Concessions and Information Cascades in Autocracies
Preliminary Version

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Abstract

This paper offers an explanation for Tocqueville's long-held insight that "The most dangerous moment for a bad government is when it begins to reform." (1856) with a formal model featuring information cascade. In the authoritarian context, this Tocquevillian proposition builds on an issue every dictator of a declining regime faces. On one hand, making concession to challengers raises the legitimacy of the regime among the beneficiaries. On the other hand, it may also reveal the weakness of the regime and thus cause challengers to demand more concessions (e.g. populist policies such as franchise extensions). This poses an interesting puzzle since, historically, we do see quite a few examples of partial concessions—e.g., franchise in England was extended progressively to a wider population in 1832, 1867, and 1884—that might undermine the regime according to Tocqueville.

This paper examines, despite this issue, when it is optimal for a dictator to make a concession in order to avoid revolutions. We develop a game theoretical model in which a dictator decides whether to make a costly concession, and then citizens sequentially decide whether to revolt. Each citizen receives a private signal about the level of grievance against the regime among the citizens, and then decides whether to revolt. Each citizen revolts if she believes that the level of grievance is sufficiently high. If a citizen revolts, a revolution is organized. If all the citizens revolt, the

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revolution is initiated. Conditional on being initiated, the revolution is successful if and only if the grievance level is sufficiently high. Since the dictator does not receive any private signal about the grievance level, the dictator's action does not reveal any information about it.

We examine the trade-offs faced by the dictator. On one hand, if he makes a concession, each citizen is treated better, which makes a revolution less attractive to them. On the other hand, the concession affects strategic inference among the citizens, which may trigger the revolution to be initiated (information cascade may be more likely to happen). An intuition is as follows. First, if the dictator makes a concession, the citizens are treated better and a revolution becomes less attractive. Thus, each citizen is less likely to revolt. Second, however, once a citizen revolts, then a revolution is more likely to be initiated after a concession (information cascade is more likely to happen). To see why, suppose that the first citizen revolts, even though the dictator has made a concession and a revolution is less attractive. Then, the following citizens would infer that the first rebel must have received a strong signal that the grievance level is high. This inference may trigger an information cascade. Thus, after a concession, a revolution is less likely to be organized but more likely to be initiated conditional on being organized.

The comparative statics of the equilibrium show that the dictator makes a concession if the information possessed by each citizen is sufficiently accurate. This suggests that dictators are more likely to make a concession if more advanced information technology becomes available to the citizens. This paper provides an explanation for when the elite implement populist policies.

1 Introduction

This paper provides a theoretical model for explaining the dictator's decision to make a concession facing a revolution threat through the lens of information cascade. In their earlier contribution on democratization, Acemoglu and Robinson (2000) argue that, in the regimes controlled by a rich elite, they are often constrained to choose between the two extreme options, repression and full democratization [1], in responding to the revolutionary threats posed by the disenfranchised poor during the time of social turbulence when the latter only have *incomplete information* about the regime strength. [2] Even though the rich could be better off by simply offering more moderate concessions instead—e.g., partial enfranchisement to selected groups—, this choice will be self-defeating since it could be interpreted by the disenfranchised poor as a sign of regime weaknesses, thus further inciting them to make demands that are even more radical. Their model thus formalizes de Tocqueville's long-held insight that "The most dangerous moment for a bad government is when it begins to reform." (1856) with a solid micro-foundation based on the information asymmetries between classes.

Against the backdrop of the recent third wave of democratization (Huntington, 1991), while this democratization-repression thesis seems to travel well enough in explaining many cases of a full extension in suffrage to all adult citizens amidst social unrest, it leaves unanswered several cases where suffrage was only partially granted to a particular group of the society in a given period of time. For example, historically, the parliamentary franchise in nineteenth century England was extended progressively to a wider population in 1832, 1867, and 1884. In the United States, the suffrage was not extended to women until 1920 and to African-Americans until 1960s. In this regard, the basic insight from the democratization-repression thesis is that partial enfranchisement (as a form of credible concessions) arises as a pure-strategy equilibrium only when the information about the regime type is known to the disenfranchised poor—i.e., the complete-information case. [3] These cases pose several interesting theoretical puzzles to political economists. First of all, while a partial extension of suffrage (either proactive or passive) to a selected group could be less costly to the original ruling group in a short run, this decision, however, could also be revealing of the regime strength (weakness) to potential challengers. How could we account for this risky move? Second, from today's vintage point, almost all cases of partial enfranchisement did not stop at a particular extension and eventually, they all converged to a full democracy of some kind. Why did the leaders in these regimes choose to embark on this slippery slope toward the end of their political privileges? What was the driving force that moved the process forward?

More generally, this implies that we need a theoretical model for predicting when the

[1] Of course, in reality, the universal suffrage does mean that literally everyone is granted a right to vote. In practice, the franchise is rarely extended to those below 18 years old. In this sense, what we mean by "full democratization" is actually one only for adults according to a certain pre-defined age threshold.

[2] There are three regime types in Acemoglu and Robinson (2000), tough, flexible, and weak. It should be noted here that, in their paper, whether the information about the regime strength is complete or incomplete is assumed to be exogenous to the poor's ability to challenge the regime.

[3] Under the case of incomplete information, partial enfranchisement can only arise as a *mixed-strategy* equilibrium.

dictator make less extreme choices, e.g., concessions that might please a part of the population and their effects on the dynamics of citizens' collection actions. Through the lens of information cascade, our model explains why some dictators do not offer concessions or reforms when they are under the pressure of being overthrown by citizens, while some do. More critically, our model also helps identity two critical effects of concessions on the occurrence of revolutionary cascade: strategic and informational effects.

The paper is structured as follows. Section 2 introduces the basic setup of the model, followed by Section 3 where we explain our equilibrium concept. Section 4 discusses the the major predictions of our model, and Section 6 explains its empirical implications. Finally, Section 7 concludes.

2 The Model

We construct a simple model of a regime change and information cascade. There are two citizens $i \in \{1, 2\}$ and the current regime, which is denoted by r.

2.1 Uncertainty about the Regime's Quality

Each citizen faces uncertainty about the payoff when the current regime is maintained (i.e., the payoff under the status quo).[4] This payoff is $-q$, where q takes either $\bar{q}$ or $\underline{q}$ with an equal probability. As for the normalization, we assume that $\bar{q} = 1$ and $\underline{q} = 0$. This payoff is common across citizens. For instance, this uncertainty corresponds to the uncertainty about how well the regime can manage the economy.

Though each citizen does not know the exact value of q, each one receives a private signal about q, which is denoted by s_i. To be specific, $s_i \equiv q + \varepsilon_i$, where ε_i follows a standard normal distribution $N(0, 1)$. ε_i is independently drawn across citizens.

2.2 Revolution

Citizens sequentially decide whether to revolt or not: first, citizen 1 decides whether to revolt and after that citizen 2 decides about it. The decision of citizen 1 is observable to citizen 2. Citizen i's action is denoted by $a_i \in \{r, n\}$, where $a_i = r$ represents that the citizen revolts.

The participation in the revolution incurs a private cost $c_c > 0$,[5] and the revolution succeeds if and only if both citizens revolt. If only citizen 1 revolts, the revolution fails and citizen 1 pays the additional cost ρ for this failure. This cost corresponds to the punishment by the regime. If the revolution becomes successful, the regime changes and each citizen receives zero as a payoff.

This structure of the game implies that the participation in the revolution can be described as a voluntary public good provision game with a threshold.

[4] We assume that the regime also does not know this value. Lohmann (2000) also introduce the uncertainty about the status quo payoff.

[5] Citizens pay this cost independently of whether the revolution is successful.

2.3 Regime

At the beginning of the game, the regime chooses b_i, which is the level of concession for citizen i, and ρ, which is the punishment level for the unsuccessful revolution. Concession for citizen i is the additional payoff citizen i receives if citizen i does not revolt and the regime remains.

Concession incurs cost $c_r(b_i)$ for each b_i. If the regime changes, the regime receives payoff $-C_R$, where $C_R > 0$. If only one citizen revolts, the regime receives payoff $-C_S$, where $C_S > 0$. C_S corresponds to the cost for suppression.

In this article, we just conduct a comparative statics of the equilibrium outcome with respect to b_i and ρ. That is, we do not endogenize the regime's decision. However, to understand the implications from the comparative statics, it is useful to take the regime's payoff into account. That is why we introduce the regime's payoff here.

2.4 Citizen's Payoff

Based on these settings, we have citizen i's payoff as follows.

First, suppose that citizen i does not revolt. Then, her/his payoff is given by

$$U_i(n) \equiv \mathbf{1}\{R\} \cdot 0 + (1 - \mathbf{1}\{R\})(-q + b_i), \tag{1}$$

where $\mathbf{1}\{R\}$ is an indicator function which takes one if and only if the regime changes.

Similarly, the payoff when citizen i revolts is given by

$$U_i(r) \equiv \mathbf{1}\{R\}(0 - c_c) + (1 - \mathbf{1}\{R\})(-q - c_c - \rho). \tag{2}$$

Citizen 1 revolts if and only if $E[U_1(n)|s_1] \leq E[U_1(r)|s_1]$. Citizen 2 revolts if and only if $E[U_1(n)|s_2, a_1] \leq E[U_1(r)|s_2, a_1]$.[6] Here, citizen 2's decision depends on a_1 simply because citizen 2 decides whether to revolt after observing citizen 1's decision.

2.5 Timing of the Game

The timing of the game is summarized as follows:

1. The regime chooses (b_1, b_2, ρ).
2. Nature chooses (q, s_1, s_2). Citizen i observes s_i.
3. Citizen 1 chooses action a_1.
4. After observing a_1, citizen 2 chooses action a_2.
5. The payoffs are realized.

Note that in this study, we consider the subgame after period 1. That is, the regime's decision is exogenously given.

The equilibrium concept is a pure strategy perfect Bayesian equilibrium, which is a standard concept for an incomplete information game.

[6] Whether each citizen revolts when s/he is indifferent between two choices do not change our results at all. This is just for the simplicity.

3 Equilibrium

In this section, we characterize the equilibria. The pure strategy of citizen 1 is $\alpha_1 : \mathbb{R} \to \{r, n\}$ and that of citizen 2 is $\alpha_2 : \mathbb{R} \times \{r, n\} \to \{r, n\}$. Let the equilibrium α_i be α_i^*.

3.1 Authoritarian Equilibrium

We start with the following simple observation.

Fact 1. *There always exists an equilibrium wherein $\alpha_1^*(s_1) = n$ for all s_1; and $\alpha_2^*(s_2, a_2) = n$ for all s_2 and a_1. We refer to this class of equilibria as authoritarian equilibrium.*

Proof. Suppose that $\alpha_2^* = n$ for any history. Then, citizen 1 has no incentive to revolt because it is never successful. That is, $\alpha_1^* = n$ constitutes an equilibrium strategy given citizen 2's strategy. Next, consider citizen 2's strategy. When $a_1 = n$, the revolution is never successful so that citizen 2 has no incentive to revolt. When $a_1 = r$, an off-equilibrium path occurs so that any belief formation on q is allowed. By setting an appropriate belief, it is shown that citizen 2 has no incentive to revolt. Therefore, $\alpha_2^* = n$ also constitutes an equilibrium strategy. ■

This observation implies that there always exists an equilibrium in which no one participates in the revolution. This is not surprising given the nature of our game. As discussed in Section 2.2, our game is a public good game such that the public good is provided only if all the participants contribute to its provision. Hence, if each citizen believes that the other one does not participate in the revolution, no one has an incentive to revolt. This mechanism creates the existence of the authoritarian equilibrium.

3.2 Revolution Equilibrium

Although the existence of this equilibrium is interesting, it does not imply that the revolution never arises. We have another equilibrium in which $\alpha_1^*(s_1) = r$ for some s_1. We refer to this class of equilibria as *revolution equilibrium*. Since our objective is to analyze the effect of concession on the likelihood of revolution, from now on, we focus on the class of revolution equilibria.

To begin with, it is shown that the equilibrium strategy of each citizen is the threshold strategy.

Lemma 3.1. *Suppose that (α_1^*, α_2^*) constitutes a revolution equilibrium. Then, the following three properties hold:*

(i). There exists $\mu_1^* \in \mathbb{R}$ such that $\alpha^*(s_1) = r$ if and only if $s_1 \geq \mu_1^*$.

(ii). There exists $\mu_2^* \in \mathbb{R}$ such that $\alpha^*(s_2, r) = r$ if and only if $s_2 \geq \mu_2^*$.

(iii). $\alpha^*(s_2, n) = n$ for all s_2.

Proof. This is straightforward. Thus, we omit the proof. ■

The higher s_i implies the higher probability of q being $\bar{q}$ (i.e., the lower expected payoff when the regime continues). Hence, when s_i is high, citizen i should have an incentive to revolt. This is the reason why the equilibrium strategy can be characterized as a threshold strategy. What we need to do next is to derive the values of μ_1^* and μ_2^*.

3.2.1 Citizen 2's Decision

We solve the game backwardly. That is, we first determine the value of μ_2^* given μ_1^*.

Given that citizen 1 revolts, the revolution is successufl if and only if citizen 2 revolts. Hence, citizen 2's payoff when s/he revolts is

$$-c_c, \tag{3}$$

while her/his payoff when not revolting is

$$-E[q|s_2, a_1 = r] + b_2. \tag{4}$$

Hence, citizen 2 revolts if and only if

$$(3) \geq (4) \Leftrightarrow b_2 + c_c \leq E[q|s_2, a_1 = r]. \tag{5}$$

Here,

$$\begin{aligned} E[q|s_2, a_1 = r] =& \Pr(q = 1|s_1 \geq \mu_1, s_2) \\ =& \frac{0.5\phi(s_2 - 1)(1 - \Phi(\mu_1 - 1))}{0.5\phi(s_2 - 1)(1 - \Phi(\mu_1 - 1)) + 0.5\phi(s_2)(1 - \Phi(\mu_1))} \\ =& \frac{\phi(s_2 - 1)(1 - \Phi(\mu_1 - 1)}{\phi(s_2 - 1)(1 - \Phi(\mu_1 - 1)) + \phi(s_2)(1 - \Phi(\mu_1))}, \end{aligned} \tag{6}$$

where ϕ and Φ are the density and cumulative distribution functions of the standard normal distribution respectively. The first equality comes from the fact that $a_1 = r$ if and only if $s_1 \geq \mu_1$ and the second equality comes from the Bayes rule. Hence, (5) can be rewritten as

$$(1 - b_2 - c_c)\phi(s_2 - 1)(1 - \Phi(\mu_1 - 1)) \geq (b_2 + c_c)\phi(s_2)(1 - \Phi(\mu_1)) \tag{7}$$

This inequality could hold only when $1 > b_2 + c_c$.[7] That is, μ_2^* exists (i.e., a revolution equilibrium exists) only when $1 > b_2 + c_c$. For now, we assume the existence of a revolution equilibrium so that we assume $1 > b_2 + c_c$. Then,[8]

$$\begin{aligned} (7) \Leftrightarrow & \frac{(b_2 + c)(1 - \Phi(\mu_1))}{(1 - b_2 - c_c)(1 - \Phi(\mu_1 - 1))} \leq \exp\left(-\frac{(s_2 - 1)^2}{2} + \frac{s_2^2}{2}\right) \\ \Leftrightarrow & s_2 \geq \mu_2(\mu_1) \equiv 0.5 + \log \frac{(b_2 + c_c)(1 - \Phi(\mu_1))}{(1 - b_2 - c_c)(1 - \Phi(\mu_1 - 1))} \end{aligned} \tag{8}$$

In (8), we finally obtain the threshold μ_2 given μ_1.

We summarize the result in the following lemma.

Lemma 3.2. *In a revolution equilibrium, $\mu_2^* = \mu_2(\mu_1^*)$ holds.*

[7] Otherwise, the left-hand side becomes non-positive while the right-hand side is positive.

[8] Here, we use the exact formula of the density function of the standard normal distribution.

3.2.2 Citizen 1's Decision

Given the result in Lemma 3.2, we next turn to the analysis of citizen 1's decision. Now, we derive μ_1 given μ_2.

Though we omit the detailed derivation in the main text (see Appendix 8), the derivation is basically the same as that of μ_2. After the calculation, we obtain the following inequality corresponding to (7):

$$[1-(1+\rho)\Phi(\mu_2-1)-b_1-c_c]\phi(s_1-1) \geq (b_1+c_c+\rho\Phi(\mu_2))\phi(s_1). \tag{9}$$

This inequality could hold only when $1 > (1+\rho)\Phi(\mu_2-1)+b_1+c_c$ That is, μ_1^* exists (i.e., a revolution equilibrium exists) only when $1 > (1+\rho)\Phi(\mu_2-1)+b_1+c_c$. For now, we assume the existence of a revolution equilibrium so that we assume this holds. Then, (9) can be rewritten as

$$s_1 \geq \mu_1(\mu_2) \equiv 0.5 + \log \frac{b_1+c_c+\rho\Phi(\mu_2)}{1-(1+\rho)\Phi(\mu_2-1)-b_1-c_c}.$$

We summarize the result in the following lemma.

Lemma 3.3. *In a revolution equilibrium,* $\mu_1^* = \mu_1(\mu_2^*)$ *holds.*

3.2.3 Equilibrium Characterization

As seen in the previous subsections, the revolution equilibrium (if exists) is characterized by the two equations: $\mu_1^* = \mu_1(\mu_2^*)$ and $\mu_2^* = \mu_2(\mu_1^*)$. The remaining task is to ensure the existence and uniqueness of the revolution equilibrium. By imposing an additional condition, we obtain these properties.

Theorem 3.4. *For sufficiently small* b_1, b_2, c_c, *and* ρ, *the revolution equilibrium uniquely exists. In addition, the equilibrium threshold* (μ_1^*, μ_2^*) *are characterized by* $\mu_1^* = \mu_1(\mu_2^*)$ *and* $\mu_2^* = \mu_2(\mu_1^*)$.

Proof. See Appendix 9. ∎

Here, we assume that b_1, b_2, c_c, and ρ are sufficiently small. This assumption itself is unsurprising. When, for example, b_1 is higher than one, citizen 1 prefers the current regime to the revolution. In that case, obviously, there is no revolution equilibrium. To avoid such cases, we need an assumption that these values are sufficiently small. Note that the assumption is unnecessary for the uniqueness of the revolution equilibrium. That is essential only for the existence part.

4 Effect of Concession

From now on, we assume that the revolution equilibrium exists and analyze the effect of concession on the revolution equilibrium.

We obtain the following comparative statics result, which is our main result.

Proposition 1. *The following three properties are obtained:*

(i). μ_1^* is increasing in b_1, while μ_2^* is decreasing in b_1.

(ii). μ_1^* and μ_2^* are increasing in b_2.

(iii). μ_1^* is increasing in ρ, while μ_2^* is decreasing in ρ.

Proof. See Appendix 10. ■

(i) is about the effect of concession for citizen 1. The first part of (i) argues that the concession increases μ_1^*, which is the equilibrium threshold such that agent 1 revolts if and only if $s_1 \geq \mu_1^*$. That is, the concession reduces citizen 1's incentive to revolt because the payoff when not revolting increases as a result of concession. This is the benefit of concession for the regime, which is usually expected. The interesting result is the effect on citizen 2's incentive. The second part of (i) argues that the concession decreases μ_2^* i.e., the concession for citizen 1 increases the probability of citizen 2's revolt conditional on citizen 1's revolt.

To understand the mechanism, we first explore how the revolt by citizen 1 affects citizen 2's incentive. It has two effects: a strategic effect and an information effect. Without citizen 1's revolt, revolution becomes never successful so that citizen 2 revolts only if citizen 1 decides to do so. This strategic complementarity implies that citizen 1's revolt enhances citizen 2's incentive to revolt. This is the strategic effect. Another effect is about information transmission. Citizen 1 revolts only when the received signal indicates the regime's low quality. Hence, citizen 1's revolt tells citizen 2 that citizen 1 receives the signal about the low quality. As a result, citizen 2 upwardly updates the probability of the regime having only low quality. This encourages citizen 2 to revolt.

As discussed, when the concession for citizen 1 is large, citizen 1 revolts only when the received signal strongly indicates the regime's low quality. This implies that the information value of citizen 1's revolt is increasing in the level of concession b_1. Hence, the larger concession makes the information effect larger, meaning that citizen 2's incentive to revolt increases. As a result, concession is not necessarily beneficial for the regime.

Here, it should be noted that this information effect also weakens the effect on citizen 1. Concession for citizen 1 directly decreases her/his incentive to revolt. However, we have another indirect effect through citizen 2's incentive. Citizen 1 has a larger incentive to revolt when citizen 2 is more likely to revolt due to the strategic complementarity. Since concession increases citizen 2's incentive to revolt, concession for citizen 1 indirectly increases citizen 1's incentive to revolt. Although this indirect effect is always dominated by the direct effect, the direct effect is at least weakened by the indirect effect. Hence, concession for citizen 1 might not necessarily be a strong device to prevent citizen 1 from revolting. These are the findings in (i).

(iii) argues that a similar mechanism works for another parameter, ρ. This is not surprising, because the punishment when the revolution is suppressed has a similar work with the concession.

5 A Historical Case: Late Qing Constitutional Reforms and Its Collapse

In this section, we use a historical case in the Chinese history to illustrate how reforms might actually facilitate an information cascade for protests or revolutions when they are rejected by some reform beneficiaries. One good example is a series of political reforms implemented by the imperial government during the late Qing Dynasty in China.

Almost immediately after the Russo-Japanese War in 1905 (7 years before the final collapse of the dynasty), the fact that Japan, as a newly industrialized country on the rise, was able to defeat the Russian empire, an established western superpower, made most Chinese intellectuals and activists believe that a constitutional monarchy was the only way to make "China great again." In other words, they didn't think that China's problem lay in its backward technologies, insufficient resources, or even the race (since Japanese were also Asian), but in its political institutions. This shift in ideas therefore made the relatively superficial reforms such as western technology adoption, industrial restructuring, and military upgrading the Qing government had put in place since 1901 appear to be obsolete and irrelevant.

In response to the growing demand for political reforms, the Qing royal court then decided to introduce more radical reforms in its political institutions. In 1906, the actual rule of the Qing dynasty, Empress Dowager Cixi, issued an official decree that a constitution would be drafted immediately and its guideline was published in 1908 with an announcement that the constitution would take effect in ten years. In the following year, the elections for the Advisory Council were held in all provinces. The Council had 200 members, half of whom were elected, while the other half were picked by the royal court. Its opening session was held in 1910, followed by the introduction of the western-style cabinet led by the prime minister to replace the old emperor-centered bureaucracy. In other words, while how profound and sincere these reforms were is debatable, it is undeniable the Qing government had made concessions to include or co-opt more Chinese elites in its political system.

According to the theoretical framework of revolutionary cascade, should all these co-opted elites have had accepted the offer made by the Qing government and stopped challenging the regime, the Dynasty might have been able to survive beyond 1912. This is exactly where our model comes into play. At the same time when the Qing government was trying to revive its legitimacy through the concessions it made, the campaigns for more radical reforms also mushroomed across the country. Specifically, many political elites including provincial governors and high-ranking military officers jointly filed a petition in 1910 through the Advisory Council for shortening the preparatory period for the constitution to be enforced and opening the national assembly in the following year. This means that the government's concessions were rejected by the political elites, and, for other political actors who were watching how the reforms were received, they immediately captured such a signal that the situation was in fact so bad that the beneficiaries of reforms declined to side with the regime. According to our model, if even an invitation to join the regime was not accepted, the threshold for other political actors who made their decisions sequentially will also be lowered and a cascade was triggered to attract more people to join the revolution. The case of Qin dynasty is consistent with our model's predictions. When a relatively large concession was rejected, it led to a larger revolution. More intellectuals and radical activists became disillusioned about the regime and supported a more radical approach— overthrowing it! The Dynasty eventually collapsed in midst of riots and insurrections across the country shortly after in 1912.

6 Discussion and Implications

Our theoretical findings have profound empirical implications for several strands of literature on collective action. First of all, our model provides an alternative approach to "Tocqueville's paradox." Different from Acemoglu and Robinson's (2000) weakness-revealing argument and Finkel and Gehlbach's (2019) behavioral argument of reference-dependent agents, our simpler model solves the paradox by identifying two critical effects of concessions (or agent-specific reforms) through the theoretical lens of information cascade. This makes our model more empirically implementable since it doesn't depend on people's perceptions of the regime strength, which are more difficult to measure. Instead, our key parameter, the regime quality, is readily available from all kinds of survey research and poll numbers. Moreover, our model doesn't impose any behavioral assumption that might a model less generalizable for a potential discrepancy between the assumption and people's actual decision-making patterns.

Moreover, our model also helps extend the frontier of the recently burgeoning literature on responsive authoritarianism. In the Chinese context, a number of recent empirical studies have shown that such a strategy actually reflects an underlying principle of governance, responsive authoritarianism, according to which the Chinese government responds to social demands expressed through either institutional—e.g., People's Congress at the central (Truex, 2016) and local (Manion, 2016) levels—, or non-institutional—media reports (Huang, Boranbay-Akan, and Huang, 2019), online criticisms (Chen, Pan, and Xu, 2016), and protests (Lorentzen, 2013, 2014)—channels. From a supply-side perspective, it is precisely the government's authoritarian responsiveness that has made the Chinese regime so resilient (Nathan, 2003). Nonetheless, this empirical literature fails to take into account the potential repercussions from the authoritarian governments' responses, be they concessions or reforms. That is, the literature seems to assume that, once problems have been identified and addressed by a government, the regime will be stabler. Our model shows that it's not necessary the case since concession or reforms can actually have a different effect on the momentum of protests. Cognitively, more concessions can actually make followers more disillusioned about the regime when their predecessors declined to accept them. Our theoretical findings thus enrich the literature by clarifying different effects of the "responsiveness."

The conclusion here also paves the road for further extensions to networked cascades. Compared to the setup with independent agents, the effect of concessions on a cascade will be subsided when agents share the same networks through which information about the regime quality can be communicated. Interestingly, networks can actually make concessions more effective. In other words, there will only be *strategic* effect and no *informational* effect, since the "surprise" in the non-networked case is absent now. Specifically, our model predicts that concessions are more likely to disrupt cascades and stabilize an authoritarian regime in a highly networked society.

7 Concluding Remarks

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Appendices

8 Citizen 1's Decision in a Revolution Equilibrium

8.1 Payoff when Revolting

We start with deriving the expected payoff when citizen 1 revolts. There are two cases: (i) citizen 2 also revolts so that the revolution becomes successful; and (ii) citizen 2 does not revolt so that the revolution fails. The probability that case (i) ((ii)) occurs is the probability that citizen 2 receives signal $s_2 \geq (<) \mu_2$. Hence, the payoff we want to get is

$$\Pr(s_2 \geq \mu_2 | s_1) \cdot 0 + \Pr(s_2 < \mu_2 | s_1) \cdot (-E[q|s_1, s_2 < \mu_2] - \rho) - c_c.$$

We now derive the second term in the above formulation. From the Bayes rule,

$$\Pr(q = 1|s_1, s_2) = \frac{\phi(s_1 - 1)\phi(s_2 - 1)}{\phi(s_1 - 1)\phi(s_2 - 1) + \phi(s_1)\phi(s_2)};$$

and the density of s_2, denoted by η is

$$\begin{aligned} \eta(s_2 = s'|s_1) =& \Pr(q = 1|s_1) \cdot \phi(s' - 1) + \Pr(q = 0|s_1) \cdot \phi(s') \\ =& \frac{\phi(s_1 - 1)}{\phi(s_1 - 1) + \phi(s_1)}\phi(s' - 1) + \frac{\phi(s_1)}{\phi(s_1 - 1) + \phi(s_1)}\phi(s'). \end{aligned} \tag{10}$$

By using them, the second term can be rewritten as

$$\begin{aligned} &\Pr(s_2 < \mu_2|s_1) \cdot (-E[q|s_1, s_2 < \mu_2] - \rho) \\ =& \int_{\mu_2}^{-\infty} [-\Pr(q = 1|s_1, s_2) - \rho]\eta(s_2 = s'|s_1) ds' \\ =& -\int_{\mu_2}^{-\infty} \left[\frac{\phi(s_1 - 1)}{\phi(s_1 - 1) + \phi(s_1)}\phi(s' - 1) + \frac{\phi(s_1)}{\phi(s_1 - 1) + \phi(s_1)}\phi(s')\right] \cdot \left[\rho + \frac{\phi(s_1 - 1)\phi(s' - 1)}{\phi(s_1 - 1)\phi(s' - 1) + \phi(s_1)\phi(s')} \right. \\ =& -\left[\frac{\phi(s_1 - 1)}{\phi(s_1 - 1) + \phi(s_1)}\Phi(\mu_2 - 1) + \frac{\phi(s_1)}{\phi(s_1 - 1) + \phi(s_1)}\Phi(\mu_2)\right]\rho - \frac{\phi(s_1 - 1)}{\phi(s_1 - 1) + \phi(s_1)}\Phi(\mu_2 - 1) \\ =& -\frac{\phi(s_1 - 1)}{\phi(s_1 - 1) + \phi(s_1)}\Phi(\mu_2 - 1)(1 + \rho) - \frac{\phi(s_1)}{\phi(s_1 - 1) + \phi(s_1)}\Phi(\mu_2)\rho. \end{aligned} \tag{11}$$

Hence, citizen 1's expected payoff when revolting is

$$-\frac{\phi(s_1 - 1)}{\phi(s_1 - 1) + \phi(s_1)}\Phi(\mu_2 - 1)(1 + \rho) - \frac{\phi(s_1)}{\phi(s_1 - 1) + \phi(s_1)}\Phi(\mu_2)\rho - c_c. \tag{12}$$

8.2 Payoff when Not Revolting

Next, we derive citizen 1's expected payoff when not revolting. Since the regime remains in this case, the expected payoff is

$$-E[q|s_1] + b_1.$$

Here,

$$E[q|s_1] = \Pr(q = 1|s_1) = \frac{\phi(s_1 - 1)}{\phi(s_1 - 1) + \phi(s_1)}.$$

Hence, the expected payoff is

$$-\frac{\phi(s_1 - 1)}{\phi(s_1 - 1) + \phi(s_1)} + b_1 \tag{13}$$

Therefore, citizen 1 revolts if and only if (13)≤(12). By rearranging this inequality, we have (9).

9 Proof of Theorem 3.4

9.1 Uniqueness

We start by proving the following lemma.

Lemma 9.1. $\log(1 - \Phi(\mu_1)) - \log(1 - \Phi(\mu_1 - 1))$ *is decreasing in* μ_1*.*

Proof. Since the standard normal distribution is symmetric around zero, $1 - \Phi(x) = \Phi(-x)$ holds for all x. Hence,

$$\begin{aligned}\log(1 - \Phi(\mu_1)) - \log(1 - \Phi(\mu_1 - 1)) &= \log(\Phi(-\mu_1)) - \log(\Phi(-\mu_1 + 1)) \\ &= -\left[\log(\Phi(1 - \mu_1)) - \log(\Phi(-\mu_1))\right].\end{aligned} \tag{14}$$

Here, $\log(\Phi(1 + x)) - \log(\Phi(x))$ is decreasing in x because $\log(\Phi(x))$ is concave.[9] Hence, (14) is decreasing in μ_1. ■

This lemma guarantees the following property:

- $\mu_2(\mu_1)$ is decreasing in μ_1.
- $\mu_1(\mu_2)$ is increasing in μ_2.

This property directly implies that the solution to $\mu_1(\mu_2)$ and $\mu_2(\mu_1)$ are uniquely determined (if exists).

Proposition 2. *If a revolution equilibrium exists, that is unique.*

[9] It is known that the density function of a normal distribution is log-concave. Furthermore, it is also known that if the density function is log-concave, the cumulative distribution function is also log-concave (Bagnoli and Bergstrom 2005). Thus, we obtain the property.

9.2 Existence

The remaining task is to show the existence of the revolution equilibrium.

Proposition 3. *For sufficiently small b_1, b_2, c_c, and ρ, the revolution equilibrium exists.*

Proof. We assume that $b_1 + c_c < 1$ and

$$1 > (1+\rho)\Phi\left(\log\frac{b_2+c_c}{1-b_2-c_c} - 0.5\right) + b_1 + c_c. \tag{15}$$

Since both inequities hold for sufficiently small b_1, b_2, c_c, and ρ, it suffices to prove the existence of the solution to $\mu_1(\mu_2)$ and $\mu_2(\mu_1)$ under these two inequalities.[10]

Step 1. Construct an inverse function of $\mu_1 = \mu_1(\mu_2)$. To this end, we need to know both the domain and the range of $\mu_1(\mu_2)$.

First, we derive its domain. $\mu_1(\mu_2)$ is defined only over μ_2 satisfying $1 > (1+\rho)\Phi(\mu_2 - 1) + b_1 + c_c$. Let

$$\bar{\mu}_2 \equiv \sup\{\mu_2 | 1 > (1+\rho)\Phi(\mu_2 - 1) + b_1 + c_c\}.$$

It can be easily observed that $\bar{\mu}_2$ exists and for all $\mu_2 \in (-\infty, \bar{\mu}_2)$, $1 > (1+\rho)\Phi(\mu_2-1) + b_1 + c_c$ holds. Hence, $\mu_1(\mu_2)$ is defined over $\mu_2 \in (-\infty, \bar{\mu}_2)$. We obtained the domain of $\mu_1(\mu_2)$.

Next, we obtain the range. When $\mu_2 \to -\infty$, $\mu_1(\mu_2) \to \underline{\mu_1} \equiv 0.5 + \log\frac{b_1+c_c}{1-b_1-c_c}$. In addition, when $\mu_2 \to \bar{\mu}_2$, $\mu_1(\mu_2) \to \infty$. By combining this and the continuity of $\mu_1(\mu_2)$, we obtain the range: $R \equiv (\underline{\mu_1}, \infty)$.

Since $\mu_1(\mu_2)$ is strictly decreasing function, we can obtain its inverse function: $\mu_2 = \mu_1^{-1}(\mu_1)$, where the domain is defined as R. We denote this function by $\mu_2 = f(\mu_1)$. This function is also a decreasing function and

$$\lim_{\mu_1 \to \underline{\mu_1}} f(\mu_1) = -\infty; \ \lim_{\mu_1 \to \infty} f(\mu_1) = \bar{\mu}_2.$$

Step 2. By combining $f(\mu_1)$ and $\mu_2(\mu_1)$, we can define a new function $g(\mu_1) \equiv f(\mu_1) - \mu_2(\mu_1)$. Note that its domain is again R. It suffices to prove that there exists μ_1 satisfying $g(\mu_1) = 0$. Since g is a continuous function, there exists such $\mu_1 \in R$ if

$$\lim_{\mu_1 \to \underline{\mu_1}} g(\mu_1) < 0; \ \lim_{\mu_1 \to \infty} f(\mu_1) > 0. \tag{16}$$

This is the immediate consequence of the intermediate value theorem. Hence, it is enough to prove (16). First,

$$\begin{aligned}\lim_{\mu_1 \to \underline{\mu_1}} g(\mu_1) &= \lim_{\mu_1 \to \underline{\mu_1}} f(\mu_1) - \lim_{\mu_1 \to \underline{\mu_1}} \mu_2(\mu_1) \\ &= -\infty - \lim_{\mu_1 \to \underline{\mu_1}} \mu_2(\mu_1) < 0.\end{aligned}$$

[10](15) is just a sufficient condition.

The last inequality comes from the fact that $\lim_{\mu_1 \to \underline{\mu_1}} \mu_2(\mu_1)$ is bounded. Second,

$$\begin{aligned}
\lim_{\mu_1 \to \infty} g(\mu_1) &= \lim_{\mu_1 \to \infty} f(\mu_1) - \lim_{\mu_1 \to \infty} \mu_2(\mu_1) \\
&> \lim_{\mu_1 \to \infty} f(\mu_1) - \lim_{\mu_1 \to \underline{\mu_1}} \mu_2(\mu_1) \\
&= \bar{\mu}_2 - \lim_{\mu_1 \to \underline{\mu_1}} \mu_2(\mu_1) \\
&> \bar{\mu}_2 - \lim_{\mu_1 \to -\infty} \mu_2(\mu_1) \\
&= \bar{\mu}_2 - \left(\log \frac{b_2 + c_c}{1 - b_2 - c_c} + 0.5 \right) > 0.
\end{aligned}$$

The last inequality comes from the fact that $\log \frac{b_2+c_c}{1-b_2-c_c} + 0.5$ satisfies $1 > (1+\rho)\Phi(\mu_2 - 1) + b_1 + c_c$ from (15).

Hence, we finally establish the existence of the solution to $g(\mu_1) = 0$. ■

10 Proof of Proposition 1

We only prove (i). (ii) and (iii) can be proven in a similar way.

Let

$$f^1(\mu_1, \mu_2; b_1) \equiv 0.5 + \log \frac{b_1 + c_c + \rho\Phi(\mu_2)}{1 - (1+\rho)\Phi(\mu_2 - 1) - b_1 - c_c} - \mu_1;$$

$$f^2(\mu_1, \mu_2; b_1) \equiv 0.5 + \log \frac{(b_2 + c_c)(1 - \Phi(\mu_1))}{(1 - b_2 - c_c)(1 - \Phi(\mu_1 - 1))} - \mu_2.$$

By applying the implicit function theorem,

$$\begin{pmatrix} \frac{\partial \mu_1^*}{\partial b_1} \\ \frac{\partial \mu_2^*}{\partial b_1} \end{pmatrix} = -Df_\mu^{-1} \begin{pmatrix} \frac{\partial f^1}{\partial b_1} \\ \frac{\partial f^2}{\partial b_1} \end{pmatrix}, \tag{17}$$

where

$$Df_\mu \equiv \begin{pmatrix} \frac{\partial f^1}{\partial \mu_1} & \frac{\partial f^1}{\partial \mu_2} \\ \frac{\partial f^2}{\partial \mu_1} & \frac{\partial f^2}{\partial \mu_2} \end{pmatrix}.$$

Here,

$$\frac{\partial f^1}{\partial \mu_1} = -1; \ \frac{\partial f^1}{\partial \mu_2} > 0; \ \frac{\partial f^2}{\partial \mu_1} < 0; \ \frac{\partial f^2}{\partial \mu_2} = -1.$$

Note that the third one comes from Lemma 9.1. By substituting these into (17) and computing it, we have

$$\frac{\partial \mu_1^*}{\partial b_1} < 0; \ \frac{\partial \mu_1^*}{\partial b_1} > 0.$$