On Dictatorships

by

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Abstract

This dissertation consists of three essays on dictatorships. The first two study the economic impact of power struggles in dictatorships. They focus on one mechanism used by dictators to remain in power, shuffling, where delegates have a short and uncertain tenure in any assignment. In these models, there is a ruler, a delegate and a population. The ruler and the delegate have a 'type', characterizing their ability as a ruler. The population can mount an insurrection, replacing the ruler with the delegate. The type of the ruler is known, while the type of the delegate is unknown to the other players.

In Chapter 1, I assume that the delegate does not know his type, but can reveal it through an investment decision. I then show that shuffling is useful politically, even though it produces an economic cost, in that it reduces the delegate's incentive to invest, which prevents information about his type from being revealed. I also show that the ability to shuffle has some economic benefits, in that it assures the ruler that he can eliminate growing political threats, which induces him to encourage some investment.

In Chapter 2, I assume that the delegate knows his type and can call for an insurrection. I show that shuffling can ensure the ruler's survival when it is a punishment on the delegate. With sufficiently low payoffs, even a bad type wants to replace the ruler, so that no call for insurrection can be trusted. The same logic explains why a ruler would invest in a white elephant project to remain in power.

In Chapter 3, I propose a general model of divide and rule. I show that a ruler maximizes rents by playing off divisions in the population. Typically, a ruler relies on an extreme support base, who is most afraid of the alternative regime, and invests in any technology which exacerbates popular divisions. I argue that the model offers an explanation for the negative correlation between corruption and freedom of the media, which has been widely documented. This explanation is consistent with widespread awareness of corruption in the population.

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Chapter 1

Political Strength and Economic Efficiency in a Multi-Agent State

1.1 Introduction

Dictatorship has been the prevalent system of government for most of human history and is still entrenched in many countries today. For the rulers of such regimes, the question of political survival is particularly tricky. How does a dictator ensure that his delegates do not topple him? What are the economic implications of this power struggle among the elite? And how does a foreign power deal with such regimes, when it cares about the welfare of the population? These are some of the most important questions in economic history, comparative politics and international relations. Yet they have received little attention from game theorists.

This essay addresses such questions with the help of a simple model. It focuses on one particular mechanism that dictators have used to discipline their delegates: the 'big shuffle' or the 'wheel of fortune'. This is a practice whereby delegates are rotated from one function to another, and promoted and demoted at will. It is very ancient and was used in a variety of cases. In Mughal India, nobles were in charge of tax collection in a particular region, called *jagir,* for only a short amount of time. In the Ottoman empire, cavalrymen would receive a military fief, called *timar*, also for a short amount of time, and provincial governors would also be rotated.[1]

The practice was also used in more recent history.[2] The most famous example may come from the Mobutu regime in Zaire. At the top of the state hierarchy, close advisors were constantly threatened to lose their privileges. Nguza Karl i Bond, for example, was chosen as Mobutu's foreign minister in early 1972. He was arrested in 1977, tortured, tried for treason, condemned to death, only to be released in 1978, becoming foreign minister again in 1979 and prime minister in 1980-1. He then suddenly fled Zaire, publicly denouncing the excesses of the regime, but was eventually readmitted into the government, being named ambassador to the US in 1986 and subsequently foreign minister and prime minister. Many other top officials encountered a similar fate, prompting scholars to write : 'A Second Republic ministry was a hostel for courtiers in transit, not a baronial fief.' (Young and Turner 1985, 56). The frequent rotation of officials also trickled down in the state hierarchy. For example, regional commissioners (ie provincial governors) were shuffled annually from 1967 to 1970, and every 3 years from then on (Young and Turner 1985, 225 and Callaghy 1984, 246).

Shuffling delegates is generally believed to prevent them from building their own support base, protecting the ruler against a break-up of his territory or a direct coup. Consider the three cases mentioned above. In Mughal India, although the dynasty was eventually secure in the capital, the empire was vast and expanding, and the threat of secession was real. Ultimately, the empire disintegrated into a series of successor states, with provinces breaking away from the capital, led by regional nobles (in the case of the Deccan, Bengal and Awadh).[3] In the Ottoman empire, the rotation of officials prevented an alliance between nobles and peasants against the central state, explaining the absence of peasant rebellions in the 17th century (Barkey 1991, 1994). To meet growing fiscal needs, however, the empire auctioned off lifetime tax farming contracts, starting in 1695. Local notables rose in prominence. Ultimately, secessions became possible, with the striking case of Muhammad Ali, who established his own dynasty in Egypt.[4] In Zaire, shortly after independence, the central state was undermined by strong

[1] More precisely, in Mughal India, tenure in a jagir could vary between less than a year and 2-3 years in the 16th and early 17th century (Habib 1999, 301). In the Ottoman empire, most governors would stay between 1 and 3 years in the same province in the late 16th and early 17th century (Goyunc 2000, 523).

[2] For a detailed discussion, see Migdal (1988).

[3] See Habib (2003).

[4] For a general review of the history of the Ottoman empire, see Quataert (2000). For more on the rise of

regional movements, in particular the secession of the province of Katanga, led by its president Moise Tshombe (see Willame 1972, chapter 3). Mobutu, having risen to power through a coup, needed to establish his legitimacy. He quickly reduced the number of the provinces and dealt with the threat of rebellions and coups (notably the wars in Shaba in 1977 and 1978, and the failed coup of 1975).

While shuffling delegates may have some political benefits, it can also hurt the economy. With a short and uncertain tenure, delegates have little incentive to invest in the future. In Mughal India, travelers and scholars alike described the negative effect of the jagirdari system on growth. In a famous account, the French traveler Francois Bernier described as follows the incentives of the jagirdar:

'Why should the neglected state of this land create uneasiness in our minds? And why should we spend our money and time to render it fruitful? We may be deprived of it in a single moment, and our exertions would benefit neither ourselves nor our children. Let us draw from the soil all the money we can, though the peasant should starve or abscond, and we should leave it, when commanded to quit, a dreary wilderness.' (Bernier 1996, 227).

Commenting on the quote above, the historian Barrington Moore suggests that although the Frenchman may have exaggerated his case, 'there is abundant evidence to show that he put his finger on the main defect in the Mogul polity.' (Moore 1966, 328)[5] Likewise, in the Ottoman empire, the central state's effort to maintain political prominence is believed to have restricted economic activity (Pamuk 2004). The same argument is made about Zaire. Schatzberg (1980, 1988) argues that a short and uncertain tenure tempted regional officials to extract as much as they could from the territory they controlled. This prompted what he called a 'dialectic of oppression', where agents at any layer of the state apparatus exploited their subordinates, with dire consequences for the population. Even central authorities recognized the disastrous effect of the big shuffle on the economy, and yet this practice persisted.[6]

And so the question is: why was the shuffling of delegates practiced? If a dictator is able to stay in power for a long period, does he not have the best incentives to promote the growth

local notables, or *ayans*, see McGowan (1994), Ozkaya (2000) and Mert (2000).

[5]For a classic case of the negative economic impact of the jagirdari system, see Habib (1999). This position has not reached consensus in the literature. See Marshall (2003).

[6]"It is clear that frequent transfer of territorial agents and others have grave consequences both for the territorial service and for the agents themselves and their families." (quoted in Callaghy 1984, 249).

of his economy? And as a foreign country, what policies should we adopt if we care to improve the welfare of the population? Would abolishing the practice of shuffling necessarily benefit the population?

To answer such questions, this paper presents a simple formal model. It is a game of incomplete information and symmetric learning, with three sets of players: a ruler, a delegate and a population. There is a single economic decision, which is an investment in a public good, taken by the delegate. A delegate's success in the investment project depends on his type, which is initially unknown by all players in the game. The type of the ruler, however, is known, capturing the fact that he has had the opportunity to establish a reputation. The population, observing the investment decision and investment outcome, learns about the type of the delegate and decides whether to mount an insurrection, toppling the ruler and replacing him with the delegate.

In this case, we conclude that a ruler's incentive to promote economic growth depends on his strength, as measured by the cost that a population must expend to replace him. When a ruler is strong, he is safely in power and encourages investment. When a ruler has intermediate strength, however, he would be replaced by an insurrection if his delegate succeeds in the investment. Therefore, the ruler shuffles any delegate who invests and poses a political threat. This gives very low incentives for investment, and output is low as a result. The model therefore offers a simple explanation of the fact that long-lived rulers may not have the best incentives to encourage economic growth: success can be appropriated by a ruler's underling and threaten the ruler. Moreover, we can show that, even if shuffling has negative economic consequences, it is also constrained optimal. Indeed, shuffling provides the ruler with the assurance that he can eliminate growing political threats. If the ruler could not shuffle, then he may simply reorganize his state, leaving no discretion to his delegates. This will hurt to the population, since the bad ruler is able to stay in power, and does so by restricting economic activity to a minimum.

With this simple model, we can draw a set of policy prescriptions, for a foreign country that cares about the welfare of the population. First, military support is useful if it drastically reduces the cost of insurrection. In this case, the bad ruler can easily be replaced, and a good politician may take over the reigns of the country. If this is not possible, however, marginal military support will weaken the ruler without leading to his replacement. In this case, the ruler will have greater incentives to restrict economic activity so that he can stay in power. Second, fostering an environment where politicians are more likely to be good (for example, by training them abroad) will hurt the population if it is done on a small-scale. Likewise, allowing good politicians to better distinguish themselves (for example, with a more decentralized system) may actually hurt the population. In both cases, the ruler will still be strong enough that he can stay in power and yet the increased threat will force him to restrict economic activity.

Let me say a few words about how the paper relates to the literature. It is part of a growing literature on political struggles in weakly institutionalized polities (Bueno de Mesquita et al. 2003, Acemoglu, Robinson and Verdier 2004, Azam, Bates and Biais 2005, Egorov and Sonin 2005, 2006, Padro-i-Miquel 2006, Acemoglu, Debs and Sonin 2006, Gandhi and Przeworski 2006, Myerson 2006a, Svolik 2006, Debs 2007a,b). Egorov and Sonin (2006) highlight the important trade-off that a ruler faces between the competence and the loyalty of his agent. Bueno de Mesquita et al. (2003) solve a dynamic model where a dictator faces a challenger and chooses the optimal mix of public and private goods, depending on the size of the coalition and pool of potential supporters (selectorate). Svolik (2006) and Myerson (2006a) focus on the moral hazard problem of the dictator, tempted to shirk in his payment to his supporters, in a static and dynamic game, respectively. Acemoglu, Robinson and Verdier (2004) show how a dictator can stay in power using a divide-and-rule strategy. Padro-i-Miquel (2006) adds that the dictator can exploit his own support base in doing so, and Debs (2007a) argues that manipulation of the media can be explained with such a logic. Parallel to this economics literature, there is a literature in sociology and political science on patrimonial states (Weber 1968, Chehabi and Linz 1998). Weber (1968) coins the term of 'patrimonial state' to refer to political systems where the ruler governs the country as his personal domain. Chehabi and Linz (1998) discuss various forms of patrimonial state and offer a good survey of cases in the 20th century.

With its focus on economic outcomes, the paper contributes to a literature on inefficient policies (Coate and Morris 1995, McGuire and Olson 1996, Robinson 1998, Acemoglu 2005a, 2005b, 2006, Eggertsson 2005, Robinson and Torvik 2005 and Paltseva 2006). McGuire and Olson (1996), for example, present the classic argument that long-lived rulers have the best incentives to encourage growth, since they can earn the benefits of any increase in future economic performance. While certainly intuitive, this results does not explain why many of the recent dictators stayed in power for long periods of time, even as their economy was floundering. On this note, the paper is also related to a literature on the economic impact of political institutions, and the economic conditions for political change and stability (see Londregan and Poole 1990, Przeworski et al. 2000, Acemoglu et al. 2006 and Acemoglu and Robinson 2006, Jones and Olken 2005, Persson and Tabellini 2006). In particular, Jones and Olken (2005) show that leaders have a significant impact on the growth of their economy, but suggest there is no systematic relationship between the length of a ruler's tenure and the growth of the economy.

The following paper proposes a solution based on agency problems in dictatorship. In that regard, it is also related to the large organizational economics literature. Aghion and Tirole (1997) present a classic study of the optimal allocation of authority between a principal and an agent. In the model, however, the agent cannot replace the principal. As far as we know, there are few papers tackling directly the 'political economy' of the firm (see e.g. Milgrom and Roberts 1988, Friebel and Raith 2004, Argyres and Mui 2005). The closest paper may be Friebel and Raith (2004), which argues that hierarchical communication can help mitigate the incentives for bad manager to hire incompetent subordinates. If a subordinate could communicate with top executives, then he could reveal the incompetence of his manager and make a case that he would be a better replacement.

Summing up, the main contribution of the paper, along with Debs (2007b), is to develop a model of agency problems within the state, where the principal can be replaced by the agent, but can also manipulate the reputation of the agent, and focuses on the economic impact of this power struggle. The main difference with Debs (2007b) is that, in the latter, the delegate knows his own type, wants to signal it in a cheap talk game, and the dictator tries to make this signal uninformative.

The rest of the paper is organized as follows. Section 1.2 introduces the baseline model. Section 1.3 solves a simplified version of the model, establishing some key results. Section 1.4 solves the baseline model, establishing the comparative statics and welfare analysis. Section 1.5 discusses an efficiency rationale for shuffling. Section 1.6 concludes. Formal proofs and figures are included in the appendix.

1.2 The Baseline Model

This is an infinitely-repeated game where, at any time $t \geq 1$, there is a ruler r_t, a delegate l_t and a population p. There is a single economic decision, which is an investment I_t in a public good, taken by the delegate l_t at cost $K^I > 0$ (where $I_t = 1$ mean that the investment does take place, and $I_t = 0$ means that it does not). Let the quality of the public good A_t take two values ($A_t \in \{0,1\}$), and assume that the public good takes a value of 1 if and only if the delegate invests in the public good and is successful, where his success depends on his type $q(l_t)$. More precisely,

$$prob(A_t = 1) = \begin{cases} 1 & \text{if } I_t = 1 \text{ and } q(l_t) = g \\ \theta & \text{if } I_t = 1 \text{ and } q(l_t) = b \\ 0 & \text{if } I_t = 0 \end{cases} \tag{1.1}$$

where $\theta \in (0,1)$. In other words, a good delegate always succeeds with the investment project, whereas a bad delegate may fail. We let the delegate play a mixed strategy, where $\rho_t = prob(I_t = 1)$.

Depending on the outcome of the investment, and the type of the ruler $q(r_t)$, the population, the ruler and the delegate get a flow payoff of $u_p(q(r_t), A_t)$, $u_r(q(r_t), A_t)$ and $u_l(q(r_t), A_t)$ respectively. We assume that these payoffs are weakly positive and strictly increasing in the quality of the public good and the type of a ruler:[7]

Condition 1 *(Monotonicity)* $\forall a \in \{p, r, l\}$

$$u_a(q(r_t), 1) \;>\; u_a(q(r_t), 0) \geq 0 \;\forall q(r_t) \tag{1.2}$$

$$u_a(g, A_t) \;>\; u_a(b, A_t) \geq 0 \;\forall A_t \tag{1.3}$$

Upon observing the investment decision and outcome, the population can mount an insurrection. This decision is captured by the variable $i_t \in \{0,1\}$. $i_t = 1$ means that the population mounts an insurrection, which we assume is successful with probability 1 and costs $K^p > 0$.

[7] In our model, a type strictly refers to a politician's ability to increase the welfare of the population. For example, a politician may be a great speaker and an astute negotiator, but he may be unable to address the particular needs of his population, if he cares to discover them at all. In our definition, this politician will be 'bad'.

Through an insurrection, the ruler is ousted and replaced by the delegate. Moreover, we assume that insurrections lead to an absorbing state, where the delegate combines the functions of ruler and delegate and is safely in power. We restrict our attention to insurrection decisions being pure strategies.

While we do not let the ruler fight an insurrection, we allow him to shuffle the delegate before the population can mount an insurrection. Let $S_t \in \{0,1\}$ denote whether there is a shuffle or not, where $S_t = 1$ means that a shuffle does take place. Upon shuffling, a delegate is taken out of his assignment and gets a flow payoff and a continuation payoff of 0. He is replaced by another delegate l_t^o, taken from a pool of politicians of infinite supply. Let l_t' designate the local agent after the insurrection decision. We have

$$l_t' = \begin{cases} l_t & \text{if } S_t = 0 \\ l_t^o & \text{if } S_t = 1 \end{cases}$$

We assume that shuffling costs $\varepsilon \geq 0$ to the ruler.[8] We let the ruler pick a mixed strategy $s_t = prob(S_t = 1)$. Shuffling therefore replaces the current delegate with another unknown politician, and may alter the insurrection decision of the population. On this note, let me say a few words about the informational structure, the timing of the game and equilibrium concept.

1.2.1 Informational Structure

All actions in the game are observable. The type of the ruler is known, capturing the fact that he has had a chance to establish a reputation. The type of the delegate is unknown to all players in the game (including the delegate himself). Let the probability assessment about the type of the delegate be written μ, with prior beliefs $\mu(q(l_1) = g) = \mu_0 \in (0,1)$. Write μ_m as the posterior belief that a delegate is good if he has launched m consecutive projects ($m \geq 0$). By Bayes' rule, we have

$$\mu_{m+1} = \frac{\mu_m}{\mu_m + (1-\mu_m)\theta} \tag{1.4}$$

[8] This cost could come from various sources, for example any expense incurred in the transfer of duties to the new agent. Mathematically, though, $\varepsilon > 0$ ensures that the equilibrium of section 1.3 is unique, which simplifies the presentation.

1.2.2 Timing of the Game

At any time t, decisions are taken as follows:

1. l_t decides I_t

2. r_t implements S_t

3. A_t and $u_a(q(r_t), A_t)$ are realized

4. p decides i_t

From this timing, we see that the flow payoffs are accrued before the insurrection decision. When choosing whether to mount an insurrection, the population trades off the current cost of insurrection against the expected future benefit of replacing the current dictator. When choosing whether to shuffle the delegate, the ruler wants to secure his future rents, but may in equilibrium deter the delegate from investing (since the delegate must pay the cost of investment at step 1 and benefits from his investment only if he is not shuffled).

We assume that players discount their future payoffs by δ and are risk-neutral. As a function of the state of the game at the start of period t, $\omega_t = (q(r_t), \mu(q(l_t) = g))$, we write the value of the game for players (p, r_t, l_t) as follows:

$$v_p(\omega_t) = u_p(q(r_t), A_t) + i_t[-K^p + \delta v_p^i(q(l_t'))] + (1 - i_t)\delta v_p(q(r_t), \mu(q(l_t') = g)) \tag{1.5}$$

$$v_r(\omega_t) = u_r(q(r_t), A_t) - \varepsilon S_t + (1 - i_t)\delta[S_t v_r(q, \mu_0) + (1 - S_t)v_r(q(r_t), \mu(q(l_t') = g))] \tag{1.6}$$

$$\begin{aligned} v_l(\omega_t) = &-I_t K^I + (1 - S_t)u_l(q(r_t), A_t) \\ &+\delta(1 - S_t)[i_t v_r^i(q(l_t')) + (1 - i_t)v_l(q(r_t), \mu(q(l_t') = g))] \end{aligned} \tag{1.7}$$

where $v_a^i(q)$ is the continuation value of player a after an insurrection, when the type of the new ruler is q.

We want to see how shuffling can help a ruler secure his hold on power, while possibly affecting the investment decision of the delegate. Let us focus on the case where the delegate does invests in the public good, if he is certain not to be shuffled, given the increase in his flow payoffs. In other words,

$$K^I < \theta[u_l(q,1) - u_l(q,0)] \quad \forall q \tag{1.8}$$

In this sense, the investment is 'efficient' and should occur along the equilibrium path, if not for political constraints.

1.2.3 Equilibrium Concept

We are solving for a Markov Perfect Bayesian Equilibrium, where strategies depend on history only through the state $\omega_t = (q(r_t), \mu(q(l_t) = g))$, they are optimal given beliefs, and beliefs are updated using Bayes' rule. Strategies are captured by the variables $\rho(q(r_t), \mu(q(l_t) = g))$, $s(I, q(r_t), \mu(q(l_t) = g))$, $i(q(r_t), \mu(q(l_t') = g))$. We add a superscript * to denote equilibrium strategies.

1.3 A Simplified Version

Let us consider a simple version of this infinitely-repeated game. In this set-up, decisions are taken in a single period $t = 1$. After this first period, players get an exogenous 'continuation payoff' equal to $v_a(q(r_2))$, which is a function of the type of the ruler at the end of the first period.[9] We impose

$$0 < \varepsilon < \delta[\mu_0 + (1-\mu_0)\theta]v_r(b) \tag{1.9}$$

$$K^I > [\mu_0 + (1-\mu_0)\theta][u_l(b,1) - u_l(b,0)] - \delta(1-\mu_0)(1-\theta)v_r(b) \tag{1.10}$$

$$\frac{v_p(g) - v_p(b)}{u_p(b,1) - u_p(b,0)} > \frac{\mu_0 + (1-\mu_0)\theta}{\delta\mu_0} \tag{1.11}$$

(1.9) ensures that the ruler does not shuffle the delegate unless it is strictly profitable for him to do so, and the cost of shuffling is not prohibitively high. (1.10) states that the delegate does not want to invest when he is ensured of becoming the ruler by staying put. (1.11) says

[9] If there is an insurrection, then write $v_r^i(q(r_2)) = v_r(q(r_2)) + v_l(q(r_2))$, since the new ruler combines the functions of ruler and delegate.

that the benefit of having a good ruler in the continuation game is sufficiently high.[10] With these conditions, we can show the following result:

Lemma 1 *If $q(r) = g$, then the unique equilibrium has $\rho^*(g, \mu_0) = 1$, $s^*(I, g, \mu_0) = 0\ \forall I$, $i^*(g, \mu') = 0\ \forall \mu'$. If $q(r) = b$, then there is generically a unique equilibrium, with the following strategies:*

$$\rho^*(b, \mu_0) = 1 \Leftrightarrow K^p > \mu_1 \delta[v_p(g) - v_p(b)] \tag{1.12}$$

$$s^*(0, b, \mu_0) = 0 \tag{1.13}$$

$$s^*(1, b, \mu_0) = 1 \Leftrightarrow K^p \in (\mu_0 \delta[v_p(g) - v_p(b)], \mu_1 \delta[v_p(g) - v_p(b)]) \tag{1.14}$$

$$i^*(b, \mu') = 1 \Leftrightarrow K^p < \mu' \delta[v_p(g) - v_p(b)] \tag{1.15}$$

Proof. *See the appendix.* ■

This lemma states that any good ruler is safely in power and encourages investment. For a bad ruler, the incentives to encourage investment depend on his strength (see figure 1). A strong ruler is safely in power and encourages investment. A ruler of intermediate strength, however, will be replaced if the delegate invests in the project and is successful. Therefore, the ruler threatens to shuffle any delegate who invests and, in equilibrium, there is no investment. When the ruler is weak, he knows that any delegate of unknown type replaces him. Therefore, he would like to encourage investment, hoping that it fails, which would reveal that the delegate is bad. But if the future rents as a ruler are sufficiently high (ie (1.10) holds), then the delegate is not willing to take such a risk, and passively waits for an insurrection.

Focusing on the welfare of the population, we reach the following conclusions (see figure 2 and remark 4 in the appendix). Given that the population cares sufficiently about having a good ruler in the continuation game (condition 1.11 holds), then in the best-case scenario, the bad ruler should be weak, because the population can replace him with a good delegate with positive probability. Failing this, it would be better if the ruler were strong, since he would feel secure enough in power to encourage investment. In this sense, we may compare these

[10](1.9) is imposed simply to ensure that there is a unique equilibrium. Relaxing (1.10) could lead to a different equilibrium outcome when the cost of insurrection is sufficiently low. (1.11) helps us in our welfare analysis.

strong rulers to the stationary bandits of McGuire and Olson (1996), who are long-lived and encourage investment. Note however that their incentive to encourage growth does not come from the length of their rule -an equilibrium outcome- but from their political strength. Indeed, rulers of intermediate strength also remain in power, but they do not want investment to take place, because any success can be appropriated by the delegate and trigger an insurrection. Therefore, the model offers a simple framework where long-lived rulers do not necessarily have the best incentives to encourage growth, a conclusion which seems consistent with empirical observations. This is a novel argument. Previous papers assume that the dictator does not directly benefit from growth and/or do not consider power struggles within the state (Bueno de Mesquita et al. 2003, Acemoglu 2005b, 2006, Paltseva 2006).

Let us now take the comparative statics with respect to the important parameters of the model (μ_0 and θ, see figures 2a and 2b). First, we note that when the ruler's strength is extreme, the population benefits from a greater proportion of good delegates (μ_0): assuming that the ruler is strong, it increases the probability that a project is successful; assuming that the ruler is weak, it increases the probability that a good delegate comes to power. But an increase in μ_0 can also hurt the population. If it is more likely that a delegate is good, the population is willing to mount an insurrection for higher values of the cost of insurrection, which may force the ruler to prevent any investment to ensure his survival.

Second, an increase in θ benefits the population. On the one hand, it increases the probability that an investment project is successful, which directly benefits the population when the ruler is strong and the delegate invests. On the other hand, it reduces the informational content of a successful project. Therefore, the population is less willing to mount an insurrection after observing a successful project, and the ruler may feel safely enough in power to encourage investment. We can speculate about the factors which determine the value of θ. It may be lower when the set of responsibilities of the ruler and the delegate are 'more similar' or when the investment project is more complex. Interpreted in this way, we can compare our result to Myerson (2006b), which suggests that a system where politicians can easily reveal their type (e.g. federalism) is beneficial to the population. In our current principal-agent model, the delegate's ability to reveal his type is endogenous, manipulated by the principal. If delegates can reveal their type too easily when they invest (ie θ is low), the principal may just induce them not to invest at all, threatening to shuffle them if they do invest.

Summing up, we obtain a variety of results in a simplified version of this game. First, long-lived dictators do not necessarily have the best incentive to encourage economic growth. Second, the welfare of the population is non-monotonic in the strength of a bad ruler. Note, however, that we can get much richer results in the full dynamic game. In that case, shuffling a delegate also affects the *future* strength of the ruler. In some cases, a delegate may not be an immediate political threat, but he could slowly become one. It is interesting, therefore, to see how this affects the ruler's incentive to shuffle delegates.

1.4 Solution of the Baseline Model

Let us now focus our attention to the full game. First, we can endogeneize the values $v_a^i(q)$ for $a \in \{p, r\}$. Assume that an insurrection has taken place. Given that the ruler combines the functions of ruler and delegate, and given that the project is sufficiently productive (condition (1.8) holds), then any ruler invests with probability one after an insurrection. In that case, we get:

$$v_p^i(q) = \frac{(\mu + (1-\mu)\theta)u_p(q,1) + (1-\mu)(1-\theta)u_p(q,0)}{1-\delta} \tag{1.16}$$

$v_r^i(q) = v_{rr}^i(q) + v_{rl}^i(q)$, where

$$\begin{aligned} v_{rr}^i(q) &= \frac{(\mu + (1-\mu)\theta)u_r(q,1) + (1-\mu)(1-\theta)u_r(q,0)}{1-\delta} &(1.17)\\ v_{rl}^i(q) &= \frac{-K^I + (\mu + (1-\mu)\theta)u_l(q,1) + (1-\mu)(1-\theta)u_l(q,0)}{1-\delta} &(1.18)\end{aligned}$$

and $\mu = 1 \Leftrightarrow q = g$.

Now consider the case of a bad ruler who faces the possibility of an insurrection. Solving the model, we impose the following conditions:

$$\delta \geq \frac{\theta}{\mu_0 + (1-\mu_0)\theta} \tag{1.19}$$

$$\varepsilon = 0 \tag{1.20}$$

$$K^I > [\mu_0 + (1-\mu_0)\theta]\,[u_l(b,1) - u_l(b,0)] - \delta(1-\mu_0)(1-\theta)v^i_{rr}(b) \tag{1.21}$$

$$u_l(b,0) \to 0 \tag{1.22}$$

$$\frac{u_p(g,1) - u_p(b,1)}{u_p(b,1) - u_p(b,0)} \to \infty \tag{1.23}$$

$$\frac{u_r(b,1) - u_r(b,0)}{u_r(b,0)} \to 0 \tag{1.24}$$

(1.19) imposes that players are sufficiently patient. (1.20) says that shuffling is not too costly.[11] (1.21) says that the delegate will not invest if he is assured of becoming the ruler by staying put. (1.22), on the other hand, when coupled with (1.8), ensures that the delegate invests in the public good when he does not expect to be shuffled and remains a delegate by staying put. (1.23) says that the population cares sufficiently about having a good ruler, as opposed to having a high value of public good under a bad ruler. (1.24) imposes that the ruler cares infinitely more about being in power than about having a high value of public good.[12]

Inspired by the solution of section 1.3, we postulate three types of equilibrium. In a first type, the ruler encourages economic efficiency and stays in power with probability one. In a second type, he does stay in power, but by restricting investment by the delegate. In a third type, he is replaced with positive probability. First, we will say that *the equilibrium is efficient, and the threat of insurrection is moot* if

(i) $\forall \mu \geq \mu_0$, $\rho^*(b,\mu) = 1$, $s^*(1,b,\mu) = 0$

(ii) $\forall \mu'$, $i^*(b,\mu') = 0$

In this equilibrium, a delegate invests with probability one, even if he is believed to be good with arbitrarily large probability, and the ruler does not shuffle him (*i*). In response, the population never mounts an insurrection, no matter what are the beliefs about the delegate (*ii*). With these conditions, we obtain the following lemma:

[11] Remember that we assumed $\varepsilon > 0$ simply to ensure the uniqueness of the equilibrium of the simplified version.

[12] (1.23) and (1.24) can be relaxed. They are used to simplify the presentation. The appendix provides explicit bounds such that the results in the text go through.

Lemma 2 *Any efficient equilibrium where the threat of insurrection is moot has $\rho^*(b,0) = 0$, $s^*(I,b,0) = 1$ $\forall I$. Such an equilibrium exists if and only if*

$$K^p \geq K_s = \frac{\delta}{1-\delta}\left[u_p(g,1) - u_p(b,1)\right] \tag{1.25}$$

Proof. *See the appendix.* ■

This lemma says that in any efficient equilibrium, the ruler searches for a good delegate. Whenever a delegate reveals himself to be bad, he is shuffled. As a result, such delegates have no incentive to invest, which temporarily depresses the economy. Yet shuffling bad delegates is preferable to the ruler. Indeed, any agent of unknown type has a higher probability of success and does not pose a political threat. And since the ruler is sufficiently patient (condition (1.19) holds), these future gains outweigh the temporary drop in output.

Now note that this efficient equilibrium exists only if the cost of insurrection is sufficiently high (condition (1.25) holds). The bound is determined as follows. In the efficient equilibrium, any delegate of unknown type invests with probability one in any period. As it is more likely that the delegate is good, it is more tempting for the population to mount an insurrection. At the limit, mounting an insurrection produces a per-period payoff of $u_p(g,1)$, whereas staying still produces a per-period payoff of $u_p(b,1)$. If the cost of insurrection is then too high to warrant an insurrection, then it is never beneficial to replace the bad ruler. In that case, the bad ruler is safely in power, does not shuffle delegates who are likely to be good, and encourages them to invest with probability one.[13]

If the cost of insurrection is not high enough, however (ie (1.25) does not hold), then the ruler cannot safely encourage economic efficiency. Instead, he may need to shuffle any delegate who is too likely to be good, and poses too great a political threat. We will say that an equilibrium is such that *shuffling prevents slow learning* if

[13] We can pause to justify condition (1.22). We would like that, in this equilibrium, the delegate invests with probability one whenever he does not expect to be shuffled in the current period and does not become a ruler by staying put. In the simplified example, (1.8) alone is sufficient to ensure this result. In any dynamic game, however, it is not. After any investment, the delegate reveals some information about his type. Depending on that information, continuation payoffs may differ. For example, in this efficient equilibrium, if the delegate reveals himself to be bad, then he will be shuffled with probability one in the next period. If he does not invest, however he will be kept in place. Assuming (1.22), therefore, ensures that the delegate has 'nothing to lose' and invests if he is not shuffled in the current period.

(i) $\exists \overline{m} \geq 0$ s.t. either $\rho^*(b, \mu_{\overline{m}}) = 0$ or $s^*(1, b, \mu_{\overline{m}}) = 1$

(ii) if $\overline{m} > 1$, then $\forall \mu_m$, $\mu_0 \leq \mu_m \leq \mu_{\overline{m}-1}$, we have $\rho^*(b, \mu_m) \neq 0$, $s^*(1, b, \mu_m) \neq 1$.

(iii) $\exists \overline{\overline{m}} \geq \overline{m}$ s.t. $\forall \mu' \leq \mu_{\overline{\overline{m}}+1}$, $i^*(b, \mu') = 1 \Leftrightarrow \mu' = \mu_{\overline{\overline{m}}+1}$

In words, along the equilibrium path, the belief about a delegate's type is bounded. No delegate of unknown type launches more than $\overline{m}$ successful projects without being shuffled (i), but can launch exactly $\overline{m}$ projects along the equilibrium path (ii). Moreover, the population does not mount an insurrection along the equilibrium path, but it would if it observed a sufficiently large number of successful projects $(\overline{\overline{m}} + 1 > \overline{m})$ (iii). Then we obtain the following lemma:

Lemma 3 *Any equilibrium where shuffling prevents slow learning has* $\overline{m} \in \{0, 1\}$.

a)Any equilibrium with $\overline{m} = 0$ *has* $\rho^*(b, \mu_0) = 0$ *and* $s^*(1, b, \mu_0) > 0$. *Such an equilibrium exists if and only if*

$$K^p > K_{i0} = \frac{\delta}{1-\delta}\left[\mu_0[u_p(g,1) - u_p(b,1)] + \{1 - (1-\mu_0)(1-\theta)\}[u_p(b,1) - u_p(b,0)]\right] \quad (1.26)$$

b)Any equilibrium with $\overline{m} = 1$ *has* $\rho^*(b, 0) = 1$ *and* $s^*(I, b, 0) = 0 \; \forall I$*;*

$$\rho^*(b, \mu_0) = \frac{(1-\mu_0)(1-\theta)\theta}{\mu_0 + (1-\mu_0)\theta} \frac{1}{1 - \delta[\mu_0 + (1-\mu_0)\theta]} \quad (1.27)$$

and $s^*(1, b, \mu_0) \in (0, 1)$*;* $\rho^*(b, \mu_1) = 0$ *and* $s^*(0, b, \mu_1) = 1$. *Such an equilibrium exists if and only if*

$$K^p > K_{i1} = \frac{\delta}{1-\delta}\left[\mu_1[u_p(g,1) - u_p(b,1)] + \{1 - \frac{(1-\mu_1)(1-\theta)}{1 - \delta[\mu_0 + (1-\mu_0)\theta]}\}[u_p(b,1) - u_p(b,0)]\right] \quad (1.28)$$

Proof. *See the appendix.* ■

In short, this lemma states that there are two types of equilibria where shuffling prevents slow learning. In a first case, the ruler threatens to shuffle any delegate who invests in the public good. As a result, no delegate invests and the population does not mount an insurrection. In a second case, the ruler actively searches for a bad delegate, and does not allow any delegate to invest in more than one project. If the delegate is successful in period t, he poses too great a political threat and he is shuffled with probability one in period $t+1$ ($s^*(0,b,\mu_1)=1$). If the delegate is unsuccessful, he does not pose any political threat and he is kept in place forever ($s^*(I,b,0)=0\ \forall I$). As a result, he has maximal incentives to invest in the public good ($\rho^*(b,0)=1$). Note also that, in this second equilibrium, shuffling is used to depress the delegate's incentive to invest in the public good (we need $s^*(1,b,\mu_0)\in(0,1)$, so that $\rho^*(b,\mu_0)\in(0,1)$). Indeed, if such a delegate invested with probability one, then the value of having a new delegate would be too high, and the ruler would always shuffle delegates. But then delegates of unknown type would have no incentive to invest, producing a contradiction.

Studying the equilibria where shuffling prevents slow learning, we note the following. First, the ruler who does use shuffling along the equilibrium path actually provides the delegate with the *best* incentives to invest. Indeed, shuffling is partly used to discard any delegate who poses a political threat. But this requires that the delegate is able to build at least *some* political support base. Therefore, it is not clear that the practice of shuffling necessarily hurts the population (for more on this question, see section 1.5).

Second, there is no equilibrium where the delegate invests in more than a single project, no matter how many projects would be needed to induce an insurrection ($\overline{m}\not>1$). This comes from an unraveling argument.[14] First, recall the observation that, in the initial state, the delegate must be indifferent about investing in the public good ($\rho^*(b,\mu_0)\in(0,1)$) and the ruler must be indifferent about shuffling the delegate ($s^*(1,b,\mu_0)\in(0,1)$). Now note that two states can be reached from $\omega_t=(b,\mu_0)$ when a delegate invests and is not shuffled: $\omega_{t+1}=(b,0)$ if the delegate fails and $\omega_{t+1}=(b,\mu_1)$ if he is successful. Recall that the ruler gets a maximal value with a bad delegate ($v_r(b,0)>v_r(b,\mu_0)$). Therefore, the ruler is indifferent about shuffling a delegate who invests if he gets a relatively low value when the delegate is successful ($v_r(b,\mu_1)<v_r(b,\mu_0)$). This requires that the delegate does not invest with probability one in such a state ($\rho^*(b,\mu_1)\in(0,1)$). And again, this is optimal only if the delegate is shuffled with a certain probability when he invests ($s^*(1,b,\mu_1)\in(0,1)$). Proceeding by induction, we show that these indifference conditions must hold until the delegate reaches his maximal number of investment projects $\overline{m}$. But then we obtain a contradiction. As more and more successful

[14]Details are in the proof of the lemma, and the current paragraph may be skipped if the reader is not interested in technical details.

projects are launched, it is more likely that the delegate is good, and that the next project will be successful. Since these states provide the ruler with a lower payoff than if the project failed, his value must be strictly increasing in the number of successful projects, so that he is indifferent about shuffling the delegate. But this is impossible, since the ruler gets his minimal value after the delegate has launched his last project.

Finally, note that such an equilibrium exists only if the cost of insurrection is of intermediate value (either (1.26) or (1.28) holds, while (1.25) does not). What equilibrium do we obtain if the cost of insurrection is small? Following section 1.3, we think that there is an equilibrium where the ruler is replaced with positive probability. Formally, an equilibrium is such that *the ruler is replaced with positive probability* if

(i) $\exists \underline{m} \geq 0$ s.t. either $\rho^*(b, \mu_{\underline{m}}) = 0$ or $s^*(1, b, \mu_{\underline{m}}) = 1$

(ii) if $\underline{m} \geq 1$, then $\forall \mu_m$, $\mu_0 \leq \mu_m \leq \mu_{\underline{m}-1}$, we have $\rho^*(b, \mu_m) \neq 0$ and $s^*(1, b, \mu_m) \neq 1$

(iii) $\forall \mu' \leq \mu_{\underline{m}}$, $i^*(b, \mu') = 1 \Leftrightarrow \mu' = \mu_{\underline{m}}$

In words, along the equilibrium path, the belief about a delegate's type is bounded. No delegate of unknown type launches more than $\underline{m}$ successful projects without being shuffled (i), but can launch exactly $\underline{m}$ projects along the equilibrium path (ii). Moreover, the population mounts an insurrection when it observes the delegate's $\underline{m}^{th}$ successful project. With this definition, we claim:

Lemma 4 *Any equilibrium where the ruler is replaced with positive probability has* $\underline{m} = 0$ *and exists if and only if*

$$K^p < K_{i0} = \frac{\delta}{1-\delta} \left[\mu_0[u_p(g, 1) - u_p(b, 1)] + \{1 - (1 - \mu_0)(1 - \theta)\}[u_p(b, 1) - u_p(b, 0)]\right] \quad (1.29)$$

Proof. *See the appendix* ■

This lemma first states that in any equilibrium where the ruler is replaced with positive probability, the population is willing to mount an insurrection simply based on its prior ($\underline{m} = 0$). The intuition is as follows. First assume that $\underline{m} > 1$. Consider the ruler's decision when the delegate of unknown type invests in his $\underline{m}^{th}$ project. If the ruler is willing to run the risk of being replaced, then he must strictly prefer having a bad delegate to having any new delegate ($v_r(b,0) > v_r(b,\mu_0)$). This again requires that the delegate does not invest with probability one in state (b,μ_0) ($\rho^*(b,\mu_0) \in (0,1)$). And this is optimal only if the delegate is shuffled with some probability when he invests ($s^*(1,b,\mu_0) \in (0,1)$). But the ruler cannot be indifferent about shuffling a delegate in state (b,μ_0). If he does not shuffle with probability one a delegate who invests in his $\underline{m}^{th}$ project, then he must strictly prefer not to shuffle a delegate who invests for the first time ($s^*(1,b,\mu_0) = 0$). In the latter case, the delegate is more likely to fail, producing the high continuation value associated with state $(b,0)$. And even if he succeeds, the ruler is not immediately replaced. Therefore, we obtain a contradiction. Also, if $\underline{m} = 1$, then the ruler could secure his hold on power simply by shuffling any delegate who invests, which is strictly optimal, given that the value of staying in power is sufficiently high (condition (1.24) holds). But if the delegate is always shuffled when he invests, then he cannot invest in equilibrium, and the ruler cannot be replaced with positive probability, producing a contradiction. Note also that an equilibrium where the ruler is replaced with positive probability requires that the cost of insurrection is sufficiently low (condition (1.29) holds). We have thus characterized equilibria for any region of the parameter space. We can now focus on population welfare.

1.4.1 Welfare Analysis

To perform any welfare analysis, we would like to know which equilibrium will be played under which circumstances. First, we can show the following remark:

Remark 1

$$K_{i0} < K_{i1} < K_s$$

Proof. *See the appendix.* ■

This shows that we can nicely order the critical values of K^p that we found in the previous lemmas. Note that we rely on condition (1.23). Indeed, recall that $K^p = K_{i0}$ is such that the population is just indifferent about mounting an insurrection when the delegate never invests, and $K^p = K_{i1}$ is such that the population is just indifferent about mounting an insurrection when the delegate invests once before being shuffled. It is not immediate that $K_{i0} < K_{i1}$. On the one hand, observing a successful project provides more evidence that the delegate is good, and makes it more tempting to mount an insurrection. On the other hand, the continuation value for staying put is higher, since delegates do invest along the equilibrium path. Therefore, in order to ensure that the insurrection constraint is tightest in the equilibrium where the delegate invests once, we need to impose that the gains from having a good ruler are relatively high, compared to the gains from having a high value of public good with a bad ruler (condition (1.23) holds). For the same reason, we need to impose such a condition in order to show that $K_{i1} < K_s$. With this condition, however, we obtain unique strategies along the equilibrium path.[15] Writing the value of the game for the population as $v_p(b, \mu_0)$, we have:

$$v_p(b,\mu_0) = \begin{cases} v_p(b,\mu_0)_s & \text{if } K^p > K_s \\ v_p(b,\mu_0)_{i1} & \text{if } K^p \in (K_{i1}, K_s) \\ v_p(b,\mu_0)_{i0} & \text{if } K^p \in (K_{i0}, K_{i1}) \\ v_p(b,\mu_0)_w & \text{if } K^p < K_{i0} \end{cases}$$

where

$$v_p(b,\mu_0)_s = \frac{u_p(b,1) - [\frac{(1-\mu_0)(1-\theta)(1-\delta^2)}{(1-\delta\theta)-\delta^2(1-\mu_0)(1-\theta)}][u_p(b,1) - u_p(b,0)]}{1-\delta} \tag{1.30}$$

$$v_p(b,\mu_0)_{i1} = \frac{u_p(b,0) + [\frac{(1-\mu_0)(1-\theta)\theta}{1-\delta[\mu_0+(1-\mu_0)\theta]}][u_p(b,1) - u_p(b,0)]}{1-\delta} \tag{1.31}$$

$$v_p(b,\mu_0)_{i0} = \frac{u_p(b,0)}{1-\delta} \tag{1.32}$$

$$v_p(b,\mu_0)_w = u_p(b,0) - K^p + \delta[\mu_0 v_p^i(g) + (1-\mu_0)v_p^i(b)] \tag{1.33}$$

These values are drawn in figure 3 (see remark 6 of the appendix). They show that the welfare of the population is non-monotonic in the strength of the ruler. Ideally, the bad ruler should be weak, so that he may be replaced by a good delegate, which is extremely valuable.[16] When

[15] Note that, if we relaxed condition *(iii)* in the definition of an equilibrium where shuffling prevents slow learning, then we would obtain a multiplicity of equilibria. Indeed, it could be that when $K^p > K_s$, any of the equilibria of lemma 3 is played. If a delegate of unknown type has experienced a success, but expects to be shuffled, then he will not invest. If the ruler expects the delegate not to invest after his first success if he keeps him in place, then he prefers to shuffle him. However, the efficient equilibrium where the threat of insurrection is moot would be Pareto-optimal for the population and the ruler.

[16] Note that condition (1.23) ensures that the population prefers a weak ruler to a strong ruler. The reason why we need to impose this condition is the following. In the equilibrium where the ruler is weak, a good ruler may come to power. This is certainly preferable to having a bad ruler who is strong. However, if the population mounts an insurrection for a bad delegate, then the population ends up with a bad delegate forever (the new

$K^p \in (K_{i0}, K_{i1})$, the ruler blocks any investment and the welfare of the population reaches its minimum. When $K^p \in (K_{i1}, K_s)$, welfare is higher, since the ruler does encourage some investment, even if he is searching for a bad delegate. Welfare increases even further when the ruler is strong ($K^p > K_s$), in which case he encourages investment, and actively searches for a good delegate.

Let us now take comparative statics with respect to the other two interesting parameters of the model, μ_0 and θ. First, we have

Remark 2

$$\begin{array}{ll} \frac{\partial v_p(b,\mu_0)_s}{\partial \mu_0} > 0 & \frac{\partial K_s}{\partial \mu_0} = 0 \\ \frac{\partial v_p(b,\mu_0)_{i1}}{\partial \mu_0} < 0 & \frac{\partial K_{i1}}{\partial \mu_0} > 0 \\ \frac{\partial v_p(b,\mu_0)_{i0}}{\partial \mu_0} = 0 & \frac{\partial K_{i0}}{\partial \mu_0} > 0 \\ \frac{\partial v_p(b,\mu_0)_w}{\partial \mu_0} > 0 & \end{array}$$

Proof. *Omitted. The results are straightforward.* ■

This remark says that, fixing the strength of the ruler, a greater proportion of good delegates does not always increase the welfare of the population (the left column in the remark). When the ruler is strong, an increase in μ_0 makes it more likely that the investment projects are successful, and also shortens the search for a good delegate, both effects benefiting the population. When the ruler has intermediate strength and $\underline{m} = 1$, then an increase in the proportion of good delegates hurts the population. The reason is as follows. First, an increase in μ_0 makes it more likely that any delegate of unknown type provides a high quality of public good. This should directly help the population. The problem, however, is that the ruler is searching for a bad delegate, who does not pose a political threat. If a delegate of unknown type is successful, then he is shuffled after his success, which provides him with no incentive to invest. Therefore, the greater is μ_0, the longer is the search for a bad delegate, and the lower is the welfare of the population. When the ruler has intermediate strength and $\underline{m} = 0$, then there is no investment along the equilibrium path, so that an increase in μ_0 has no consequence. When the ruler is

ruler combines both functions and does not shuffle himself!). This is actually worse than having a bad ruler who is strong, since this ruler shuffles any bad delegate. Therefore, the population will prefer the equilibrium where the ruler is weak if and only if the gains from having a good ruler, compared to the gains of having a high value of public good with a bad ruler, are relatively large (condition (1.23) holds). Note that (1.23) can be relaxed, and the proof gives an explicit bound such that our statement holds.

weak, then an increase in the proportion of good delegates benefits the population, since it is more likely to mount an insurrection for a good delegate.

Now consider the impact of an increase in μ_0 on the strength of the ruler (the right column in the remark). As a general rule, an increase in the proportion of good delegates reduces the strength of a ruler. It is more likely that the population is willing to mount an insurrection, even if it does not know the type of the delegate ($\frac{\partial K_{i0}}{\partial \mu_0} > 0$). This benefits the population, since it may put in power a good delegate. Also, stronger rulers are now forced to prevent any investment, so as to ensure their political survival ($\frac{\partial K_{i1}}{\partial \mu_0} > 0$). This hurts the population, who otherwise benefited from some investment in the public good.

Taking comparative statics with respect to θ, we have:

Remark 3

$$\begin{array}{ll} \frac{\partial v_p(b,\mu_0)_s}{\partial \theta} > 0 & \frac{\partial K_s}{\partial \theta} = 0 \\ \frac{\partial v_p(b,\mu_0)_{i1}}{\partial \theta} < 0 \Leftrightarrow \theta > \underline{\theta} & \frac{\partial K_{i1}}{\partial \theta} < 0 \\ \frac{\partial v_p(b,\mu_0)_{i0}}{\partial \theta} = 0 & \frac{\partial K_{i0}}{\partial \theta} > 0 \\ \frac{\partial v_p(b,\mu_0)_w}{\partial \theta} > 0 & \end{array}$$

where

$$\underline{\theta} = \frac{(1-\delta\mu_0) - \sqrt{(1-\delta\mu_0)(1-\delta)}}{\delta(1-\mu_0)}$$

Proof. *See the appendix.* ■

This lemma states that the comparative statics with respect to θ are particularly rich, since θ combines two functions in the model. On the one hand, θ determines whether the public good takes a high value, conditional on the bad delegate investing in the project. On the other, it represents the informational content of a successful project. Consider the comparative statics on the welfare of the population, holding fixed the strength of the ruler (the left column in the remark). When the ruler is strong, an increase in θ strictly benefits the population, since any investment is more likely to be successful. When the ruler has intermediate strength and searches for a bad delegate ($K^p \in (K_{i1}, K_s)$), the effect of an increase in θ is ambiguous. On the one hand, a higher θ increases the welfare of the population after the ruler has found a bad delegate. On the other hand, a higher θ makes it harder for the ruler to find a bad delegate. It is now more likely that bad delegates are shuffled after their first project and there are more periods where there is no investment. The net effect on the welfare of the population is ambiguous. When the ruler has intermediate strength and prohibits investment ($K^p \in (K_{i0}, K_{i1})$), an increase in θ certainly has no impact. When the ruler is weak ($K^p < K_{i0}$), an increase in θ strictly benefits the population, since it gets strictly higher payoffs if it mounts an insurrection for a bad delegate.

Now consider the comparative statics on the strength of the ruler (the right column in the remark). First, note that an increase in θ does not affect the probability that a ruler is strong. It does affect, however, the probability that a ruler has intermediate strength. With an increase in θ, weaker rulers can now encourage some investment and search for a bad delegate ($\frac{\partial K_{i1}}{\partial \theta} < 0$). The main reason is that the informational content of a successful project is now reduced, so that the population is less willing to mount an insurrection. More specifically, recall that K_{i1} is the value of K^p such that the population is just indifferent about mounting an insurrection, when it observes a single successful project. As θ increases, the population is less likely to put a good delegate to power ($\frac{\partial \mu_1}{\partial \theta} < 0$), but it obtains a higher payoff, conditional on mounting an insurrection for a bad delegate ($\frac{\partial v_p^i(b)}{\partial \theta} > 0$). If the gains from having a good ruler are sufficiently high, the former negative effect dominates, and also swamps any effect on the value of staying put (recall that the sign of $\frac{\partial v_p(b,\mu_0)_{i1}}{\partial \theta}$ is ambiguous). Moreover, it is clear that an increase in θ increases the payoff of having a bad delegate come to power, and therefore makes it more attractive to mount an insurrection, when the current ruler prevents any investment ($\frac{\partial K_{i0}}{\partial \theta} > 0$).

Summing up, we reach the following conclusions about the welfare of the population. First, the ideal situation for the population is that the bad ruler is weak, so that he encourages investment and can be replaced by a good delegate. If this is not possible, then the welfare of the population is increasing in the strength of the ruler. Also, we see that the population may not necessarily benefit from an increase in the proportion of good delegates (μ_0) or a more decentralized state (where θ is lower). In the important case where the ruler has intermediate strength and uses shuffling to remain in power ($K^p \in (K_{i1}, K_s)$), both changes reduce the strength of a ruler and increase the length of his search for a bad delegate, which hurt the population.

Now that we have studied the welfare of the population under a particular regime, where the ruler shuffles a delegate at will, we may ask the following question: what if we could prevent the ruler from shuffling any delegate? Would the population necessarily benefit? This question is explored in the next section.

1.5 Discussion: An Efficiency Rationale for Shuffling

Consider the following revised game. Assume that the ruler cannot shuffle the delegate in any period, but must instead choose the organizational structure ϕ of his government at the start of the game. Let the set of possible structures be $\Phi = \{\phi^0, \phi^1\}$. Call ϕ^0 the case of 'no discretion', where the ruler imposes $I_t = 0\ \forall t$. We could think of this case as a country where the ruler only hands down menial tasks to his delegate, who cannot improve the quality of the public good. Call ϕ^1 the case of 'high discretion', where the delegate is free to choose $I_t \in \{0,1\}\ \forall t$.[17] In any period, the population can still mount an insurrection. We again impose that insurrections lead to an absorbing state, where the ruler combines the functions of ruler and delegate. Looking at the timing of this revised game, we have:

Timing of the Revised Game

- At $t = 0$, r picks $\phi \in \{\phi^0, \phi^1\}$
- If $\phi = \phi^0$, then the following decisions are taken at each t ($t \geq 1$): p picks i_t
- If $\phi = \phi^1$, the following decisions are taken at each t ($t \geq 1$):

    1. l_t picks I_t
    2. p picks i_t

Let us solve this game by backward induction.

[17] We can think of different ways of decentralizing power. In one case, the ruler commits not to tamper with the investment decision. In another, he increases the complexity of the projects handed out to the delegate (so that the types are more easily distinguishable). In this section, we focus on the decision to undertake I_t, holding θ fixed, while recall that, in the baseline model, we considered changes in θ, holding fixed the decision I_t.

The Case of No Discretion ($\phi = \phi^0$)

In this case, the population has a generically unique optimal strategy:

Lemma 5 *Assume $\phi = \phi^0$, then $i^*(b, \mu_0) = 0 \Leftrightarrow K^p > K_{i0}$*

Proof. *See the appendix* ■

In other words, either there is an insurrection in period 1 or there is never any insurrection, since the delegate cannot invest in the public good, beliefs about his type are stationary and the population faces the same problem in every period.

The Case of High Discretion ($\phi = \phi^1$)

In this case, we show the following lemma:

Lemma 6 *Assume $\phi = \phi^1$. There is an equilibrium with the following strategies along the equilibrium path:*

- *if $K^p > K_s$: $\rho^*(b, \mu) = 1 \ \forall \mu$, $i^*(b, \mu') = 0 \ \forall \mu$*
- *if $K^p \in (K_{i0}, K_s)$: $\exists \widehat{m}(K^p)$, $1 \leq \widehat{m}(K^p) < \infty$ such that $\forall m \leq \widehat{m}(K^p) - 1$*

$$\begin{aligned} \rho^*(b, \mu_m) &= 1 \\ i^*(b, \mu_m) &= 1 \Leftrightarrow m = \widehat{m}(K^p) \end{aligned}$$

- *if $K^p < K_{i0}$: $\rho^*(b, \mu_0) = 0$, $i^*(b, \mu_0) = 1$*

Proof. *See the appendix.* ■

In this equilibrium, there is a generically unique outcome. When the ruler is strong ($K^p > K_s$), the delegate invests in any period and never triggers an insurrection. Otherwise, the population mounts an insurrection when it is sufficiently convinced that the delegate is good (after observing $\widehat{m}(K^p)$ consecutive successful projects when $K^p \in (K_{i0}, K_s)$, or none at all when $K^p < K_{i0}$). Now let us focus on the choice of organizational structure by the ruler.

The Choice of Organizational Structure

Let $\phi^*(\Phi)$ be the optimal strategy for the ruler. We can show the following lemma:

Lemma 7 *In period* 0, *the optimal decision by the ruler is*

$$\phi^*(\Phi)\begin{cases} =\phi^1 & \text{if } K^p > K_s \\ =\phi^0 & \text{if } K^p \in (K_{i0}, K_s) \\ \in \{\phi^0, \phi^1\} & \text{if } K^p < K_{i0} \end{cases}$$

Proof. *See the appendix* ■

This lemma states that the ruler will choose high discretion if he is sufficiently strong ($K^p > K_s$), no discretion if he has intermediate strength ($K^p \in (K_{i0}, K_s)$) and any structure when he is weak ($K^p < K_{i0}$). Certainly, if $K^p > K_s$, the ruler can let the delegate invest without worrying for his political survival. Therefore, he will choose high discretion. If $K^p \in (K_{i0}, K_s)$, he will not let the delegate invest in the public good. In that case, if the delegate is free to invest, then the ruler will be replaced with positive probability in finite time, which is extremely costly to the ruler, who cares infinitely more about being in power than having a public good of high quality.[18] If $K^p < K_{i0}$, then the ruler is indifferent between either structure. In that case, the population mounts an insurrection simply based on its prior, and the delegate does not invest when $\phi = \phi^1$, for fear of revealing his bad type. Therefore, both organizational structures lead to the same outcome for the ruler. Let us now study the welfare of the population.

[18] The fact that $\phi^*(\Phi) = \phi^0 \ \forall K^p \in (K_{i0}, K_s)$ is only true at the limit, where $\frac{u_r(b,1)-u_r(b,0)}{u_r(b,0)} \to 0$. Fixing $\frac{u_r(b,1)-u_r(b,0)}{u_r(b,0)} > 0$, there is a value of K^p (call it $\widehat{K}$) such that $\phi^*(\Phi) = \phi^1 \ \forall K^p \in (\widehat{K}, K_s)$. The intuition is that, fixing $\frac{u_r(b,1)-u_r(b,0)}{u_r(b,0)} > 0$, there are values of K^p close enough to K_s that the population needs to observe 'sufficiently many' successful projects before mounting an insurrection, so that the ruler prefers high discretion and benefit from a high value of public good for many periods.

Welfare of the Population

Write $v_p(b, \mu_0|\phi^*(\Phi))$ as the value of the game for the population given the ruler's optimal organizational structure. We get

$$v_p(b, \mu_0|\phi^*(\Phi)) = \begin{cases} v_p(b, \mu_0|\phi^*(\Phi))_s & \text{if } K^p > K_s \\ v_p(b, \mu_0|\phi^*(\Phi))_i & \text{if } K^p \in (K_{i0}, K_s) \\ v_p(b, \mu_0|\phi^*(\Phi))_w & \text{if } K^p < K_{i0} \end{cases}$$

where

$$v_p(b, \mu_0|\phi^*(\Phi))_s = \frac{[\mu_0 + (1-\mu_0)\theta]u_p(b,1) + (1-\mu_0)(1-\theta)u_p(b,0)}{1-\delta} \tag{1.34}$$

$$v_p(b, \mu_0)_i = \frac{u_p(b,0)}{1-\delta} \tag{1.35}$$

$$v_p(b, \mu_0|\phi^*(\Phi))_w = u_p(b,0) - K^p + \delta[\mu_0 v_p^i(g) + (1-\mu_0)v_p^i(b)] \tag{1.36}$$

These values are displayed in figure 4, and show a non-monotonic relationship between the strength of a ruler and the welfare of the population. For very low values of K^p ($K^p < K_{i0}$), the population mounts an insurrection. With positive probability, this leads to the rule of a good politician, which certainly benefits the population. And even if a bad delegate comes to power, he is at least safely in power and does invest in the public good. A ruler of intermediate strength ($K^p \in (K_{i0}, K_s)$) chooses the regime of no discretion, so as to ensure his political survival. Because there is no investment in this case, the welfare of the population reaches its minimum. When a ruler is sufficiently strong ($K^p > K_s$), he chooses the regime of high discretion, so that the delegate invests, and the population never mounts an insurrection. Let us compare these values to the welfare of the population in the baseline model (which we write $v_p(b, \mu_0|\phi^s)$ for convenience). We conclude:

Lemma 8 *Comparing welfare in $\phi^*(\Phi)$ and ϕ^s, we get:*

$$\begin{aligned} v_p(b, \mu_0|\phi^*(\Phi)) &< v_p(b, \mu_0|\phi^s) && \text{if } K^p > K_s \\ v_p(b, \mu_0|\phi^*(\Phi)) &< v_p(b, \mu_0|\phi^s) && \text{if } K^p \in (K_{i1}, K_s) \\ v_p(b, \mu_0|\phi^*(\Phi)) &= v_p(b, \mu_0|\phi^s) && \text{if } K^p < K_{i1} \end{aligned}$$

Proof. *See the appendix.* ■

This lemma states that the welfare implication of prohibiting shuffling is uniformly negative. When the ruler is strong ($K^p > K_s$), he cannot actively search for a good delegate. When the ruler has intermediate strength ($K^p \in (K_{i0}, K_s)$), he chooses the regime of no discretion, so as to ensure his political survival. This strictly hurts the population if the ruler would have otherwise allowed some investment ($K^p \in (K_{i1}, K_s)$) and leaves it indifferent if there would not have been any investment ($K^p \in (K_{i0}, K_{i1})$). In this sense, shuffling is socially useful, since it gives the assurance that the ruler can eliminate a growing political threat. When the ruler is weak ($K^p < K_{i0}$), the delegate does not invest, no matter what regime has been chosen by the ruler, and the population mounts an insurrection in the first period. The population is therefore again indifferent about the prohibition to shuffle.

1.6 Conclusion

The main goal of this paper is to characterize how a particular mechanism, the shuffling of agents, can be used by an autocrat ruler to maintain his hold on power, and how this mechanism can have deleterious effect on growth. It concludes that shuffling is used by dictators of intermediate strength to remain in power. Such rulers can ensure their survival by blocking investment, which could enhance the reputation of the delegate and undermine the ruler's authority.

We believe that this model presents a simple framework to think about the growth experience of many countries and empires, such as Zaire, Mughal India and the Ottoman empire, where dictators did shuffle delegates. We also believe that it can inform our foreign policy with current dictatorships. On this note, we reach the following conclusions about the impact of certain measures on the welfare of the population. First, it is ideal to make a bad ruler as weak as possible, so that he can be easily replaced. But if this is not possible, strong rulers are actually better than rulers of intermediate strength, since they have greater incentives to encourage economic growth. Second, fostering an environment where politicians are more likely to be good can benefit the population. But such changes must be drastic. Otherwise, the ruler will remain in power, and his search for bad delegates will be slower, further depressing economic growth. Third, imposing a more decentralized system, where good delegates are more likely to reveal their type, has an ambiguous effect on the welfare of the population. Finally, we conclude that, although the shuffling mechanism seems particularly hurtful to the population when the ruler has intermediate strength (incentives for investment are low, bad local agents are not shuffled, the bad ruler stays in power), it can in fact increase population welfare, since it gives the ruler the assurance that he can eliminate growing political threats, and therefore allows for at least *some* investment in the public good.

There are many natural extensions to the current model. First, we could consider the cases where coups are mounted by a coalition of delegates. Second, we can ask what forces make it more likely that the regime remains a dictatorship after an insurrection, as opposed to becoming a democracy. Third, we can allow for political threats to come from outside the state. Fourth, we can enrich the hierarchical structure of the state. These are important questions for future research.

1.7 Appendix

Proof. (Proof of lemma 1). The proof for $q(r) = g$ is trivial. Now assume that $q(r) = b$. $i^*(b, \mu') = 1$ if and only if

$$\begin{aligned} -K^p + \delta[\mu' v_p(g) + (1-\mu')v_p(b)] &> \delta v_p(b) \\ \Leftrightarrow K^p &< \delta\mu'[v_p(g) - v_p(b)] \end{aligned} \tag{1.37}$$

Moving up, $s^*(0, b, \mu_0) = 0$ if and only if

$$-\varepsilon + \delta v_r(b)[1 - i^*(b, \mu_0)] < \delta v_r(b)[1 - i^*(b, \mu_0)]$$

which is true by $\varepsilon > 0$. $s^*(1, b, \mu_0) = 1$ if and only if

$$-\varepsilon + \delta v_r(b)[1 - i^*(b, \mu_0)] > \delta v_r(b)\{(\mu_0 + (1-\mu_0)\theta)[1 - i^*(b, \mu_1)] + (1-\mu_0)(1-\theta)(1 - i^*(b, 0))\}$$

which gives (1.14), using (1.37) and $0 < \varepsilon < \delta v_r(b)[\mu_0 + (1-\mu_0)\theta]$.

Moving up, $\rho^*(b,\mu_0)=1$ if and only if

$$\begin{aligned}&-K^I+(1-s^*(1,b,\mu_0))\{u_l(b,0)+[\mu_0+(1-\mu_0)\theta][u_l(b,1)-u_l(b,0)]\}\\&+(1-s^*(1,b,\mu_0))\delta\{v_l(b)+i^*(b,\mu_1)[\mu_0(v_r(g)+v_l(g)-v_l(b))+(1-\mu_0)\theta v_r(b)]\}\\&>u_l(b,0)+\delta\{v_l(b)+i^*(b,\mu_0)[\mu_0(v_r(g)+v_l(g)-v_l(b))+(1-\mu_0)v_r(b)]\}\end{aligned}$$

where we use $s^*(0,b,\mu_0)=0$, $i^*(b,0)=0$ to simplify the expression.

$\forall K^p>\delta\mu_1[v_p(g)-v_p(b)]$, $s^*(1,b,\mu_0)=0$, $i^*(b,\mu_1)=i^*(b,\mu_0)=0$, so that $\rho^*(b,\mu_0)=1\Leftrightarrow K^I<[\mu_0+(1-\mu_0)\theta][u_l(b,1)-u_l(b,0)]$, which is true by (1.8).

$\forall K^p\in(\delta\mu_0[v_p(g)-v_p(b)],\delta\mu_1[v_p(g)-v_p(b)])$, $s^*(1,b,\mu_0)=1$, so that $\rho^*(b,\mu_0)=0$.

$\forall K^p<\delta\mu_0[v_p(g)-v_p(b)]$, $s^*(1,b,\mu_0)=0$, $i^*(b,\mu_0)=i^*(b,\mu_1)=1$, so that $\rho^*(b,\mu_0)=0\Leftrightarrow$ (1.10) holds. ■

Remark 4 *The value of the game for the population is*

$$v_p(b,\mu_0)=\begin{cases}u_p(b,0)+[\mu_0+(1-\mu_0)\theta][u_p(b,1)-u_p(b,0)]+\delta v_p(b) & \text{if } K^p>\overline{K}\\ u_p(b,0)+\delta v_p(b) & \text{if } K^p\in(\underline{K},\overline{K})\\ u_p(b,0)-K^p+\delta[\mu_0v_p(g)+(1-\mu_0)v_p(b)] & \text{if } K^p<\underline{K}\end{cases}$$

where $\overline{K}=\delta\mu_1[v_p(g)-v_p(b)]$, $\underline{K}=\delta\mu_0[v_p(g)-v_p(b)]$. *We note the following:*

$$\lim_{K^p\to0}v_p(b,\mu_0)>\lim_{K^p\to\infty}v_p(b,\mu_0)\Leftrightarrow\frac{v_p(g)-v_p(b)}{u_p(b,1)-u_p(b,0)}>\frac{\mu_0+(1-\mu_0)\theta}{\delta\mu_0}$$

$\frac{\partial v_p(b,\mu_0)}{\partial\mu_0}>0$ *if* $K^p\notin(\underline{K},\overline{K})$, $\frac{\partial v_p(b,\mu_0)}{\partial\mu_0}=0$ *otherwise;* $\frac{\partial v_p(b,\mu_0)}{\partial\theta}>0$ *if* $K^p>\overline{K}$, $\frac{\partial v_p(b,\mu_0)}{\partial\theta}=0$ *otherwise;* $\frac{\partial\overline{K}}{\partial\mu_0},\frac{\partial\underline{K}}{\partial\mu_0}>0,\frac{\partial\overline{K}}{\partial\theta}<0,\frac{\partial\underline{K}}{\partial\theta}=0.$

Proof. *Obvious from lemma 1.* ■

Proof. (Proof of lemma 2). Let us characterize equilibrium strategies. By definition

$$v_r(b,0)=u_r(b,0)+\rho^*(b,0)\theta[u_r(b,1)-u_r(b,0)]+\delta\max\{v_r(b,0),v_r(b,\mu_0)\}\tag{1.38}$$

and given that $\forall m \geq 0$, $\rho^*(b, \mu_m) = 1$ and $s^*(1, b, \mu_m) = 0$, we have

$$v_r(b, \mu_m) \geq u_r(b, 0) + [\mu_m + (1 - \mu_m)\theta][u_r(b, 1) - u_r(b, 0)] + \delta v_r(b, \mu_0) \ \forall m \geq 0 \tag{1.39}$$

Then we can show that $v_r(b, 0) < v_r(b, \mu_0)$. Assume not. Replacing in (1.38) implies

$$\begin{aligned} v_r(b, 0) &= \frac{u_r(b, 0) + \rho^*(b, 0)\theta[u_r(b, 1) - u_r(b, 0)]}{1 - \delta} \\ &< \frac{u_r(b, 0) + \rho^*(b, 0)[\mu_0 + (1 - \mu_0)\theta][u_r(b, 1) - u_r(b, 0)]}{1 - \delta} \leq v_r(b, \mu_0) \end{aligned}$$

where the last inequality follows from (1.39). This produces a contradiction.

Therefore, $v_r(b, 0) < v_r(b, \mu_0) \Rightarrow s^*(I, b, 0) = 1 \ \forall I \Rightarrow \rho^*(b, 0) = 0$.

Moreover, $\forall m \geq 1$, $s^*(1, b, \mu_{m-1}) = 0$ is optimal only if

$$\begin{gathered} [\mu_{m-1} + (1 - \mu_{m-1})\theta]v_r(b, \mu_m) + (1 - \mu_{m-1})(1 - \theta)v_r(b, 0) \geq v_r(b, \mu_0) \\ \Rightarrow v_r(b, \mu_m) > v_r(b, \mu_0) \Rightarrow s^*(0, b, \mu_m) = 0 \end{gathered}$$

where we used $v_r(b, 0) < v_r(b, \mu_0)$. Also, clearly, any $s^*(0, b, \mu_0) \in [0, 1]$ is optimal.

Let us now characterize the conditions under which such an equilibrium exists. There is no strictly profitable deviation from $s^*(1, b, \mu_m) = 0 \ \forall m \geq 0$ if and only if

$$v_r(b, \mu_0) \leq [\mu_m + (1 - \mu_m)\theta]v_r(b, \mu_{m+1}) + (1 - \mu_m)(1 - \theta)v_r(b, 0) \tag{1.40}$$

Now note that given the equilibrium strategies,

$$v_r(b, \mu_m) = \mu_m \frac{u_r(b, 1)}{1 - \delta} + (1 - \mu_m)[\frac{\theta u_r(b, 1) + (1 - \theta)[u_r(b, 0) + \delta v_r(b, 0)]}{1 - \delta\theta}] \tag{1.41}$$

so that, clearly, $v_r(b, \mu_{m+1}) > v_r(b, \mu_m) \ \forall m \geq 0$. Therefore, $v_r(b, \mu_{m+1}) > v_r(b, \mu_0) > v_r(b, 0)$ implies that (1.40) holds $\forall m \geq 0$ if and only if it holds for $m = 0$. Using (1.41), (1.40) holds for $m = 0$ if and only if

$$v_r(b, 0) \geq \frac{\theta u_r(b, 1) + (1 - \theta)u_r(b, 0)}{1 - \delta} \tag{1.42}$$

Now, $\rho^*(b, 0) = 0$ and $s^*(0, b, 0) = 1$ imply $v_r(b, 0) = u_r(b, 0) + \delta v_r(b, \mu_0)$. Replacing in (1.41) gives

$$v_r(b,\mu_0) = \frac{u_r(b,1) - [\frac{(1-\mu_0)(1-\theta)(1-\delta^2)}{(1-\delta\theta)-\delta^2(1-\mu_0)(1-\theta)}][u_r(b,1)-u_r(b,0)]}{1-\delta}$$

$$\Rightarrow v_r(b,0) = \frac{\delta\left[1 - \frac{(1-\mu_0)(1-\theta)(1-\delta^2)}{(1-\delta\theta)-\delta^2(1-\mu_0)(1-\theta)}\right]u_r(b,1) + \left(1-\delta\left[1-\frac{(1-\mu_0)(1-\theta)(1-\delta^2)}{(1-\delta\theta)-\delta^2(1-\mu_0)(1-\theta)}\right]\right)u_r(b,0)}{1-\delta}$$

Therefore, (1.42) holds if and only if

$$\delta\left(\frac{1-\frac{(1-\mu_0)(1-\theta)}{1-\delta\theta}}{1-\frac{(1-\mu_0)(1-\theta)\delta^2}{1-\delta\theta}}\right) \geq \theta \tag{1.43}$$

which reduces to (1.19).

Moreover, there is no strictly profitable deviation from $\rho^*(b,\mu_m) = 1$ if

$$v_l(b,\mu_m) \geq (1-s^*(0,b,\mu_m))\{u_l(b,0) + \delta v_l(b,\mu_m)\} \tag{1.44}$$

where

$$\begin{aligned} v_l(b,\mu_m) \quad &= \quad -K^I + u_l(b,0) + [\mu_m + (1-\mu_m)\theta][u_l(b,1) - u_l(b,0)] \\ &\quad\quad +\delta\{[\mu_m + (1-\mu_m)\theta]v_l(b,\mu_{m+1}) + (1-\mu_m)(1-\theta)v_l(b,0)\} \end{aligned}$$

Taking $u_l(b,0) \to 0$, and given that, in any equilibrium, $v_l(b,\mu_{m+1}) \geq 0$, $v_l(b,0) \geq 0$, then (1.8) is a sufficient condition such that (1.44) holds $\forall m \geq 0$.

Finally, there is no profitable deviation from $i^*(b,\mu') = 0$ if and only if

$$-K^p + \delta\left\{\mu' v_p^i(g) + (1-\mu')v_p^i(b)\right\} \leq \delta v_p(b,\mu') \tag{1.45}$$

Computing the value functions for the population, we get

$$v_p(b,\mu') = \begin{cases} u_p(b,0) + \delta v_p(b,\mu_0) & \text{if } \mu' = 0 \\ \mu'\frac{u_p(b,1)}{1-\delta} + (1-\mu')[\frac{\theta u_p(b,1)+(1-\theta)[u_p(b,0)+\delta v_p(b,0)]}{1-\delta\theta}] & \text{if } \mu' = \mu_m \ \forall m \end{cases}$$

It is clear that (1.45) holds when $\mu' = 0$, since by (1.19), $v_p(b,0) \geq v_p^i(b)$. Moreover, it is clear that if (1.45) holds for $\mu' = \mu_{m+1}$, then it holds for $\mu' = \mu_m$, since

$$\begin{aligned} & \delta[v_p(b,\mu_{m+1}) - v_p(b,\mu_m)] \\ = \; & \delta[\mu_{m+1} - \mu_m][\frac{u_p(b,1)}{1-\delta} - [\frac{\theta u_p(b,1) + (1-\theta)[u_p(b,0) + \delta v_p(b,0)]}{1-\delta\theta}]] \\ < \; & \delta[\mu_{m+1} - \mu_m][v_p^i(g) - v_p^i(b)] \end{aligned}$$

where we used $\frac{u_p(b,1)}{1-\delta} < v_p^i(g)$ and $v_p(b,0) \geq v_p^i(b)$. Therefore, (1.45) holds $\forall m \geq 0$

$$\Leftrightarrow \lim_{\mu' \to 1} -K^p + \delta\left\{\mu' v_p^i(g) + (1-\mu')v_p^i(b)\right\} < \lim_{\mu' \to 1} \delta v_p(b,\mu')$$

which is equivalent to (1.25). ■

Proof. (Proof of lemma 3). Let us prove part a), where $\overline{m} = 0$. First, $\rho^*(b,\mu_0) = 0$. Assume not. Then by definition, $s^*(1,b,\mu_0) = 1$. However, $\rho^*(b,\mu_0) \neq 0$ only if

$$-K^I + 0 \geq (1 - s^*(0,b,\mu_0))[u_l(b,0) + \delta v_l(b,\mu_0)]$$

which cannot hold. Second, $s^*(1,b,\mu_0) > 0$. Indeed, there is no deviation from $\rho^*(b,\mu_0) = 0$ only if

$$\begin{aligned} v_l(b,\mu_0) \;\; \geq \;\; & -K^I + (1 - s^*(1,b,\mu_0))\{[\mu_0 + (1-\mu_0)\theta][u_l(b,1) + \delta v_l(b,\mu_1)] \\ & +(1-\mu_0)(1-\theta)[u_l(b,0) + \delta v_l(b,0)]\} \end{aligned} \tag{1.46}$$

where $v_l(b,\mu_0) = \{1 - s^*(0,b,\mu_0)\}\{u_l(b,0) + \delta v_l(b,\mu_0)\}$. Taking $u_l(b,0) \to 0$, and given that, in any equilibrium, $v_l(b,\mu_1) \geq 0$, $v_l(b,0) \geq 0$, (1.46) and (1.8) imply $s^*(1,b,\mu_0) > 0$.

Next, let us characterize the conditions under which an equilibrium with $\overline{m} = 0$ exists. $\rho^*(b,\mu_0) = 0 \Rightarrow v_p(b,\mu_0) = \frac{u_p(b,0)}{1-\delta}$. Therefore, $i^*(b,\mu_0) = 0$ only if

$$-K^p + \delta[\mu_0 v_p^i(g) + (1-\mu_0)v_p^i(b)] \leq \delta\frac{u_p(b,0)}{1-\delta}$$

or (1.26) holds. Likewise, $i^*(b,0) = 0$ only if

$$-K^p + \delta v_p^i(b) \leq \delta v_p(b,0) \tag{1.47}$$

Finally, the ruler has no deviation from $s^*(1,b,\mu_0) > 0$ if and only if

$$v_r(b,\mu_0) \geq [\mu_0 + (1-\mu_0)\theta](1 - i^*(b,\mu_1))v_r(b,\mu_1) + (1-\mu_0)(1-\theta)v_r(b,0) \tag{1.48}$$

Therefore, the strategies off the equilibrium path must be constructed such that (1.47) and (1.48) hold. It is clear that the following completes the specification of an equilibrium: $\rho^*(b,\mu) = 0\ \forall \mu \neq \mu_0$, $s^*(I,b,\mu) = 1\ \forall (I,\mu) \neq (1,\mu_0)$, $i^*(b,\mu) = 1 \Leftrightarrow \mu \geq \mu_{\overline{\overline{m}}+1}$ where $\overline{\overline{m}}$ is such that

$$-K^p + \delta[\mu v_p^i(g) + (1-\mu)v_p^i(b)] \geq \frac{\delta}{1-\delta}u_p(b,0) \Leftrightarrow \mu \geq \mu_{\overline{\overline{m}}+1}$$

Now consider part b), where $\overline{m} \neq 0$. As in a), $\rho^*(b,\mu_{\overline{m}}) = 0$, so that

$$v_r(b,\mu_{\overline{m}}) = \begin{cases} \frac{u_r(b,0)}{1-\delta} & \text{if } s^*(0,b,\mu_{\overline{m}}) = 0 \\ u_r(b,0) + \delta v_r(b,\mu_0) & \text{otherwise} \end{cases}$$

Now remember that

$$v_r(b,\mu_0) \geq u_r(b,0) + \rho^*(b,\mu_0)[\mu_0 + (1-\mu_0)\theta][u_r(b,1) - u_r(b,0)] + \delta v_r(b,\mu_0) \tag{1.49}$$

and $\overline{m} \neq 0 \Rightarrow \rho^*(b,\mu_0) > 0 \Rightarrow v_r(b,\mu_0) > v_r(b,\mu_{\overline{m}}) \Rightarrow s^*(0,b,\mu_{\overline{m}}) = 1$.

Now let us show that $\rho^*(b,0) = 1$ and $s^*(I,b,0) = 0\ \forall I$. $s^*(1,b,\mu_{\overline{m}-1}) \neq 1$ is optimal only if

$$v_r(b,\mu_0) \leq [\mu_{\overline{m}-1} + (1-\mu_{\overline{m}-1})\theta]v_r(b,\mu_{\overline{m}}) + (1-\mu_{\overline{m}-1})(1-\theta)v_r(b,0) \Rightarrow v_r(b,\mu_0) < v_r(b,0)$$

where the last implication follows from $v_r(b,\mu_0) > v_r(b,\mu_{\overline{m}})$. Therefore, $s^*(I,b,0) = 0\ \forall I$ and, by (1.8), $\rho^*(b,0) = 1$.

Now let us show that $\overline{m} = 1$. First, we can show the following remark

Remark 5 $\forall m \in \{0,...,\overline{m}-1\}$

$$\rho^*(b,\mu_m) \in (0,1) \tag{1.50}$$

$$s^*(1,b,\mu_m) \in (0,1) \tag{1.51}$$

Proof. *By induction.* $\rho^*(b,0)=1$ *and* $s^*(I,b,0)=0\ \forall I$ *imply*

$$v_r(b,0)=\frac{u_r(b,0)+\theta[u_r(b,1)-u_r(b,0)]}{1-\delta} \tag{1.52}$$

Together with $v_r(b,\mu_0)<v_r(b,0)$, *(1.49) and (1.52) imply that* $\rho^*(b,\mu_0)\in(0,1)$, *which is optimal if and only if*

$$\begin{aligned} v_l(b,\mu_0) &= -K^I+(1-s^*(1,b,\mu_0))\{[\mu_0+(1-\mu_0)\theta][u_l(b,1)+\delta v_l(b,\mu_1)] \\ &\quad +(1-\mu_0)(1-\theta)[u_l(b,0)+\delta v_l(b,0)]\} \end{aligned}$$

$$v_l(b,\mu_0)=\{1-s^*(0,b,\mu_0)\}\{u_l(b,0)+\delta v_l(b,\mu_0)\}$$

By a familiar argument, taking $u_l(b,0)\to 0$, *(1.8) implies that* $s^*(1,b,\mu_0)\in(0,1)$.

Next assume that $\overline{m}>1$ *and (1.50) and (1.51) hold for* $m'\in\{0,...,\overline{m}-2\}$. *There is no profitable deviation from* $s^*(1,b,\mu_{m'})\in(0,1)$ *if and only if*

$$v_r(b,\mu_0)=[\mu_{m'}+(1-\mu_{m'})\theta]v_r(b,\mu_{m'+1})+(1-\mu_{m'})(1-\theta)v_r(b,0) \tag{1.53}$$

which, using $v_r(b,\mu_0)<v_r(b,0)$, *implies* $v_r(b,\mu_0)>v_r(b,\mu_{m'+1})$. *This further implies*

$$\rho^*(b,\mu_{m'+1})[\mu_{m'+1}+(1-\mu_{m'+1})\theta]<\rho^*(b,\mu_0)[\mu_0+(1-\mu_0)\theta] \tag{1.54}$$

since otherwise we get

$$\begin{aligned} v_r(b,\mu_{m'+1}) &\geq u_r(b,0)+\rho^*(b,\mu_{m'+1})[\mu_{m'+1}+(1-\mu_{m'+1})\theta][u_r(b,1)-u_r(b,0)]+\delta v_r(b,\mu_0) \\ &\geq u_r(b,0)+\rho^*(b,\mu_0)[\mu_0+(1-\mu_0)\theta][u_r(b,1)-u_r(b,0)]+\delta v_r(b,\mu_0)=v_r(b,\mu_0) \end{aligned}$$

where the equality follows from $s^*(1,b,\mu_0)\in(0,1)$. *A contradiction. (1.54) then implies* $\rho^*(b,\mu_{m'+1})\in(0,1)$, *which holds only if*

$$\begin{aligned} v_l(b,\mu_{m'+1}) &= -K^I+(1-s^*(1,b,\mu_{m'+1}))\{[\mu_{m'+1}+(1-\mu_{m'+1})\theta][u_l(b,1)+\delta v_l(b,\mu_{m'+2})] \\ &\quad +(1-\mu_{m'+1})(1-\theta)[u_l(b,0)+\delta v_l(b,0)]\} \end{aligned}$$

and $v_l(b, \mu_{m'+1}) = \{1 - s^*(0, b, \mu_{m'+1})\}\{u_l(b, 0) + \delta v_l(b, \mu_{m'+1})\}$. *By (1.8) and* $u_l(b, 0) \to 0$ *again, we conclude that* $s^*(1, b, \mu_{m'+1}) \in (0, 1)$. ■

Now let us show that $\overline{m} \not> 1$. Assume $\overline{m} > 1$, then (1.53) holds for at least two values, $m' = \overline{m} - 1$ and $m' = m'' - 1 < \overline{m} - 1$, so that $v_r(b, \mu_m) < v_r(b, 0)$ for $m \in \{m'', \overline{m}\}$ and

$$\frac{v_r(b, \mu_{\overline{m}}) - v_r(b, 0)}{v_r(b, \mu_{m''}) - v_r(b, 0)} = \frac{\mu_{m''-1} + (1 - \mu_{m''-1})\theta}{\mu_{\overline{m}-1} + (1 - \mu_{\overline{m}-1})\theta} < 1 \Rightarrow v_r(b, \mu_{\overline{m}}) > v_r(b, \mu_{m''})$$

which is impossible, since

$$\begin{aligned} v_r(b, \mu_{m''}) &\geq u_r(b, 0) + \rho^*(b, \mu_{m''})[\mu_{m''} + (1 - \mu_{m''})\theta][u_r(b, 1) - u_r(b, 0)] + \delta v_r(b, \mu_0) \\ &> u_r(b, 0) + \delta v_r(b, \mu_0) = v_r(b, \mu_{\overline{m}}) \end{aligned}$$

Then, $\underline{m} = 1$, (1.52) and (1.53) imply

$$v_r(b, \mu_0) = \frac{u_r(b, 0) + [\frac{(1-\mu_0)(1-\theta)\theta}{1-\delta[\mu_0+(1-\mu_0)\theta]}][u_r(b, 1) - u_r(b, 0)]}{1 - \delta} \tag{1.55}$$

Moreover, $s^*(1, b, \mu_0) \in (0, 1)$ and the definition of $v_r(b, \mu_0)$ imply

$$v_r(b, \mu_0) = u_r(b, 0) + \rho^*(b, \mu_0)[\mu_0 + (1 - \mu_0)\theta][u_r(b, 1) - u_r(b, 0)] + \delta v_r(b, \mu_0) \tag{1.56}$$

Equating (1.55) and (1.56) gives (1.27).

Now $s^*(1, b, \mu_0) \in (0, 1)$ and $s^*(0, b, \mu_0) \in [0, 1]$ must be chosen such that

$$\begin{aligned} v_l(b, \mu_0) &= -K^I + (1 - s^*(1, b, \mu_0))\{[\mu_0 + (1 - \mu_0)\theta][u_l(b, 1) + \delta v_l(b, \mu_1)] \\ &\quad +(1 - \mu_0)(1 - \theta)[u_l(b, 0) + \delta v_l(b, 0)]\} \end{aligned}$$

$$v_l(b, \mu_0) = \{1 - s^*(0, b, \mu_0)\}\{u_l(b, 0) + \delta v_l(b, \mu_0)\}$$

which admits a solution, given (1.8) and $u_l(b, 0) \to 0$.

Let us finally characterize the condition under which such an equilibrium exists. There is no insurrection along the equilibrium path if and only if $\forall \mu' \in \{0, \mu_0, \mu_1\}$

$$-K^p + \delta \left\{ \mu' v_p^i(g) + (1-\mu') v_p^i(b) \right\} < \delta v_p(b, \mu') \tag{1.57}$$

We can calculate $v_p(b, \mu')$ the same way that we calculated $v_r(b, \mu')$. We get

$$v_p(b, 0) = \frac{\theta u_p(b,1) + (1-\theta) u_p(b,0)}{1-\delta} = v_p^i(b)$$

$$v_p(b, \mu_1) = u_p(b, 0) + \delta v_p(b, \mu_0)$$

$$v_p(b, \mu_0) = \frac{u_p(b,0) + [\frac{(1-\mu_0)(1-\theta)\theta}{1-\delta[\mu_0 + (1-\mu_0)\theta]}][u_p(b,1) - u_p(b,0)]}{1-\delta}$$

Clearly, (1.57) holds for $\mu' = 0$. Also, it holds for $\mu' \in \{\mu_0, \mu_1\}$ if and only if it holds for $\mu' = \mu_1$, which reduces to (1.28).

Finally, it is easy to show that the following off-the-equilibrium-path strategies complete the specification of the equilibrium: $\rho^*(b, \mu) = 0 \;\; \forall \mu \geq \mu_2$, $s^*(I, b, \mu) = 1 \; \forall \mu \geq \mu_2 \forall I$ and for $(I, \mu) = (1, \mu_1)$, $i^*(b, \mu') = 1 \Leftrightarrow \mu' \geq \mu_{\overline{\overline{m}}+1}$ where $\overline{\overline{m}}$ is such that

$$-K^p + \delta \left\{ \mu' v_p^i(g) + (1-\mu') v_p^i(b) \right\} \geq \delta [u_p(b,0) + \delta v_p(b, \mu_0)] \Leftrightarrow \mu' \geq \mu_{\overline{\overline{m}}+1}$$

■

Proof. (Proof of lemma 4). Let us prove, by contradiction, that $\underline{m} = 0$. Assuming $\underline{m} \geq 1$, then $s^*(1, b, \mu_{\underline{m}-1}) \neq 1$ is optimal only if

$$v_r(b, \mu_0) \leq (1 - \mu_{\underline{m}-1})(1-\theta) v_r(b, 0) \tag{1.58}$$

so that $v_r(b, \mu_0) < v_r(b, 0)$ and $s^*(I, b, 0) = 0 \; \forall I$, $\rho^*(b, 0) = 1$,

$$v_r(b, 0) = \frac{u_r(b,0) + \theta[u_r(b,1) - u_r(b,0)]}{1-\delta} \tag{1.59}$$

Now assume $\underline{m} > 1$. (1.58) implies

$$v_r(b, \mu_0) < (\mu_0 + (1-\mu_0)\theta) v_r(b, \mu_1) + (1-\mu_0)(1-\theta) v_r(b, 0) \Rightarrow s^*(1, b, \mu_0) = 0 \Rightarrow \rho^*(b, \mu_0) = 1$$

where the last implication follows by a familiar argument, using (1.8) and $u_l(b,0) \to 0$. But $\rho^*(b,\mu_0) = 1$ implies

$$v_r(b,\mu_0) \geq u_r(b,0) + (\mu_0 + (1-\mu_0)\theta)[u_r(b,1) - u_r(b,0)] + \delta v_r(b,\mu_0)$$

which contradicts (1.58), given (1.59).

Now assume $\underline{m} = 1$. We must have $s^*(1,b,\mu_0) \neq 0$, for otherwise we get, by a familiar argument, that $\rho^*(b,\mu_0) = 1$, which contradicts (1.58), given (1.59). Then $s^*(1,b,\mu_0) \neq 0$ is optimal if and only if

$$v_r(b,\mu_0) = (1-\mu_0)(1-\theta)v_r(b,0) \tag{1.60}$$

while, by definition, $s^*(1,b,\mu_0) \neq 0$ implies

$$v_r(b,\mu_0) = u_r(b,0) + \rho^*(b,\mu_0)(\mu_0 + (1-\mu_0)\theta)[u_r(b,1) - u_r(b,0)] + \delta v_r(b,\mu_0) \tag{1.61}$$

Equating (1.60) and (1.61), using (1.59), gives

$$\rho^*(b,\mu_0) = \frac{(1-\mu_0)(1-\theta)\theta}{\mu_0 + (1-\mu_0)\theta} - \frac{u_r(b,0)}{u_r(b,1) - u_r(b,0)}$$

which is impossible if (1.24) holds or, more precisely, $\frac{u_r(b,1)-u_r(b,0)}{u_r(b,0)} < \frac{\mu_0+(1-\mu_0)\theta}{(1-\mu_0)(1-\theta)\theta}$.

Now $\underline{m} = 0 \Rightarrow \rho^*(b,\mu_0) = 0$, $s^*(1,b,\mu_0) = 0$, $s^*(0,b,\mu_0) \in [0,1]$, $i^*(b,\mu_0) = 1$, since $0 < (1-\mu_0)(1-\theta)v_r(b,0) \Rightarrow s^*(1,b,\mu_0) = 0 \Rightarrow \rho^*(b,\mu_0) = 0$, where the last implication follows by definition of the equilibrium. Let us characterize the conditions under which this equilibrium holds. $\rho^*(b,\mu_0) = 0$ and $i^*(b,\mu_0) = 1$ imply

$$v_p(b,\mu_0) = u_p(b,0) - K^p + \delta[\mu_0 v_p^i(g) + (1-\mu_0)v_p^i(b)]$$

Therefore, $i^*(b,\mu_0) = 1$ is optimal if and only if

$$-K^p + \delta[\mu_0 v_p^i(g) + (1-\mu_0)v_p^i(b)] \geq \delta v_p(b,\mu_0)$$

or (1.29) holds. Also, $\rho^*(b,\mu_0)=0$ is optimal if and only if

$$\begin{aligned}
& -K^I+u_l(b,0)+[\mu_0+(1-\mu_0)\theta][u_l(b,1)-u_l(b,0)] \\
& +\delta[\mu_0 v_r^i(g)+(1-\mu_0)[\theta v_r^i(b)+(1-\theta)v_l(b,0)]] \\
\leq\ & (1-s^*(0,b,\mu_0))[u_l(b,0)+\delta[\mu_0 v_r^i(g)+(1-\mu_0)v_r^i(b)]]
\end{aligned}$$

which admits a solution if (1.21) holds.

Let us now characterize strategies off the equilibrium path. Define $m_i(K^p)$, m_I and $K^p_{m_I}$ such that

$$K^p \leq \frac{\delta\mu_m[u_p(g,1)-u_p(b,1)]}{1-\delta[\mu_m+(1-\mu_m)\theta]} \Leftrightarrow m \geq m_i(K^p) \tag{1.62}$$

$$K^I \leq [\mu_m+(1-\mu_m)\theta]\,[u_l(b,1)-u_l(b,0)]-(1-\mu_m)(1-\theta)\delta v_{rr}^i(b) \Leftrightarrow m \geq m_I \tag{1.63}$$

$$K^p_{m_I} = \frac{\delta\mu_{m_I}[u_p(g,1)-u_p(b,1)]}{1-\delta[\mu_{m_I}+(1-\mu_{m_I})\theta]} \tag{1.64}$$

Note that these variables are well-defined and

$$\begin{gathered}
0 \leq m_i(K^p) < \infty \quad \forall K^p < K_{i0} \\
K^{p\prime} > K^{p\prime\prime} \Rightarrow m_i(K^{p\prime}) \geq m_i(K^{p\prime\prime}) \\
1 \leq m_I < \infty
\end{gathered} \tag{1.65}$$

Then, we can show that the following is the complete description of an equilibrium: $\rho^*(b,0)=1$, $s^*(I,b,0)=0\ \forall I$, $i^*(b,0)=0$ and

if $K^p \leq K^p_{m_I}$

$$\rho^*(b,\mu_m)=\begin{cases}0 & \text{if } m<m_I \\ 1 & \text{otherwise}\end{cases}$$

$s^*(I,b,\mu_m)=0\ \ \forall I,m$

$i^*(b,\mu_m)=1\ \forall m\geq 0$

if $K^p > K^p_{m_I}$

$$\rho^*(b,\mu_m)=\begin{cases}0 & \text{if } m=0 \\ 1 & \text{otherwise}\end{cases}$$

$s^*(I,b,\mu_m)=0\ \ \forall I,m$

$i^*(b,\mu_m)=0 \Leftrightarrow 1\leq m<m_i(K^p)$

Strategies where $(b,\mu)=(b,0)$ are clearly optimal.

Now assume $K^p \leq K^p_{m_I}$. $i^*(b, \mu_m) = 1$ $\forall m \geq m_I$ is optimal by definition of $m_i(K^p)$ and $K^p \leq K^p_{m_I} \Rightarrow m_I \geq m_i(K^p)$. $i^*(b, \mu_m) = 1$ $\forall m < m_I$ is optimal by $K^p < K_{i0}$. Moving up, there is clearly no deviation from $s^*(I, b, \mu_m) = 0$ $\forall I, m$. Moving up, $\rho^*(b, \mu_m) = 1 \Leftrightarrow m \geq m_I$ by definition of m_I.

Now assume $K^p > K^p_{m_I}$. $\forall m \geq m_i(K^p) - 1$, $i^*(b, \mu_m) = 1 \Leftrightarrow m \geq m_i(K^p)$ by definition of $m_i(K^p)$. Then we can show by induction that, $\forall 1 \leq m \leq m_i(K^p) - 1$, $i^*(b, \mu_m) = 0$. It is true for $m = m_i(K^p) - 1$. Now assume that $i^*(b, \mu_m) = 0$ for $2 \leq m \leq m_i(K^p) - 1$, there is no deviation from $i^*(b, \mu_{m-1}) = 0$ if

$$-K^p + \delta[\mu_{m-1} v^i_p(g) + (1 - \mu_{m-1}) v^i_p(b)] \leq \delta v_p(b, \mu_{m-1}) \tag{1.66}$$

Now note that $i^*(b, \mu_m) = 0$, along with $\rho^*(b, \mu_m) = 1$, $s^*(1, b, \mu_m) = 0$, implies

$$\begin{aligned} v_p(b, \mu_{m-1}) \geq \; & u_p(b, 0) + [\mu_{m-1} + (1 - \mu_{m-1})\theta][u_p(b, 1) - u_p(b, 0)] \\ & -K^p[\mu_{m-1} + (1 - \mu_{m-1})\theta] + \delta\{\mu_{m-1} v^i_p(g) + (1 - \mu_{m-1}) v^i_p(b)\} \end{aligned}$$

so that (1.66) holds if $K^p \geq \frac{\delta\mu_{m-1}[u_p(g,1) - u_p(b,1)]}{1 - \delta[\mu_{m-1} + (1 - \mu_{m-1})\theta]}$, which is true by $m \leq m_i(K^p) - 1$. Moving up, $s^*(I, b, \mu_m) = 0$ $\forall I, m$ is clearly optimal. Moving up, there is no deviation from $\rho^*(b, \mu_m) = 1$ $\forall m \geq m_i(K^p)$ by definition of m_I and $K^p > K^p_{m_I} \Rightarrow m_i(K^p) \geq m_I$. Also, there is no deviation from $\rho^*(b, \mu_m) = 1$ $\forall 1 \leq m \leq m_i(K^p) - 1$ given (1.8) and $u_l(b, 0) \to 0$. Finally, there is no deviation from $\rho^*(b, \mu_0) = 0$ if

$$\begin{aligned} & -K^I + u_l(b, 0) + [\mu_0 + (1 - \mu_0)\theta][u_l(b, 1) - u_l(b, 0)] \\ & +\delta\{[\mu_0 + (1 - \mu_0)\theta] v_l(b, \mu_1) + (1 - \mu_0)(1 - \theta) v_l(b, 0)\} \\ \leq \; & u_l(b, 0) + \delta\{\mu_0 v^i_r(g) + (1 - \mu_0) v^i_r(b)\} \end{aligned}$$

It is easy to check that this is implied by (1.21). Indeed, we only need to show that

$$[\mu_0 + (1 - \mu_0)\theta] v_l(b, \mu_1) < \mu_0 v^i_r(g) + (1 - \mu_0)\theta v^i_r(b)$$

To see that this inequality holds, note that given equilibrium strategies,

$$\begin{aligned}
v_l(b,\mu_1) &= \mu_1\left[\frac{1-\delta^{m_i(K^p)-1}}{1-\delta}(-K^I+u_l(b,1))+\delta^{m_i(K^p)-1}v_r^i(g)\right] \\
&+(1-\mu_1)\left[\frac{1-(\delta\theta)^{m_i(K^p)-1}}{1-\delta}[-K^I+\theta u_l(b,1)+(1-\theta)u_l(b,0)]\right] \\
&+(1-\mu_1)(\delta\theta)^{m_i(K^p)-1}v_r^i(b)
\end{aligned}$$

so that $v_l(b,\mu_1)$ is strictly decreasing in $m_i(K^p)$, given (1.3). Also note that $m_I \geq 1$, (1.65) and $K^p > K^p_{m_I} \Rightarrow m_i(K^p) \geq 2$. Therefore

$$\begin{aligned}
v_l(b,\mu_1) &< v_l(b,\mu_1)|_{m^i(K^p)=1} = \mu_1 v_r^i(g)+(1-\mu_1)v_r^i(b) \\
&\Rightarrow [\mu_0+(1-\mu_0)\theta]v_l(b,\mu_1) < \mu_0 v_r^i(g)+(1-\mu_0)\theta v_r^i(b)
\end{aligned}$$

■

Proof. (Proof of remark 1). With some algebra, we can show

$$K_{i0} < K_{i1} \Leftrightarrow \frac{u_p(g,1)-u_p(b,1)}{u_p(b,1)-u_p(b,0)} > \frac{1}{\mu_0}\left[\frac{\theta}{1-\delta[\mu_0+(1-\mu_0)\theta]}-[\mu_0+(1-\mu_0)\theta]\right]$$

$$K_{i1} < K_s \Leftrightarrow \frac{u_p(g,1)-u_p(b,1)}{u_p(b,1)-u_p(b,0)} > \frac{1}{1-\mu_1}\left[1-\frac{(1-\mu_1)(1-\theta)}{1-\delta[\mu_0+(1-\mu_0)\theta]}\right]$$

so that $K_{i0} < K_{i1} < K_s$ is ensured by (1.23). ■

Remark 6

$$v_p(b,\mu_0)_s > v_p(b,\mu_0)_{i1} > v_p(b,\mu_0)_{i0} = \lim_{K^p\to K_{i0}} v_p(b,\mu_0)_w$$

and $\lim_{K^p\to 0} v_p(b,\mu_0)_w > v_p(b,\mu_0)_s$ *if and only if*

$$\frac{u_p(g,1)-u_p(b,1)}{u_p(b,1)-u_p(b,0)} > \frac{1}{\delta\mu_0}\left[1-\delta[\mu_0+(1-\mu_0)\theta]-\frac{(1-\mu_0)(1-\theta)(1-\delta^2)}{(1-\delta\theta)-\delta^2(1-\mu_0)(1-\theta)}\right]$$

Proof. *The results are straightforward. To show $v_p(b,\mu_0)_s > v_p(b,\mu_0)_{i1}$, note that*

$$\begin{aligned}\left(1-\frac{(1-\mu_0)(1-\theta)(1-\delta^2)}{(1-\delta\theta)-\delta^2(1-\mu_0)(1-\theta)}\right) &> \delta\left(1-\frac{(1-\mu_0)(1-\theta)(1-\delta^2)}{(1-\delta\theta)-\delta^2(1-\mu_0)(1-\theta)}\right)\\ &> \theta > \frac{(1-\mu_0)(1-\theta)\theta}{1-\delta[\mu_0+(1-\mu_0)\theta]}\end{aligned}$$

where the second inequality is implied by $\delta \geq \frac{\theta}{\mu_0+(1-\mu_0)\theta}$, as we showed in (1.43). ■

Proof. (Proof of remark 3). The proofs are straightforward. Note that

$$\begin{aligned}\frac{\partial v_p(b,\mu_0)_{i1}}{\partial\theta} &< 0 \Leftrightarrow \frac{\partial}{\partial\theta}\left(\frac{(1-\mu_0)(1-\theta)\theta}{1-\delta[\mu_0+(1-\mu_0)\theta]}\right) < 0\\ &\Leftrightarrow f(\theta) = \theta^2\delta(1-\mu_0)-(2\theta-1)(1-\delta\mu_0) < 0\end{aligned}$$

Note that $f(\theta)$ is a quadratic function of θ, with roots

$$\theta_1 = \tfrac{(1-\delta\mu_0)-\sqrt{(1-\delta)(1-\delta\mu_0)}}{\delta(1-\mu_0)} \quad \theta_2 = \tfrac{(1-\delta\mu_0)+\sqrt{(1-\delta)(1-\delta\mu_0)}}{\delta(1-\mu_0)}$$

We have $\theta_1 \in (0,1)$, $\theta_2 > 1$, so that $\frac{\partial v_p(b,\mu_0)_{i1}}{\partial\theta} < 0 \Leftrightarrow \theta > \theta_1 = \underline{\theta}$. Also, with some algebra, we can show that $\frac{\partial K_{i1}}{\partial\theta} < 0$ if and only if

$$\frac{u_p(g,1)-u_p(b,1)}{u_p(b,1)-u_p(b,0)} > \frac{\theta(1-\delta)\frac{\mu_0+(1-\mu_0)\theta}{1-\delta[\mu_0+(1-\mu_0)\theta]}-\mu_0(1-\theta)}{\mu_0[1-\delta[\mu_0+(1-\mu_0)\theta]]}$$

■

Proof. (Proof of lemma 5) Assume that $i^*(b,\mu_0)=0$. Then $v_p(b,\mu_0)=\frac{1}{1-\delta}u_p(b,0)$ and $i^*(b,\mu_0)=0$ is optimal if and only if $-K^p+\delta[\mu_0 v_p^i(g)+(1-\mu_0)v_p^i(b)] \leq \delta v_p(b,\mu_0)$ or $K^p \geq K_{i0}$. Now assume that $i^*(b,\mu_0)=1$. Then

$$v_p(b,\mu_0) = u_p(b,0)-K^p+\delta[\mu_0 v_p^i(g)+(1-\mu_0)v_p^i(b)]$$

and $i^*(b,\mu_0)=1$ is optimal if and only if $K^p \leq K_{i0}$. ■

Proof. (Proof of lemma 6). First assume that $K^p > K_s$. Let us show that there is no deviation from $\rho^*(b,\mu) = 1\ \forall\mu$, $i^*(b,\mu') = 0\ \forall\mu'$. Given the postulated strategies:

$$v_p(b,\mu_m) = \frac{\mu_m u_p(b,1) + (1-\mu_m)[\theta u_p(b,1) + (1-\theta)u_p(b,0)]}{1-\delta}$$

There is no profitable deviation from $i^*(b,\mu') = 0\ \forall\mu'$ if and only if

$$-K^p + \delta[\mu_m v_p^i(g) + (1-\mu_m)v_p^i(b)] < \delta v_p(b,\mu_m) \Leftrightarrow K^p > \frac{\delta}{1-\delta}\mu_m\left[u_p(g,1) - u_p(b,1)\right]$$

which is ensured by $K^p > K_s$.

Now assume that $K^p < K_{i0}$. Then, by the same reasoning as in lemma 4, the following is the complete description of an equilibrium: $\rho^*(b,0) = 1$, $i^*(b,0) = 0$ and

if $K^p \leq K^p_{m_I}$

$$\rho^*(b,\mu_m) = \begin{cases} 0 & \text{if } m < m_I \\ 1 & \text{otherwise} \end{cases}$$

$$i^*(b,\mu_m) = 1\ \forall m \geq 0$$

if $K^p > K^p_{m_I}$

$$\rho^*(b,\mu_m) = \begin{cases} 0 & \text{if } m = 0 \\ 1 & \text{otherwise} \end{cases}$$

$$i^*(b,\mu_m) = 0 \Leftrightarrow 1 \leq m < m_i(K^p)$$

Now assume that $K^p \in (K_{i0}, K_s)$. Define $\widehat{m}_i(K^p)$ such that

$$\begin{aligned} K^p &\leq \frac{\delta}{1-\delta}\left[\mu_m[u_p(g,1) - u_p(b,1)] + \{1 - (1-\mu_m)(1-\theta)\}[u_p(b,1) - u_p(b,0)]\right] \\ &\Leftrightarrow m \geq \widehat{m}_i(K^p) \end{aligned} \tag{1.67}$$

It is easy to show that

$$1 \leq \widehat{m}_i(K^p) \leq m_i(K^p) < \infty\quad \forall K^p$$

$$K^{p\prime} > K^{p\prime\prime} \Rightarrow \widehat{m}_i(K^{p\prime}) \geq \widehat{m}_i(K^{p\prime\prime})$$

Then we can show that the following is the complete characterization of an equilibrium:

$\rho^*(b,0)=1$, $i^*(b,0)=0$ and

if $K^p \leq K^p_{m_I}$

$$\rho^*(b,\mu_m)=\begin{cases} 0 & \text{if } \widehat{m}_i(K^p)\leq m<m_I \\ 1 & \text{otherwise}\end{cases}$$

$$i^*(b,\mu_m)=0 \Leftrightarrow m\leq \widehat{m}_i(K^p)-1$$

if $K^p > K^p_{m_I}$

$$\rho^*(b,\mu_m)=1$$

$$i^*(b,\mu_m)=0 \Leftrightarrow m\leq m_i(K^p)-1$$

Strategies in state $(b,0)$ are obviously optimal.

Now assume that $K^p \leq K^p_{m_I}$. There is no deviation from $i^*(b,\mu_m)=1\ \forall m\geq m_I$ by definition of $m_i(K^p)$ and $K^p\leq K^p_{m_I}$, which implies $m_I\geq m_i(K^p)$. There is no deviation from $i^*(b,\mu_m)=1\ \forall \widehat{m}_i(K^p)\leq m\leq m_I-1$ by definition of $\widehat{m}_i(K^p)$. Then we can show by induction that there is no deviation from $i^*(b,\mu_m)=0\ \forall m\leq \widehat{m}_i(K^p)-1$. First note that it holds for $m=\widehat{m}_i(K^p)-1$ if and only if $K^p\geq \frac{\delta\mu_{\widehat{m}_i(K^p)-1}[u_p(g,1)-u_p(b,1)]}{1-\delta[\mu_{\widehat{m}_i(K^p)-1}+(1-\mu_{\widehat{m}_i(K^p)-1})\theta]}$, which is ensured by $\widehat{m}_i(K^p)\leq m_i(K^p)$. Second, assume that $i^*(b,\mu_m)=0$ for $m\leq \widehat{m}_i(K^p)-1$. There is no deviation from $i^*(b,\mu_{m-1})=0$ if

$$-K^p+\delta[\mu_{m-1}v^i_p(g)+(1-\mu_{m-1})v^i_p(b)]\leq \delta v_p(b,\mu_{m-1}) \tag{1.68}$$

But note that since $i^*(b,\mu_m)=0$, $\rho^*(b,\mu_m)=1$,

$$\begin{aligned} v_p(b,\mu_{m-1}) \ \geq\ & u_p(b,0)+[\mu_{m-1}+(1-\mu_{m-1})\theta][u_p(b,1)-u_p(b,0)] \\ & -K^p[\mu_{m-1}+(1-\mu_{m-1})\theta]+\delta\{\mu_{m-1}v^i_p(g)+(1-\mu_{m-1})v^i_p(b)\}\end{aligned}$$

so that (1.68) holds if $K^p\geq \frac{\delta\mu_{m-1}[u_p(g,1)-u_p(b,1)]}{1-\delta[\mu_{m-1}+(1-\mu_{m-1})\theta]}$, which is ensured by $m\leq \widehat{m}_i(K^p)-1\leq m_i(K^p)-1$. Now consider $\rho^*(b,\mu_m)$. Take $m\geq \widehat{m}_i(K^p)$, then there is no deviation from $\rho^*(b,\mu_m)=1$ if and only if $m\geq m_I$ by definition of m_I. Also, there is no deviation from $\rho^*(b,\mu_m)=1\ \forall 0\leq m\leq \widehat{m}_i(K^p)-1$ by (1.8) and $u_l(b,0)\to 0$.

Now assume that $K^p>K^p_{m_I}$. Take $m\geq m_i(K^p)-1$, then there is no deviation from $i^*(b,\mu_m)=1\Leftrightarrow m\geq m_i(K^p)$, by definition of $m_i(K^p)$. By an argument that is now familiar, we can show by induction that $i^*(b,\mu_m)=0$ for $m\leq m_i(K^p)-1$. Moving up, consider $\rho^*(b,\mu_m)$. There is no deviation from $\rho^*(b,\mu_m)=1\ \forall m\geq m_i(K^p)$ by definition of m_I and the fact that

$K^p > K^p_{m_I} \Rightarrow m_i(K^p) \geq m_I$. Also, by (1.8) and $u_l(b,0) \to 0$, then there is no deviation from $\rho^*(b, \mu_m) = 1 \; \forall m < m_i(K^p)$.

Summing up, the variable $\widehat{m}(K^p)$, presented in the lemma, is given by

$$\widehat{m}(K^p) = \begin{cases} \widehat{m}_i(K^p) & \text{if } K^p \leq K^p_{m_I} \\ m_i(K^p) & \text{if } K^p > K^p_{m_I} \end{cases}$$

where it is easy to show that

$$K^{p\prime} > K^{p\prime\prime} \Rightarrow \widehat{m}(K^{p\prime}) \geq \widehat{m}(K^{p\prime\prime}) \tag{1.69}$$

■

Proof. (Proof of lemma 7). Write $v_r(b, \mu_0|\phi)$ as the value of the game to the ruler with organizational structure ϕ. It is straightforward to compute:

$$\begin{array}{lll} & v_r(b,\mu_0|\phi^0) & v_r(b,\mu_0|\phi^1) \\ K^p > K_s: & \frac{1}{1-\delta}u_r(b,0) & \frac{1}{1-\delta}u_r(b,0) + x \\ K^p \in (K_{i0}, K_s): & \frac{1}{1-\delta}u_r(b,0) & \frac{1}{1-\delta}u_r(b,0) + x - y \\ K^p < K_{i0}: & u_r(b,0) & u_r(b,0) \end{array}$$

where

$$\begin{aligned} x &= \frac{(\mu_0 + (1-\mu_0)\theta)[u_r(b,1) - u_r(b,0)]}{1-\delta} \\ y &= \frac{\delta^{\widehat{m}(K^p)}}{1-\delta}[\mu_0 u_r(b,1) + (1-\mu_0)\theta^{\widehat{m}(K^p)}[\theta u_r(b,1) + (1-\theta)u_r(b,0)]] \end{aligned}$$

Consider $K^p \in (K_{i0}, K_s)$. To compute $v_r(b, \mu_0|\phi^1)$, recall that, along the equilibrium path, there is an insurrection after the $\widehat{m}(K^p)^{th}$ successful project, and if a delegate is unsuccessful, he is kept in service and invests in every period. Then if $K^p \in (K_{i0}, K_s)$, $\phi^*(\{\phi^0, \phi^1\}) = \phi^1$ if and only if

$$\frac{u_r(b,1)}{u_r(b,0)} - 1 > \frac{\delta^{\widehat{m}(K^p)}[\mu_0 + (1-\mu_0)\theta^{\widehat{m}(K^p)}]}{[\mu_0 + (1-\mu_0)\theta] - \delta^{\widehat{m}(K^p)}[\mu_0 + (1-\mu_0)\theta^{\widehat{m}(K^p)+1}]} \tag{1.70}$$

We can show that

i) $\exists \widehat{K} \in [K_{i0}, K_s]$ such that $\phi^*(\{\phi^0, \phi^1\}) = \phi^1 \Leftrightarrow K^p > \widehat{K}$

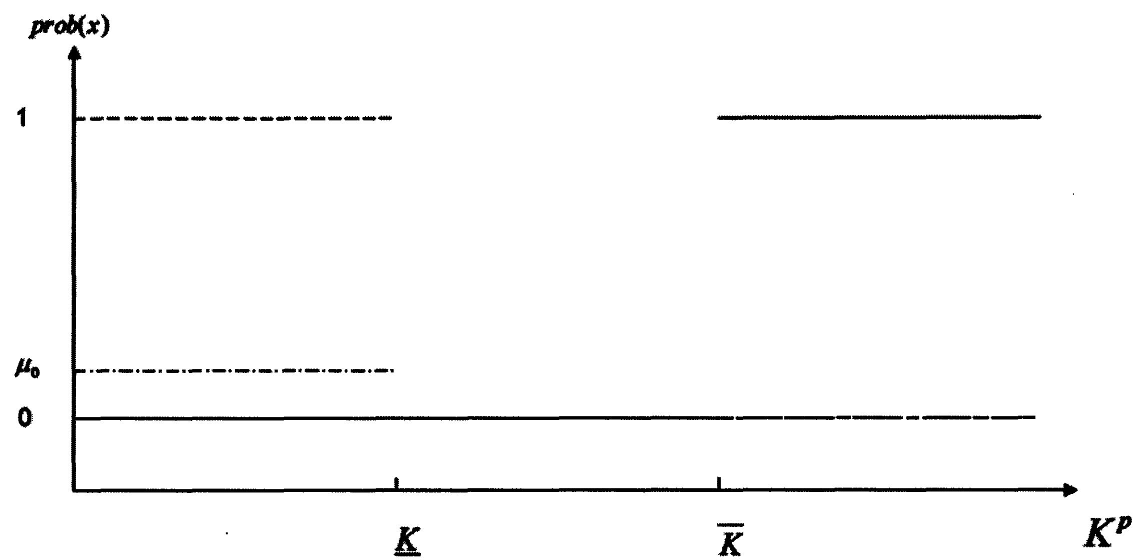
ii)

$$\lim_{\frac{u_r(b,1)}{u_r(b,0)} \to 1} \widehat{K} = K_s$$

Indeed, *i*) follows from the fact that the right-hand side of (1.70) is decreasing in $\widehat{m}(K^p)$ and (1.69). *ii*) is immediate. ■

Proof. (Proof of lemma 8). We use the values in (1.30)-(1.33) and (1.34)-(1.36). The results are straightforward for $K^p < K_s$. For $K^p > K_s$, use (1.19) to show the result. ■

Figure 1
Political Strength and Economic Efficiency in the Simplified Version



Legend

$\overline{K} = \delta\mu_1[v_p(g) - v_p(b)]$

$\underline{K} = \delta\mu_0[v_p(g) - v_p(b)]$

line	*x*
——	$I = 1$
----	$i = 1$
–·–	$q(r_2) = g$

Figure 2
Population Welfare in the Simplified Version

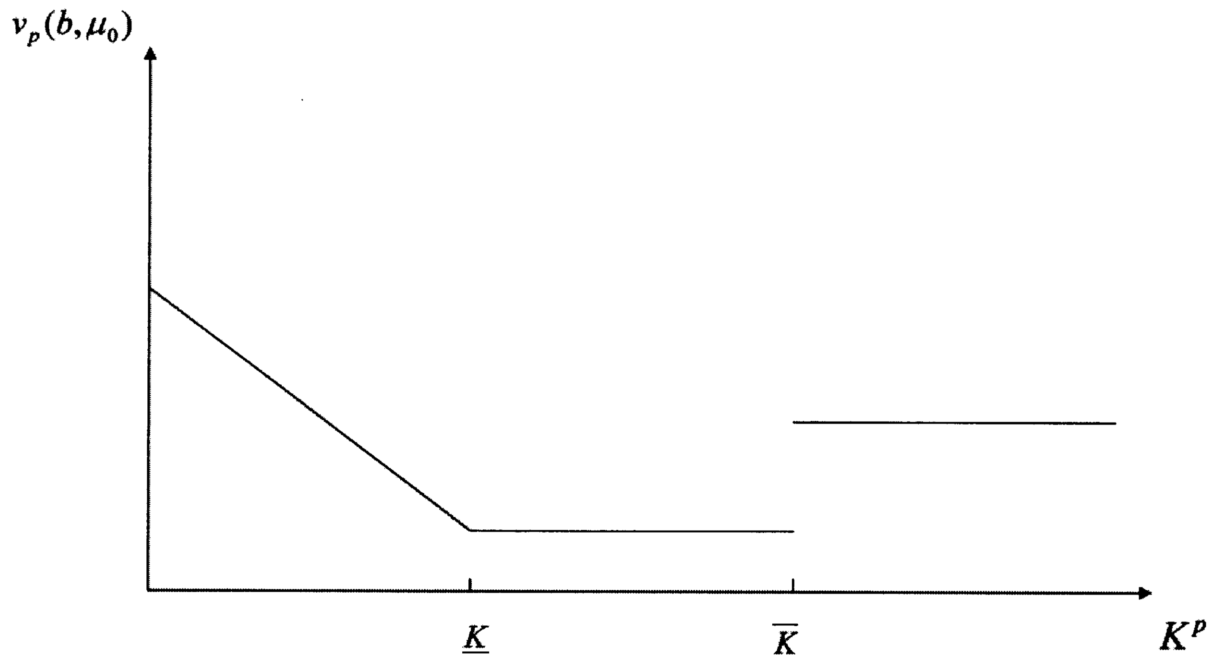


Figure 2a

Population Welfare in the Simplified Version: Increasing μ_0

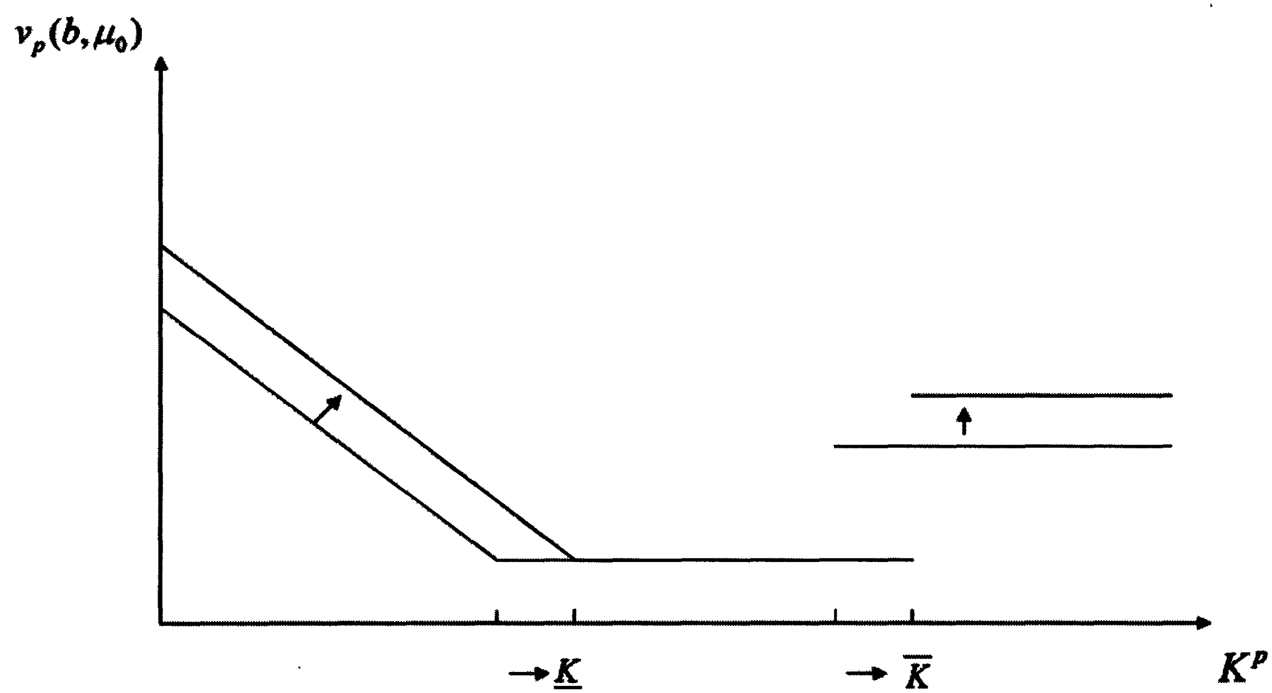


Figure 2b

Population Welfare in the Simplified Version: Increasing θ

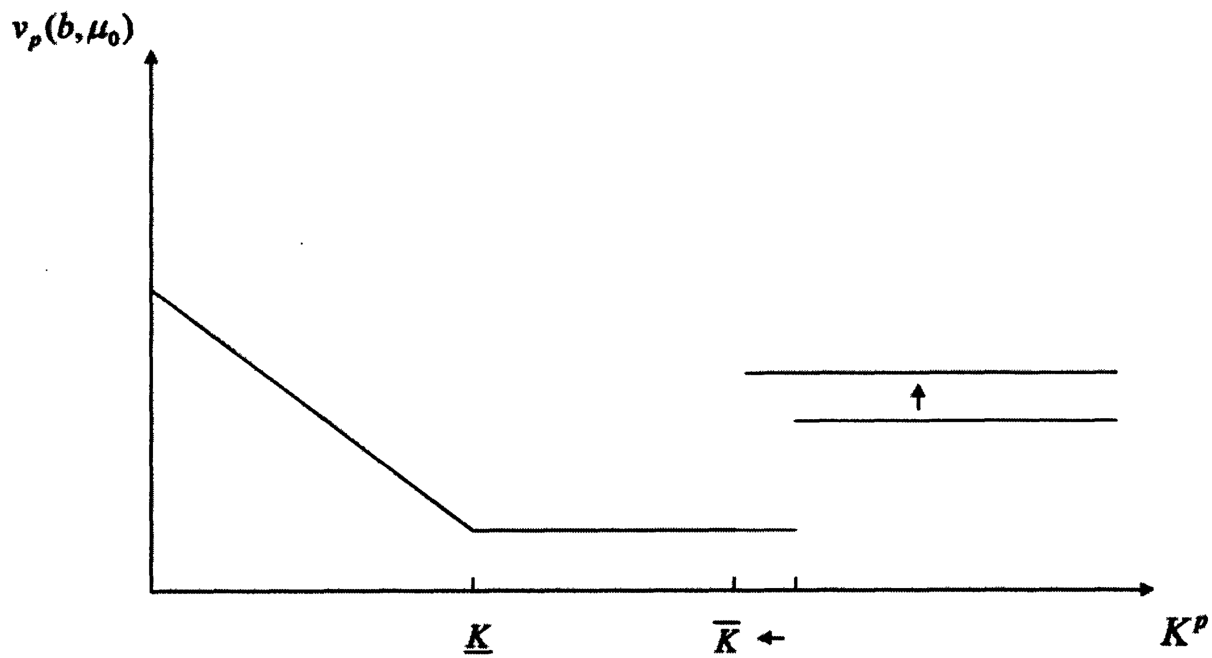


Figure 3
Population Welfare in the Baseline Model

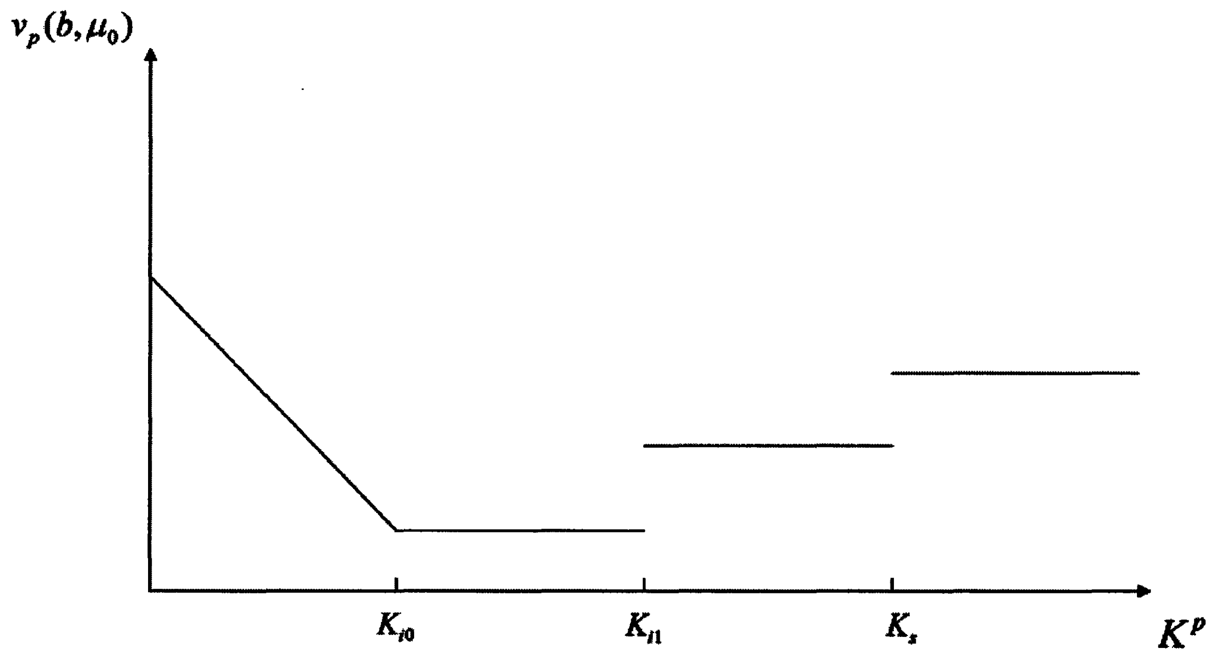


Figure 3a

Population Welfare in the Baseline Model: Increasing μ_0

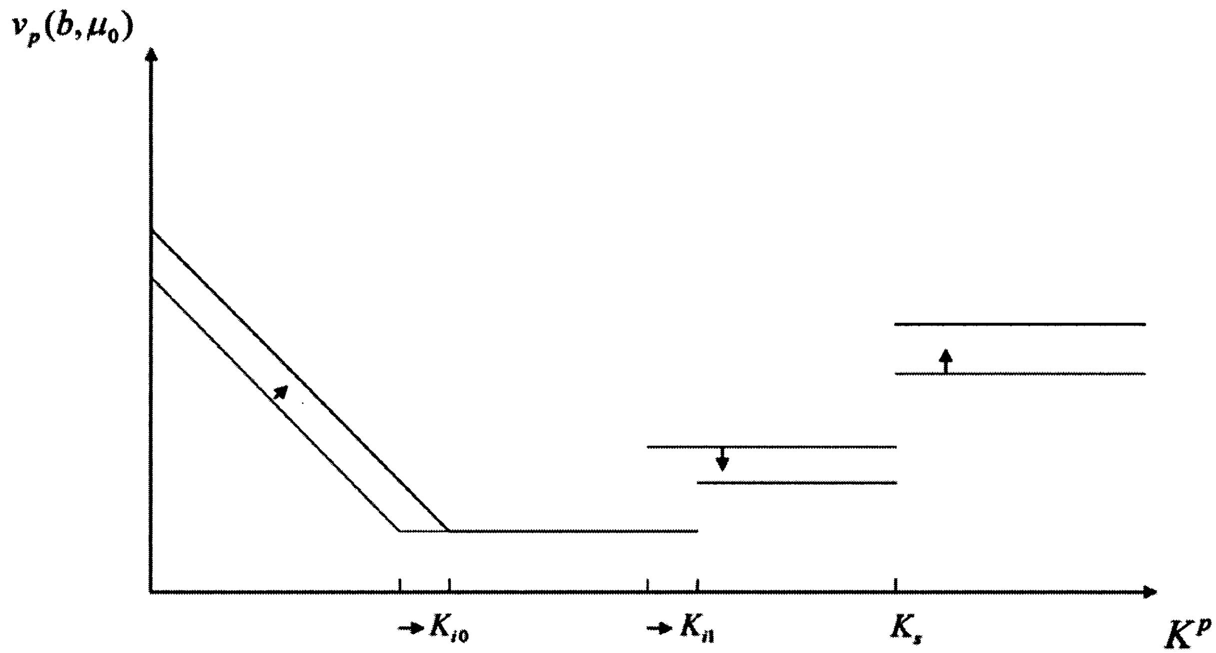


Figure 3b

Population Welfare in the Baseline Model: Increasing θ

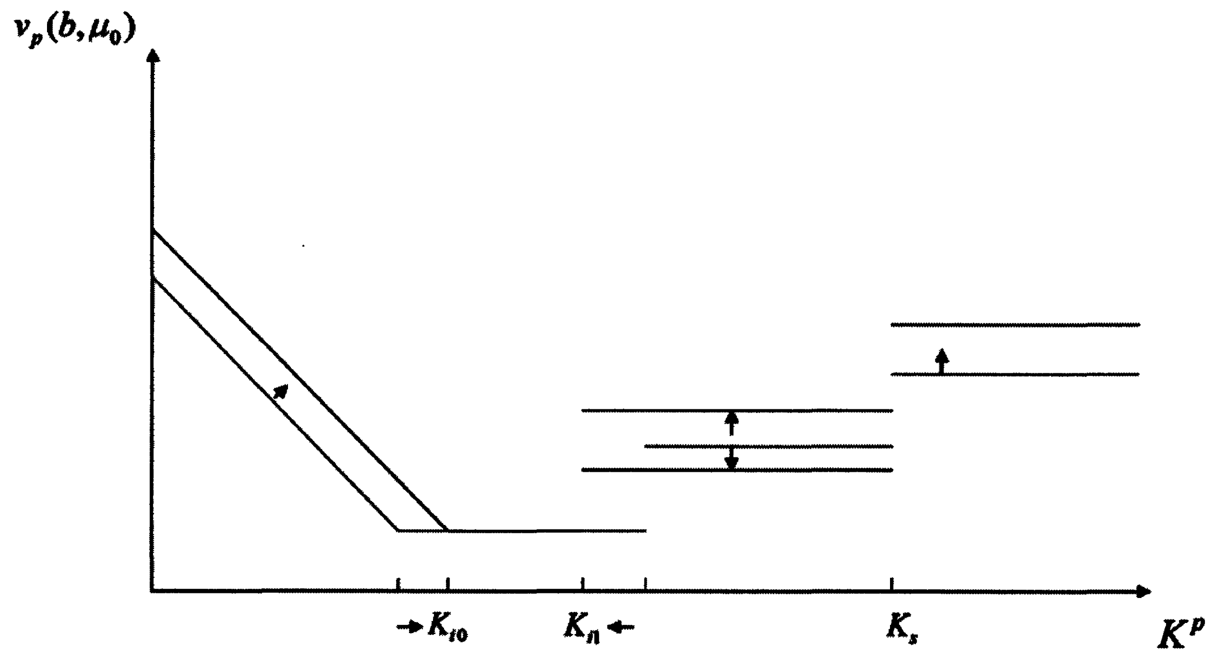
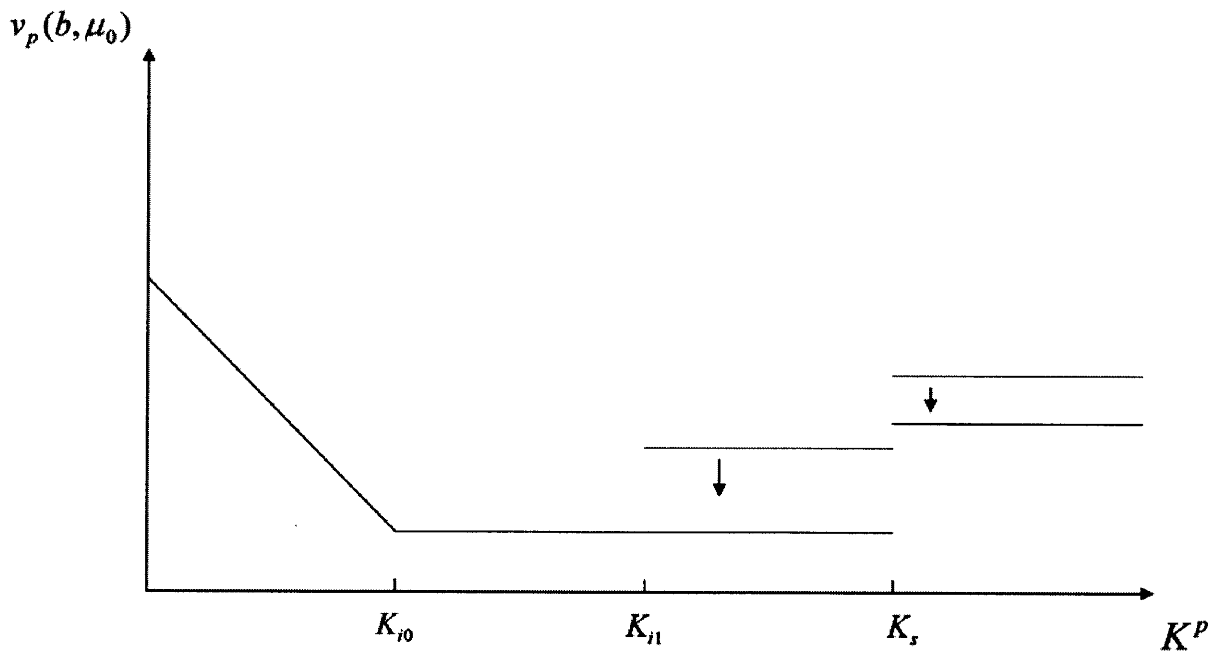


Figure 4
Population Welfare in the Baseline Model when Shuffling is Forbidden



Chapter 2

The Wheel of Fortune: Agency Problems in Dictatorships

2.1 Introduction

Rulers have always had to delegate authority to implement their policies, whether it be because of the size of the territory they control, or the complexity of the problems at hand. Delegation saves on time and resources, but it brings its own set of problems. In particular, the ruler must ensure that the delegate does not attempt to undermine his authority. To solve this problem, various stratagems have been used throughout history. For example, a ruler could demand that the relatives of aristocrats reside at the court as 'hostages' (this was the case in Imperial Japan). Also, he could recruit officials with little autonomous power, so as to ensure that they are dependent upon him for their authority.

This paper focuses on a particular mechanism used by a ruler to secure his agent's loyalty: the 'big shuffle' or 'the wheel of fortune', i.e. the practice of shuffling agents from one assignment to another. It was used, for example, in Mughal India, the Ottoman Empire and Zaire under Mobutu. Politically, this measure appears to have been a great success. For example, the shuffle is credited with ensuring the territorial integrity of the Ottoman Empire, preventing any alliance against the emperor between the nobles and the population: 'Generally, provincial officials were assigned to a different location every three years to prevent them from acquiring clients loyal to themselves and, by implication, disloyal to the sultan.' (Barkey 1991, 704).

While this measure may have the intended effect of undermining the rise in power of subordinates, scholars have also stressed its economic drawback: a short and uncertain tenure in any assignment increases the temptation for the agent to plunder the territory he oversees. Take the example of the nobles of Mughal India (or *jagirdars*). In a famous account, Francois Bernier, a French traveller of the mid-17th century, describes their problem as follows:

'Why should the neglected state of this land create uneasiness in our minds? And why should we spend our money and time to render it fruitful? We may be deprived of it in a single moment, and our exertions would benefit neither ourselves nor our children. Let us draw from the soil all the money we can, though the peasant should starve or abscond, and we should leave it, when commanded to quit, a dreary wilderness.' (Bernier 1996, 227).

The potential impact on the strength of the state and on development is huge. For Bernier, the form of government caused the rapid decline of India. Barrington Moore, commenting on the quote above, suggests that although the Frenchman may have exaggerated his case, 'there is abundant evidence to show that he put his finger on the main defect in the Mogul polity.' (Moore 1966, 328).

Nevertheless, evidence on the economic impact of the big shuffle is scant, and many historians have questioned the argument (For a discussion of the case of Mughal India, and the debate surrounding its decline, see section 2.5). One objection concerns the timing of the decline. In particular, how could the empire truly decline in the late 17th and early 18th century, when the centralized state apparatus was still strong? In other words, how could a strong emperor, who lived off tax revenues from all regions at any time, tolerate that agents depress the economy of any region that was temporarily under their control?

This paper attempts to answer such a question, arguing that the ruler may himself make inefficient decisions so as to secure his hold on power. The model is structured as follows. This is a one-shot game of asymmetric information with three sets of players: a ruler, a delegate and a population. The ruler picks policies which affect the productivity of the economy, directly through his type (good or bad) and also through an investment project. The ruler also decides whether to reconduct the delegate in his functions or 'shuffle' him to another assignment. We assume that shuffling imposes a cost on the delegate, who gets no rent while he waits to be reassigned.[1] The delegate has private information about his type (as a potential ruler) and can signal it to the population through a call for insurrection. The population decides whether to respond to the call for insurrection, replacing the ruler with the delegate. We then show how a bad ruler may decide to depress the payoff of the delegate, through shuffling, so as to remain in power. The reasoning is as follows: by depressing the payoff of the delegate to such a point that even a bad type wants to replace him, then no call for insurrection can be trusted by the population and the ruler can stay in power. Extending this logic further, we show that if the punishment of shuffling is not harsh enough, the ruler might also invest in an inefficient project, destroying output and further reducing the payoff of the delegate so as to remain in power. Coming back to the case of Mughal India, this model suggests a different explanation of the empire's decline than that presented by Bernier and Moore, which is consistent with a strong centralized state.

In this sense, the paper is related to the literature on weak states and strong states in development (e.g. Migdal 1988, Acemoglu 2005). Migdal (1988) shows how this concern for political control has encouraged the leaders of some recent developing countries to weaken their own state. Among other mechanisms, he documents instances of the 'big shuffle'. Acemoglu (2005) offers a formal model of weak states and strong states, where the 'strength' of a state is defined as its ability to extract resources from the population (economic power) or its ability to remain entrenched from the citizens (political power). He finds that both excessively strong and weak states create distortions. He does not model, however, agency problems within the state. Also, other papers outline conditions under which a ruler chooses to make an inefficient investment decision (e.g. Coate and Morris 1995, McGuire and Olson 1996, Robinson and Torvik 2005), but again these do not emphasize agency problems within the state. For example, McGuire and Olson (1996) predict that 'stationary bandits' have the greatest incentives to invest in public goods. We find it difficult to apply this argument to the case of Mughal India. Instead, we ask whether a principal-agent set-up constitutes a better framework.

Egorov and Sonin (2006) take a first step in modeling agency problems in the state. They show that a dictator faces a trade-off between competence and loyalty in the choice of his

[1] It was notorious that the process of shuffling was costly to the nobles in Mughal India. See section 2.5 for more details.

agent. Competence, in their model, is the ability of the agent to recognize the seriousness of an exogenous threat. In contrast, in our model, the threat of replacement is endogenous, coming directly from the agent. It is by manipulating the incentive of the agent to overthrow him that the dictator prevents learning about the agent's type, and can therefore stay in power. Moreover, our paper stresses how this logic of political survival produces economic inefficiency. The strategic manipulation of beliefs by the principal is also the main difference with Myerson (2006b). This paper argues that a federalist democracy is particularly good at selecting types, by first testing politicians at the local level. In the model, though, the federal government cannot manipulate the learning process about the type of the local agents, which is the main concern of the current paper.

In that regard, the paper is related to the growing literature on the logic of political survival in weakly institutionalized societies (Bueno de Mesquita et al. 2003, Acemoglu, Robinson and Verdier 2004, Egorov and Sonin 2005, Myerson 2006a, Padro-i-Miquel 2006, Paltseva 2006, Svolik 2006, Debs 2007a,b). Acemoglu, Robinson and Verdier (2004) show how an autocrat plays off divisions in the population to prevent a coordinated attack by making threats off the equilibrium path. Padro-i-Miquel (2006) develops a model where citizens are divided along ethnic lines, and support a corrupt ruler from their own group for fear of an even worse regime by a strong man from another ethnic group. Debs (2007a) argues that the same logic offers an explanation for the negative correlation between corruption and freedom of the media, an explanation which is consistent with widespread awareness of corruption. None of these papers, however, models agency problems within the state.[2]

With such a focus, the paper is also related to the huge literature on agency problems in organizations. Aghion and Tirole (1997) present a classic study of the optimal allocation of authority between a principal and an agent. In the model, however, the agent cannot replace the principal. As far as we know, there are few papers tackling directly the 'political economy' of the firm (see e.g. Milgrom and Roberts 1988, Friebel and Raith 2004, Argyres and Mui 2005). The

[2]Parallel to the economics literature on weakly institutionalized polities is a literature in sociology and political science on patrimonialism, starting with Weber (1968). Weber (1968) coins the term of 'patrimonial state' to refer to any type of government that is structured as an extension of the ruler's personal domain. Although the ruler of such a state bases his authority upon personal loyalty, and may use his power arbitrarily, there are limits to the control that he exerts upon his delegates, on whom he depends to implement policies and maintain order. In this sense, the term 'patrimonial state' may be more appropriate to describe the Mughal state, but we use dictatorship for simplicity.

closest paper may be Friebel and Raith (2004), which argues that hierarchical communication can help mitigate the incentives for a bad manager to hire incompetent subordinates. If a subordinate could communicate with top executives, then he could reveal the incompetence of his manager and make a case that he would be a better replacement.

Summing up, the main contribution of the paper, along with Debs (2007b), is to develop a model of agency problems within the state, where the principal can be replaced by the agent, but can also manipulate the reputation of the agent, and focuses on the economic impact of this power struggle. The main difference with Debs (2007b) is that the latter is a model of symmetric learning, where information about the type of the delegate can be revealed through the outcome of an investment decision.

The rest of the paper is structured as follows. Section 2.2 presents the baseline model. Section 2.3 shows how shuffling and inefficient investment can be used by the ruler to secure his hold on power. Section 2.4 discusses the robustness of the results, allowing for side payments to the delegate. Section 2.5 shows how the model relates to the case of Mughal India, and the debate surrounding the empire's decline at the end of the 17th century. Section 2.6 concludes. Formal proof of the results are in the appendix.

2.2 The Baseline Model

This is a one-shot game with three players: a ruler r, a delegate l and a population p. The ruler picks a set of economic policies. First, he makes an investment decision $I \in \{0, 1\}$ which determines the value of public infrastructure A' (formally, $A' = I$). Investment I comes at cost IK^I to the ruler. Second, he makes a number of decisions, which are not explicitly modeled, but which affect the economy through his type $q(r)$, either good or bad (formally, $q(r) \in \{g, b\}$, where g stands for good and b for bad). Depending on the value of the public infrastructure A' and the type of the ruler at the end of the game, $q(r')$, any player a receives a payoff $v_a(q(r'), A') > 0$, for $a \in \{r, l, p\}$.

Characterizing these payoffs, we assume first that a good ruler produces higher payoffs to all players in the game, for any value of public good:

Condition 2 *(Monotonicity)*

$$v_a(g, A') > v_a(b, A') \quad \forall A' \forall a \in \{r, l, p\} \tag{2.1}$$

Second, we restrict attention to two types of projects: productive if

$$v_a(q(r'), 1) > v_a(q(r'), 0) \ \forall q(r') \forall a$$

and unproductive (or white elephant) if

$$v_a(q(r'), 1) < v_a(q(r'), 0) \ \forall q(r') \forall a$$

One of our main objectives is to understand how the ruler's struggle for political survival can produce economic inefficiency. As we shall see, we will obtain similar conditions, whether a project is productive or unproductive. Finally, we assume that the delegate's payoff is sufficiently dependent on the value of public infrastructure, relative to the ruler's payoff:

Condition 3 *(Relative Dependence of the Delegate): $\exists \alpha \in (0, 1)$ such that*

$$\alpha \left| v_l(b, 1) - v_l(b, 0) \right| > \left| v_r(b, 1) - v_r(b, 0) \right| \tag{2.2}$$

This holds, for example, if the delegate's payoff depends largely on taxes on output, while the ruler's payoff depends mostly on certain rents from holding office, which are independent of the productivity of the economy.

We also assume that the delegate has a type, $q(l) \in \{g, b\}$, and that the population sees him as a potential replacement to the ruler.[3] Given condition 2, the population would want to replace a bad ruler with a good delegate, if types were observable. However, we assume that the type of a delegate is unknown, since he has not had the opportunity to prove his worth as a ruler, while the type of the ruler is known. Let the probability assessment about the type of the delegate be written $\boldsymbol{\mu}$, and assume that prior beliefs are that the delegate is good with

[3] The fact that the payoffs specified above do not directly depend on the type of the delegate does not mean that he serves no economic function. For example, it could be that the tasks handled by the delegate do not require any skill, or that the skills of a good ruler are unrelated to the skills of a good delegate.

probability μ_0, i.e. $\boldsymbol{\mu}(q(l) = g) = \mu_0 \in (0, 1)$. Even if the delegate's type is unknown, we let him send a signal to the population, calling for an insurrection. Formally, let there be a signaling game, where the delegate sends a signal $c \in \{0, 1\}$ and $c = 1$ is a call for insurrection, and the population picks a decision $i \in \{0, 1\}$, where $i = 1$ denotes an insurrection. Any insurrection costs K^p to the population and K^c to the delegate. We assume that K^c is not too large, relative to the value of being a ruler:

$$K^c < v_r(q(r'), A') \ \forall q(r') \forall A' \tag{2.3}$$

Any insurrection is always successful and leads to the replacement of the ruler by the delegate. Any unanswered call for insurrection leads to the death of the delegate, who gets a payoff of 0.

We assume that the ruler cannot fight an insurrection. However, he can shuffle delegates conditional on staying in power.[4] Let $S \in \{0, 1\}$ denote whether there is a shuffle or not, where $S = 1$ means that a shuffle does take place. When a shuffle takes place, the delegate in function and a delegate waiting for assignment switch responsibilities. Let (l', l'_w) be the configuration of delegates at the end of the period, when there is no insurrection ($i = 0$).[5] We have:

$$(l', l'_w) = \begin{cases} (l, l_w) & \text{if } S = 0 \\ (l_w, l) & \text{if } S = 1 \end{cases}$$

The crucial aspect of shuffling that we want to focus on here is that it is a punishment. In other words, upon shuffling, a delegate gets a payoff of $v_{l_w}(q(r'), A')$, where

$$v_{l_w}(q(r'), A') = \gamma v_l(q(r'), A') \ \forall q(r') \forall A' \tag{2.4}$$

and $\gamma \in (\alpha, 1)$. This is true, for example, if the delegate earns rents only when he is actively in function, and there is some loss in waiting for reassignment. On the other hand, we assume that shuffling is costless to the ruler. This would hold if, during a shuffle, the transfer of power

4 We exclude any possible repression on the part of the ruler so as to isolate the role of shuffling. In section 2.4, we also allow the ruler to bribe the delegate through a side payment, and show that the logic of the basic model still holds.

5 To close the model, we will assume that, if $i = 1$, the new ruler picks a new delegate to be in function and another to be waiting for assignment.

between delegates can be made smoothly. We let the ruler pick a mixed strategy $s = prob(S = 1)$.

Let us make the timing of the game more explicit and introduce our solution concept.

2.2.1 Timing of the Game

Decisions are taken as follows:[6]

1. r implements I and announces s
2. l decides c
3. p decides i
4. if $i = 0$, then s is implemented
5. $v_a(q(r'), A')$ is realized

Players (r, l, p) are risk-neutral and receive the following value in the game:[7]

$$v_r = -IK^I + (1-i)v_r(q(r), I) \tag{2.5}$$

$$v_l = i[-K^c + v_r(q(l), I)] + (1-i)(1-c)[Sv_{lw}(q(r), I) + (1-S)v_l(q(r), I)] \tag{2.6}$$

$$v_p = i[-K^p + v_p(q(l), I)] + (1-i)v_p(q(r), I) \tag{2.7}$$

2.2.2 Equilibrium Concept

We are solving for a Perfect-Bayesian Equilibrium, where strategies are optimal given beliefs, and beliefs are updated using Bayes' rule. We add a superscript * to denote equilibrium strategies. Finally, because of the multiplicity of equilibria in signaling games, we will restrict attention to equilibria that survive the Intuitive Criterion of Cho and Kreps (1987).

[6] The fact that the ruler announces s in step 1 is done to obtain a unique equilibrium outcome. It will be easy to see that there is no strictly profitable deviation from any choice of s in step 4.

[7] We omit to write the payoff of l_w, since he does not take any decision.

2.3 Solution of the Baseline Model

We are interested in the case where a ruler, known to be bad, wants to secure his hold on power, and where the population wants to revolt against the bad ruler only if it is convinced that the delegate is good. Solving the game backwards, we first consider the signaling game, where the delegate sends a signal c and the population answers by an insurrection decision i. We can show that this signaling game has a generically unique equilibrium, when we impose the Intuitive Criterion of Cho and Kreps (1987). Formally:

Lemma 9 *Fix any strategy s, I and assume that*

$$K^p \in (\mu_0[v_p(g,I) - v_p(b,I)], [v_p(g,I) - v_p(b,I)]) \tag{2.8}$$

a) *A separating equilibrium, where $c = 1 \Leftrightarrow q(l) = g$ and $i = 1 \Leftrightarrow c = 1$, exists if and only if*

$$sv_{l_w}(b,I) + (1-s)v_l(b,I) \in [-K^c + v_r(b,I), -K^c + v_r(g,I)] \tag{2.9}$$

b) *A pooling equilibrium, where $c = 0$ $\forall q(l)$ and $i = 0$ $\forall c$, supported by appropriate off-the-equilibrium-path beliefs, survives the Intuitive Criterion if and only if*

$$sv_{l_w}(b,I) + (1-s)v_l(b,I) \notin (-K^c + v_r(b,I), -K^c + v_r(g,I)) \tag{2.10}$$

Proof. *See the appendix.* ■

This lemma states that the Intuitive Criterion eliminates pooling equilibria which rely on unappealing off-the-equilibrium-path beliefs. By condition (2.8), in any pooling equilibrium, the population must believe sufficiently strongly that a delegate who calls for an insurrection is bad. Yet consider the case where only the good delegate strictly prefers to mount a successful insurrection ((2.10) does not hold). In that case, by the Intuitive Criterion, the population should put no weight on the event that the delegate who calls for an insurrection is bad. Therefore, any pooling equilibrium is ruled out.

Lemma 9 then suggests that a bad ruler may secure his hold on power by punishing a loyal delegate. Let us consider the case where the informational problem is sufficiently important that the population wants to mount an insurrection only if it is convinced that the delegate is good:

$$K^p \in (\mu_0 \max_I [v_p(g, I) - v_p(b, I)], \min_I [v_p(g, I) - v_p(b, I)]) \tag{2.11}$$

Let us define the unconstrained optimal level of investment, I^U, as the decision that maximizes the ruler's payoff, assuming that he remains in power with probability one:

$$I^U = \arg\max_I -IK^I + v_r(b, I) \tag{2.12}$$

It is clear that, if the project is unproductive, $I^U = 0$; and let us assume that, if the project is productive, $I^U = 1$. Also assume that

$$v_l(b, I^U) \in (-K^c + v_r(b, I^U), -K^c + v_r(g, I^U)) \tag{2.13}$$

so that, if the ruler does not shuffle the delegate and picks the optimal level of investment, then no pooling equilibrium survives the Intuitive Criterion. In this case, one way for the ruler to secure his hold on power is by reducing the delegate's payoff, either through shuffling (which acts as a punishment) or inefficient investment. Let us see how this works.

2.3.1 Political Survival Through Private Punishment

Consider first the case where, even with efficient investment, the bad delegate would prefer to mount an insurrection if the shuffling probability is sufficiently high:

$$v_{l_w}(b, I^U) < -K^c + v_r(b, I^U) \tag{2.14}$$

Then we can show the following lemma:

Lemma 10 *Any equilibrium has shuffling with positive probability, efficient investment and no insurrection along the equilibrium path.*

Proof. *See the appendix.* ■

This lemma says that the ruler can still pick the first best level of investment with sufficient shuffling. When the bad delegate expects sufficiently low payoffs in the regime of the ruler, he too would like to replace the ruler. In that case, calls for insurrection become uninformative, and the ruler can stay in power.

This lemma therefore shows that a ruler may stay in power by imposing a private punishment on the delegate. However, it is also possible that a ruler would pick an inefficient policy so as to remain in power. We explore this possibility in the next section.

2.3.2 Political Survival Through Public Inefficiency

Assume that the punishment of shuffling is not harsh enough. More precisely, let

$$v_{l_w}(b, I^U) > -K^c + v_r(b, I^U) \tag{2.15}$$

While shuffling cannot ensure the political survival of the ruler, inefficient investment could do so, if[8]

$$\max_I[-K^c + v_r(b, I) - v_{l_w}(b, I)] > 0 \tag{2.16}$$

Let us assume that the ruler cares sufficiently about being in power that he would like to enforce the pooling equilibrium, even if it comes at the cost of inefficient investment:

$$\min_I -IK^I + v_r(b, I) > \max_I -IK^I + (1 - \mu_0)v_r(b, I) \tag{2.17}$$

Then we can show the following lemma:

Lemma 11 *Any equilibrium has shuffling with positive probability, inefficient investment and no insurrection along the equilibrium path.*

Proof. *See the appendix.* ■

This lemma shows that the ruler will obtain the pooling equilibrium through a combination of shuffling and inefficient investment. In particular, the ruler is willing to invest in a project even if it is unproductive, i.e. he may spend resources to destroy output because, in this case, even the bad delegate wants to replace him, and any call for insurrection becomes uninformative.

[8]Note that condition 3 is necessary for (2.15) and (2.16) to be compatible.

2.4 Robustness of the Results

The results presented so far suggest a particular way in which the ruler enforces the pooling equilibrium: by depressing the payoff of the delegate, so that even the bad type wants to replace him. With this logic, the ruler might want to make an inefficient investment decision, as we saw in lemma 11.

Intuitively, we may expect the ruler to enforce a pooling equilibrium by increasing the payoff of the delegate, so that even the good type does not want to replace him, and the ruler can still take the efficient investment decision. Let us consider the case where the ruler can offer a side payment π, bribing good delegates not to call for an insurrection. As we will see, although this method is intuitively appealing, it assumes a strong ability to commit, either on the part of the ruler (if the payment is made after the insurrection decision) or on the part of the delegate (if the payment is made before the insurrection decision).

Let us consider the case of section 2.3.2, where conditions (2.11), (2.13), (2.15), (2.16) and (2.17) hold. Now allow the ruler to offer a side payment π, and consider first the case where this payment is to be made after the insurrection decision. In other words, the revised timing is

1. r implements I and announces (s, π)
2. l decides c
3. p decides i
4. if $i = 0$, then (s, π) is implemented
5. $v_a(q(r'), A')$ is realized

The revised game produces the following value for the ruler and the delegate:

$$v_r = -IK^I + (1-i)[v_r(q(r), I) - \pi] \tag{2.18}$$

$$v_l = i[-K^c + v_r(q(l), I)] + (1-i)(1-c)[\{Sv_{lw}(q(r), I) + (1-S)v_l(q(r), I)\} + \pi] \tag{2.19}$$

Then we can rewrite lemma 9 as follows

Lemma 12 *Fix any strategy s, I, π and assume that*

$$K^p \in (\mu_0[v_p(g,I) - v_p(b,I)], v_p(g,I) - v_p(b,I)) \tag{2.20}$$

a) *A separating equilibrium, where $c = 1 \Leftrightarrow q(l) = g$ and $i = 1 \Leftrightarrow c = 1$, exists if and only if*

$$sv_{l_w}(b,I) + (1-s)v_l(b,I) + \pi \in [-K^c + v_r(b,I), -K^c + v_r(g,I)] \tag{2.21}$$

b) *A pooling equilibrium, where $c = 0\ \forall q(l)$ and $i = 0\ \forall c$, supported by appropriate off-the-equilibrium-path beliefs, survives the Intuitive Criterion if and only if*

$$sv_{l_w}(b,I) + (1-s)v_l(b,I) + \pi \notin (-K^c + v_r(b,I), -K^c + v_r(g,I)) \tag{2.22}$$

Proof. *Omitted.* ■

Therefore, it is conceivable that the ruler would refrain from shuffling the delegate ($s = 0$) and offer a payment

$$\pi = -K^c + v_r(g, I^U) - v_l(b, I^U) \tag{2.23}$$

so that the good delegate is indifferent about calling for an insurrection, when the efficient investment decision is made. The ruler would prefer to do so if

$$\begin{aligned} & -I^U K^I + v_r(b, I^U) - \left(-K^c + v_r(g, I^U) - v_l(b, I^U)\right) \\ > \ & -I' K^I + v_r(b, I') \end{aligned} \tag{2.24}$$

where $I' \neq I^U$. The problem, however, is that this promise of payment requires commitment power on the part of the ruler. If he could revise his decision at the time of making the payment (step 4 of the revised timing), then he would prefer to renege on his promise, since the threat of insurrection is already averted. Therefore, any equilibrium where side payments are offered after the threat of insurrection is fragile.[9]

[9] On the other hand, the promise to shuffle the delegate is credible, since it is costless to the ruler and the payoff $v_r(b, I)$ does not depend on the type of the delegate.

Let us now allow the ruler to offer a payment that would be paid before the insurrection decision is made, and the delegate decides whether to take the payment (captured by the variable $t \in \{0, 1\}$, where $t = 1$ means that the delegate takes the payment. Again, for simplicity, we are solving for equilibria where t is a pure strategy, and we assume that t is observable to the population, as we did for all other strategies.) The revised timing is:

1. r implements I and announces (s, π)

2. l decides (c, t)

3. p decides i

4. if $i = 0$, then s is implemented

5. $v_a(q(r'), A')$ is realized

The revised game produces the following value for the ruler and the delegate:

$$v_r = -IK^I - t\pi + (1-i)v_r(q(r), I) \tag{2.25}$$

$$v_l = t\pi + i[-K^c + v_r(q(l), I)] + (1-i)(1-c)[Sv_{lw}(q(r), I) + (1-S)v_l(q(r), I)] \tag{2.26}$$

The idea is that the ruler could bribe the delegate not to call for an insurrection. In that case, the ruler could implement the efficient level of investment and offer a payment to the delegate as defined in (2.23). Again, condition (2.24) would determine whether the ruler prefers such a strategy to that outlined in the basic model. The problem, however, is that we have now replaced a commitment problem on the part of the ruler by a commitment problem on the part of the delegate, since the side payment is already cashed in, and continuation payoffs are such that only a good delegate wants to replace the ruler, when $(s, I) = (0, I^U)$ (see lemma 13 in the appendix).

Let us see how this model can shed light on a particular historical example, as we survey the debate surrounding the decline of the Mughal empire.

2.5 The Case of Mughal India

The Mughal empire was founded with the early victories of Babur in 1526 and came to dominate almost the entire Indian subcontinent for about 200 years. During that time, with a highly centralized government, it accumulated military victories, controlled a highly monetized economy, and constructed many historical landmarks, the most famous of which being arguably the Taj Mahal. The degree of centralization of the government was particularly striking and historians see in the decay of that structure - more than in the end of the dynasty itself - the collapse of the empire.[10] What exactly, then, was the nature of the Mughal administration system, and what role did it play in the success - and collapse - of the empire?

2.5.1 A Description

The Mughal administration was set up during the reign of Akbar (1556-1605) and remained virtually unchanged until the end of the reign of Aurangzeb (1658-1707).[11] At the center of the structure stood the emperor, who devised policies with the advice of his ministers.[12] The emperor also relied on nobles to participate in the imperial army and, in return, he let them extract revenue on a given territory. The extent of the territory controlled by any noble was determined by his rank (*mansab*), with the value of a region being assessed by imperial officers, allowing for variations in agricultural yields (this constituted the *zabt* system).[13] The main source of tax revenue came from a tax on agricultural produce. The empire regulated the maximal share that the nobles could extract, with the limit set as high as one-half of output.

In order to regulate the power of the nobles, a number of measures were taken. As a general rule, assignments (or *jagirs*) were allocated to a noble (or *jagirdar*, as in holder of the *jagir*) only for a short amount of time.[14] This practice of rotating agents was a true innovation of Akbar.

[10] For example, Richards (1995) chooses 1719 as the time of the collapse, since by then the centralized structure of the empire was disintegrated beyond repair, even though the Mughal dynasty was still in power (1719 marks the accession to the throne of Muhammad Shah).

[11] This section is based on Richards (1995), especially chapters 3, 4, Habib (1999), especially chapters VI and VII, Athar Ali (1997) and Majumdar (1973).

[12] They were the *Diwan*, *Mir Bakhshi*, *Khan-i-Saman* and *Sadr*, who were responsible, respectively, for finance and revenue; army and intelligence; public works, including the royal household; and judiciary and religious patronage.

[13] A noble's rank in effect constituted of two numbers: the *zat* which determined the noble's personal pay, and the *sawar* which determined the military contingent which the noble had to maintain.

[14] Habib (1999) estimates that, under Shah Jahan, around Agra, tenures averaged 2.7 years. For more distant

Its expressed aim was to prevent nobles from developing their own political support base. Many examples of the period showed the danger of disintegration of an empire. For example, prior to the Mughals, in southern India, the Bahmani kingdom suffered from the secession of the provinces of Ahmadnagar, Bijapur, Berar (in 1490) and Golconda (in 1518) (see Majumdar 1973, chapter XIV). During the last years of Aurangzeb's reign, a noble named Riza Khan was able to set up a parallel government from the town of Ramgir in the Deccan (see Bhadra 1998, 496-499). An important feature of the shuffling mechanism was that it acted as a punishment on the delegate. Between assignments, nobles had to wait at the court, earning no income. This problem was particularly acute in the later period of the empire, when there was an increasing imbalance between the number of nobles and the number of territories available (a *jagirdari* crisis).[15]

While transfers were costly to the delegate, the emperor built an elaborate system to smooth out transitions, minimizing the cost to the emperor, and also monitor the *jagirdars*. A number of agents served the emperor in any region and were not affected by the transfers. There was a *qanungo*, or an accountant helping with tax assessment; and a *chaudhuri*, who helped with tax collection. Also, each area contained a *diwan*, or head of revenue, who could report misdeeds to the emperor; a *faujdar* or imperial police, who was in charge of maintaining law and order, and could help with tax collection; and some *waqi'a-navis* or *sawanih-nigar*, i.e. news reporters with the duty of reporting cases of irregularities and oppression to the emperor (Habib 1999, 331-340).

As mentioned, the system remained intact until the end of Aurangzeb's reign, during which time the empire was apparently prosperous and the nobility respectful of the authority of the emperor. However, signs of decline had already started to appear, as noted by historians and contemporary observers (e.g. Richards 1995, 252 and Athar Ali 1997, 91). Shortly after, the

areas, the figures were as follows: 1.7 years for Bhakkar (Multan province) between 1574-90; 2.6 years for Sehwan (Sind) between 1592-1634; 3.3 years for Dahr (Malwa) between 1653-85; 3.5 years for Indur (Telangana) between 1631-58 (Habib 1999, 301-302). Note, though, that there were exceptions to the rotation system. Some lands, called *watan-jagirs*, were assigned permanently to an individual and his heirs. These were usually the dominions of local lords (*zamindars*) before these were incorporated in the state apparatus. Also, a portion of the territory (called *khalisa*) remained under the direct control of the emperor. The division of the lands between *khalisa* and *jagirs* fluctuated between the time of Akbar and Aurangzeb; but it seems that no less than four-fifths of total revenues were granted as jagirs (Athar Ali 1997, 74).

[15] The number of *jagirdars* grew, in part, because of the increased military commitment in the Deccan and the absorption of rebellious Marathas in the administration. See Athar Ali (1997) and Habib (1999), 311-312.

empire would disintegrate into a series of successor states, with provinces breaking away from the capital, some of them being led by regional *jagirdars* (in the case of the Deccan, Bengal and Awadh; see Habib 2003). Was the *jagirdari* system in any way responsible for this decline? Did the centralized system contain the seeds of its own decline?

2.5.2 A Debate

In a seminal book, Irfan Habib, of Aligarh university, suggests that part of the decline of the empire resulted from the oppressiveness of the *jagirdari* system (see Habib 1999, chapter IX).[16] Following Bernier and other historians, Habib argues that the *jagirdari* system was hurtful to growth. Quite simply, the interests of the *jagirdars* clashed with those of the emperor. While the latter cared for long-term development, nobles were very short-sighted, and preferred to extract as much as possible from the region they controlled.

The thesis has been influential for many years, and many other theories have followed, sometimes strengthening the basic story, sometimes criticizing its focus, or even attacking its basic premise. For example, Athar Ali (1997), who documents the *jagirdari* crisis in the late Aurangzeb, raises some doubts about Habib's thesis. He is puzzled by one aspect of the argument. The central state was still strong during Aurangzeb's time, so how could a strong emperor tolerate excessive levels of taxation? In the same vein, Richards (1995) rejects Habib's explanation, arguing that the economy declined even if the political structure of the empire was still functional. Also, Clingingsmith and Williamson (2005) doubt that a strong centralized state was deleterious to growth.[17] Another group of scholars has gone further in their criticism of Habib's thesis. Some of these 'revisionists' challenge the idea that India was declining in the early 18th century (Bayly 1983) and reject the image of a strong and centralized state, arguing that the thesis overshadows regional differences in imperial administration, and the efforts of local lords to build their own political support base (Alam 1986).

This paper does not aim to settle the debate between the Aligarh school and the revisionists,

[16]The survey represents, from our understanding of the literature, the main hypotheses on the decline of Mughal India. For alternative theories, see Pearson (1976) and Leonard (1979).

[17]They argue that the decline of the Mughal economy was caused by a variety of factors. As concerns the political economy of the empire, they argue that the centralization of the state was good for growth (ensuring law and order, etc.) and see rather the disintegration of the empire into warring states as a cause for the economic decline. Their newly compiled dataset, however, goes only as far back as 1765.

on whether the economy was declining and taxes were excessive in the late 17th and early 18th century. What the paper offers is a missing link in the argument of the Aligarh school, and a potential answer to Athar Ali's question. Even though an emperor cares for long-term development and controls a centralized state, he may have an incentive to depress the economy, even by launching unproductive (white elephant) projects, since it is precisely with such an instrument that he extends his hold on power. When the nobles under his command get sufficiently low payoffs, then they would all prefer to break free from his rule. In that case, the population may not be able to trust any call for insurrection, and the ruler can maintain his hold on power.

2.6 Conclusion

This paper presents a model of agency problems in dictatorships. It focuses on the case of a ruler struggling to maintain his hold on power, when a delegate can build his own support base and undermine his authority. It concludes that a ruler may have an incentive to depress the delegate's payoff to remain in power. With relatively low payoffs, even the bad delegate wants to replace him. In that case, why should the population trust a delegate who calls for insurrection, as he may be just as inefficient as the current ruler?

We show that the ruler may use various tools to depress the delegate's payoff. One is the 'big shuffle', with delegates being rotated from one assignment to another, and losing rent in the process. This is a mechanism which imposes a purely private cost on the delegate. Other tools, however, generate public inefficiencies, e.g. investing in white elephant projects. In that sense, the paper contributes to the debate on whether (and how) Mughal India declined in the late 17th and early 18th century. It strengthens the case of those who believe that the empire did decline, even when the central state apparatus was still strong.

Certainly, the paper focuses on one mechanism (shuffling) and on one aspect of such a mechanism (that it acts as a punishment) to explain how a ruler can stay in power. We may think that shuffling operates through a different mechanism. For example, it could be that the type of the delegate, although initially unknown to all, directly matters for output, and can be revealed through a successful investment project. In that case, a bad ruler may shuffle the delegate so as to depress his incentive to invest. As a result, there would be no information on the delegate's type, and the ruler would be able to stay in power. This possibility is explored in Debs (2007b). Finally, it may be that the real threat to the ruler comes from a coalition of delegates, and shuffling prevents them from forming a coalition. It would be interesting to understand this mechanism and its impact, if any, on economic efficiency.

2.7 Appendix

Proof. (Proof of lemma 9). Let us use the notation of Cho and Kreps (1987). Let $v_a(q,c,i)$ be the expected payoff of actor a, when the delegate is of type q, sends signal c, and the population responds with i. Let

$$BR(\boldsymbol{\mu},c) = \arg\max_{i\in\{0,1\}} \sum_q v_p(q,c,i)\boldsymbol{\mu}(q)$$

be the best-response of the population, when signal c is sent and beliefs about the delegate are $\boldsymbol{\mu}(q)$. Then it is clear that if (2.8) holds,

$$BR(\boldsymbol{\mu},c) = \begin{cases} 1 & \text{if } \boldsymbol{\mu}(g) = 1 \\ 0 & \text{if } \boldsymbol{\mu}(g) \in \{0,\mu_0\} \end{cases} \tag{2.27}$$

Therefore, there is a separating equilibrium as described in a) if and only if (2.9) holds.

Moreover, any pooling equilibrium can be sustained with appropriate off-the-equilibrium-path beliefs, for example $\boldsymbol{\mu}(q(l) = g|c) = 0$, where $\boldsymbol{\mu}(q(l) = g|c) = 0$ is the probability assessment that the delegate is good, conditional on him sending signal c. However, they do not all satisfy the Intuitive Criterion. Let

$$BR(Q',c) = \cup_{\{\boldsymbol{\mu}:\boldsymbol{\mu}(Q')=1\}} BR(\boldsymbol{\mu},c) \tag{2.28}$$

for $Q' \subseteq Q = \{b,g\}$ a subset of the set of types. Let $v_l^*(q)$ be the equilibrium payoff of a delegate l of type q. Then the Intuitive Criterion reads as follows:

Definition 1 *(The Intuitive Criterion. Cho and Kreps 1987, 202) For each out of equilibrium* *message c, form the set $S(c)$ of all types q such that*

$$v_l^*(q) > \max_{i \in BR(Q,c)} v_l(q,c,i)$$

If for message c there is some type $q' \in I$ (necessarily not in $S(c)$) such that

$$v_l^*(q') < \min_{i \in BR(Q \setminus S(c),c)} v_l(q',c',i)$$

then the equilibrium is said to fail the Intuitive Criterion.

Consider a pooling equilibrium where

$$sv_{l_w}(b,I) + (1-s)v_l(b,I) \in (-K^c + v_r(b,I), -K^c + v_r(g,I)) \tag{2.29}$$

Then

$$v_l^*(b) = sv_{l_w}(b,I) + (1-s)v_l(b,I) > \max_{i \in BR(Q,1)} v_l(b,1,i) = -K^c + v_r(b,I)$$

but

$$v_l^*(g) = sv_{l_w}(b,I) + (1-s)v_l(b,I) < \min_{i \in BR(\{g\},1)} v_l(g,1,i) = -K^c + v_r(g,I)$$

since $BR(\{g\},1) = 1$ by (2.28) and (2.27). Therefore, this equilibrium fails the Intuitive Criterion.

Now consider a pooling equilibrium where (2.29) does not hold. Then either

$$sv_{l_w}(b,I) + (1-s)v_l(b,I) \leq -K^c + v_r(b,I)$$

so that $S(1) = \emptyset$ and the Intuitive Criterion has no bite, or

$$sv_{l_w}(b,I) + (1-s)v_l(b,I) \geq -K^c + v_r(g,I)$$

so that $S(1) = Q$ and, again, the Intuitive Criterion has no bite. ■

Proof. (Proof of lemma 10). Let us solve the game by backward induction. There are two equilibria of the signaling game. Equilibrium 1 has

$$c^*(q(l) = g) = 1 \Leftrightarrow sv_{l_w}(b,I) + (1-s)v_l(b,I) > -K^c + v_r(b,I) \tag{2.30}$$
$$c^*(q(l) = b) = 0 \;\forall s \tag{2.31}$$

$$i^*(c = 1) = 1 \Leftrightarrow sv_{l_w}(b,I) + (1-s)v_l(b,I) > -K^c + v_r(b,I) \tag{2.32}$$
$$i^*(c = 0) = 0 \tag{2.33}$$

where the population's beliefs are given using Bayes' rule along the equilibrium path, and appropriate beliefs off the equilibrium path, if $sv_{l_w}(b,I) + (1-s)v_l(b,I) \leq -K^c + v_r(b,I)$, for example $\mu(q(l) = g|c = 1) = \mu_0$.

Equilibrium 2 has

$$c^*(q(l) = g) = 1 \Leftrightarrow sv_{l_w}(b,I) + (1-s)v_l(b,I) \geq -K^c + v_r(b,I) \tag{2.34}$$
$$c^*(q(l) = b) = 0 \;\forall s \tag{2.35}$$

$$i^*(c = 1) = 1 \Leftrightarrow sv_{l_w}(b,I) + (1-s)v_l(b,I) \geq -K^c + v_r(b,I) \tag{2.36}$$
$$i^*(c = 0) = 0 \tag{2.37}$$

where the population's beliefs are given using Bayes' rule along the equilibrium path, and appropriate beliefs off the equilibrium path, if $sv_{l_w}(b,I) + (1-s)v_l(b,I) < -K^c + v_r(b,I)$, for example $\mu(q(l) = g|c = 1) = \mu_0$.

Moving up, the ruler solves

$$\max_{s,I} -IK^I + (1-i)v_r(b,I) \tag{2.38}$$

anticipating the equilibrium in the signaling game. Given (2.14), then for $(s,I) = (1,I^U)$, any equilibrium of the signaling game produces $i = 0$. Therefore, the ruler can implement the unconstrained optimal level of investment. Assuming that equilibrium 1 is played, the ruler picks

$$s^* \in [\frac{1}{1-\gamma}(1-\frac{-K^c+v_r(b,I^*)}{v_l(b,I^*)}),1] \quad (2.39)$$
$$I^* = I^U \quad (2.40)$$

Assuming that equilibrium 2 is played, the ruler picks

$$s^* \in (\frac{1}{1-\gamma}(1-\frac{-K^c+v_r(b,I^*)}{v_l(b,I^*)}),1] \quad (2.41)$$
$$I^* = I^U \quad (2.42)$$

■

Proof. (Proof of lemma 11). Solving the game backwards, there are again two equilibria of the signaling game, as given in the proof of lemma 10. Moving up, the ruler solves (2.38) anticipating the equilibrium in the signaling game. Given (2.15), any strategy with $I = I^U$ produces a unique outcome of the signaling game, where $i = 1$. However, given (2.16), then for $s = 1$, $I \neq I^U$, the signaling game produces a single outcome, where $i = 0$. Given (2.17), the ruler strictly prefers to obtain pooling in the signaling game than to obtain a separating equilibrium. Assuming that equilibrium 1 is played, the ruler picks

$$s^* \in [\frac{1}{1-\gamma}(1-\frac{-K^c+v_r(b,I^*)}{v_l(b,I^*)}),1] \quad (2.43)$$
$$I^* \neq I^U \quad (2.44)$$

Assuming that equilibrium 2 is played, the ruler picks

$$s^* \in (\frac{1}{1-\gamma}(1-\frac{-K^c+v_r(b,I^*)}{v_l(b,I^*)}),1] \quad (2.45)$$
$$I^* \neq I^U \quad (2.46)$$

■

Lemma 13 *There is no equilibrium that survives the Intuitive Criterion where* $(s^*(t=1), I) = (0, I^U)$,

$$(c^*(q(l)=g), t^*(q(l)=g)) = (0,1)$$

$$i^*((c,t)=(0,1))=0$$

Proof. *First note that, in principle, the shuffling strategy s could be a function of the decision t. Given that t is observable to the population, we define*

$$BR(\boldsymbol{\mu},(c,t))=\arg\max_{i\in\{0,1\}}\sum_q v_p(q,(c,t),i)\boldsymbol{\mu}(q)$$

as the best-response of the population, when the delegate picks (c,t) and beliefs about the delegate are $\boldsymbol{\mu}(q)$. Then it is clear that if (2.11) holds,

$$BR(\boldsymbol{\mu},(c,t))=\begin{cases}1 & \text{if } \boldsymbol{\mu}(g)=1\\ 0 & \text{if } \boldsymbol{\mu}(g)\in\{0,\mu_0\}\end{cases} \tag{2.47}$$

Therefore, there is no profitable deviation from $i^*((c,t)=(0,1))=0$ only if

$$(c^*(q(l)=g),t^*(q(l)=g))=(c^*(q(l)=b),t^*(q(l)=b))$$

Write $v_a(q,(c,t),i)$ as the expected payoff of actor a, when the delegate is of type q, picks decisions (c,t), and the population responds with i. Again, let $v_l^*(q)$ be the equilibrium payoff of a delegate l of type q. By (2.13),

$$v_l^*(b)=\pi+v_l(b,I^U)>\max_{i\in BR(Q,(1,1))}v_l(b,(1,1),i)=\pi-K^c+v_r(b,I^U)$$

while

$$v_l^*(g)=\pi+v_l(b,I^U)<\min_{i\in BR(\{g\},(1,1))}v_l(g,(1,1),i)=\pi-K^c+v_r(g,I^U)$$

Therefore, there is no equilibrium, as described above, that survives the Intuitive Criterion. ■

Chapter 3

Divide-and-Rule and the Media

> 'As citizens have more precise knowledge about both the policies adopted by politicians and the environment in which they are implemented, policy makers have less room to divert resources to themselves.' (Adserá, Boix and Payne 2003, 448)

3.1 Introduction

How do popular divisions affect the stability of political regimes? And if rulers can directly attenuate or exacerbate popular divisions, which policy will they choose? These are very important questions in political economy. Political institutions, by definition, arbitrate conflict to produce collective decisions. There are many historical examples where rulers have benefited from salient popular divisions (over such issues as the appropriate response to a foreign threat, the fear of communism, abortion or the rights of minorities), and divide-and-rule is one of the strategies most commonly used to implement inefficient policies (see Eggertsson 2005, chapter 5).

Yet the logic of divide and rule is not well understood. Under what circumstances will it be used? Do rulers implement it to favor their support base or exploit it, playing on the fear of the alternative regime? This paper presents a simple and general model to tackle such questions. The set-up is as follows. The ruler decides a policy on a unidimensional space, sets taxes and invests in a heterogeneity-reducing (or heterogeneity-increasing) technology. Citizens have heterogeneous preferences on the unidimensional space. They decide whether to mount an insurrection, after which an alternative regime implements a given vector of policy and taxes. We show that, in equilibrium, as long as the ruler can survive with the support of a sufficiently small group, he chooses an extremist policy, since extremists citizens are most afraid of the alternative regime. Therefore, although the ruler appears to be favoring his support base in the choice of his policy, he does play on their fear of the alternative regime to maximize the rents that he can extract. By the same logic, the ruler invests in the heterogeneity-*increasing* technology, so as to worsen popular divisions, maximize the fear of his own support base and extract greater rents.

We apply this simple model to the case where the technology affecting the heterogeneity of preferences is a manipulation of the media. The interpretation is as follows. Citizens may initially disagree over the correct policy, but may come to an agreement with a sufficiently informative signal from the media. Therefore, with a less informative signal, individual differences are more salient, and the ruler's support base is willing to tolerate higher rents. The model thus offers an explanation for the negative correlation between corruption and freedom of the media, which has been widely documented in the literature (see Ahrend 2002, Adserá, Boix and Payne 2003, Brunetti and Weder 2003, Lederman, Loayza and Soares 2005).

We then consider a couple of extensions. First, we show that the results of the model are robust to the case where the ruler can impose different taxes on supporters and opponents. Although the ruler imposes lower taxes on his supporters and picks the policy preferred by his marginal supporter, he still invests in the heterogeneity-increasing so as to exploit his own support base, maximizing its fear of the alternative regime. Second, we ask whether this investment in heterogeneity-increasing technology is a complementary or a substitute strategy to repression. We show that it is a complementary strategy, when repression reduces the size of the minimal support base for the ruler, but that it is an independent strategy, when repression increases the cost of mounting an insurrection.

Let me say a few words about how the paper connects to the literature. First, it is related to the literature on politics in plural societies. For example, Dahl (1971), Rabushka and Shepsle (1972) and Horowitz (2000) warn of the dangers of cleavages in democratic stability, while Fearon and Laitin (1996) show that inter-ethnic conflicts are on the whole relatively rare (see also Cederman and Girardin 2007 and Fearon et al. 2007). In democratic settings, scholars have debated whether the optimal strategy for politicians is to favor their support base (Cox and McCubbins 1986) or attract the support of pivotal voters (Lindbeck and Weibull 1987, Dixit and Londregan 1996). In weakly institutionalized settings, different models of divide and rule have been proposed (Acemoglu, Robinson and Verdier 2004, Padro-i-Miquel 2006, see also Weingast 1997 and Perez 2004). For example, Padro-i-Miquel (2006) stresses the idea that a ruler exploits own support base with a divide-and-rule strategy. In his model, divisions among the population are exogenously-given along ethnic lines: a particular ethnic group tolerates high taxes and corruptions from their own kin, afraid of what would happen were the ruler to be replaced by a member of the other ethnic group. In our model, divisions in the population are determined endogenously by a decision of the ruler.

Focusing on this divide-and-rule strategy produces a very different result from Alesina and Spolaore (2003), who use a very similar set-up, but instead conclude that the ruler should be centrist and invest in the heterogeneity-reducing technology. This different conclusion comes from the fact that, in their model, the outside option is exogenous, while in our model it is endogenous. We argue that our assumption is sensible. For example, a good signal from the media fixes the state of knowledge, and thereby the consequence of any policy, whether implemented by the ruler or the alternative regime.

The paper is also related to a large literature on the importance of free media for democracy and accountability (see e.g. Lichtenberg 1987, Lichtenberg 1990, O'Neil 1998, Gunther and Mughan 2000, Kalathil and Boas 2003). For example, Lichtenberg (1987), following the work of Alexander Meiklejohn, identifies two main functions of the media as a pillar of democracy and responsible government. First, it serves an *informative* function in that it allows citizens to make informed decisions and it helps political leaders stay connected with their constituents' interests. Second, it serves a *critical* function in that it represents the people's watchdog against government abuse. Several recent studies fall into these categories. Following an informative rationale, Besley and Burgess (2002) find evidence in a case study in India that a more informed and politically active electorate strengthens incentives for the government to be responsive to the citizens. Also, Stromberg (2004a) finds that U. S. counties with many radio listeners received more relief funds during the New Deal era. Stromberg (2004b) argues that mass media forces the government to bias policy toward larger constituencies. For the critical rationale, Besley and Prat (2006) develop a model where media can detect the type of a government (corrupt or not). With more independent media outlets, the cost to capture the media market is higher. The current paper blends those two functions in the following way. First, the message of the media is about the state of the world, which allows for an informed decision. Second, precise information checks government abuses in that it reduces the disagreement in the population, and therefore the willingness of the ruler's support base to tolerate rents.

Other papers have focused on the role of information as helping citizens to coordinate an attack against a government (see Lohmann 1994, Angeletos, Hellwig and Pavan 2004 and Edmond 2005). We see the current paper as complementary to their work, as we abstract from coordination problems. Note, though, that our model offers an explanation for the negative correlation between freedom of the media and corruption, which is consistent with common knowledge about the corruption of a government (whereas coordination games typically exhibit multiple equilibria, when the type of the government is common knowledge).

Our paper instead focuses on the political divisions within the population, and how they affect the ruler's incentive to manipulate information. In that regard, it is related to Banerjee and Somanathan (2001), who instead study how the configuration of preferences of groups and their leader can elicit voice from an informed member. Let us now flesh out the set-up of the baseline model.

3.2 The Baseline Model

Consider an economy where there is a continuum of citizens of mass 1 and a ruler r. Citizens pay taxes and derive utility from a policy decision. The utility of agent i with bliss point l_i and policy (t^c, l^c) is

$$u_i(t^c, l^c) = y - t^c - a(l^c - l_i)^2 \tag{3.1}$$

where y is the income of the citizen ($y_i = y \ \forall i$). In other words, taxes enter linearly in the utility function, and the utility derived from the policy follows a standard quadratic loss function ($a > 0$).

A key feature of the set-up is that citizens differ in their ideal point l_i. We leave the nature of this heterogeneity to be fairly general. We allow for an aggregate shock z to the preferences and for uncertainty about the state of the world l^t. We simply impose that any shock z is order-preserving (ie $l_i = \alpha b_i + \beta$ for $\alpha > 0$, where b_i is an individual parameter, which follows a distribution F in the population and F is invertible).

The ruler initially in power suggests a tax and policy decision (t^r, l^r) and invests m in a technology M which affects the heterogeneity of preferences ($m \geq 0$). Let us focus on cases where M has a monotonic impact on the heterogeneity of preferences. We will say that:

Definition 2 *The technology M is heterogeneity-increasing if $\forall l_i \neq l^r \forall m$*

$$\frac{\partial a(l^r - l_i)^2}{\partial m} > 0$$

and heterogeneity-reducing if $\forall l_i \neq l^r \forall m$

$$\frac{\partial a(l^r - l_i)^2}{\partial m} < 0$$

In other words, the technology is heterogeneity-increasing(-reducing) if it increases(reduces) the 'effective distance' between the ideal point of citizens and the policy of the ruler. Given the parameters of the model, we allow a, α and β to depend on m. To make matters a little more concrete, we can think of the following examples as special cases of the general model:

Example 1 Alesina and Spolaore (2003)

In this set-up, citizens differ in their bias ($l_i = b_i$) and there is no uncertainty about the state of the world l_t ($z = l_t$). However, the ruler can affect the importance of individual differences through an investment in M (ie a is a (monotonic) function of m).[1]

Example 2 Normal Learning Model

Let l^t be the true state of the world, which directly informs the correct policy (say, l^t is a measure of the extent of a foreign threat). Citizens would like the policy to match their expectation of the state of the world ($l_i = E[l^t]$). They initially disagree about the state

[1] One interpretation could be that l_c is the location of a 'center of modernity' and M corresponds to the road infrastructure, where citizens incur a cost to accessing public goods.

of the world, where individual i believes that

$$l^t \sim_i N\left(b_i, \frac{1}{h_0}\right) \tag{3.2}$$

The signal z is an unbiased report on the state of the world, $z = l^t + \varepsilon$ and $\varepsilon \sim N(0, \frac{1}{h_\varepsilon(m)})$, where the precision of the signal can be manipulated by the ruler. Upon receiving the signal z, individual i believes that

$$l^t \sim_i N\left(\frac{h_0 b_i + h_\varepsilon(m)z}{h_0 + h_\varepsilon(m)}, \frac{1}{h_0 + h_\varepsilon(m)}\right) \tag{3.3}$$

In other words, citizens have their own prior, agree to disagree, but can be convinced to revise their position if they observe a public and unbiased signal about the true state of the world. The relative weight that they put on this public signal is a function of the precision of the signal ($h_\varepsilon(m)$), which the ruler can manipulate. Translating into the notation from the general set-up, we have $l_i = \alpha(m)b_i + \beta(m)$, where $\alpha(m) = \frac{h_0}{h_0 + h_\varepsilon(m)}$ and $\beta(m) = \frac{h_\varepsilon(m)z}{h_0 + h_\varepsilon(m)}$. We also assume, for simplicity, that $a'(m) = 0$.

The goal of the ruler is to maximize the collection of taxes and remain in power. Let his utility be

$$R = \omega t^r - C(m)$$

where $C(m)$ is the cost of investing m, with $C(m), C'(m), C''(m) \geq 0$ and ω is an indicator function equal to 1 if and only if the ruler stays in power.

The ruler stays in power if a fraction δ of the population supports him ($\delta \in [0,1]$). If he does not gather this support, he is replaced by what is called an 'insurrection'. Here, the language is particularly appropriate where for replacements done through extra-legal means, but it can also apply to cases where replacement is done within the confines of the law. This is the case if a ruler faces elections, but he is able to rig them more or less freely, depending on δ, and it is costly for citizens to uncover fraud and impose free and fair elections. Let us assume that, after a ruler is deposed, an alternative regime is set up and implements a policy (t^o, l^o). Let the decision to mount an insurrection be captured by the variable s_i (where $s_i = 1$ means that the citizen participates in the insurrection). We abstract from the problem of collective action and assume that citizens decide as a block on whether to mount an insurrection. In other words, $s_i = \overline{s}\ \forall i$ and $\overline{s} = 0 \Leftrightarrow \int_S dF \geq \delta$, where

$$S = \{i | u_i(t^c, l^c) - u_i(t^o, l^o) \geq -c\} \tag{3.4}$$

and c is the cost of mounting an insurrection. We assume that (t^o, l^o) is selected by some general mechanism, where $l^o = \alpha b_o + \beta$ for some b_o.[2]

Let us specify the timing of the game and equilibrium concept before we solve the model.

3.2.1 Timing of the Game

- The ruler picks a policy (t^r, l^r, m). m is implemented.
- Signal z is publicly observed.
- Citizen i chooses s_i.
- Payoffs are realized.

3.2.2 Equilibrium Concept

The model solves for a subgame-perfect equilibrium, which is a vector of strategies $\{t^r, l^r, m\}$ for the ruler and $\{s_i\}$ for each citizen i. In particular, we let the ruler propose a tax rate t^r and policy l^r which are functions of the signal z.

3.3 Solution of the Baseline Model

The following lemmas present the solution to the model:

Lemma 14 $\exists \overline{y} | \forall y > \overline{y}\ \forall m$*, the optimal tax and policy vector* (t^r, l^r) *is given by:*

$$t^r = t^o + a(l^r - l^o)^2 + c \tag{3.5}$$

[2] A previous version of the paper solves for (t^o, l^o) in the case of a regime of 'direct self-rule', where all citizens vote first on t^o and then on l^o.

$$l^r \begin{cases} = l^o & \textit{if } \delta \geq \max\{F(b_o), 1-F(b_o)\} \\ = l_{F^{-1}(1-\delta)} & \textit{if } F(b_o) \leq \delta < 1-F(b_o) \\ = l_{F^{-1}(\delta)} & \textit{if } 1-F(b_o) \leq \delta < F(b_o) \\ \in \arg\max_{j \in \{F^{-1}(\delta), F^{-1}(1-\delta)\}} (l_j - l^o)^2 & \textit{if } \delta < \min\{F(b_o), 1-F(b_o)\} \end{cases} \tag{3.6}$$

where $l_{F^{-1}(x)} = l_i$ for i such that $b_i = F^{-1}(x)$.

Proof. *See the appendix.* ■

This lemma says that the ruler always picks extreme citizens as his support base. Indeed, given the convexity of the loss function ($\frac{\partial^2 a(l^c - l_i)^2}{\partial (l^c - l_i)^2} > 0$), they have the most to lose from the implementation of the alternative regime, and they are willing to tolerate the highest rents. If the ruler must please too large a coalition, then he is forced to offer the same policy as that of the alternative regime, since any move away from it reduces the willingness to pay of the marginal supporter.

Also, the ruler can manipulate the distance between the ideal point of his supporters and the policy of the alternative regime. Solving for m, we can show the following lemma:

Lemma 15 $\exists \overline{y} | \forall y > \overline{y}$, *the ruler invests in M if and only if $\delta < \max\{F(b_o), 1-F(b_o)\}$ and M is heterogeneity-increasing.*

Proof. *See the appendix.* ■

Lemma 15 states that the ruler invests in M so as to maximally differentiate his policy from that of the alternative regime, which is possible only if institutions are sufficiently weak ($\delta < \max\{F(b_o), 1-F(b_o)\}$). Note that, by increasing the distance between his policy and the policy of the alternative regime, the ruler also increases the distance between his policy and the ideal point of all citizens (except his marginal supporter, ie j such that $l^r = l_j$). In other words, the ruler actually has an incentive to *reduce* the utility of the citizens in his regime, which allows him to extract *more* rents. The reason is that the ruler already offers the ideal point of his marginal supporter. To increase this supporter's willingness to pay, the ruler must depress his utility under the alternative regime. Note that, ironically, the ruler's support base rewards him with higher taxes for increasing the distance between his policy and that of the alternative regime. Yet if the ruler did not invest in M, his support base would not be so afraid of the alternative regime!

Now we can take comparative statics with respect to the ex ante heterogeneity of biases and other parameters of the model. To ensure the existence of an interior solution, let us impose $\frac{\partial^2 a(m)\alpha(m)^2}{\partial m^2} < 0 \; \forall m > 0$, so that the marginal impact of an investment in M is decreasing. Also let us define parameters p_a and p_c such that $\frac{\partial a(m)\alpha(m)^2}{\partial p_a} \geq 0$ and $\forall m > 0$, $\frac{\partial^2 a(m)\alpha(m)^2}{\partial m \partial p_a} > 0$, $\frac{\partial C'(m)}{\partial p_c} > 0$. In words, the total and marginal benefit of investing in M are monotonically increasing in p_a and the marginal cost of investing in the heterogeneity-increasing technology is monotonically increasing in p_c. Then we get

Corollary 1 $\forall \delta \geq \max\{F(b_o), 1 - F(b_o)\}$, $\frac{dt^r}{dx} = \frac{\partial m^*}{\partial x} = 0$ *for* $x \in \{\delta,\ (b_j - b_o)^2,\ p_a,\ p_c\}$ *and* $\forall \delta < \max\{F(b_o), 1 - F(b_o)\}$

$$\frac{dt^r}{d\delta} < 0 \quad \frac{\partial m^*}{\partial \delta} < 0$$

$$\frac{dt^r}{d(b_j - b_o)^2} > 0 \quad \frac{\partial m^*}{\partial (b_j - b_o)^2} > 0$$

$$\frac{dt^r}{dp_a} > 0 \quad \frac{\partial m^*}{\partial p_a} > 0$$

$$\frac{dt^r}{dp_c} < 0 \quad \frac{\partial m^*}{\partial p_c} < 0$$

Proof. *See the appendix.* ■

Corollary 1 says that, whenever the ruler uses the divide-and-rule strategy, he is hurt by a stronger institutional constraint, extracting lower levels of rent ($\frac{dt^r}{d\delta} < 0$) and investing less in the heterogeneity-increasing technology ($\frac{\partial m^*}{\partial \delta} < 0$). Also, the ruler benefits from greater heterogeneity of biases b_i. In this case, his marginal supporter is more afraid of the alternative regime. He is willing to tolerate higher taxes, for any level of m, and is also more affected by any investment in M. Likewise, any increase in the effectiveness of the heterogeneity-increasing technology (p_a) directly benefits the ruler and also increases the incentives to invest in M. Finally, any increase in the cost of investment (p_c) reduces the incentive to invest in M, which then reduces the taxes that the ruler can extract. Taken together, these comparative statics imply that we should observe a positive correlation between taxes and investment in heterogeneity-increasing technology, as we change one set of parameters of the model.

Taking stock, we can interpret the model in light of our two leading examples.

Example 1 (Continued) Alesina and Spolaore (2003)

Lemma 15 states that the ruler of a weakly institutionalized country chooses an extremist position and invests in heterogeneity-increasing technology. Note that the model offers a different conclusion from Alesina and Spolaore (2003), who nevertheless use a similar set-up. The difference comes from the fact that, in their model, the alternative regime brings a constant level of utility u_0 to all citizens. Therefore, the ruler should maximize the utility of citizens in his regime and invest in heterogeneity-reducing technology. We believe that our assumption is realistic, if M represents the manipulation of the media, which fixes the state of knowledge in any regime.[3]

Example 2 (Continued) Normal Learning Model

Lemma 15 and corollary 1 state that the ruler has an incentive to obstruct the media (if $\frac{\partial h_\varepsilon(m)}{\partial m} < 0$), and that we should observe a negative relationship between rents and freedom of the media. In particular, this negative relationship obtains as we vary h_0, since $\frac{\partial \alpha(m)}{\partial h_0} > 0$ and $\frac{\partial^2 \alpha(m)}{\partial m \partial h_0} > 0 \; \forall m \Leftrightarrow \lim_{m \to \infty} h_\varepsilon(m) > h_0$. In other words, populations with stronger priors (h_0) tolerate higher levels of taxes and invite the ruler to invest more in the heterogeneity-increasing technology. This negative relationship between corruption and freedom of the media has been widely documented in the literature (see Ahrend 2002; Adserá, Boix and Payne 2003; Brunetti and Weder 2003; Lederman, Loayza and Soares 2005). While other explanations have been put forward, ours is consistent with the level of corruption being common knowledge. It focuses on the possible divisions that exist in the population, which can be attenuated when there is precise and credible evidence about the correct policy to adopt.[4]

[3] As mentioned, Alesina and Spolaore (2003) also suggest to interpret the model as a physical distance between individuals and government services, which can be affected by an investment in roads. In that case, though, we can tentatively refer to some evidence that the rulers of weakly institutionalized countries, say in post-colonial Africa, invested little in roads, especially if the territory they governed had areas of high population density that were distant from one another (see Collier and Gunning 1999, 71 and Herbst 2000, 166). Moreover, there is also some evidence that public good provision tends to be concentrated in support areas (where rulers such as Mobutu and Houphouet-Boigny are notorious for such a strategy). Certainly, other explanations can be offered for this low investment in roads, for example if they disproportionately favor the insurgents (Robinson 2001).

[4] For an alternative approach, using global games methods, see Edmond (2005) and Angeletos, Hellwig and Pavan (2006). These papers focus on the coordination of citizens to attack a regime, where citizens get private and public signals about the type of a regime. This set-up, however, ignores any division within the population on policy grounds.

3.4 Extensions

We now present two extensions to the main model. First, we allow the ruler to impose different tax rates. We show that, although the ruler favors his support base with lower taxes, he still invests in the heterogeneity-increasing technology, so as to exploit their fear of the alternative regime. Second, we ask whether the investment in heterogeneity-increasing technology is a complementary strategy to repression. We show that it is, when repression reduces the size of the minimal support base (δ), but not when it increases the cost of mounting an insurrection (c).

3.4.1 Divide-and-Rule and Discrimination

Let the modified set-up be as follows: the ruler can set two different tax rates, one for supporters, t_s^r, and another for opponents, t_{ns}^r. In that case, we can show the following lemma:

Lemma 16 *$\exists \overline{y} | \forall y > \overline{y}\ \forall m$, the optimal tax and policy vector (t_{ns}^r, t_s^r, l^r) is $t_{ns}^r = y$, $t_s^r = t^r$ as given in (3.5) and l^r as given in (3.6). Moreover, the optimal level of investment m^* is as given in the baseline model.*

Proof. *See the appendix.* ■

This proposition states that the policy chosen and the level of taxes on the supporters are the same as in the baseline model. This comes from the fact that, for any policy l^r, there is a unique ordering of citizens in terms of their willingness to pay. Therefore, the ruler picks the same extreme citizens as his support base, and sets maximal taxes on his opponents. Because the equilibrium policy is the same, the benefit of investing in M is unchanged and we obtain the same comparative statics. Therefore, the model can be extended to the case where the ruler sets different tax rates on different groups of citizens. He appears to be favoring his support base, in that they face lower taxes. Yet the media is still used as a divide-and-rule mechanism, so as to instill fear among his support base and maximize its willingness to pay.[5]

[5] Note that Kasara (2007) suggests that a ruler might in fact impose *higher* taxes on the agricultural products of their own supporters, suggesting information asymmetries on the optimal way to tax different groups.

3.4.2 Divide-and-Rule and Repression

Let us now allow the ruler to repress the population. First, assume that the ruler can set δ at cost $C(\delta)$, with $C'(\delta) < 0$, $C''(\delta) > 0$. In other words, it is costly for the ruler to decrease δ, and the marginal cost of lifting the institutional constraint (reducing δ) is increasing. Let us also assume that the distribution of biases F is such that $\frac{\partial^2 (b_j - b_o)^2}{\partial \delta^2} \leq 0$ (so as to satisfy the second-order condition). Also, let us index the set of cost functions $C(\delta)$ by a parameter p_δ, such that $\frac{\partial C'(\delta)}{\partial p_\delta} < 0$, i.e. the marginal cost of repression is monotonically increasing in p_δ. Then we have

Lemma 17 $\forall \delta < \max\{F(b_o), 1 - F(b_o)\}$

$$\frac{\partial^2 R}{\partial m^* \partial \delta^*} < 0 \tag{3.7}$$

$$\tfrac{dt^r}{dp_\delta} < 0 \quad \tfrac{\partial m^*}{\partial p_\delta} < 0 \quad \tfrac{\partial \delta^*}{\partial p_\delta} > 0 \tag{3.8}$$

Proof. *See the appendix.* ■

The inequality (3.7) states that investment in heterogeneity-increasing technology and repression are complementary strategies, when repression decreases the size of the minimal support base for the ruler. Since, with greater repression, the ruler's support base is more extreme, and therefore more afraid of the alternative regime, then the ruler gains more in investing in heterogeneity-increasing technology. The inequalities in (3.8) state that we should expect a positive correlation between rents and investment in heterogeneity-increasing technology, and a negative correlation between rents and the strength of institutional constraint (if the latter is endogenous), when countries differ by the cost of repression.

Now let us allow the ruler to repress by increasing the cost of insurrection c at cost $C(c)$, with $C'(c) > 0$, $C''(c) > 0$. In other words, it is costly for the ruler to increase c, and the marginal cost of increasing the cost of insurrection is increasing. Also, let us index the set of cost functions $C(c)$ by a parameter p_c, such that $\frac{\partial C'(c)}{\partial p_c} > 0$, i.e. the marginal cost of repression is monotonically increasing in p_c. Then we have

Lemma 18 $\forall\delta < \max\{F(b_o), 1 - F(b_o)\}$

$$\frac{\partial^2 R}{\partial m^* \partial c^*} = 0 \tag{3.9}$$

$$\tfrac{dt^r}{dp_c} < 0 \quad \tfrac{\partial m^*}{\partial p_c} = 0 \quad \tfrac{\partial c^*}{\partial p_c} < 0 \tag{3.10}$$

Proof. *See the appendix.* ■

This lemma states that investment in heterogeneity-increasing technology and repression are independent strategies, when repression increases the cost of insurrection. The reason is that the cost of repression is a fixed value, independent of the divisions among the population. Therefore, we should not expect any relationship between rents and investment in heterogeneity-increasing technology, but a positive relationship between rents and the cost of insurrection (if the latter is endogenous), when countries differ by the cost of repression.

3.5 Conclusion

This paper presents a simple and general model where a ruler manipulates popular divisions so as to extract the maximum level of rents and remain in power. The major results are the following. First, the ruler relies on an extreme support base, which has most to lose if the ruler is replaced. Second, the ruler invests in heterogeneity-increasing technology so as to exploit his own support base. We show that the model accounts for the negative correlation between freedom of the media and corruption, as documented by many studies, an explanation which is consistent with widespread awareness (in fact, common knowledge) of corruption in the population.

There are natural extensions to this paper. For one, citizens might tolerate high levels of corruption because of a coordination failure, a problem which was assumed away here. It would be interesting to study this question, and combine the approach with the mechanism outlined in global games methods (e.g. Edmond 2005). Another extension would be to develop a richer model of the media. Here, it is represented as a single entity providing an unbiased signal about the state of the world. This could come about as the result of a 'competition of ideas', where an open consideration of many viewpoints leads to an unbiased, and more or less precise, assessment of the truth. It would be interesting, though, to spell out this mechanism, and combine our approach with models of media bias in competitive markets (e.g. Mullainathan and Shleifer 2005, Gentzkow and Shapiro 2006). Finally, it would be interesting to write a complete model of propaganda using this set-up, a process which generally exalts the success of the ruler while sending terrifying signals about the alternative regime (Zeman 1964).

3.6 Appendix

Proof. (Proof of lemma 14). Note that $i \in S$ if and only if

$$\begin{aligned} & y - t^r - a(l^r - l_i)^2 \geq y - t^o - a(l^o - l_i)^2 - c \\ & \Leftrightarrow t^r \leq t_i^{\max} \equiv t^o + a(l^o - l_i)^2 - a(l^r - l_i)^2 + c \end{aligned} \tag{3.11}$$

Let us fix $\overline{y}$ such that $\forall i, l^r, l^o$, $t_i^{\max} < \overline{y}$ so that we solve for an interior solution. Then note that

$$\frac{\partial t_i^{\max}}{\partial l_i} > 0 \Leftrightarrow \frac{\partial a(l^o - l_i)^2}{\partial l_i} > \frac{\partial a(l^r - l_i)^2}{\partial l_i} \Leftrightarrow l^o < l^r \tag{3.12}$$

by the strict convexity of $a(l^c - l_i)^2$ in $(l^c - l_i)$. Therefore, we can nicely order citizens in terms of their willingness to pay for l^r and avoid l^o.

The program for the ruler becomes $max_{\ t^r, l^r, m} t^r$ s.t.

$$t^r \leq \max_{j \in F^{-1}(\delta), F^{-1}(1-\delta)} t_j^{\max} \tag{3.13}$$

where $t_{F^{-1}(x)}^{\max}$ is short-hand for $t_j^{\max}$, where j is such that $b_j = F^{-1}(x)$. By the strict convexity of $a(l^r - l_i)^2$ in l^r and the fact that it attains a minimum at $l^r = l_i$, we have

$$\frac{\partial t_i^{\max}}{\partial l^r} \lesseqqgtr 0 \Leftrightarrow l^r \gtreqqless l_i \tag{3.14}$$

Therefore, the solution is given by (3.5), (3.6) $\forall m$. ■

Proof. (Proof of lemma 15). The program of the ruler is $\max_m R = t^r - C(m)$ subject to (3.5) and (3.6). It is clear that the ruler invests in M if and only if $\delta < \max\{F(b_o), 1 - F(b_o)\}$.

The ruler strictly invests if M is heterogeneity-increasing since

$$\frac{\partial R}{\partial m}|_{m=0} = \frac{\partial a(l^r - l_i)^2}{\partial m} > 0$$

while he does not invest if M is heterogeneity-reducing since $\forall m$

$$\frac{\partial R}{\partial m} = \frac{\partial a(l^r - l_i)^2}{\partial m} - C'(m) < 0$$

■

Proof. (Proof of corollary 1). Assume that $\delta \geq \max\{F(b_o), 1-F(b_o)\}$, then $\frac{dt^r}{d\delta} = \frac{\partial m^*}{\partial \delta} = 0$. If $\delta < \max\{F(b_o), 1 - F(b_o)\}$, then m^* is given by

$$\frac{\partial R}{\partial m^*} = \frac{\partial a(m^*)\alpha(m^*)^2}{\partial m^*}[b_j - b_o]^2 - C'(m^*) = 0 \tag{3.15}$$

with $\frac{\partial a(m^*)\alpha(m^*)^2}{\partial m^*} > 0$. Also, by the implicit function theorem,

$$\frac{\partial m^*}{\partial \delta} = -\frac{\frac{\partial^2 R}{\partial \delta \partial m^*}}{\frac{\partial^2 R}{\partial m^{*2}}} = -\frac{\frac{\partial a(m^*)\alpha(m^*)^2}{\partial m^*}\frac{\partial [b_j - b_o]^2}{\partial \delta}}{\frac{\partial^2 R}{\partial m^{*2}}} < 0$$

since $\frac{\partial [b_j - b_o]^2}{\partial \delta} < 0$ (by virtue of F being invertible) and $\frac{\partial^2 R}{\partial m^{*2}} < 0$ (by the second-order condition). Also,

$$\frac{dt^r}{d\delta} = \frac{\partial t^r}{\partial m^*}\frac{\partial m^*}{\partial \delta} + \frac{\partial t^r}{\partial \delta} < 0$$

since $\frac{\partial t^r}{\partial m^*} = C'(m^*) > 0$, $\frac{\partial m^*}{\partial \delta} < 0$, $\frac{\partial t^r}{\partial \delta} = a(m^*)\alpha(m^*)^2\frac{\partial [b_j - b_o]^2}{\partial \delta} < 0$. The comparative statics on $(b_j - b_o)^2$, p_a, p_c follow from the same arguments. ■

Proof. (Proof of lemma 16). The program for the ruler is the program reads as follows:

$$\max_{\{t^r_s, t^r_{ns}, l^r, m\}} t^r_s \int_S dF + t^r_{ns}[1 - \int_S dF] - C(m) \tag{3.16}$$

s.t. $\int_S dF \geq \delta$. It is clear that $t^r_{ns} = y$ is optimal. Now consider the group of supporters. Note that $i \in S$ if and only if $t^r_s \leq t^{\max}_i$, where $t^{\max}_i$ is as defined in (3.11). (3.12) still holds, so that $t^r_s = t^r$ is as given in (3.5) and l^r is as given in (3.6). ■

Proof. (Proof of lemma 17). The optimal m and δ are given by

$$\begin{aligned}\max_{m,\delta} R &= t^r - C(m) - C(\delta) \\ &= t^o + c + a(m)\alpha(m)^2[b_j - b_o]^2 - C(m) - C(\delta)\end{aligned}$$

$\forall\delta < \max\{F(b_o), 1 - F(b_o)\}$, $b_j \neq b_o$, and the solution is given by the first-order conditions:

$$\frac{\partial R}{\partial m^*} = \frac{\partial a(m^*)\alpha(m^*)^2}{\partial m^*}[b_j - b_o]^2 - C'(m^*) = 0$$
$$\frac{\partial R}{\partial \delta^*} = a(m^*)\alpha(m^*)^2\frac{\partial[b_j - b_o]^2}{\partial \delta^*} - C'(\delta^*) = 0$$

It is clear that

$$\frac{\partial^2 R}{\partial m^* \partial \delta^*} = \frac{\partial a(m^*)\alpha(m^*)^2}{\partial m^*}\frac{\partial[b_j - b_o]^2}{\partial \delta^*} < 0$$

Now use the implicit function theorem:

$$\frac{\partial m^*}{\partial p_\delta} = -\frac{\begin{vmatrix} \frac{\partial^2 R}{\partial m^* \partial p_\delta} & \frac{\partial^2 R}{\partial m^* \partial \delta^*} \\ \frac{\partial^2 R}{\partial \delta^* \partial p_\delta} & \frac{\partial^2 R}{\partial \delta^{*2}} \end{vmatrix}}{\begin{vmatrix} \frac{\partial^2 R}{\partial m^{*2}} & \frac{\partial^2 R}{\partial m^* \partial \delta^*} \\ \frac{\partial^2 R}{\partial m^* \partial \delta^*} & \frac{\partial^2 R}{\partial \delta^{*2}} \end{vmatrix}} < 0$$

since $\frac{\partial^2 R}{\partial m^* \partial p_\delta} = 0$, $\frac{\partial^2 R}{\partial \delta^* \partial p_\delta} = -\frac{\partial C'(\delta^*)}{\partial p_\delta} > 0$ and, by the definition of a maximum, $\frac{\partial^2 R}{\partial m^{*2}} < 0$, $\frac{\partial^2 R}{\partial \delta^{*2}} < 0$ and $\begin{vmatrix} \frac{\partial^2 R}{\partial m^{*2}} & \frac{\partial^2 R}{\partial m^* \partial \delta^*} \\ \frac{\partial^2 R}{\partial m^* \partial \delta^*} & \frac{\partial^2 R}{\partial \delta^{*2}} \end{vmatrix} > 0$. Also,

$$\frac{\partial \delta^*}{\partial p_\delta} = -\frac{\begin{vmatrix} \frac{\partial^2 R}{\partial m^{*2}} & \frac{\partial^2 R}{\partial m^* \partial p_\delta} \\ \frac{\partial^2 R}{\partial m^* \partial \delta^*} & \frac{\partial^2 R}{\partial \delta^* \partial p_\delta} \end{vmatrix}}{\begin{vmatrix} \frac{\partial^2 R}{\partial m^{*2}} & \frac{\partial^2 R}{\partial m^* \partial \delta^*} \\ \frac{\partial^2 R}{\partial m^* \partial \delta^*} & \frac{\partial^2 R}{\partial \delta^{*2}} \end{vmatrix}} > 0$$

$$\begin{aligned}\frac{dt^r}{dp_\delta} &= \frac{\partial t^r}{\partial m^*}\frac{\partial m^*}{\partial p_\delta} + \frac{\partial t^r}{\partial \delta^*}\frac{\partial \delta^*}{\partial p_\delta} + \frac{\partial t^r}{\partial p_\delta} \\ &= C'(m^*)\frac{\partial m^*}{\partial p_\delta} + a(m^*)\alpha(m^*)^2\frac{\partial [b_j - b_o]^2}{\partial \delta^*}\frac{\partial \delta^*}{\partial p_\delta} < 0\end{aligned}$$

■

Proof. (Proof of lemma 18). The optimal m and c are given by

$$\begin{aligned}\max_{m,c} R &= t^r - C(m) - C(c) \\ &= t^o + c + a(m)\alpha(m)^2[b_j - b_o]^2 - C(m) - C(c)\end{aligned}$$

$\forall \delta < \max\{F(b_o), 1 - F(b_o)\}$, $b_i \neq b_o$, and the solution is given by the first-order conditions:

$$\frac{\partial R}{\partial m^*} = \frac{\partial a(m^*)\alpha(m^*)^2}{\partial m^*}[b_j - b_o]^2 - C'(m^*) = 0$$
$$\frac{\partial R}{\partial c^*} = 1 - C'(c^*) = 0$$

It is clear that $\frac{\partial^2 R}{\partial m^* \partial c^*} = \frac{\partial^2 R}{\partial m^* \partial p_c} = 0$, so that $\frac{\partial m^*}{\partial p_c} = 0$, $\frac{\partial c^*}{\partial p_c} = -\frac{\frac{\partial^2 R}{\partial c^* \partial p_c}}{\frac{\partial^2 R}{\partial c^{*2}}} = -\frac{-\frac{\partial C'(c^*)}{\partial p_c}}{-C''(c^*)} < 0$ and

$$\frac{dt^r}{dp_c} = \frac{\partial t^r}{\partial m^*}\frac{\partial m^*}{\partial p_c} + \frac{\partial t^r}{\partial c^*}\frac{\partial c^*}{\partial p_c} + \frac{\partial t^r}{\partial p_c} = \frac{\partial c^*}{\partial p_c} < 0$$

■

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