{01}(Q, \varnothing, \omega) + (1 - \delta') V_i^{00}(Q, \varnothing) \].

Hence, \( V V \geq ZZ \), and claiming \( \omega \) does not offer a profitable deviation.

Thus, IC constraint is satisfied. 

**Proof of Proposition 2**

Define \( \gamma^{**} = \inf_{\gamma \text{ is an equilibrium}} \gamma^* \). First of all it is well defined. We then show that

(a) it is an equilibrium;

(b) \( \gamma^{**} > 0 \); and

(c) it maximizes the government’s welfare and minimizes openness.

Recall that the payoff gain of the government is

\[ G_{diff}(\gamma, \hat{\gamma}_0^*) = M(\gamma, p_0(\hat{\gamma}_0^*, \varnothing)) - p\gamma \min\{W(p_0(1, \varnothing)), \sigma \mu + (1 - \sigma)W(p_0(1, \varnothing))\} - 2p(1 - \gamma)p_0(0, \varnothing)\rho_1 \]  

(A28)

(d) By the definition of \( \gamma^{**} \), a series of equilibria \( \gamma_i^* \) exist such that \( G_{diff}(\gamma_i^*, E(\gamma | \gamma \geq \gamma_i^*)) = 0 \), and \( \gamma_i^* \rightarrow \gamma^{**} \). By the continuity of \( G_{diff}(x, E(\gamma | \gamma \geq x)) \), we know that \( G_{diff}(\gamma^{**}, E(\gamma | \gamma \geq \gamma^{**})) = 0 \) so that \( \gamma^{**} \) is also an equilibrium.

(e) \( G_{diff}(0, E(\gamma | \gamma \geq 0) = 2pp_1(p_0(E(\gamma), \varnothing) - p_0(0, \varnothing)) > 0 \), therefore \( \gamma^{**} > 0 \).

(f) We need to show the following property: if \( \gamma_a^* > \gamma_b^* \) and they are both equilibria, then the government’s welfare is strictly higher under \( \gamma_b^* \) than under \( \gamma_a^* \). Denote \( G(\gamma; \gamma^*) \) as the government’s welfare under the equilibrium \( \gamma^* \).
When $\gamma < \gamma^*_b$, the government opens public communication under both equilibria, therefore, $G(\gamma; \gamma^*_b) = G(\gamma; \gamma^*_a)$.

When $\gamma \in [\gamma^*_b, \gamma^*_a)$, under the equilibrium $\gamma^*_b$, the government prefers forbidding public communication. Thus its welfare $G(\gamma; \gamma^*_b)$ is strictly higher than the welfare under openness which equals to $G(\gamma; \gamma^*_a)$.

When $\gamma \geq \gamma^*_a$, $G(\gamma; \gamma^*_a) = -M(\gamma, p_0(E(\gamma|\gamma \geq \gamma^*_a), \overline{\omega})), G(\gamma; \gamma^*_b) = -M(\gamma, p_0(E(\gamma|\gamma \geq \gamma^*_b), \overline{\omega}))$. Since $\gamma^*_a > \gamma^*_b$, $E(\gamma|\gamma \geq \gamma^*_a) \geq E(\gamma|\gamma \geq \gamma^*_b)$. Because $M(\gamma, x)$ is increasing in $x$, we get $G(\gamma; \gamma^*_a) \leq G(\gamma; \gamma^*_b)$.

Since $\gamma^{**}$ is the “smallest” equilibrium cut-point, it is obvious that it allows minimum level of openness among all equilibria. ■

Equilibrium characterization in private-polling game

Upon two pro-reform citizens, the government’s payoff is $-\mu$ when the reform policy is launched and $-W(p_0(q(\varepsilon^*)))$ when the status quo is kept, where $W(\cdot)$ is defined by Equation 8. The government’s equilibrium choice $\varepsilon^*$ must solve the following problem:

$$\max_{\varepsilon \in [0,1]} \varepsilon \sigma(-\mu) + (1 - \varepsilon \sigma)[-W(p_0(q(\varepsilon^*)))].$$  \hspace{1cm} (A29)

There are two scenarios to be considered. An equilibrium with $\varepsilon^* > 0$ exists, if $W(p_0(\overline{\gamma})) > \mu$. An equilibrium with $\varepsilon^* = 0$ exists, if $\mu \geq W(p_0(\overline{\gamma}))$. As $W(p_0(\cdot))$ is an increasing function, $W(p_0(\overline{\gamma})) > \mu$ if and only if the public perceived social homogeneity is sufficiently high. The following proposition compares the government’s expected payoffs in the equilibrium of the private-polling game and in the equilibrium of the benchmark model with the choice between public communication and no communication.
Proposition 5 (Public communication v.s. private polling)  

(1) Provided $p \leq \frac{1}{2}$, and $W(p_0(0, \Bar{\omega})) < \mu$ whenever $\sigma = 1$, then $\exists \gamma \in (0, 1]$, such that, for any $\gamma < \gamma$, the government’s welfare in the public communication game is strictly higher than its welfare in the private polling game;

(2) Provided conditions in Proposition 1 and $\rho_2 > \mu$, when the government’s private signal indicates that they are relatively homogeneous ($\gamma \geq \gamma^{**}$) and it knows that the citizens believe they are heterogeneous ($W(p_0(\Bar{\gamma}, \Bar{\omega})) \leq \mu$), the government’s welfare in the private polling game is strictly higher than its welfare in the public communication game.

Proof of Proposition 5 Observe that: an equilibrium with $\varepsilon^* > 0$ exists, if $W(p_0(\Bar{\gamma}, \Bar{\omega})) > \mu$; an equilibrium with $\varepsilon^* = 0$ exists, if $\mu \geq W(p_0(\Bar{\gamma}, \Bar{\omega}))$.

Without loss of generality, assume $\sigma > 0$.

(1) The government’s expected payoff under public communication ($\varepsilon = 1$) is

$$-p\gamma \min\{[\sigma \mu + (1 - \sigma)W(p_0(1, \Bar{\omega})], W(p_0(1, \Bar{\omega}))\} - 2p(1 - \gamma)[p_0(0, \Bar{\omega})\rho_1].$$

The government’s expected payoff in the private polling equilibrium ($\varepsilon^*$) is

$$-p\gamma \min\{[\sigma \mu + (1 - \sigma)W(p_0(q(\varepsilon^*), \Bar{\omega}))], W(p_0(q(\varepsilon^*), \Bar{\omega}))\} - 2p(1 - \gamma)p_0(q(\varepsilon^*), \Bar{\omega})\rho_1.$$

Under the assumption that “$W(p_0(0, \Bar{\omega})) < \mu$ whenever $\sigma < 1$,” we always have $q(\varepsilon^*) > 0$. Therefore for sufficiently small $\gamma$, i.e., $\gamma \to 0^+$, the government strictly prefers public communication ($\varepsilon = 1$) to private polling equilibrium.

(2) Suppose $\mu \geq W(p_0(\Bar{\gamma}, \Bar{\omega}))$, we must have $\varepsilon^* = 0$. Thus the government never adjusts policy, and the the citizens’ belief about social homogeneity is $\Bar{\gamma} = E(\gamma)$, which is lower than the belief they hold in the public communication game when the communication platform is shut down, that is $E(\gamma | \gamma \geq \gamma^{**})$. Therefore the collective action is less likely to happen and the government gets a strictly higher payoff in the private polling game. ■
Extensions

More sophisticated information management

As implied by Proposition 2, the government needs to keep the degree of openness to the minimum possible level in order to achieve its maximum welfare. In practice, an authoritarian may use propaganda or internet censorship to manipulate citizens’ belief and persuade them that the government is popularly supported by at least a proportion of citizens so as to distort their incentives to join the protest (Stockmann and Gallagher 2011; Shadmehr and Bernhardt 2011; Dimitrov 2014). For example, the Chinese government not only deletes “negative” news online that can potentially raise popular anger (King, Pan and Roberts 2013), but also hires Internet commentators to post favorable comments toward government policies as a way to sway public opinion (Kalathil and Boas 2003).² Even in authoritarian legislatures, an incumbent could manipulate voices in a very sophisticated way (such as personnel control) to his own favor (Gandhi 2008; Truex 2013).

In Proposition 6 as follows, we extend the benchmark model by allowing the government to flexibly manipulate information. This extension not only demonstrates that the benchmark model is useful in capturing the more sophisticated information management by an authoritarian, but also more importantly illustrates that the logic of censorship and propaganda relies on the key trade-off between coordination effect and the discouragement effect introduced in the benchmark. When the citizens are likely to think they are homogeneously against the government, the coordination event is more likely to happen. Thus the government would want to reduce their perception that they are homogeneously against the government by creating discouragement information and by keeping the coordination effect at the

---

²The commentators are commonly called “fifty-cent party” by netizens as a satire since they are said to be paid RMB fifty cents for each post.
minimum. We show that the government does not fully allow information disclosure when both citizens are homogeneously angry with the government, and in the case when they are heterogeneous, the government truthfully discloses it.

Specifically we consider the following signal-jamming technology:

When both citizens claim they are pro-reform, the government truthfully discloses it (as “popular anger”) to the public with probability \((1-c)\) and reports “heterogeneous opinions” with probability \(c\); otherwise it always reports “heterogeneous opinions.”

**Proposition 6 (A signal-jamming technology)** Consider the above signal-jamming technology. Provided \(\sigma < 1\) and \(W(p_0(1, \overline{\omega})) > \mu\),

1. the government always has an incentive to censor the information indicating that citizens are homogeneously against it; namely, in any equilibrium \(c^* > 0\); and
2. provided \((1 - \lambda)L > 1, \gamma_0 \triangleq \frac{1 - \lambda L}{(1 - 2\lambda)L}\), any \(c^* \in \left[\frac{1}{1 - \sigma} \frac{\gamma_0}{1 - \gamma_0} \frac{1 - \sigma}{\gamma}, 1\right]\) is an equilibrium.

**Proof of Proposition 6**

Because \(W(p_0(1, \overline{\omega})) > \mu\), after disclosing the information “popular anger,” the regime makes effort \(e = 1\), and gets \(\sigma(-\mu) + (1 - \sigma)[-W(p_0(1, \overline{\omega}))]\).

1. Suppose an equilibrium exists with \(c^* = 0\). Upon the news “heterogeneous opinions” and the failure of reform, a pro-reform citizen believes that the other citizen is anti-reform, thus upon two pro-reform citizens, if the government chooses to disclose it as “heterogeneous opinions” it will get max\(\{\max\{\frac{1}{1 - \sigma} \frac{\gamma_0}{1 - \gamma_0} \frac{1 - \sigma}{\gamma} \frac{1 - \sigma}{\gamma}, 1\}\}\).

If \(W(p_0(0, \overline{\omega})) \geq \mu\),

\[\max\{-W(p_0(0, \overline{\omega})), \sigma(-\mu) + (1 - \sigma)[-W(p_0(0, \overline{\omega}))]\}\]
\[
\sigma(-\mu) + (1 - \sigma)[-W(p_0(0, \overline{\omega}))]
\]
\[
> \sigma(-\mu) + (1 - \sigma)[-W(p_0(1, \overline{\omega}))].
\]

If \( W(p_0(0, \overline{\omega})) < \mu \),
\[
\max\{-W(p_0(0, \overline{\omega})), \sigma(-\mu) + (1 - \sigma)[-W(p_0(0, \overline{\omega}))]\}
\]
\[
= -W(p_0(0, \overline{\omega}))
\]
\[
> \sigma(-\mu) + (1 - \sigma)[-W(p_0(1, \overline{\omega}))].
\]

Thus there is always a profitable deviation. As a result, \( c^* = 0 \) cannot be an equilibrium.

(2) Let’s focus on the equilibrium where the government always makes an effort to adjust policy when facing two pro-reform citizens. The government’s incentive compatibility constraint is therefore
\[
W(p_0(1, \overline{\omega})) \geq \mu, W(p_0(q^*, \overline{\omega})) \geq \mu,
\]
where \( q^* = \frac{\gamma c^*(1-\sigma)}{\gamma c^*(1-\sigma) + (1-h)} \) is the probability with which each pro-reform citizen thinks the other citizen has the same preference upon the failure of reform and the news “heterogeneous opinions.”

We also need incentive compatibility constraint on disclosing the information
\[
W(p_0(q^*, \overline{\omega})) = W(p_0(1, \overline{\omega})).
\]

As long as \( q^* \geq \gamma_0 \), we get both \( W(p_0(q^*, \overline{\omega})) \geq \mu \) and \( W(p_0(q^*, \overline{\omega})) = W(p_0(1, \overline{\omega})) \).

So we only need to check if \( q^* \geq \gamma_0 \).

And \( q^* \geq \gamma_0 \) is equivalent to \( c^* \geq \frac{1}{1-\sigma} \frac{\gamma_0}{1-\gamma_0} \frac{1-h}{\gamma} \). As a result, any \( c^* \geq \frac{1}{1-\sigma} \frac{\gamma_0}{1-\gamma_0} \frac{1-h}{\gamma} \) is an equilibrium.

Private channels of horizontal interaction

Specifically we model the private channel of citizens’ horizontal communication in the following way. When public communication is not allowed, with probability \( h \), through certain private channels of communication, citizens can directly learn each other’s preference; with probability \( 1-h \), their communication is not
successful so that they still do not know each other’s preference. Thus $h$ captures the effectiveness of citizens’ horizontal interaction without the government’s communication platform. Proposition 7 shows that such a possibility will push the government to become more open and more willing to allow public communication.

**Proposition 7 (Private channels of horizontal communication)** Assume $W(p_0(1, \omega)) > \mu$, $p \leq \frac{1}{2}$, and $\rho_1 \leq \rho_2 \leq \mu$.

1. $\exists \delta > 0$ such that, $\forall h \in [0, \delta]$, $\sigma \in (0, \delta]$ in the equilibrium that maximizes the government’s welfare, the government allows public communication if and only if its private signal indicates that citizens are sufficiently heterogeneous, i.e.,

$$\alpha^* = \begin{cases} 1 & \text{if } \gamma < \gamma^*(h, \sigma) \\ 0 & \text{if } \gamma \geq \gamma^*(h, \sigma) \end{cases} \quad (A30)$$

2. even if the chance of a successful private communication among citizens is tiny, this possibility always forces the government to become more open; namely provided the condition in 1, $\gamma^*(h, \sigma) > \gamma^*(0, \sigma)$, $\forall h > 0$; and

3. when the likelihood of a successful private communication among citizens is large ($h = 1$), the government always allows public communication.

**Proof of Proposition 7**

0. First we show that whenever public communication is not allowed, the government never makes effort, namely $e_0^*(\gamma; h, \sigma) = 0$.

When the citizens communicate successfully, a successful reform brings the government a cost of at least $\mu$, and the status quo policy brings the government a cost

$$p\gamma W(p_0(1, \omega)) + 2p(1 - \gamma)p_0(0, \omega) \rho_1$$

$$< p\gamma p_0(1, \omega)^2(\rho_2 - 2 \rho_1) + 2p\gamma \rho_1 p_0(1, \omega) + 2p(1 - \gamma)p_0(1, \omega) \rho_1$$
\[ \leq p[p_0(1, \omega)^2(\rho_2 - 2\rho_1) + 2\rho_1 p_0(1, \omega)] \]
\[ \leq p\rho_2 \]
\[ \leq \mu. \]

When the citizens do not communicate successfully, a successful reform brings the government a cost of at least \( \mu \), and the status quo policy brings the government a cost
\[ p\gamma p_0(\hat{\gamma}_0, \omega)^2(\rho_2 - 2\rho_1) + 2p\rho_1 p_0(\hat{\gamma}_0, \omega) \]
\[ \leq p\rho_2 \]
\[ \leq \mu. \]

As a result, \( e^*_0(\gamma; h, \sigma) = 0 \).

(1) The government’s payoff gain is therefore
\[ G_{diff}(\gamma, \hat{\gamma}^*_0; h) = (1 - h)M(\gamma, p_0(\hat{\gamma}^*_0, \omega)) \]
\[ + h[p\gamma W(p_0(1, \omega)) + 2p(1 - \gamma)p_0(0, \omega)\rho_1] \]
\[ - p\gamma[\sigma\mu + (1 - \sigma)W(p_0(1, \omega))] - 2p(1 - \gamma)p_0(0, \omega)\rho_1 \]
\[ = pp_0(1, \omega)^2(\rho_2 - 2\rho_1) + h2p\rho_1[p_0(1, \omega) - p_0(0, \omega)] \]
\[ + p\sigma(W(p_0(1, \omega)) - \mu) - pW(p_0(1, \omega)) + 2pp_0(0, \omega)\rho_1 \]
\[ = h2p\rho_1[p_0(1, \omega) - p_0(0, \omega)] \]
\[ + p\sigma(W(p_0(1, \omega)) - \mu) - 2p\rho_1[p_0(1, \omega) - p_0(0, \omega)] \]
\[ = p\sigma(W(p_0(1, \omega)) - \mu) - 2p\rho_1[p_0(1, \omega) - p_0(0, \omega)](1 - h). \]

Fix any \( h_0 \in (0, 1) \), for any \( h \in [0, h_0] \), \( \sigma \in [0, \frac{2p\rho_1[p_0(1, \omega) - p_0(0, \omega)](1 - h_0)}{W(p_0(1, \omega)) - \mu}] \), the slope of the payoff gain is always negative.
Thus any equilibrium must follow the cut-point rule.

By repeating the logic in the proof of Proposition 2, we know that the equilibrium that maximizes the government’s welfare is the one with the smallest cut-point $\gamma^{**}(h, \sigma)$.

$$G_{\text{diff}}(x, E(\gamma|\gamma \geq x); h)|_{x=0} = (1 - h)2pp_1p_0(1, \overline{\omega}) + h \cdot 2pp_1p_0(0, \overline{\omega}) - 2pp_0(0, \overline{\omega})\rho_1 > 0.$$  

So we know that $\forall x \in [0, \gamma^{**}(h, \sigma))$, $G_{\text{diff}}(x, E(\gamma|\gamma \geq x); h) > 0$, otherwise it will be contradictory to the definition that $\gamma^{**}(h, \sigma)$ is the smallest zero point. We can verify that

$$G_{\text{diff}}(\gamma, \overline{\gamma}^*; h) = (1 - h)G_{\text{diff}}(\gamma, E(\overline{\gamma}|\overline{\gamma} \geq \gamma); h = 0) + hV_{\text{vertical}}(\gamma),$$

where

$$V_{\text{vertical}} = \sigma p\gamma[W(p_0(1, \overline{\omega}) - \mu] > 0$$

$\forall \gamma \in [0, \gamma^{**}(0, \sigma)]$, $G_{\text{diff}}(\gamma, E(\overline{\gamma}|\overline{\gamma} \geq \gamma); h = 0) \geq 0, V_{\text{vertical}}(\gamma) > 0$.

Therefore $G_{\text{diff}}(\gamma, \overline{\gamma}^*; h) > 0$, so that we must have $\gamma^{**}(h, \sigma) > \gamma^{**}(0, \sigma)$ for $h > 0$.

(3) When $h = 1$, the government’s payoff gain equals the value of vertical information $V_{\text{vertical}}(\gamma) > 0$, hence it always wants to allow public communication.

Asymmetric citizens

In our benchmark model, the citizens are ex ante the same and have the same prior distribution $p$. However in reality, the preference of some groups of citizens may already be publicly known and the uncertainty is only about the other citizens’ opinions. In Proposition 8, we investigate such a possibility in a variant version of the model. We show that the basic insight in the benchmark model directly applies to the case with ex ante asymmetric citizens, and the government allows public communication if and only if its private signal indicates that the two citizens share divergent preferences.
We consider the following environment. Citizen 1 is pro-reform type $\omega$ for sure, she and the government face the uncertainty about citizen 2’s preference. With probability $\theta$, citizen 2 supports reform and with probability $1 - \theta$, she strictly prefers the status quo. The government directly observes $\theta$ whereas citizen 1 only knows that $\theta$ is determined according to a cumulative distribution function $G(\theta)$. A higher $\theta$ implies a higher likelihood that citizens are both discontent with the status quo policy.\footnote{What $\theta$ also captures is the preference divergence between the government and citizen 2.} Similarly as the main result, Proposition 8 shows that the government allows public communication if and only if its private signal indicates that the two citizens share divergent preferences, i.e., $\theta$ is low.

**Proposition 8** Assume $k_i$ is i.i.d uniform distribution on $[0,1]$ and $\rho_2 \geq 2\rho_1$.\footnote{What $\theta$ also captures is the preference divergence between the government and citizen 2.} \exists L_0 > 0 $ such that $\forall L = L_0 \in (0, L_0]$, the government allows public communication if and only if government’s private signal indicates that citizen 2 is likely to prefer the status quo policy (i.e., $\theta$ is low).

**Proof of Proposition 8**

(1) Suppose $\hat{\theta}$ is citizen 1’s equilibrium perception toward $\theta$.

According to the same logic of Lemma 4’s proof, we know that the probability that $i$ protests in collective action (upon the status quo policy) $P_i(\hat{\theta})$ is pinned down by

$$\hat{\theta}(1 - 2\lambda)L P_2(\hat{\theta}) + \lambda L = P_1(\hat{\theta}),$$

$$(1 - 2\lambda)L P_1(\hat{\theta}) + \lambda L = P_2(\hat{\theta}).$$

Hence, $P_1(\hat{\theta}) = \frac{\hat{\theta}(1 - 2\lambda)L + \lambda L}{1 - \hat{\theta}(1 - 2\lambda)L^2}$, $P_2(\hat{\theta}) = (1 - 2\lambda)L P_1(\hat{\theta}) + \lambda L$, both of which are smaller than 1 (provided $L$ is sufficiently small) and strictly increasing in $\hat{\theta}$.

As $L$ is sufficiently small, the cost that the government suffers when the status quo is kept is also sufficiently small. As a result, the government will never make
an effort. Thus the government’s payoff gain in terms of allowing public communication is
\[
\theta P_1(\hat{\theta})P_2(\hat{\theta})\rho_2 + P_1(\hat{\theta})(1 - \hat{\theta}P_2(\hat{\theta}))\rho_1 + \theta P_2(\hat{\theta})(1 - P_1(\hat{\theta}))\rho_1 \\
-\theta[P_1(1)P_2(1)\rho_2 + P_1(1)(1 - P_2(1))\rho_1 + P_2(1)(1 - P_1(1))\rho_1] \\
-(1 - \theta)P_1(0)\rho_1
\]

It is a linear function in \(\theta\). The slope is
\[
P_1(\hat{\theta})P_2(\hat{\theta})\rho_2 - P_1(\hat{\theta})P_2(\hat{\theta})\rho_1 - P_2(\hat{\theta})P_1(\hat{\theta})\rho_1 \\
-[P_1(1)P_2(1)\rho_2 + P_1(1)(1 - P_2(1))\rho_1 + P_2(1)(1 - P_1(1))\rho_1] \\
+P_1(0)\rho_1 \\
= -[P_1(1)P_2(1) - P_1(\hat{\theta})P_2(\hat{\theta})](\rho_2 - 2\rho_1) \\
-[P_1(1) + P_2(1) - P_1(0)]\rho_1 < 0
\]

As a result, the government allows public communication if and only if \(\theta\) is sufficiently low. ■

**When citizens cannot Bayesian-update information**

In the benchmark, we implicitly assume that citizens are purely rational and can update information based on the action the government takes. In Proposition 9, we will relax this assumption by assuming that citizens cannot update any information based on the government’s action (especially the action regarding the openness). We show that the main result still holds. However as citizens become less sophisticated, the government will become less open.

Suppose that citizens cannot infer \(\gamma\) from the decisions of the government. Without public communication, their belief toward the social homogeneity is always \(\bar{\gamma} = E(\gamma)\) and is unaffected even when they see the government’s actions. Under the assumptions in Lemma 5, we can show that the government never makes effort when communication is not allowed by the similar logic of its proof. Accordingly
we write down the government’s payoff gain function as follows:

$$G_{\text{diff}}(\gamma) = M(\gamma, p_0(1, \omega)) - p_\gamma \min \{W(p_0(1, \omega)), \sigma \mu + (1-\sigma)W(p_0(1, \omega))\} - 2p(1-\gamma)p_0(0, \omega)\rho_1,$$

(A34)

Under the assumptions of Proposition 4 and by the similar logic of its proof, we can show that the payoff gain function is strictly decreasing, therefore in any equilibrium, the government allows public communication if and only if $\gamma$ is small. Suppose $\gamma^{***}$ is one of the new cut-point equilibria. When $\gamma = \gamma^{**}$, which is the equilibrium that maximizes the government’s welfare when the citizens are purely rational, the government’s welfare without the communication in the new equilibrium $\gamma^{***}$ should be higher than its payoff under the equilibrium $\gamma^{**}$ without communication. This is because in the new equilibrium $\gamma^{***}$ citizens’ belief $\overline{\gamma}$ is lower than their belief about social homogeneity $E(\gamma|\gamma \geq \gamma^{**})$ in the equilibrium $\gamma^{**}$. In other words, in the new equilibrium when the government shuts down the communication, it gets a higher degree of social stability than in the old case when citizens can update information. Hence, the government’s payoff without communication when $\gamma = \gamma^{**}$ under the new equilibrium $\gamma^{***}$ should be strictly higher than its payoff with communication. As a result, we must have $\gamma^{***} < \gamma^{**}$. This implies that the less sophistication of citizens makes the government less open. We summarize the result as follows.

**Proposition 9** Provided conditions in Lemma 5 and Proposition 4, when citizens cannot Bayesian-update information, in any equilibrium, the government allows communication if and only if its private signal indicates that citizens are sufficiently
heterogeneous, that is
\[
\alpha^* = \begin{cases} 
1 & \text{if } \gamma < \gamma^{**} \\
0 & \text{if } \gamma \geq \gamma^{**} 
\end{cases}; \tag{A35}
\]

Furthermore, any equilibrium \( \gamma^{**} \) induces a lower degree of openness than the welfare-maximizing equilibrium \( \gamma^{*} \) when citizens are purely rational, i.e., \( \gamma^{**} < \gamma^{*} \).

**High state capacity and willingness to adjust policy**

**Proposition 10 (High state capacity)** Assume \( W(p_0(0, \overline{\omega})) > \mu \) and condition (a) in Lemma 5 is satisfied. \( \exists \sigma_0 \in (0, 1) \) such that \( \forall \sigma \in [\sigma_0, 1] \), in any equilibrium, the government allows public communication if and only if its private signal indicates that the citizens are homogeneous, i.e.,

\[
\alpha^* = \begin{cases} 
1 & \text{if } \gamma > \gamma^* \\
0 & \text{if } \gamma \leq \gamma^* 
\end{cases}, \tag{A36}
\]

\( \gamma^* \in [0, 1] \).

**Proof of Proposition 10**

Provided condition (a) in Lemma 5, we know that the government never makes any effort when public communication is not allowed. \( W(p_0(0, \overline{\omega})) > \mu \) implies \( W(p_0(1, \overline{\omega})) > \mu \), so that the government always makes an effort when facing two pro-reform citizens. The government’s payoff gain is therefore

\[
p \gamma p_0(\overline{\gamma}_0, \overline{\omega})^2(2\rho_2 - \rho_1) + 2p_0(\overline{\gamma}_0, \overline{\omega})\rho_1 \\
- p \gamma [\sigma \mu + (1 - \sigma)W(p_0(1, \overline{\omega}))] - 2p(1 - \gamma)p_0(0, \overline{\omega})\rho_1.
\]

It is a linear function of \( \gamma \) and the slope is
\[ pp_0(\tilde{\gamma}_0, \overline{\omega})^2 (2\rho_2 - \rho_1) \]
\[-p[\sigma \mu + (1 - \sigma)W(p_0(1, \overline{\omega}))] + 2pp_0(0, \overline{\omega})\rho_1 \]
\[ \geq p[p_0(0, \overline{\omega})^2 (2\rho_2 - \rho_1) + 2p_0(0, \overline{\omega})\rho_1 - W(p_0(1, \overline{\omega}))] \]
\[ + p[W(p_0(1, \overline{\omega})) - \mu] \sigma \]
\[ > 0, \]
given \( \sigma > \frac{W(p_0(1, \overline{\omega}) - W(p_0(0, \overline{\omega}))}{W(p_0(1, \overline{\omega}) - \mu}. \]

As a result, the payoff gain is a strictly increasing function in \( \gamma \). \( \blacksquare \)
### Summary of propositions and their implications

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4In the table, propositions in the parenthesis are the generalized versions of the corresponding ones.
Supplementary Appendix

When the government does not know more than citizens

In this part, we present a variant version of the model where both the government and the citizens observe the realization of $\gamma$.\footnote{It is equivalent to assume that both the government and citizens only know the expected preference correlation, $E(\gamma)$.} Because citizens know more than in the benchmark model, they can coordinate their behavior based on the realization of the social homogeneity $\gamma$ even without the public communication platform.

We make several additional assumptions in this part to simplify the analysis.

First, each player’s gain from the policy is larger than the upper bound of the collective-action cost, i.e., $L = L > 1$. Second, the probability that an individual challenge succeeds is relatively small, i.e.,

$$\lambda < \min\{\frac{1}{L}, 1 - \frac{1}{L}\}.$$ \hspace{1cm} (S1)

Furthermore assume $\rho_2 \geq 2\rho_1$.

Denote $A \equiv (1 - \lambda)L$, which is the payoff gain of joining a protest (excluding the protest cost) provided that the other citizen also participates. Similarly, $B \equiv \lambda L$, is the payoff gain when the other citizen does not participate. Hence, we have $0 < B < 1 < A$.

$$M = p\gamma p_0(\gamma)^2 \rho_2 + 2pp_0(\gamma)\rho_1(1 - \gamma p_0(\gamma))$$ \hspace{1cm} (S2)

is the government’s expected loss from citizens’ collective action. Without the public communication, if the government makes an effort, it gets a cost $\sigma(\mu + \ldots$
\( M \) + \((1 - \sigma)M\), thus it never makes an effort without public communication and gets a payoff \(-M\).

When deliberation is allowed, the government will get \(-\mu\) if it sees two pro-reform citizens, get \(-p_0(0)\rho_1\) if it sees only one pro-reform citizen and get 0 if it receives no complaints. The difference in the government’s payoff therefore is:

\[
M - p\gamma\mu - 2p(1 - \gamma)p_0(0)\rho_1. \tag{S3}
\]

**Proposition 11 (Citizens’ preference correlation pushes regime openness)**

Provided that \(\frac{F^{-1}(y) - B}{y}\) is concave,\(^2\) when \(\lambda\) is sufficiently small, in the truth telling equilibrium, the government allows the citizens to speak if and only if the preference correlation of the citizens \(\gamma\) is sufficiently high. Specifically, \(\exists \gamma^* \in (0, \gamma_0),\) where \(\gamma_0 = \frac{1-B}{A-B},\) such that

\[
\alpha^* = \begin{cases} 
1 & \text{if } \gamma > \gamma^* \\
0 & \text{if } \gamma \leq \gamma^* 
\end{cases}. \tag{S4}
\]

This proposition seems contradictory to the main result in Proposition 4 that the government allows public communication when its privately observed \(\gamma\) is small. Under the assumption that the government does not know more about \(\gamma\) than the citizens, \(\gamma\) serves as a piece of public information that can coordinate citizens’ actions. The common knowledge on \(\gamma\) allows the citizens to have “implicit” communication even if the government does not allow them to communicate publicly. Namely, since \(\gamma\) is publicly observable, even without public communication, the two citizens can coordinate their actions based on \(\gamma\) through logic of “high order beliefs” naturally imbedded in the game structure. Thus \(\gamma\) here not only serves as the signal of the government, but also serves as the coordination device that ho-

\(^2\)The uniform distribution naturally satisfies this condition.
rizontally connects the citizens. From this point of view, this comparative statics is consistent with Proposition 7 that investigates the effect of citizens’ horizontal communication on the government’s openness, as the publicly observable \( \gamma \) captures how citizens are horizontally connected even without the platform of public communication provided by the government. More broadly, if we interpret \( \gamma \) as how sophisticated the citizens can privately connect with each other, this comparative statics is also consistent with Proposition 9 that shows less sophistication of citizens will make the government less open. In addition, if we focus on the trade-off between the cost of collective action and the benefit of horizontal learning, this result just reflects the intuition in Proposition 10 that shows that the government will allow public communication when the social homogeneity is higher, provided a sufficiently high state capacity and willingness to adjust the policy.

To prove the proposition, the following two lemmas will be in use.

**Lemma 7** Suppose \( f : I \to f(I) \) is a real-value function, \( I \) is an inertial on \( \mathbb{R} \). \( f(x) \) is concave and strictly increasing, then \( f^{-1}(y) \) is convex.

**Proof of Lemma 7**

\( \forall y_1, y_2 \in f(I) \) and \( y_1 < y_2, \forall \theta \in [0, 1], \) suppose \( x_1 = f^{-1}(y_1), x_2 = f^{-1}(y_2) \). We need to show \( f^{-1}(\theta y_1 + (1 - \theta) y_2) \leq \theta f^{-1}(y_1) + (1 - \theta) f^{-1}(y_2) \).

It is equivalent to \( f[f^{-1}(\theta y_1 + (1 - \theta) y_2)] \leq f[\theta f^{-1}(y_1) + (1 - \theta) f^{-1}(y_2)] \)

i.e., \( \theta y_1 + (1 - \theta) y_2 \leq f(\theta x_1 + (1 - \theta) x_2) \)

i.e., \( \theta f(x_1) + (1 - \theta) f(x_2) \leq f(\theta x_1 + (1 - \theta) x_2) \).

It is exactly the concavity of \( f(x) \). \( \blacksquare \)

**Lemma 8** Suppose \( \frac{F^{-1}(y) - B}{y} \) is concave, then \( p_0(\gamma) \) is convex in \( \gamma \) when \( \gamma \leq \gamma_0 \).
**Proof of Lemma 8**

By Lemma 4, we know that $T_0(\gamma)$ is strictly increasing in $\gamma$ when $\gamma \leq \gamma_0$, so $p_0(\gamma) = F(T_0(\gamma))$ is also strictly increasing in $\gamma$ when $\gamma \leq \gamma_0$.

To apply Lemma 7, we only need to check that $p_0^{-1}(\cdot)$ is concave. When $\gamma \leq \gamma_0$, according to Lemma 1, $T_0(\gamma)$ is determined by $T_0(\gamma) = \gamma F(T_0(\gamma))(A - B) + B$. Thus $p_0$ is determined by:

$$F^{-1}(p_0) = \gamma p_0(A - B) + B, \quad (S5)$$

which is equivalent to $\gamma = \frac{F^{-1}(p_0) - B}{(A - B)p_0}$. Because $\frac{F^{-1}(y) - B}{y}$ is concave by assumption, $p_0^{-1}(\cdot)$ is concave, therefore by Lemma 7, $p_0(\gamma)$ is convex in $\gamma$ when $\gamma \leq \gamma_0$. ■

**Proof of Proposition 11**

First we provide the more generalized conditions, of which the conditions stated in Proposition 11 are a special case.

- $\rho_2 \geq 2\rho_1$;
- $\rho_2 > \mu \geq \max\{F(B)\rho_1, 2p\rho_0(0)\rho_1\}$
- $\mu > F(B)[2\rho_1f(F(B)) + (\rho_2 - 2\rho_1)F(B) + 2\rho_1]$

(a) Given Equation (S2), whenever $\gamma \neq \gamma_0$,

$$\frac{dM}{d\gamma} = \zeta_1 p_0'(\gamma) + \zeta_2 \gamma 2p_0(\gamma)p_0'(\gamma) + \zeta_2 p_0(\gamma)^2, \quad (S6)$$

where $\zeta_1 = 2p\rho_1, \zeta_2 = p(\rho_2 - 2\rho_1)$. Therefore $M(\gamma)$ is strictly increasing in $\gamma$.

(b) According to Lemma 2, whenever $\gamma \geq \gamma_0$, the coordination effect is 0, therefore the government’s payoff gain is always positive, provided $\rho_2 > \mu$, so that in the following we will only consider the government’s payoff gain when $\gamma < \gamma_0$.  

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(c) When $\gamma < \gamma_0$,

$$\frac{d^2 M}{d\gamma^2} = \zeta_1 p_0''(\gamma) + 2\zeta_2 (p_0(\gamma)p_0''(\gamma) + (p_0'(\gamma))^2)\gamma + 4\zeta_2 p_0(\gamma)p_0'(\gamma). \quad (S7)$$

So $M$ is strictly increasing and convex in $\gamma$ given we already know $p_0''(\gamma)$ is convex by Lemma 8, when $\gamma \leq \gamma_0$. Thus the payoff gain function when $\gamma \leq \gamma_0$ is convex.

(d) $\text{payoff gain}|_{\gamma=0} = 2pp_0(0)\rho_1 - 2pp_0(0)\rho_1 = 0$.

(e) $\frac{dp\text{payoff gain}}{d\gamma}|_{\gamma=0} = \frac{dM}{d\gamma}|_{\gamma=0} - p\mu + 2pp_0(0)\rho_1. \quad (S8)$

We have

$$\frac{dM}{d\gamma}|_{\gamma=0} = \zeta_1 p_0'(0) + \zeta_2 p_0(0)^2. \quad (S9)$$

Recall that $p_0$ is determined by Equation (S5), we have:

$$\frac{1}{f(p_0(0))}p_0'(0) = p_0(0)(A - B). \quad (S10)$$

That is, $p_0'(0) = f(p_0(0))p_0(0)(A - B)$. Put it into Equation (S9) and Equation (S9) we have:

$$\frac{dp\text{payoff gain}}{d\gamma}|_{\gamma=0} = p\{F(B)[2\rho_1 f(F(B))(A - B) + (\rho_2 - 2\rho_1)F(B) + 2\rho_1] - \mu\}. \quad (S11)$$

Because $\mu > F(B)[2\rho_1 f(F(B)) + (\rho_2 - 2\rho_1)F(B) + 2\rho_1]$, we have $\frac{dp\text{payoff gain}}{d\gamma}|_{\gamma=0} < 0$.

(f) Because $\frac{dp\text{payoff gain}}{d\gamma}|_{\gamma=0} < 0$, payoff gain $|_{\gamma=0} = 0$, payoff gain $|_{\gamma \geq \gamma_0} > 0$, the payoff gain has a unique zero point in $(0, \gamma_0)$. ■