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To my family

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ABSTRACT

This dissertation consists of 3 chapters that study topics in the politics of bureaucracy, institutions and political survival.

Chapter 1 studies why governments sometimes do not develop meritocratic bureaucracy facing electoral competition. Meritocracy improves the efficiency of public goods provision, which aids governments in elections. However meritocracy hinders the government's ability to conduct targeted redistribution and patronage. Hence the development of meritocracy is affected by the salience of public goods provision versus redistribution. Moreover, the bureaucracy is a long-lasting institution, where earlier decisions constraints future governments' ability to make adjustments. Hence incumbents can strategically "sabotage" the efficiency of the bureaucracy by excluding talented bureaucrats from their own groups. When redistribution is moderately salient, challengers cannot commit to hire these talented bureaucrats in the future due to redistribution concerns. But the incumbent can commit to such hiring. This gives the incumbent an electoral advantage at the expense of not developing meritocracy and lower bureaucratic efficiency.

Chapter 2 studies how governments and politicians can ensure their survival by choosing policies and institutions that endogenously affect their challengers' payoffs from rebellions. Rebellions often require the coordination of multiple challengers. But a conflict of interest often exists among challengers regarding their post-rebellion payoff. The governments can use policies and institutions to affect such payoffs to hinder coordination among challengers and ensure survival. Specifically, the government should target the weaker challengers. Over time the government should begin an institution path with an institution that puts the weaker challengers at a disadvantage, and then transit to an institution that makes them more powerful. The transition time point cannot be too early so that the weaker challengers are easily satiated, or too late such that the transition is not enough to compensate them. The government's ability to commit to such an institution path is key for its survival.

Chapter 3 studies why governments sometimes do not regulate long-term corruption despite its negative effect on social welfare. Long-term corruption allows bureaucrats to capitalize on current favorable environment for corruption to guarantee future benefits, even though the future environment becomes less desirable for corruption. The increased corruption reduces social welfare. Hence ex ante it is optimal to institute policies that prevent them from existing. However corruption also creates distributional effects by altering who has access to publicly provided goods and services. If corruption directs such goods and services to those with higher valuations, long term corruption may increase social welfare by increasing the efficiency of distribution of such goods and services. When positive distributional effects are realized, politicians may find it interim optimal to allow long term corruption relationships to exist. This creates a time inconsistency problem.

CHAPTER 1

DEVELOPMENT OF MERITOCRATIC BUREAUCRACY

1.1 Introduction

An efficient bureaucracy recruited on the principle of meritocracy is a key input to achieving effective governance and development (Weber [2019], Evans and Rauch [1999], Rauch and Evans [2000]). A meritocracy bureaucracy can include talents from across the society, which increases the capacity of the bureaucracy in harnessing resources and implementing policies. However, in spite of its apparent importance, meritocratic bureaucracy is certainly not universal. Across many underdeveloped countries, the composition of bureaucracy is still highly influenced by ethnicity, traditional lineage, and patronage, all of which precludes large share of talented individuals from across the society to contribute to the bureaucracy. Understanding why meritocratic bureaucracy is not widely used is important to understand underdevelopment.

In this paper, I study the interplay between political competition and the decision to develop a meritocratic bureaucracy. Normatively, the bureaucracy is often idealized as being insulated from political influences, and serves as only a neutral tool for any government to achieve its goals. However, in many cases the composition of the bureaucracy plays an important role in shaping the politics of countries, affecting the salience of issues and the landscape of political competition. On one hand, in the face of political competition, government can compete to increase the efficiency of the bureaucracy to appeal to citizens. This provide incentives for the government to develop a meritocratic bureaucracy, where the incentive for survival outweighs the calculation of redistribution versus public interest. On the other hand, the bureaucracy can be used by the government as channels of targeted redistribution and patronage, which hinders meritocracy. Hence the relative importance of public goods provision versus redistribution is a major factor that affects the development of meritocracy.

This mechanism is further complicated by the fact that the bureaucracy is a long lasting institution. Decisions regarding the composition of the bureaucracy made by one government constrain the ability of later governments to make adjustments. These constraints, paired with high incentives for survival, can sometimes lead to perverse outcomes. With strong electoral incentives, governments can find it optimal to not establish a fully efficient bureaucracy, because such a bureaucracy can be credibly inherited by challengers, eliminating the government's incumbency advantage. Hence governments have strategic incentives to establish a bureaucracy that is inefficient, and that they themselves have a distinctive advantages in fixing, compared to the challengers. To do so, the government strategically excludes talented individuals from its own group, and includes talented individuals from other groups to begin with. If the issue of redistribution is salient, this creates a dilemma for the challenger from the other group, since the challenger can only fix the bureaucracy by hiring talented individuals from the government's group, whom she dislikes due to redistribution concerns. The government's ability to credibly fix the bureaucracy by hiring talented individuals from her own group later creates an electoral advantage, at the expense of the efficiency of the bureaucracy. Notice though that such strategy (including the talented individuals from the opponent's group rather than the government's group) reduces the payoff to the government from redistribution and patronage. Hence when redistribution concerns are extremely high, the government no longer hires the talented individuals from the opposition's group, which introduces further inefficiency.

This paper is closely related to, and motivated by the literature on state capacity, most notably by Besley and Persson [2011]. They show that governments invest in state capacity only if they expect to reap the benefit from it in the future. Hence, governments make such investments if they expect to stay in power with certainty, or if the society is cohesive, so governments formed by different groups share and pursue the same public interest. In other words, state capacity develops if the government is stable, or if a common public goods provision is salient for the society. This result is intellectually related to earlier discussions on the "stationary bandit" by Olson [1993]. Both works link state capacity to common interests and stability. However they treat state capacity as exogenous from government survival, which reflects the idea that bureaucracies are insulated from and does not affect political competition. This paper follows their basic argument, but enriches the discussion by endogenously examining the role of meritocratic bureaucracy in political competition.

This paper also relates to the literature on the the politics of inefficient policies (Acemoglu et al. [2011]). Focusing more on inefficient policies and political survival, this paper follows the idea of Egorov and Sonin [2011], which explains that dictators, especially those vulnerable and weak, face the "loyalty and competence" tradeoff when choosing its subordinates. Hence they forgo competent agents and hire mediocre but loyal subordinates. This paper shares a similar environment where concerns over the influence on redistributive policies reduces the politicians' incentives to hire talents not from their own groups. Separately this paper also displays a manifestation of the mechanism known as "white elephants". As an example, Robinson and Torvik [2005] discuss a situation where the incumbent deliberately implements an inefficient public project in the face of an election, because this inefficient project is a credible mechanism for the incumbent to target redistribution to specific voters. The inefficiency of the public project means that the challenger cannot credibly implement this project when elected, giving the incumbent an electoral advantage. Efficient projects, however, can be credibly implemented by all candidates, and hence do not bring any electoral advantage. This logic is similar to the one underlying the government's decision to strategically establish a less meritocratic bureaucracy. In both cases, it is precisely the inefficiency of the government's actions that creates a future act (continuation of the public project, restoring the bureaucracy etc) that only the government itself can commit to undertaking. Citizens valuing this future act thus have to secure the survival of the current government, fully understanding that it is the cause of the current inefficiency.

On a broader level, this paper falls into a larger literature on elections and civil service reform (Ting et al. [2013], Ujhelyi [2014]). This literature presents two major conflicting accounts on the relationship between elections and civil service reform. The "insurance" view states that incumbent governments "insulate" the bureaucracy when they anticipate an electoral defeat, so that the upcoming government cannot utilize the bureaucracy to implement policies that the current government finds undesirable (de Figueiredo, Jr [2002]). On the other hand, the "investment" view states that the incumbent implement civil service reforms only when it expects to be able to reap the benefit in the future (Besley and Persson [2011]). Recent studies have taken a deeper look at both mechanisms, emphasizing that whether civil service reforms function as insurance or investment depends on various factors, including the characteristics of the opposition (Huber and Ting [2021]) and the probability of an electoral defeat (Schuster [2020]). The mechanism described in this paper resembles the insurance view but with a twist: the incumbent government insulates the bureaucracy not anticipating a defeat, but instead to create an electoral advantage. To do so, the incumbent government insulates the bureaucracy in an inefficient state such that the challenger finds it hard to improve upon. In other words, the incumbent insulates the bureaucracy so that the challenger cannot implement policies that the voters (and even the incumbent government) desires. Yet the incumbent government is free from such insulation, and its unique ability to implement beneficial policies brings it an electoral advantage. This is similar to the results of (Schuster [2016]), where a merit-based system is incentive-compatible for the incumbent when patronage power is fragmented and government control split. This allows the incumbent to use a merit-based system to deprive the challenger patronage benefits while gaining electoral supports via the provision of public goods.

This paper is organized as follows: Section 1.2 sets up the main model. Section 1.3 presents the main analysis and results. Section 1.4 discusses the implication of the results.

Section 1.5 concludes.

1.2 Model

I build an infinitely repeated game. There are a continuum of individuals of mass 1, who live for infinitely many periods. They are equally divided into two groups, A and B. There are also two families of candidates, a_t representing group A and b_t representing group B. a_t and b_t only live in period t. In period $t+1$, a_t and b_t dies, and a_{t+1} and b_{t+1} take their places. In period 1, a_1 is in power, where she implement policies (discussed later). At the end of period 1, the continuum of individuals hold an election between (the to be born) candidates a_2 and b_2, which decides who assumes power in period 2. If at the end of period 1 the voters choose a_2 to assume power in period 2, a_1 receives a benefit of P at the end of period 1. Then both a_1 and b_1 dies. In period 2, a_2 assumes office and implement policies. If at the end of period 1 the voters choose b_2 to assume power in period 2, then both a_1 and b_1 simply die (b_1 does not receive P since she is not in power in period 1). In period 2, b_2 assumes office and implement policies. All subsequent candidates follow the same life span.

Policies and payoffs. In each period, the candidate in power, hereafter named the "ruler", needs to recruit a bureaucracy consisting of two individuals. Among all individuals, each group contains one talented individual capable of doing bureaucratic work, and many non-talented people. A non-talented individual is not productive, but the ruler can hire one at no cost. A talented bureaucrat produces 1 unit of public goods for the society for one period, which yields a payoff α for all individuals and candidates who are alive in this period (the public goods is consumed in this period and does not carry to the next). But the ruler has to pay a search cost $p < \alpha$ per talented individual in the following manner: If in period $t-1$, a talented individual was not in the bureaucracy, then the ruler in period t pays p if she hires this talented individual. If the talented individual was in the bureaucracy in period $t-1$, the ruler in period t can keep the talented bureaucrat at no cost. But if she fires the talented bureaucrat, she does not get p back. One might ask that, since the talented individual lives for infinitely many periods just like all other individuals, does the ruler in period t need to pay a search cost if a talented individual was hired before period t but also fired before period t. The answer is still yes. Recall that rulers are simply winning candidates who only live for 1 period. Hence if a talented bureaucrat was hired and fired before a ruler's period, the ruler does not live long enough to remember who the talented individual is, and has to search for the talented individual with a cost. However, if a talented individual was hired before a ruler's period but was not fired afterwards, the ruler recognizes this talented individual in the bureaucracy, and can keep her without any additional cost.

In every period the public good incurs a fixed cost c and marginal cost 0 (i.e. the fixed cost c exists whether 0, 1 or 2 units of public goods is produced). The cost is divided among the population in the following way: If group j has x members in the bureaucracy, then group $i \neq j$ bears $\frac{x}{2}$ of the fixed cost, giving a per capita cost of xc. More specifically, if the bureaucracy contains two people from group j, then members of group j do not bear any cost. Members of group i each bear a cost of $2c$. If the bureaucracy contains one person from each group, then all members of the society bears a cost of c.

In each period, all individuals and candidates receives the payoff from the public goods and bears the corresponding cost, both determined by the composition of the current bureaucracy. In addition, the ruler pays the search cost of talented individuals, and receives P if the election at the end of the period selects the candidate from her own group. Since candidates only live for 1 period, they do not derive payoffs from future periods. In other words, when the rulers make decisions, they maximize their payoff in the current period, up to and including the election. All other individuals live for infinitely many periods, and derives payoff every period. However, when they make decisions during the election, they behave myopically. This means that at the election at the end of period t, individuals vote for the candidate who brings a higher expected payoff in period $t + 1$. I discuss the election in more details below.

Election. At the end of each period t, the continuum of individuals hold an election between (the to be born) candidates a_{t+1} and b_{t+1}, which decides who assumes power in period $t+1$. Denote $U_j(A)$ as individual j's utility in period $t+1$ if the ruler is a_{t+1}, and $U_j(B)$ similarly. Individual j votes for a_{t+1} if:

$$U_j(A) - U_j(B) - \phi_i - \theta \geq 0$$

where $\phi_i \sim U[-\frac{1}{2s}, \frac{1}{2s}]$ is an individual-specific shock, and $\theta \sim U[-\frac{1}{2h}, \frac{1}{2h}]$ is a common shock for the entire population. Individuals only expect ex-post ruler optimal policies, hence candidates cannot make any credible commitments.

Strategies, states and equilibrium concepts. In each period t, the actions for the ruler a_t or b_t is simply the recruitment of the bureaucracy. She has a total of 8 possible actions

- Both talented bureaucrats are present: $AT + BT$.
- Only one talented bureaucrat is present: $AT + AN$, $AT + BN$, $BT + AN$, $BT + BN$.
- No talented bureaucrat is present: $AN + AN$, $AN + BN$, $BN + BN$.

where AT refers to the talented individual from group A, AN refers to a non-talented individual from group A, and similarly BT and BN. These actions are temporarily denoted as actions 1 through 8.

The equilibrium concept is stationary Markov perfect equilibrium, where the equilibrium strategies depend on the history, via the only payoff-relevant state. For a ruler in period t, the state for the period is the composition of the bureaucracy in period $t-1$. This gives 8 states, the same as the 8 actions, temporarily denoted as states 1 through 8. Note that while the rulers in period t and period $t+1$ are technically different players, they would behave the same as long as they are from the same group and face the same state. Hence from this point onward, I will use ruler a and ruler b to denote any ruler from group A and B that is in power in any period.

Hence in a stationary Markov perfect equilibrium, a pure strategy of ruler i is an 8-tuple $s_i = \{a_{i1}, a_{i2}, ..., a_{i8}\}$, where a_{ij} denotes ruler i's action after state j. A mixed strategy of ruler i is an 8-tuple $\sigma_i = \{\pi_{i1}, \pi_{i2}, ..., \pi_{i8}\}$, where each $\pi_{ij} = \{p_{ij1}, p_{ij2}, ..., p_{ij8}\}$ is a probability distribution over actions after state j, with p_{ijk} denotes the probability that ruler i chooses action k after state j. A stationary Markov perfect equilibrium is then a pair (σ_A, σ_B) that are mutual best responses to each other. I restrict attention to symmetric equilibria, where $\pi_{A1} = \pi_{B1}$, $\pi_{A7} = \pi_{B7}$, $\pi_{i2} = \pi_{-i5}$, $\pi_{i3} = \pi_{-i4}$, and $\pi_{i6} = \pi_{-i8}$.

1.3 Analysis

Simplifying strategy and state space. The basic layout of the game means that a stationary Markov perfect equilibrium involves 64 parameters, due to the large number of strategies and states. A few observations help simplify the strategy and state space.

First, notice that if two states has the same amount and identity of talented individuals, and only differ by the identity of non-talented individuals, then in equilibrium any ruler receives the same payoff after these two states. For example, consider ruler i and the states $AT + AN$ and $AT + BN$, and assume in equilibrium her payoff after $AT + AN$ is strictly higher than that after $AT + BN$. Then after $AT + BN$, she can first replace BN with AN at no cost. Then she simply behaves as if she is after state $AT + AN$. This would increase her payoff after state $AT + BN$, which contradicts with the conjectured equilibrium payoff. Hence her equilibrium payoff after the two states must be the same. And this holds for all states that only differ by the identity of the non-talented individuals. In short, the identity of the non-talented individuals in the previous bureaucracy is not payoff-relevant. Hence, we can divide the 8 states into 4 groups:

- Both talented bureaucrats are present: $AT + BT$.
- Only the talented bureaucrat from group A is present: $AT + AN$, $AT + BN$.

- Only the talented bureaucrat from group B is present: $BT + AN$, $BT + BN$.

- No talented bureaucrat is present: $AN + AN$, $AN + BN$, $BN + BN$.

To further simplify the solution, I restrict attention to equilibria where if two states falls in the same group listed above, then ruler i has the same equilibrium strategy after these two states. Hence, the 8 states are simplified into 4 states:

- Both talented bureaucrats are present.

- Only the talented bureaucrat from group A is present.

- Only the talented bureaucrat from group B is present.

- No talented bureaucrat is present.

For different rulers, the second and third states have different implications. Hence the state space can be further streamlined by incorporating the identity of the current ruler:

- Both talented bureaucrats are present (TT).

- Only one talented bureaucrat is present, and she is in the same group as the current ruler (ST).

- Only one talented bureaucrat is present, and she is in the opposite group as the current ruler (OT).

- No talented bureaucrat is present (NT).

With this definition of states, a symmetric equilibrium simply means that both rulers A and B choose the same strategy after each of the four states. This means that the equilibrium strategy is no longer tied to the identity of the ruler, and is simplified to be the equilibrium strategy of any ruler.

The simplification of state spaces means that once a ruler i fixes the number and identity of talented individuals in period t, simply varying the identity of the non-talented individuals does not vary the equilibrium strategy of her successor and the challenger. This means that simply varying the identity of the non-talented individuals does not affect the election result at the end of the period. Hence, varying the identity of the non-talented individuals only affect ruler i's payoff via the share of cost of public goods c that she has to bear. Clearly choosing iN instead of jN maximizes her payoff. Hence her choice of actions are narrowed down to four:

- $AT + BT$ (Efficient).
- $iT + iN$ (Partisan).
- $jT + iN$ (Reverse).
- $iN + iN$ (Inefficient).

A mixed strategy for ruler i is characterized by $4 \times 4 = 16$ probabilities denoted in table 1.1.

	Action			
State	Efficient	Partisan	Reverse	Inefficient
TT	e_1	p_1	q_1	r_1
ST	e_2	p_2	q_2	r_2
OT	e_3	p_3	q_3	r_3
NT	e_4	p_4	q_4	r_4

Table 1.1: Mixed strategy for ruler i.

Payoffs of actions and states. To characterize an equilibrium, I first conjecture a symmetric strategy profile characterized by e_1 through r_4. Then I calculate ruler i's payoff if she chooses an action after a state under the conjecture. These payoffs leads to ruler i's best responses to the conjecture. If the best responses are consistent with the conjecture, we have an equilibrium.

To start, consider ruler i's payoff if she chooses any of the four actions in the state NT. First, we have

$$U_i(NT, \text{Efficient}) = 2\alpha - 2p - c + \tfrac{P}{2},$$
$$U_i(NT, \text{Inefficient}) = \tfrac{P}{2}.$$

If ruler i chooses Efficient, the state in the next period becomes TT. Both her successor and the challenger choose the same strategy, characterized by e_1 through p_1. Hence the election breaks even. The same is true if ruler i chooses Inefficient. Then we have

$$U_i(NT, \text{Partisan}) = \alpha - p + \tfrac{P}{2} + K\alpha hP,$$
$$U_i(NT, \text{Reverse}) = \alpha - p - c + \tfrac{P}{2} - K\alpha hP.$$

where $K = (e_2 - r_2) - (e_3 - r_3)$. If ruler i chooses Partisan, the state in the next period becomes ST for her successor and OT for the challenger. Her successor chooses the strategy e_2 through r_2, and the challenger chooses e_3 through r_3. Probabilistic voting means the candidates compete on the amount of public goods provided, hence the term αhP in the payoffs. The exact electoral advantage is determined by the strategy of the successor and challenger. Intuitively, the higher probability a candidate chooses Efficient and the lower probability she chooses Inefficient, the higher her electoral advantage, hence the expression of the term K. Similarly, if ruler i chooses Reverse, the state in the next period becomes OT for her successor and ST for the challenger. The calculus is exactly the reverse. Let $W = hP$ for future derivation.

Payoffs in other states are similar. In other states, either one or two talented bureaucrats are present. When a ruler chooses an action, she receives the same payoff from the public goods, its cost and the election. The only difference is that she no longer pays the search cost for any talented bureaucrat already present. Her payoff for all actions under all states are stated in table 1.2.

Action				
State	Efficient	Partisan	Reverse	Inefficient
TT	$U_i(NT, \text{Efficient}) + 2p$	$U_i(NT, \text{Partisan}) + p$	$U_i(NT, \text{Reverse}) + p$	$U_i(NT, \text{Inefficient})$
ST	$U_i(NT, \text{Efficient}) + p$	$U_i(NT, \text{Partisan}) + p$	$U_i(NT, \text{Reverse})$	$U_i(NT, \text{Inefficient})$
OT	$U_i(NT, \text{Efficient}) + p$	$U_i(NT, \text{Partisan})$	$U_i(NT, \text{Reverse}) + p$	$U_i(NT, \text{Inefficient})$
NT	$U_i(NT, \text{Efficient})$	$U_i(NT, \text{Partisan})$	$U_i(NT, \text{Reverse})$	$U_i(NT, \text{Inefficient})$

Table 1.2: Ruler i's payoff for all actions under all states.

Differential payoffs. To better understand the mechanisms at play, I characterize 4 differential payoffs that reflects important marginal decisions a ruler makes. Characterizing an equilibrium can be more easily done by characterizing the values of the 4 differential payoffs.

- If the talented individual from the ruler's own group is not present, the differential payoff of hiring her versus not hiring her and having a same group non-talented individual is $\alpha - p + K\alpha W$. This equals to

$$U_i(NT, \text{Partisan}) - U_i(NT, \text{Inefficient}),$$
$$U_i(NT, \text{Efficient}) - U_i(NT, \text{Reverse}),$$
$$U_i(OT, \text{Partisan}) - U_i(NT, \text{Inefficient}),$$
$$U_i(OT, \text{Efficient}) - U_i(NT, \text{Reverse}).$$

- If the talented bureaucrat from the ruler's own group is present, the differential payoff of keeping her versus firing her and having a same group non-talented individual is $\alpha + K\alpha W$. This equals to

$$U_i(ST, \text{Partisan}) - U_i(NT, \text{Inefficient}),$$
$$U_i(ST, \text{Efficient}) - U_i(NT, \text{Reverse}),$$
$$U_i(TT, \text{Partisan}) - U_i(NT, \text{Inefficient}),$$
$$U_i(TT, \text{Efficient}) - U_i(NT, \text{Reverse}).$$

- If the talented individual from the opposite group is not present, the differential payoff of hiring her versus not hiring her and having a same group non-talented individual is $\alpha - c - p - K\alpha W$. This equals to

$$U_i(NT, \text{Reverse}) - U_i(NT, \text{Inefficient}),$$
$$U_i(NT, \text{Efficient}) - U_i(NT, \text{Partisan}),$$
$$U_i(ST, \text{Reverse}) - U_i(NT, \text{Inefficient}),$$
$$U_i(ST, \text{Efficient}) - U_i(NT, \text{Partisan}).$$

- If the talented bureaucrat from the opposite group is present, the differential payoff of keeping her versus firing her and having a same group non-talented individual is $\alpha - c - K\alpha W$. This equals to

$$U_i(OT, \text{Reverse}) - U_i(NT, \text{Inefficient}),$$
$$U_i(OT, \text{Efficient}) - U_i(NT, \text{Partisan}),$$
$$U_i(TT, \text{Reverse}) - U_i(NT, \text{Inefficient}),$$
$$U_i(TT, \text{Efficient}) - U_i(NT, \text{Partisan}).$$

With the 4 differential payoffs, I can characterize equilibria in a different way. First, conjecture a particular combination of the signs of the 4 differential payoffs, specifying which are positive, which are 0, and which are negative. Second, the conjectured differential payoffs lead to a set of best response strategies e_1 through r_4. The values of e_2, r_2, e_3 and r_3 are of particular importance since they determine K. Last, plug the best response strategies back into the differential payoffs and check whether they maintain the conjectured sign. If I can find parameter values that sustain the conjectured sign with the best response strategies, I can characterize an equilibrium. As is discussed in the appendix, though, the game has many families of equilibria. In fact, ignoring equilibria that occupies a parameter space of measure 0, the game has a total of 10 families of equilibria. 4 of them are strict equilibria where the players play pure strategies at each state. A complete characterization of equilibria would be too cumbersome here, which is only complicated by the prevalence of multiple equilibria as shown in Figure 1.1. Hence I leave the complete characterization of all equilibria in the appendix. In the following sections, I will first discuss some common features of all equilibria. Then I will focus on the most efficient and least efficient equilibria respectively.

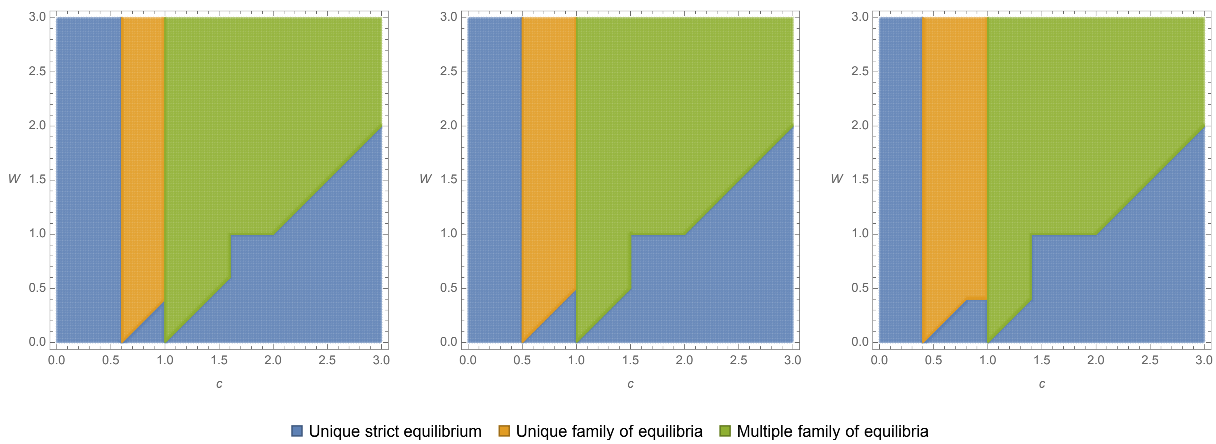

Figure 1.1: Number of family of equilibria for all parameter values.
In the left panel $\alpha > 2p$. In the middle panel $\alpha = 2p$. In the right panel $\alpha < 2p$.

1.4 Discussion

Although the number of equilibria is large, one observations is common across all equilibria.

Proposition 1.1. $K \leq 0$ *in all equilibria. Substantively, hiring the same group talented individual versus a same group non-talented individual always results in an electoral disadvantage. On the other hand, hiring the opposite group's talented individual versus a same group non-talented individual always results in an electoral advantage.*

Proof. See the appendix for values of K in each family of equilibria. In particular, $K = 0$ in equilibria 1.1, 1.3, 2.3 when $c = \alpha - p$ and 2.5 when $c = \alpha$. $K < 0$ in all other equilibria. $\square$

Conceptually, if a ruler chooses Partisan in the current period, then in the next period, her successor faces two decisions: whether to keep the same group talented bureaucrat, and whether to hire the opposite group's talented individual. The challenger, however, faces the opposite decisions: whether to keep the opposite group's talented bureaucrat, and whether to hire the same group talented individual. Since keeping a talented bureaucrat is always "cheaper" than hiring one, the challenger always has more incentive to keep an opposite group's talented bureaucrat than the successor hiring one. Hence the successor will not hire more opposite group's talented bureaucrat than the challenger. Hence, any electoral advantage for the successor must come from her ability to hire more same group talented individual than the challenger. On face value this may be possible. However, if such electoral advantage is present, then having the same group talented bureaucrat is clearly beneficial, since it brings a positive payoff from policies (more public goods without redistribution concerns) and an electoral advantage. In this case, both the successor and the challenger choose to have the same group talented bureaucrat. This eliminates the successor's electoral advantage. Hence choosing Partisan never brings an electoral advantage. Either the two candidates hire the same amount of talented bureaucrats and break even, or the same group candidate hires less talented bureaucrat, resulting in an electoral disadvantage. On the other hand, choosing Reverse either leads to an even election or brings an electoral advantage.

This doesn't mean Partisan will not be played in equilibrium. It will still be played in equilibrium if either c or W is moderately large. In fact, we see Partisan played with positive probabilities on the equilibrium path in equilibria 1.2, 1.3, 2.1 when $p_4 > 0$, 2.3 when $e_4 < 1$ and 2.5. Partisan is played with positive probabilities off the equilibrium path in 2.1 when $p_4 = 0$, 2.2 and 2.3 when $e_4 = 1$ and $c > \alpha - p$.

Proposition 1.1 also gives rise to the possibility that rulers strategically hire the talented individual from the other group and exclude the talented individual from her own group, i.e. the strategy Reverse, to achieve an electoral advantage. Mathematically this is obvious: The electoral benefit of having the same group talented individual is $K \leq 0$. Hence the electoral benefit of having the opposite group's talented individual is $-K \geq 0$. Conceptually, by having the talented bureaucrat from the other group, the ruler creates a bureaucracy that only her successor can credibly fix. To fix such a bureaucracy, the ruler's successor only needs to hire the talented individual from her own group, which she does not have to make a sacrifice on redistribution. The challenger, however, has to hire the talented individual from the opposite group to fix the bureaucracy, where she has to sacrifice on redistribution. The ability of the ruler's successor to fix the bureaucracy gives her an electoral advantage. We see Reverse played with positive probabilities on the equilibrium path in equilibria 2.1 when $p_4 > 0$ and 2.4 when $q_4 > 0$. We see Reverse played with positive probabilities off the equilibrium path in 1.4, 2.1 when $p_4 = 0$, 2.2, 2.4 when $q_4 = 0$, and 2.6.

We now examine the most and least efficient equilibrium for all parameter values.

Proposition 1.2. *Figure 1.2 shows the most efficient equilibrium for all parameter values.*

Proof. The most efficient outcome is a bureaucracy that is efficient forever. This is happens in equilibrium 1.1 and in equilibrium 2.3 if $e_4 = 1$. When this is not possible, the next most efficient outcome is a bureaucracy that "converges" to efficiency. In a convergence equilibrium, the bureaucracy starts with a partisan one with the incumbent in power. As long as the incumbent continues to remain in power, the bureaucracy remains partisan. However when the opposition takes power, the bureaucracy has a positive probability of changing to efficient, which remains so afterwards regardless of the identity of the ruler. This happens in equilibrium 1.2 and equilibrium 2.1 when $p_4 = 1$ (This also happens in equilibrium 2.5 when $e_1 = 1$, but it converges to efficiency slower than the other two equilibria). When the previous two outcomes are impossible, the next most efficient outcome is a bureaucracy that is always partisan. This happens in equilibrium 1.3. The 5 families of equilibria mentioned cover the entire parameter space. Hence the remaining 4 families of equilibria, i.e. 1.4, 2.2, 2.4 and 2.6, which are all less efficient than equilibrium 1.3 (involving partisan and inefficient bureaucracy), are not relevant. □

If the society selects on the most efficient equilibrium, then the most efficient equilibrium

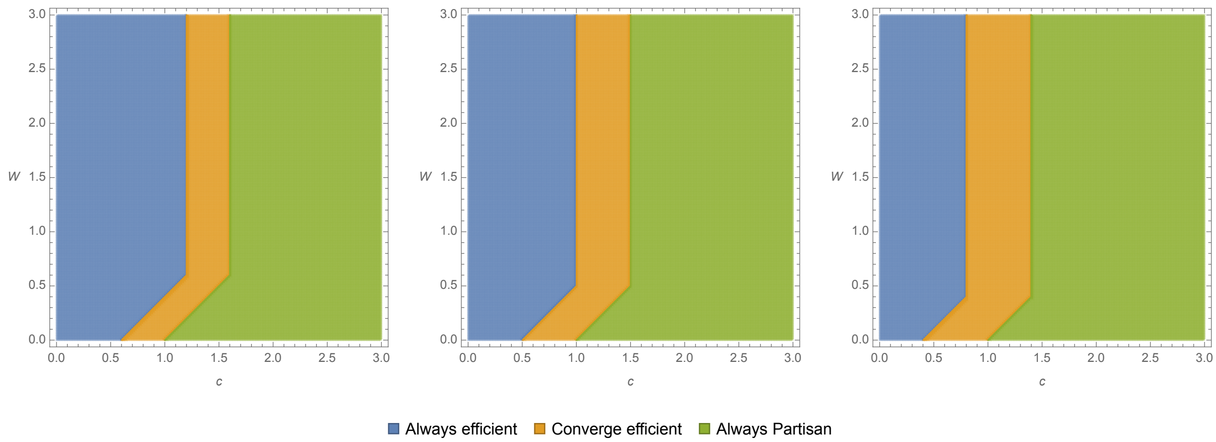

Figure 1.2: The most efficient equilibrium possible for all parameter values.
In the left panel $\alpha > 2p$. In the middle panel $\alpha = 2p$. In the right panel $\alpha < 2p$.

the society can sustain largely depends on the relative salience of redistribution versus public goods. If redistribution concern is minor, the society can sustain an equilibrium where the bureaucracy is always efficient. If redistribution concern is moderate, the society can at best sustain an equilibrium where the bureaucracy is not immediately efficient in early periods, but eventually converges to efficiency. Finally, if redistribution concern is large, the society can at best sustain an equilibrium where the bureaucracy is always partisan, i.e. it only includes the talented individual from the ruler's group. This is certainly not efficient since the bureaucracy always excludes the talented individual not from the ruler's group, but at least it always includes some talented bureaucrats. This general picture is intuitive. As the stake of redistribution increases, including the talented individual not from the ruler's group means yielding them more influence on redistribution issues, the cost of which increases with the salience of redistribution. It is also worth some explanation on how the intermediate state arises. The intermediate state arises because of the search cost for talented individuals. In early periods, hiring the talented individual from outside groups is not a best response for the initial ruler. This is because the stake of redistribution outweighs the net benefit from public goods, i.e. the value of public goods net search cost of talented individuals. But the initial ruler does hire the talented individual from her own group. However, when a power transition happens, this talented bureaucrat becomes the talented bureaucrat from the opposite group for the challenger that comes into power. The new ruler decides whether to keep the existing opposite group's talented bureaucrat, but now keeping her no longer involve a search cost. This increases the net benefit of keeping this talented bureaucrat, and keeping this talented bureaucrat becomes a best response for the new ruler. Adding the talented individual from her own group makes the bureaucracy eventually efficient. Note also that if the society selects on the most efficient equilibrium, higher electoral incentives helps the society to achieve a more efficient outcome. In this case, higher electoral incentive incentivizes rulers to hire the talented individual from the opposite group, which is by itself less desirable to the rulers.

Proposition 1.3. *Figure 1.3 shows the least efficient equilibrium for all parameter values.*

Proof. The least efficient outcome is a bureaucracy that inefficient forever. This is happens in equilibrium 1.4, equilibrium 2.1 when $p_4 = 0$, equilibrium 2.2, equilibrium 2.4 when $q_4 = 0$ and equilibrium 2.6. When this is not possible, the next least inefficient outcome is a bureaucracy that is always partisan. This happens in equilibrium 1.3. The next least inefficient outcome is a bureaucracy that is either efficient or partisan but never converges to efficient. This happens in equilibrium 2.5 when $e_1 = 0$. But when equilibrium 2.5 happens, a less efficient equilibrium also happens, making it irrelevant. The next least inefficient outcome is a bureaucracy that converges to efficiency. This happens in equilibrium 1.2 and equilibrium 2.3 when $e_4 = 0$. Finally the next least inefficient outcome is a bureaucracy that is always efficient. This happens in equilibrium 1.1. □

The picture changes however if the society selects on the least efficient equilibrium. If redistribution concern is extremely minor, the society can still sustain an efficient equilibrium. However, as long as redistribution concern is not extremely minor, it is possible for the society to sustain a fully inefficient equilibrium, where no talented individual is hired at all, provided that electoral incentives are high. Two forces leads to this undesirable outcome.

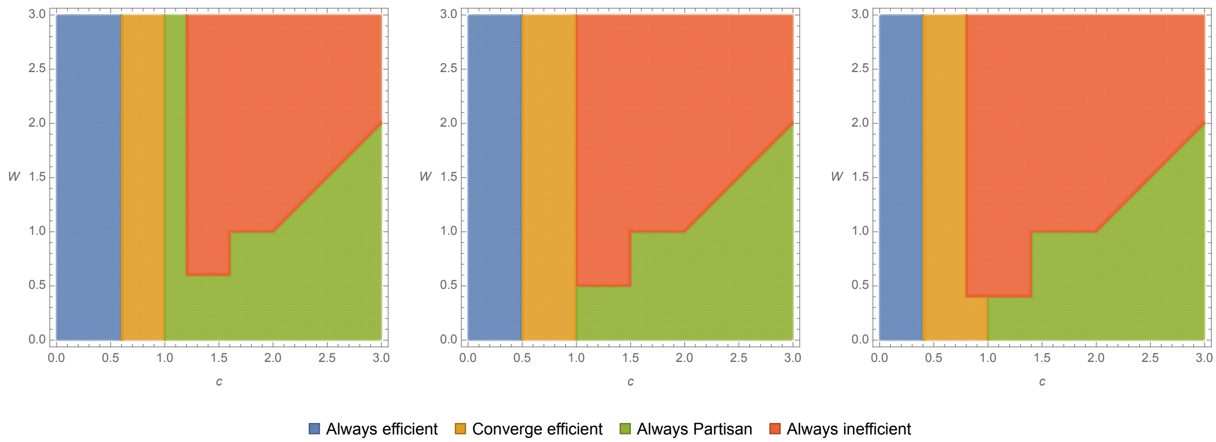

Figure 1.3: The least efficient equilibrium possible for all parameter values.
In the left panel $\alpha > 2p$. In the middle panel $\alpha = 2p$. In the right panel $\alpha < 2p$.

The first force plays similarly as in when the society selects on the most efficient equilibrium: redistribution concern prevents rulers to hire the talented individual from outside groups. The second force leads to inefficiency: Hiring the talented individual from ruler's group actually brings the ruler an electoral disadvantage. During an election, the candidates compete on the amount of public goods produced, i.e. the amounts of talented bureaucrats recruited. Due to redistribution concerns, candidates have a problem committing to hire the talented individual from outside groups. However due to the existence of search cost, candidates have less of a problem committing to keep outside talented individuals who are already employed in the bureaucracy. Hence if a ruler hires a talented individual from her own group, she is helping the opposite candidate by including a talented bureaucrat that the opposite candidate may not want to hire but are happy to keep. However, the same group candidate still faces the hard decision of whether to hire opposite group's talented individual. Thus, the incumbent's decision to hire same group talented individual actually gives the opposite candidate an edge in the election. Hence, if electoral incentives dominate policy concerns, the rulers end up not even hiring the talented individual from their own groups. Coupled with their lack of incentives hiring talented individuals from the other groups due to redistribution, the two forces leads to no talented bureaucrat ever hired in the bureaucracy, i.e.

inefficiency forever. Note that as the stake of redistribution increases, the fully inefficient equilibrium is less likely to occur, in the sense that the rulers need an even higher electoral incentive to sustain this equilibrium. As redistribution concerns increases, the candidates are less likely to keep talented individuals from the opposite groups. This reduces the electoral cost of hiring the talented individual from the ruler's own group. Hence an even larger electoral incentive is needed to dissuade the rulers from hiring talented individuals from their own groups, leading to inefficiency.

It may seem that electoral incentives play different roles in the two figures. The underlying force at play is the same though. As discussed above, having the talented individual from the ruler's group leads to an electoral disadvantage, and having the talented individual from the opposite group leads to an electoral advantage. This holds true in any equilibrium, best or worst. If players select on the best equilibrium, the first incentive does not dissuade them from having same group talented individuals, but the second incentive leads them to have the opposite group's talented individuals, resulting in efficiency. If players select on the worst equilibrium, the situation is reversed. Players are disincentivized to having same group talented individuals while not incentivized to have opposite group's talented individuals, leading to inefficiency.

1.5 Conclusions

This paper highlights two factors that affects a politician's decisions on developing meritocratic bureaucracy. The first factor is the relative salience between public goods provision and redistribution. The higher the former salience, the more incentive a politician has to develop meritocracy. The second factor, which complicates the calculus, is electoral competition. When the election is such that politicians compete on public goods provision, politicians have an incentive to recruit a bureaucracy that maximizes public goods provision. It seems obvious that this should lead to meritocracy. However, bureaucracies are long-lasting institutions, and earlier recruitment decisions constraint latter changes. Hence, electoral incentives can play out not in the simple way of maximizing meritocracy, but in a way where politicians strategically recruit a less efficient bureaucracy such that only they themselves can credibly improve upon. This leads to the behavior where politicians strategically exclude talented individuals from her own groups in favor of talented individuals from other groups, because they can credibly hire the former in the future compared to their opponents. Given this complication, whether politicians compete on maximizing meritocracy versus strategically hindering their opponents can lead to drastically different equilibria.

It should be noted that the result of the analysis arise from the setup where the electoral competition is based on public goods provision. This is due to a setup where both groups have equal size, equal responsiveness and exactly opposite preference on redistribution. This means that a politician's electoral advantage from giving one group more redistribution is exactly countered by the disadvantage from giving the other group less redistribution. This reduces the competition to public goods provision. Further studies would be needed to better understand how the incentives discussed in this paper play out in settings where political competition critically depends on other policy dimensions, such as redistribution.

1.6 Appendix: Characterization of equilibria

Section 1.3 describes 1.4 differential payoffs that characterize equilibria.

$$\alpha - p + K\alpha W,$$
$$\alpha + K\alpha W,$$
$$\alpha - c - p - K\alpha W,$$
$$\alpha - c - K\alpha W.$$

The values of these differential payoffs pin down equilibria. Among the first two, at most one equals 0. Among the last two, at most one equals 0. Hence we can characterize 3 families of equilibria: Strict equilibria (none of the differential payoffs is 0), equilibria with one differential payoffs being 0, and equilibria with two differential payoffs being 0.

Lemma 1.1. *All equilibria with two differential payoffs being 0 occupies a parameter space that has measure 0.*

Proof. Among the first two indifference payoffs, one of them equals 0, which pins down an exact value of $K\alpha W$. Plugging it in the second differential payoff that equals to 0 (the one among the last two) pins down an exact value of c. Hence any equilibrium that has two differential payoffs equal to 0 only occurs at one of the following 3 values of c: $c = 2(\alpha - p)$, $c = 2\alpha - p$, and $c = 2\alpha$. $\square$

Lemma 1.2. *There is no equilibrium where* $\alpha - p + K\alpha W < 0$ *and* $\alpha + K\alpha W > 0$.

Proof. If $\alpha - p + K\alpha W < 0$, then $K < 0$. Efficient and Partisan are strictly dominated in states OT and NT, hence $e_3 = 0$. If $\alpha + K\alpha W > 0$, Reverse and Inefficient are strictly dominated in states TT and ST. Hence $r_2 = 0$. Hence $K = (e_2 - r_2) - (e_3 - r_3) = e_2 + r_3 \geq 0$, contradiction. $\square$

1.6.1 Strict equilibria

In strict equilibria, none of the differential payoffs are 0. Hence there are two possibilities: $\alpha + K\alpha W > \alpha - p + K\alpha W > 0$, and $\alpha - p + K\alpha W < \alpha + K\alpha W < 0$.

If $\alpha + K\alpha W > \alpha - p + K\alpha W > 0$, then Reverse and Inefficient are strictly dominated in all states, i.e. $q_i = r_i = 0$ for $i = 1, 2, 3, 4$. This gives 3 further cases:

Case 1.1. $\alpha + K\alpha W > \alpha - p + K\alpha W > 0$ *and* $\alpha - c - K\alpha W > \alpha - c - p - K\alpha W > 0$. *In this case, Partisan is strictly dominated in all states, i.e.* $p_i = 0$ *for* $i = 1, 2, 3, 4$. *Hence the equilibrium conjecture is* $e_i = 1$ *for* $i = 1, 2, 3, 4$, *i.e. all rulers choose Efficient in every state. This gives* $K = 0$. *Plugging the value of* K *back into the differential payoffs,*

$\alpha + K\alpha W > \alpha - p + K\alpha W > 0$ *is obvious.* $\alpha - c - K\alpha W > \alpha - c - p - K\alpha W > 0$ *holds if* $c < \alpha - p$.

Equilibrium 1.1. *If $c < \alpha - p$, the game has the following equilibrium:*

	Action			
State	Efficient	Partisan	Reverse	Inefficient
TT	1	0	0	0
ST	1	0	0	0
OT	1	0	0	0
NT	1	0	0	0

Table 1.3: Ruler i's strategies under equilibrium 1.1

In this equilibrium $K = 0$. On the equilibrium path, the bureaucracy is always efficient.

Case 1.2. $\alpha + K\alpha W > \alpha - p + K\alpha W > 0$ *and* $\alpha - c - K\alpha W > 0 > \alpha - c - p - K\alpha W$. *In this case, Partisan is strictly dominated in states TT and OT, and Efficient is strictly dominated in states ST and NT, i.e. $p_1 = p_3 = e_2 = e_4 = 0$. Hence the equilibrium conjecture is $e_1 = e_3 = p_2 = p_4 = 1$, i.e. all rulers choose Efficient in states TT and OT, and Partisan in states ST and NT. This gives $K = -1$. Plugging the value of K back into the differential payoffs, we have*

$$\alpha - p - \alpha W > 0,$$

$$\alpha - c - p + \alpha W < 0,$$

$$\alpha - c + \alpha W > 0.$$

Solving for W gives $W \in (\frac{c}{\alpha} - 1, min\{1 - \frac{p}{\alpha}, \frac{c+p}{\alpha} - 1\})$. To make this interval having an intersection with $(0, +\infty)$, we need $1 - \frac{p}{\alpha} > \frac{c}{\alpha} - 1$ and $\frac{c+p}{\alpha} - 1 > 0$ ($1 - \frac{p}{\alpha} > 0$ is obvious). This gives $c \in (\alpha - p, 2\alpha - p)$.

Equilibrium 1.2. *If $c \in (\alpha - p, 2\alpha - p)$ and $W \in (\frac{c}{\alpha} - 1, min\{1 - \frac{p}{\alpha}, \frac{c+p}{\alpha} - 1\})$, the game has the following equilibrium:*

Action				
State	Efficient	Partisan	Reverse	Inefficient
TT	1	0	0	0
ST	0	1	0	0
OT	1	0	0	0
NT	0	1	0	0

Table 1.4: Ruler i's strategies under equilibrium 1.2

In this equilibrium $K = -1$. On the equilibrium path, the bureaucracy starts with A-partisan in period 1, and remains so as long as the group A stays continuously in power. As soon as group B first takes power, the bureaucracy changes to efficient, and remains so forever.

Case 1.3. $\alpha + K\alpha W > \alpha - p + K\alpha W > 0$ *and* $\alpha - c - p - K\alpha W < \alpha - c - K\alpha W < 0$. *In this case, Efficient is strictly dominated in all states, i.e.* $e_i = 0$ *for* $i = 1, 2, 3, 4$. *Hence the equilibrium conjecture is* $p_i = 1$ *for* $i = 1, 2, 3, 4$, *i.e. all rulers choose Partisan in every state. This gives* $K = 0$. *Plugging the value of* K *back into the differential payoffs,* $\alpha + K\alpha W > \alpha - p + K\alpha W > 0$ *is obvious.* $\alpha - c - p - K\alpha W < \alpha - c - K\alpha W < 0$ *holds if* $c > \alpha$.

Equilibrium 1.3. *If* $c > \alpha$, *the game has the following equilibrium:*

Action				
State	Efficient	Partisan	Reverse	Inefficient
TT	0	1	0	0
ST	0	1	0	0
OT	0	1	0	0
NT	0	1	0	0

Table 1.5: Ruler i's strategies under equilibrium 1.3

In this equilibrium $K = 0$. On the equilibrium path, the bureaucracy is always partisan.

If $\alpha - p + K\alpha W < \alpha + K\alpha W < 0$, then Efficient and Partisan are strictly dominated in all states, i.e. $e_i = p_i = 0$ for $i = 1, 2, 3, 4$. This gives one more case:

Case 1.4. *$\alpha - p + K\alpha W < \alpha + K\alpha W < 0$ means $K = r_3 - r_2 < 0$. In a strict equilibrium this means $r_2 = 1$, $q_2 = 0$, $r_3 = 0$ $q_3 = 1$, and $K = -1$. To support this conjecture, the differential payoffs must be $\alpha - c - K\alpha W > 0 > \alpha - c - p - K\alpha W$. This further gives $r_1 = 0$, $q_1 = 1$, $r_4 = 1$ and $q_4 = 0$. Plugging the value of K back into the differential payoffs, we have*

$$\alpha - \alpha W < 0,$$
$$\alpha - c - p + \alpha W < 0,$$
$$\alpha - c + \alpha W > 0.$$

Solving for W gives $W \in (max\{1, \frac{c}{\alpha} - 1\}, \frac{c+p}{\alpha} - 1)$. To make this interval having an intersection with $(0, +\infty)$, we need $\frac{c+p}{\alpha} - 1 > 1$. This gives $c > 2\alpha - p$.

Equilibrium 1.4. *If $c > 2\alpha - p$ and $W \in (max\{1, \frac{c}{\alpha} - 1\}, \frac{c+p}{\alpha} - 1)$, the game has the following equilibrium:*

	Action			
State	Efficient	Partisan	Reverse	Inefficient
TT	0	0	1	0
ST	0	0	0	1
OT	0	0	1	0
NT	0	0	0	1

Table 1.6: Ruler i's strategies under equilibrium 1.4

In this equilibrium $K = -1$. On the equilibrium path, the bureaucracy is always inefficient.

1.6.2 Equilibria with one differential payoffs being 0

Case 2.1. $\alpha - p + K\alpha W = 0$. *Obviously we have* $K\alpha W = p - \alpha < 0$ *and* $\alpha + K\alpha W > 0$. *This means Reverse and Inefficient are strictly dominated in states* TT *and* ST, *i.e.* $q_i = r_i = 0$ *for* $i = 1, 2$. *Hence* $K = e_2 - (e_3 - r_3)$. $K < 0$ *requires* $e_2 < 1$. *In state* ST, *the differential payoff that pins down* e_2 *is* $\alpha - c - p - K\alpha W$, *which by conjecture does not equal to 0. Hence it has to be negative to generate* $e_2 = 0 < 1$. $\alpha - c - p - K\alpha W = 2(\alpha - p) - c < 0$ *gives* $c > 2(\alpha - p)$. *Hence* $K = r_3 - e_3$. $K < 0$ *further requires* $e_3 > 0$. *In state* OT, $\alpha - p + K\alpha W = 0$ *means that the ruler is indifferent between Efficient and Reverse, and indifferent between Partisan and Inefficient. Hence* $\alpha - c - K\alpha W$, *the differential payoff between Efficient and Partisan, pins down* e_3. *This differential payoff is non-zero, and has to be positive to generate* $e_3 > 0$. *Hence we have* $\alpha - c - K\alpha W = \alpha - c + \alpha - p > 0$, *i.e.* $c < 2\alpha - p$. $\alpha - c - K\alpha W > 0$ *also means Inefficient is strictly dominated by Reverse in state* OT, *hence* $r_3 = 0$ *and* $K = -e_3$. *Plugging* $K = -e_3$ *back into* $\alpha - p + K\alpha W = 0$ *gives* $e_3 = \frac{\alpha - p}{\alpha W}$. $e_3 \in (0, 1]$ *requires* $W \geq 1 - \frac{p}{\alpha}$. *Using the differential payoffs to pin down other strategies, we have*

Equilibrium 2.1. *If* $c \in (2(\alpha - p), 2\alpha - p)$ *and* $W \geq 1 - \frac{p}{\alpha}$, *the game has the following family of equilibria:*

	Action			
State	Efficient	Partisan	Reverse	Inefficient
TT	1	0	0	0
ST	0	1	0	0
OT	$\frac{\alpha-p}{\alpha W}$	0	$1 - \frac{\alpha-p}{\alpha W}$	0
NT	0	p_4	0	$1 - p_4$

Table 1.7: Ruler i's strategies under equilibrium 2.1

where $p_4 \in [0, 1]$. In this family of equilibria $K = -\frac{\alpha - p}{\alpha W}$. The most efficient equilibrium happens when $p_4 = 1$. In this equilibrium the bureaucracy starts with A-partisan in period 1, but will eventually change to efficient and remains so forever. The least efficient equilibrium happens when $p_4 = 0$, where the bureaucracy is inefficient forever.

Case 2.2. $\alpha + K\alpha W = 0$. *Obviously we have* $K\alpha W = -\alpha < 0$ *and* $\alpha - p + K\alpha W < 0$. *This means Efficient and Partisan are strictly dominated in states* OT *and* NT. *i.e.* $e_i = p_i = 0$ *for* $i = 3, 4$. *Hence* $K = e_2 - r_2 + r - 3$. $K < 0$ *requires* $r_3 < 1$. *In state* OT, *the differential payoff that pins down* r_3 *is* $\alpha - c - K\alpha W$, *which by conjecture does not equal 0. Hence it has to be positive to generate* $r_3 = 0 < 1$. $\alpha - c - K\alpha W = 2\alpha - c > 0$ *gives* $c < 2\alpha$. *Hence* $K = e_2 - r_2$. $K < 0$ *further requires* $r_2 > 0$. *In state* ST, $\alpha + K\alpha W = 0$ *means that the ruler is indifferent between Efficient and Reverse, and indifferent between Partisan and Inefficient. Hence* $\alpha - c - p - K\alpha W$, *the differential payoff between Reverse and Efficient, pins down* r_2. *This differential payoff is non-zero, and has to be negative to generate* $r_2 > 0$. *Hence we have* $\alpha - c - p - K\alpha W = \alpha - c - p + \alpha > 0$, *i.e.* $c > 2\alpha - p$. $\alpha - c - p - K\alpha W > 0$ *also means Efficient is strictly dominated by Partisan in state* ST, *hence* $e_2 = 0$ *and* $K = -r_2$. *Plugging* $K = -r_2$ *back into* $\alpha + K\alpha W = 0$ *gives* $r_2 = -\frac{1}{W}$. $r_2 \in (0, 1]$ *requires* $W \geq 1$. *Using the differential payoffs to pin down other strategies, we have*

Equilibrium 2.2. *If* $c > 2\alpha - p$ *and* $W \geq 1$, *the game has the following family of equilibria:*

	Action			
State	Efficient	Partisan	Reverse	Inefficient
TT	e_1	0	$1 - e_1$	0
ST	0	$1 - \frac{1}{W}$	0	$\frac{1}{W}$
OT	0	0	1	0
NT	0	0	0	1

Table 1.8: Ruler i's strategies under equilibrium 2.2

where $e_1 \in [0, 1]$. In this family of equilibria $K = -\frac{1}{W}$. In all equilibria in this family, the bureaucracy is always inefficient.

Then consider the case where $\alpha - c - p - K\alpha W = 0$. Obviously $\alpha - c - K\alpha W > 0$. This means Partisan and Inefficient are strictly dominated in states TT and OT, i.e. $p_i = r_i = 0$

for $i = 1, 3$. Hence $K = (e_2 - r_2) - e_3$. To pin down the value of K, we need to examine the other two differential payoffs, $\alpha - p + K\alpha W$ and $\alpha + K\alpha W$. This gives two possibilities: both are positive and both are negative (it is impossible for one to be positive and the other negative). Hence we have:

Case 2.3. *$\alpha - c - p - K\alpha W = 0$ and $\alpha + K\alpha W > \alpha - p + K\alpha W > 0$. This means Reverse and Inefficient are strictly dominated in all states, i.e. $q_i = r_i = 0$ for $i = 1, 2, 3, 4$. Hence $K = e_2 - e_3$. Since $p_3 = 0$, $e_3 = 1$ and $K = e_2 - 1$. Plugging $K = e_2 - 1$ back into $\alpha - c - p - K\alpha W = 0$ gives $e_2 = 1 - \frac{c+p-\alpha}{\alpha W}$. $e_2 \in (0, 1)$ requires $c \geq \alpha - p$ and $W \geq \frac{c+p}{\alpha} - 1$. Plugging $K = e_2 - 1 = -\frac{c+p-\alpha}{\alpha W}$ into $\alpha - p + K\alpha W > 0$ gives $c < 2(\alpha - p)$. Using the differential payoffs to pin down other strategies, we have*

Equilibrium 2.3. *If $c \in [\alpha - p, 2(\alpha - p))$ and $W \geq \frac{c+p}{\alpha} - 1$, the game has the following family of equilibria:*

	Action			
State	Efficient	Partisan	Reverse	Inefficient
TT	1	0	0	0
ST	$1 - \frac{c+p-\alpha}{\alpha W}$	$\frac{c+p-\alpha}{\alpha W}$	0	0
OT	1	0	0	0
NT	e_4	$1 - e_4$	0	0

Table 1.9: Ruler i's strategies under equilibrium 2.3

where $e_4 \in [0, 1]$. In this family of equilibria $K = -\frac{c+p-\alpha}{\alpha W}$. The most efficient equilibrium happens when $e_4 = 1$, where the bureaucracy is always efficient. The least efficient equilibrium happens when $e_4 = 0$, where the bureaucracy starts with A-partisan in period 1, but will eventually change to efficient and remains so forever.

Case 2.4. *$\alpha - c - p - K\alpha W = 0$ and $\alpha - p + K\alpha W < \alpha + K\alpha W < 0$. This means Efficient and Partisan are strictly dominated in all states, i.e. $e_i = p_i = 0$ for $i = 1, 2, 3, 4$. Hence $K = -r_2$. Plugging $K = -r_2$ back into $\alpha - c - p - K\alpha W = 0$ gives $r_2 = \frac{c+p-\alpha}{\alpha W}$. $r_2 \in [0, 1]$*

requires $c \geq \alpha - p$ and $W \geq \frac{c+p}{\alpha} - 1$. Plugging $K = -r_2 = -\frac{c+p-\alpha}{\alpha W}$ into $\alpha + K\alpha W < 0$ gives $c > 2\alpha - p$. Using the differential payoffs to pin down other strategies, we have

Equilibrium 2.4. *If $c > 2\alpha - p$ and $W \geq \frac{c+p}{\alpha} - 1$, the game has the following family of equilibria:*

	Action			
State	Efficient	Partisan	Reverse	Inefficient
TT	0	0	1	0
ST	0	0	$1 - \frac{c+p-\alpha}{\alpha W}$	$\frac{c+p-\alpha}{\alpha W}$
OT	0	0	1	0
NT	0	0	q_4	$1 - q_4$

Table 1.10: Ruler i's strategies under equilibrium 2.4

where $q_4 \in [0, 1]$. In this family of equilibria $K = -\frac{c+p-\alpha}{\alpha W}$. The most efficient equilibrium happens when $q_4 = 1$, where the bureaucracy is partisan in some periods and inefficient in others. The least efficient equilibrium happens when $q_4 = 0$, where the bureaucracy is always inefficient.

Finally consider the case where $\alpha - c - K\alpha W = 0$. Obviously $\alpha - c - p - K\alpha W < 0$. This means Efficient and Reverse are strictly dominated in states ST and NT, i.e. $e_i = q_i = 0$ for $i = 2, 4$. Hence $K = -r_2 - (e_3 - r_3)$. To pin down the value of K, we again need to examine the other two differential payoffs, $\alpha - p + K\alpha W$ and $\alpha + K\alpha W$. This gives two possibilities: both are positive and both are negative.

Case 2.5. *$\alpha - c - K\alpha W = 0$ and $\alpha + K\alpha W > \alpha - p + K\alpha W > 0$. This means Reverse and Inefficient are strictly dominated in all states, i.e. $q_i = r_i = 0$ for $i = 1, 2, 3, 4$. Hence $K = -e_3$. Plugging $K = -e_3$ back into $\alpha - c - K\alpha W = 0$ gives $e_3 = \frac{c-\alpha}{\alpha W}$. $e_3 \in (0, 1)$ requires $c \geq \alpha$ and $W \geq \frac{c}{\alpha} - 1$. Plugging $K = -e_3 = -\frac{c-\alpha}{\alpha W}$ into $\alpha - p + K\alpha W > 0$ gives $c < 2\alpha - p$. Using the differential payoffs to pin down other strategies, we have*

Equilibrium 2.5. *If $c \in [\alpha, 2\alpha - p)$ and $W \geq \frac{c}{\alpha} - 1$, the game has the following family of equilibria:*

	Action			
State	Efficient	Partisan	Reverse	Inefficient
TT	e_1	$1 - e_1$	0	0
ST	0	1	0	0
OT	$\frac{c-\alpha}{\alpha W}$	$1 - \frac{c-\alpha}{\alpha W}$	0	0
NT	0	1	0	0

Table 1.11: Ruler i's strategies under equilibrium 2.5

where $e_1 \in [0, 1]$. In this family of equilibria $K = -\frac{c-\alpha}{\alpha W}$. The most efficient equilibrium happens when $e_1 = 1$, where the bureaucracy starts with A-partisan in period 1, but will eventually change to efficient and remains so forever. The least efficient equilibrium happens when $e_1 = 0$, where the bureaucracy is efficient in some periods and partisan in others.

Case 2.6. *$\alpha - c - K\alpha W = 0$ and $\alpha - p + K\alpha W < \alpha + K\alpha W < 0$. This means Efficient and Partisan are strictly dominated in all states, i.e. $e_i = p_i = 0$ for $i = 1, 2, 3, 4$. Hence $K = r_3 - r_2$. Since $q_2 = 0$, $r_2 = 1$ and $K = r_3 - 1$. Plugging $K = r_3 - 1$ back into $\alpha - c - K\alpha W = 0$ gives $r_3 = 1 - \frac{c-\alpha}{\alpha W}$. $r_3 \in [0, 1]$ requires $c \geq \alpha$ and $W \geq \frac{c}{\alpha} - 1$. Plugging $K = r_3 - 1 = -\frac{c-\alpha}{\alpha W}$ into $\alpha + K\alpha W < 0$ gives $c > 2\alpha$. Using the differential payoffs to pin down other strategies, we have*

Equilibrium 2.6. *If $c > 2\alpha$ and $W \geq \frac{c}{\alpha} - 1$, the game has the following family of equilibria:*

where $q_1 \in [0, 1]$. In this family of equilibria $K = -\frac{c-\alpha}{\alpha W}$. In all equilibria in this family, the bureaucracy is always inefficient.

Action				
State	Efficient	Partisan	Reverse	Inefficient
TT	0	0	q_1	$1 - q_1$
ST	0	0	0	1
OT	0	0	$\frac{c-\alpha}{\alpha W}$	$1 - \frac{c-\alpha}{\alpha W}$
NT	0	0	0	1

Table 1.12: Ruler i's strategies under equilibrium 2.6

CHAPTER 2

ENDOGENOUS REBELLION BENEFITS AND POLITICAL SURVIVAL

with Ruochen Yi

2.1 Introduction

Political actors faces survival threats from multiple sources (Bueno de Mesquita et al. [2003]). A dictator may face threats of rebellion from citizens from different social classes (Acemoglu and Robinson [2006]). A government may face insurgencies formed by different ethnic groups. Dictators may face challenges from both outsiders and their subordinates (Egorov and Sonin [2011]). Even in advanced democracies, such as a Westminster system, a leader may face potential challenges from multiple of her cabinet ministers. How should these political leaders ensure their survival facing such threats? A wealth of studies have examined how these political leaders could use repression to remove these threats to survival. By deploying repressive forces, politicians and governments increase the marginal cost of rebellions, deterring challengers from such attempts. However, fewer studies have focused on how politicians and governments can use policies and institutions to affect the marginal benefit of rebellions for challengers, and thereby achieve survival. This paper shows that endogenously affecting challenger's marginal benefit of rebellions can be another viable strategy for political survival, especially in settings where the challengers themselves face conflicts of interests.

We study settings where the politicians or governments face survival threats from multiple actors. A rebellion is successful if these actors can coordinate their rebellion effort. However coordination depends on these actors' perceived benefit from a successful rebellion. In our setting, they have a common interest in overthrowing the existing government, but they also have conflicts over the distribution of benefits post-rebellion. Challengers who expect to receive only a small share of the benefits can choose not to participate the rebellion and stall it. Furthermore, the distribution of post-rebellion benefits among challengers is affected by pre-rebellion policies and institutions, which is chosen by the existing government. We show that, the government can ensure its survival by strategically choosing institutions to leverage the conflict of interest among the challengers. Specifically, the government can choose an institution that puts some challengers at a disadvantage now, while promising to choose another institution that puts the same challengers at a more powerful position relative to other challengers in the future. The prospect of becoming more powerful in the future serves as an incentive for these challengers to delay a rebellion to a point where the distribution of payoff is more beneficial to them.

The main result of this paper highlights the government's optimal survival strategy (i.e. optimal institution choice) in the settings discussed above. To ensure maximum survival, the government should first identify the "weaker" ones among the challengers. The weaker challengers are those who stand to enjoy a larger disadvantage (or smaller advantage) under different institutions. Then, the government should choose an institution path that begins with the weaker challengers' less preferred institution. The government should keep this institution for a period of time, before switching to the weaker challengers' more preferred institution and empowering them. Once the weaker challengers are empowered enough, they have no more incentive to delay a rebellion and the government can no longer survive.

Importantly, the timing of the transition is key to survival. If the transition happens too early, the weaker challengers are satiated too early. If the transition happens too late, the weaker challengers will have accumulated too much disadvantage before the transition, making any improvement afterwards insignificant. The government should design institution paths that appeals to the weaker challengers precisely because they have strong incentive to wait for improvements. More complicated institution paths involving more than one changes of institutions cannot achieve longer survival, since they introduces additional incentive constraints for challengers. Finally, the government's ability to commit to such paths is key for its survival when choosing such institution paths.

Our paper helps explain multiple political scenarios. For example, it explains the instability of many Arab countries due to their reforms preserved rents to connected groups rather than generating benefits for the less-well-off citizens (Commander [2017]). A more detailed example is the reversal of economic reforms in China in the last decade. Briefly put, since 1978 the Chinese government has implemented multiple economic reform measures, including privatization and introduction of market economy to transfer much of its power over the economy to local governments and both state-owned and private entrepreneurs (Lin et al. [2003], Groves et al. [1994]). These reforms bring brought economic benefits to the Chinese government, even though they were accompanied by increasing political risks (Myerson [2010]). But this reform trend has reversed since 2012. From 2015 to 2020, the share of private enterprise revenue in total industrial revenue decreased by 5 percentage points, with an expansion of state-owned enterprise revenue of almost exactly the same magnitude. Even state-owned enterprises saw tighter control from the government. Since 2012, the Organization Department of the Chinese Communist Party, the department that controls staffing positions within the CCP, regained the power to nominate senior executive leaders of high-level state-owned enterprises. The recent tech crack-down is but another example of the government tightening control over the economy. This reversal in economic reforms has been accompanied by a reversal of political reforms. For example, Martinez-Bravo et al. [2020] documents that village governments in China, which were elected in the 1990s, began to lose their autonomy in the early 2000s.

Our paper's main results explains this reversal well. The Chinese government faces potential rebellion threats from its citizens, who are largely divided by economic status. The four-decade economic reform, while helping the Chinese economy take off, has also greatly widened inequality, with China's Gini coefficient increasing from 0.317 in 1078 to

0.491 in 2009. While the lives of the vast majority of Chinese citizens improved, those with lower economic status gained relatively little from the reform. This makes them the weaker challengers in China. While they may express dissatisfaction with the government, they are still hesitant about a rebellion, since they believe a rebellion would lead the upper class (entrepreneurs and capitalists) reaping all the benefit, further expropriating them. The government leverages this sentiment by partly reversing course on economic policies. This reversal curbs the massive economic and political power the local elites and entrepreneurs have accumulated, putting the working class at a less disadvantageous position. This gives them an incentive to delay their rebellion attempts in expectation of more beneficial economic institutions in the future. Indeed, the Gini coefficient slightly decreased to 0.468 in 2020, signifying that the government is at least partially successful in affecting the relative power of different classes of citizens.

Our paper is situated in the larger literature about institution and political survival. This includes the seminal model of democratization by Acemoglu and Robinson [2006], and political survival (Bueno de Mesquita et al. [2003], Bueno de Mesquita and Smith [2009]). In the Acemoglu and Robinson model the non-democratic government democratizes as a commitment devise to ensure higher payoff to its citizens, hence preventing itself from being overthrown. The government achieves survival not via repression, but precisely by affecting the payoffs citizens receive under different political settings. The models of Bueno de Mesquita et al discusses how politicians endogenously chooses institutions that facilitates or hinders the ease of coordinating a rebellion among citizens, given the government's fiscal constraints. Our paper builds on their analysis by explicitly examining the conflict of interest among multiple challengers, and explaining how governments can leverage this conflict to achieve survival.

Methodologically, our paper is motivated by studies of dynamic institution choices, including Rajan [2009] and Lagunoff [2009]. Specifically, Rajan [2009] discusses the preferences of different citizens in the society over partial versus comprehensive economic reforms based on their marginal return. Due to competitive rent preservation (citizens guarding its rent from the economy due to privileged status against others), the society can trap in inefficient states with no or only partial reform, where political leaders who propose comprehensive reforms do not command broad support from the society. We broadly follow the idea that policy choices affects different citizens' payoff from the economy differentially, which indirectly affects political survival. An earlier version of this paper closely follow the modeling techniques with micro-foundations. Though we abstracted away from those micro-foundations to focus on the aspect of political survival, the general logic of analysis still follow through.

This paper is organized as follows: Section 2.2 sets up the main model. Section 2.3 presents the main analysis and results. Section 2.4 discusses the role of government's ability of commitment. Section 2.5 concludes.

2.2 Model

Setup and timing. We build a simple continuous time game with 3 players: The Government, social group a and social group b (each regarded as a single player, hereafter referred to as player a and b). To simplify the analysis, G only acts once at the beginning of the game at $t = 0$. At this instance, G announces an institution plan, which maps any $t \geq 0$ to one of two institutions: Egalitarian and Biased. Formally, the government announces a mapping $g(t) : \{0\} \cup \mathbb{R}^+ \to \{E, B\}$. To further simplify the analysis, we restrict the government's announcement $g(t)$ to the following form. First, the government announces an initial institution $I_0 \in \{E, B\}$. Then, the government announces a series of transition time points t_i for $i \in \mathbb{N}$, with $t_0 = 0$ and $t_i > t_{i-1}$. The mapping $g(t)$ is then defined as: $g(t) = I_0$ if $t \in [t_{2n}, t_{2n+1})$ for $n \in \mathbb{N}$, and $g(t) \neq I_0$ if $t \in [t_{2n+1}, t_{2n+2})$ for $n \in \mathbb{N}$. Substantively, the mapping $g(t)$ starts the path with institution I_0 at $t = 0$, and changes the institution at each transition time points t_i for $i > 0$. We restrict t_i such that $t_i - t_{i-1} \geq \phi > 0$, so that each pair of consecutive transition points are at least ϕ apart. This means that for any finite length T, the government can only change the institution for finitely many times. We will discuss the implications of this simplification later.

After this announcement, both social grouops play a continuous time game starting from $t = 0$. Each social gruop has two actions: Rebel and Not to rebel. At any time t, if both social groups rebel, the game ends and payoffs are realized for all players. Simply put, G lays down the foundation of a continuous time game at $t = 0$, and then is removed from the game. Both social groups then play the game that G lays out by determining whether to rebel at time t, with the outcome of the game determined by layout that G sets and both social groups' rebellion decisions.

Histories and strategies. The government only plays at $t = 0$, hence the histories of the game at time t is irrelevant for G. After the government announces the institution plan, at any time t, the history of the game $h(t)$ contains two arguments. The first is whether the game has ended before t, which can take one of the following two values: $\{0, 1\}$, with 0 indicating that the game has not ended before time t and 1 vice versa. This component is determined by both players' actions before time t. The second component contains both players' political powers at time t, which is determined by the institution plan that the government announces at the beginning of the game. Specifically, player a's political power at time t is $p_{at} = \int_0^t \frac{1}{2}\mathbb{1}\{g(t) = E\} + (1-\beta)\mathbb{1}\{g(t) = B\}$, where $\frac{1}{2} < \beta < 1$. Similarly, player b's political power at time t is $p_{bt} = \int_0^t \frac{1}{2}\mathbb{1}\{g(t) = E\} + (\beta)\mathbb{1}\{g(t) = B\}$. Substantively, for any instance that the political institution is Egalitarian, both social groups accumulate political power at a rate of $\frac{1}{2}$. For any instance that the political power is Biased, player b accumulates political power at a rate of $\beta > \frac{1}{2}$, and player a at a rate $1 - \beta < \frac{1}{2}$. Obviously at any time t, $p_{at} + p_{bt} = t$. Hence, at time t where the game has not ended yet, player i's history is $h_i(t) = \{p_{it}, 0\}$, and at time t where the game has not ended yet, player i's history is $h_i(t) = \{p_{it}, 1\}$. pPayer i's strategy s_i is then a mapping from $\{h_i(t)\}$ to $\{R, N, \emptyset\}$, such that $s_i(h_it) \in \{R, N\}$ if $h_i(t) = \{p_{it}, 0\}$, and $s_i(h_it) = \emptyset$ if $h_i(t) = \{p_{it}, 1\}$.

The game has complete information, hence the equilibrium concept is Sub-game Perfect Nash equilibrium (SPNE). We restrict our attention to pure strategy SPNEs.

Payoffs. The government's payoff is simply the time that the game ends, i.e. the minimum t such that both social groups rebel. That is to say, the government's only incentive is survival. The social groups' payoffs come entirely from successfully ending the game. If the game ends at time t, both social groups divide a fixed prize of V. In particular, they divide V according to their cumulative political power p_{at} and p_{bt} at time t, which is defined earlier. Finally, both social groups have a common instantaneous interest rate r, meaning that they discount payoffs at time t at e^{-rt}. Hence, if the game ends at time $t > 0$, player i's payoff, evaluated at the beginning of the game (i.e. time 0), is $U_i(t) = e^{-rt}V\frac{p_{it}}{t}$. If the game ends at time $t = 0$, player a's payoff is $\frac{V}{2}$ if $I_0 = E$ and $(1 - \beta)V$ if $I_0 = B$. Similarly, player b's payoff is $\frac{V}{2}$ if $I_0 = E$ and βV if $I_0 = B$.

2.2.1 Discussion of Setup

Substantively, the game captures a scenario where the government faces the threat of rebellion from two social groups. The government lacks a mechanism to directly repress a rebellion, but does have the ability to endogenously affect both social groups' payoff should a rebellion succeed. Both social groups have a common interest in rebelling (i.e. end the game) sooner to avoid loss from discounting. But they also have a conflict of interest in dividing the fixed price of V. Conditional on a rebellion happening at time t, both social groups are engaged in a zero-sum situation. The government leverages on the latter dimension by choosing different institutions at different time to alter the relative political power of both social groups, in order to maximize its survival.

As explained earlier, the government lays down a complete institution path all at once at $t = 0$. Importantly, the government does not "play along" by choosing an institution at every instant t. This certainly simplifies the analysis. But this also captures an important feature of the government: full commitment to institutional path. Once the government announces the complete institution path at $t = 0$, it is removed from the game, and both social groups will play the game along the announced institution path, without any player being able to alter it. This means that at any time t, social groups have full certainty about the future institutions, and does not have to make anticipations on what institutions are to come. As will be discussed in Section 2.4, full commitment power gives the government an advantage with regards to survival. In Section 2.4 we will analyze a greatly simplified game where the government actually chooses the institutions as the game progresses. The analysis will show that the government's survival problem is more complicated.

The structure of the game played between both social groups resembles the "simple timing game" (Fudenberg and Tirole [1991], pp. 117), where both players can choose to "stop" or "not to stop" the game at any time t. The difference is that in a simple timing game, any single player stopping at time t stops the entire game, whereas in this game, both social groups need to rebel at time t to end the game. In other words, any single social group is pivotal in moving the game forward, but not pivotal in ending the game.

In this game the way both social groups accumulate political power is not symmetric. Payer a prefers institution E and player b prefers institution B. However, even under institution E, player a only gets to accumulate as much political power as player b, while player b enjoys an absolute advantage under institution B. Hence for the purpose of the analysis, we will call player b the stronger social group and player a the weaker social group. The asymmetry between the two social groups will shape the government's survival strategy in a particular manner, as we will see in the following sections.

2.3 Analysis

To identify equilibria of the game and the government's optimal strategy for maximum survival time, we first analyze both social groups' rebellion decisions given a particular institution path announced by the government. Then we analyze the government's optimal institution path for maximum survival.

2.3.1 Social groups' rebellion decisions

We assume that the social groups play weakly undominated strategies. In other words, we assume that social groups choose whether to rebel as if they are pivotal in ending the game as well. This removes any coordination problem between the two social groups when a rebellion is clearly Pareto optimal. Let U_{it} be player i's payoff if the game ends at time t. The above assumption means that if player i chooses to rebel at time t, she consider her payoff from rebellion to be simply U_{it}, regardless of the other social group's rebellion decision. This brings a simple rebellion rule for both social groups. At time t, if player i conjecture that the game will end at some $t' > t$ if she does not rebel at time t, then she rebels at time t iff $U_{it} > U_{it'}$. Implicit in this rule is that if a social group is indifferent between rebelling at time t or not, she does not rebel, which is a common assumption in similar games.

Lemma 2.1. *Player a rebels for all $t \geq \frac{2\beta-1}{2r(1-\beta)}$, and player b rebels for all $t \geq \frac{2\beta-1}{r}$.*

Corollary. *The game cannot last longer than $T = \frac{2\beta-1}{2r(1-\beta)}$.*

Proof. At time t, player a's payoff from a rebellion is $U_{at} = e^{-rt}V\frac{p_{at}}{t}$. If instead she delays the rebellion by an additional $\Delta t = h$, her payoff from a rebellion at $t+h$ is $U_{a,t+h} = e^{-r(t+h)}V\frac{p_{a,t+h}}{t+h}$. Hence she delays the rebellion if $\frac{U_{a,t+h}}{U_{at}} \geq 1$. $\frac{U_{a,t+h}}{U_{at}} = e^{-rh}\frac{p_{a,t+h}t}{p_{at}(t+h)}$ is bounded from above by the following:

First, $p_{a,t+h} \leq p_{at} + \frac{h}{2}$, since player a can only accumulate $\frac{h}{2}$ units of additional political power in a time period of h. Hence $\frac{U_{a,t+h}}{U_{at}} \leq e^{-rh}\frac{(p_{at}+\frac{h}{2})t}{p_{at}(t+h)}$.

Second, $p_{at} \geq (1-\beta)t$, since player a can at least accumulate $(1-\beta)t$ units of political power up to time t. Hence $\frac{U_{a,t+h}}{U_{at}} \leq e^{-rh} \frac{((1-\beta)t+\frac{h}{2})t}{(1-\beta)t(t+h)} = e^{-rh} \frac{2(1-\beta)t+h}{2(1-\beta)(t+h)}$. Hence if $e^{-rh} \frac{2(1-\beta)t+h}{2(1-\beta)(t+h)} < 1$, player a rebels at time t.

Note that $e^{-rh} \frac{2(1-\beta)t+h}{2(1-\beta)(t+h)}$ decreases in t. Hence for any fixed β and r, there exists a maximum t such that $e^{-rh} \frac{2(1-\beta)t+h}{2(1-\beta)(t+h)} \geq 1$, so that player a is willing to delay the rebellion. Solving $e^{-rh} \frac{2(1-\beta)t+h}{2(1-\beta)(t+h)} = 1$ gives $t^* = \frac{h(2\beta-1)}{2(1-\beta)(e^{hr}-1)} - h$. t^* decreases in h, and $\lim_{h \to 0} t = \frac{2\beta-1}{2r(1-\beta)}$. Hence for all $t > t^*$, delaying the rebellion leads to a lower payoff for player a for sure. Hence she rebels for all $t \geq \frac{2\beta-1}{2r(1-\beta)}$.

The proof that player b rebels for all $t \geq \frac{2\beta-1}{r}$ follows similar arguments.

Since $\beta > \frac{1}{2}$, $\frac{2\beta-1}{2r(1-\beta)} > \frac{2\beta-1}{r}$. Hence for all $t > T = \frac{2\beta-1}{2r(1-\beta)}$, both social groups rebel. Hence the game cannot last longer than T. $\square$

Lemma 2.1 explains an important dynamic of the game between the two social groups. As the game proceeds, both social groups accumulate more and more political power. As their stock of political power increases, any small change in political power due to a slightly delayed rebellion under certain institution becomes less significant compared to discounting. Ultimately, there comes a point where any change in political power is so small that both social groups decide to not delay the rebellion any further. This means that while the government can announce an institution plan for all $t \geq 0$, any announcement regarding $t > T = \frac{2\beta-1}{2r(1-\beta)}$ does not matter, since the social groups will not let the government survive past T anyway.

With Lemmas 2.1 and 2.1, we can characterize the social groups' optimal rebellion decision via an iterative process. To illustrate how this process works, we first give an example where only one player i exists and decides whether to rebel. Then we extend this process to two players.

- Identify the smallest t' such that U_{it} decreases for all $t \geq t'$ for player i. By lemma 2.1 this t' exists and is no greater than $T = \frac{2\beta-1}{2r(1-\beta)}$. Denote this t' as $\underline{t_{e0}}$. Player

i's optimal strategy is to rebel for all $t \geq \underline{t_{e0}}$. This is obvious. From $\underline{t_{e0}}$ onward, her utility decreases with t. Hence she always rebels.

- Identify the smallest $t'' < \underline{t_{e0}}$ such that for all t in $[t'', \underline{t_{e0}})$, $U_{it} \leq U_{i\underline{t_{e0}}}$. This t'' exists, since $\underline{t_{e0}}$ is the smallest t' such that U_{it} decreases for all $t \geq t'$ for player i. This means for small ϵ, U_{it} is non-decreasing for $t \in [\underline{t_{e0}} - \epsilon, \underline{t_{e0}})$. Denote this t'' as $\overline{t_{e1}}$. Player i's optimal strategy for $t \in [\overline{t_{e1}}, \underline{t_{e0}})$ is to not rebel. Substantively. in $t \in [\overline{t_{e1}}, \underline{t_{e0}})$, player i's utility from an immediate rebellion is no higher than her utility from the next conjectured rebellion time, which is $\underline{t_{e0}}$.

- Identify the smallest $t''' < \overline{t_{e1}}$ such that U_{it} decreases for all t in $[t''', \overline{t_{e1}})$ for player i. This t''' exists, since $\overline{t_{e1}}$ is the smallest t'' such that for all t in $[t'', \underline{t_{e0}})$, $U_{it} \leq U_{i\underline{t_{e0}}}$. This means for small ϵ, $U_{it} > U_{i\underline{t_{e0}}}$ and U_{it} decreases in t for $t \in [\overline{t_{e1}} - \epsilon, \overline{t_{e1}})$ for player i. Denote this t''' as $\underline{t_{e1}}$. Player i's optimal strategy is to rebel for all $t \in [\overline{t_{e1}}, \overline{t_{e1}})$. Substantively, for any $t \in [\overline{t_{e1}}, \overline{t_{e1}})$, if player i delays the rebellion, then the next conjectured rebellion always results in a lower payoff.

- Identify $\overline{t_{e(i+1)}}$ based on $\overline{t_{ei}}$ similar to how $\underline{t_{e1}}$ is identified. Player i's optimal strategy for $t \in [\overline{t_{e(i+1)}}, \underline{t_{ei}})$ is to not rebel. Substantively, in $[\overline{t_{e(i+1)}}, \underline{t_{ei}})$, player i delays the rebellion to $\underline{t_{ei}}$.

- Identify $\underline{t_{ei}}$ based on $\overline{t_{ei}}$ similar to how $\underline{t_{e1}}$ is identified. Player i's optimal strategy is to rebel for all $t \in [\underline{t_{ei}}, \overline{t_{ei}})$. Substantively, in $[\underline{t_{ei}}, \overline{t_{ei}})$, delaying the rebellion to the next conjectured time of rebellion leads to lower payoffs for player i.

Figure 2.1 is a hypothetical example. Player i's payoff decreases from $t = 3$ onward. Hence she always rebels from $t = 3$ onward. From $t = 1$ to $t = 3$, her payoff is lower than if she were to rebel at $t = 3$. So she does not rebel between $t = 1$ and $t = 3$. Finally, from $t = 0$ to $t = 1$, her payoff decreases in t, and is higher than if she were to rebel at $t = 3$. So she rebels between $t = 0$ and $t = 1$.

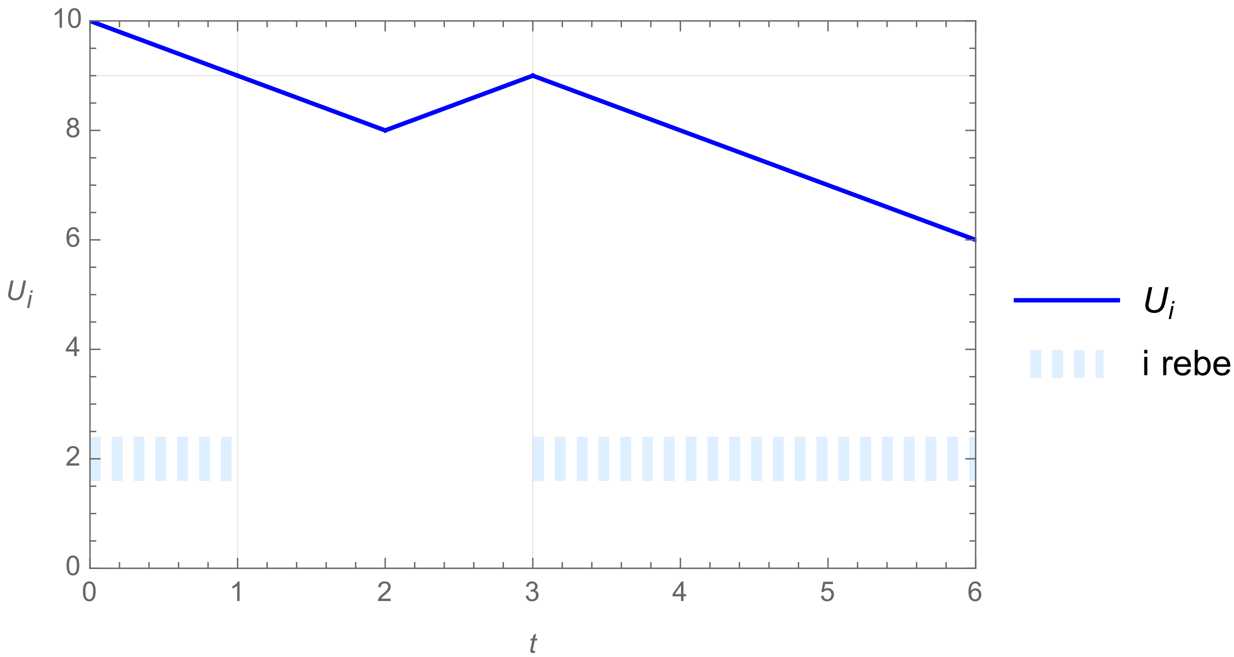

Figure 2.1: player i's payoff and rebellion decisions.

Now we extend this iterative process to two players.

- Identify the smallest t' such that U_{it} decreases for all $t \geq t'$ for both social groups. By lemma 2.1 this t' exists and is no greater than $T = \frac{2\beta-1}{2r(1-\beta)}$. Denote this t' as $\underline{t_{e0}}$. Both social groups' optimal strategy is to rebel for all $t \geq \underline{t_{e0}}$. This is obvious. From $\underline{t_{e0}}$ onward, both social groups' payoff decrease with t, hence they always rebel.

- Identify the smallest $t'' < \underline{t_{e0}}$ such that for all t in $[t'', \underline{t_{e0}})$, at least one player i has $U_{it} \leq U_{i\underline{t_{e0}}}$. This t'' exists, since $\underline{t_{e0}}$ is the smallest t' such that U_{it} decreases for all $t \geq t'$ for both social groups. This means for small ϵ, at least one social group's utility U_{it} is non-decreasing for $t \in [\underline{t_{e0}} - \epsilon, \underline{t_{e0}})$. Denote this t'' as $\overline{t_{e1}}$. Both social groups' optimal strategy for $t \in [\overline{t_{e1}}, \underline{t_{e0}})$ is to rebel iff $U_{it} > U_{i\underline{t_{e0}}}$. Substantively, in $t \in [\overline{t_{e1}}, \underline{t_{e0}})$, both social groups have a conflict of interest regarding whether to rebel now or to delay the rebellion to the next conjectured time point, which is $\underline{t_{e0}}$. In $t \in [\overline{t_{e1}}, \underline{t_{e0}})$, when one social group has $U_{it} > U_{i\underline{t_{e0}}}$ and wants to rebel now, the other social group always have $U_{jt} \leq U_{j\underline{t_{e0}}}$, so a rebellion does not happen until $\underline{t_{e0}}$.

- Identify the smallest $t''' < \overline{t_{e1}}$ such that U_{it} decreases for all t in $[t''', \overline{t_{e1}})$ for both social groups. This t''' exists, since $\overline{t_{e1}}$ is the smallest t'' such that for all t in $[t'', \underline{t_{e0}})$, at least one player i has $U_{it} \leq U_{i\underline{t_{e0}}}$. This means for small ϵ, $U_{it} > U_{i\underline{t_{e0}}}$ and U_{it} decreases in t for $t \in [\overline{t_{e1}} - \epsilon, \overline{t_{e1}})$ for both social groups. Denote this t''' as $\underline{t_{e1}}$. Both social groups' optimal strategy is to rebel for all $t \in [\overline{t_{e1}}, \overline{t_{e1}})$. Substantively, for any $t \in [\overline{t_{e1}}, \overline{t_{e1}})$, if one social group delays the rebellion, then the next conjectured rebellion always results in a lower payoff for both players. Importantly, social groups realize that a rebellion cannot happen in $[\overline{t_{e1}}, \underline{t_{e0}})$, where one social group's payoff may be higher.

- Identify $\overline{t_{e(i+1)}}$ based on $\overline{t_{ei}}$ similar to how $\underline{t_{e1}}$ is identified. Both social groups' optimal strategy for $t \in [\overline{t_{e(i+1)}}, \underline{t_{ei}})$ is to rebel iff $U_{it} > U_{i\underline{t_{ei}}}$. Substantively, in $[\overline{t_{e(i+1)}}, \underline{t_{ei}})$, social groups delay the rebellion to $\underline{t_{ei}}$.

- Identify $\underline{t_{ei}}$ based on $\overline{t_{ei}}$ similar to how $\underline{t_{e1}}$ is identified. Both social group's optimal strategy is to rebel for all $t \in [\underline{t_{ei}}, \overline{t_{ei}})$. Substantively, in $[\underline{t_{ei}}, \overline{t_{ei}})$, delaying the rebellion to the next conjectured time of rebellion leads to lower payoffs for both social groups.

- Repeat the iterative process until no more $\overline{t_{ei}}$ or $\underline{t_{ei}}$ can be identified.

Figure 2.2 is a hypothetical example. Both players' decreases from $t = 4$ onward. Hence both players rebel from $t = 4$ onward. From $t = 2$ to $t = 4$, player a's utility is higher than if she were to rebel at $t = 4$, but player b's utility is lower than that at $t = 4$. Hence from $t = 2$ to $t = 4$, only player a rebels. Player b delays the rebellion to $t = 4$. From $t = 1.5$ to $t = 2$, both player's payoffs decreases in t, and is higher than their respective payoffs if they were to rebel at $t = 4$. Hence both players rebel from $t = 1.5$ to $t = 2$. Finally, from $t = 0$ to $t = 1.5$, player a's utility is higher than if she were to rebel at $t = 1.5$, but player b's utility is lower than that at $t = 1.5$. Hence from $t = 0$ to $t = 1.5$, only player a rebels. Player b delays the rebellion to $t = 1.5$.

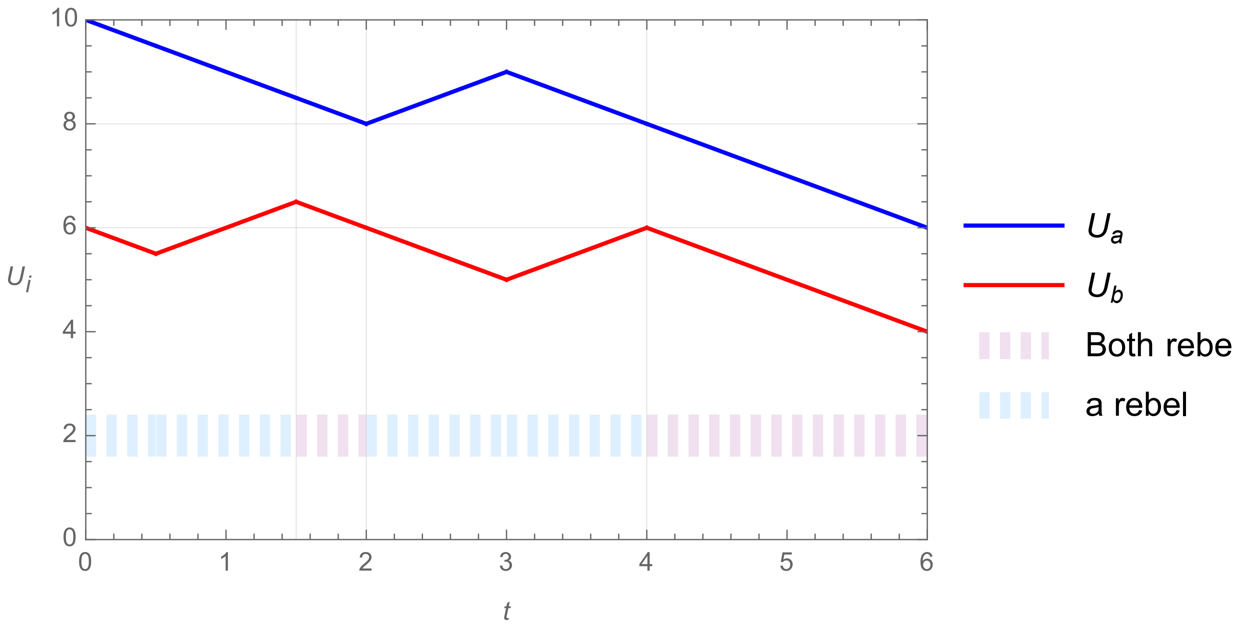

Figure 2.2: Both players' payoff and rebellion decisions.

2.3.2 Institution paths with one transition time point

With the social groups' rebelling decisions characterized, we now turn to the optimal institution path for the government's survival. Before we proceed with formal analysis, we present a rather obvious result:

Proposition 2.1. *The government cannot survive for any positive amount of time $T > 0$ if she only announces an initial institution I_0 without any transition time point (i.e. announces the same institution for all $t \geq 0$).*

The intuition is very obvious. If the government only announces the same institution for all $t \geq 0$, each social group's share of the prize V is fixed, and does not change with time. Hence both social groups' payoff from a rebellion decrease in t due to discounting. Hence both social groups rebel at $t = 0$ to split V at the earliest instance possible.

Proposition 2.1 means that the government cannot survive without introducing some variation in its institution paths. The variation would lead to a change in relative political power along the path, potentially leading social groups to delay a rebellion to a time point where it is relatively more advantageous. In the following sections, we examine how the government should introduce such variations to maximize its survival time. In this section, we show the optimal institution path if the government is restricted to announcing only the initial institution I_0 and one transition time point t. In the next section, we show that the government cannot survive even longer by announcing more transition time points.

Lemma 2.2. *If the government announces an institution path with $I_0 = B$, the optimal transition time point t_1 is the unique solution to a function $f_a(t_1) = 0$. Denote this transition time point as t_a^*. This optimal transition time point allows the government to survive for $T_a^* = t_a^*(\beta - \frac{1}{2}) + \frac{\sqrt{t_a^*(2\beta-1)(4+(2\beta-1)rt_a^*)}}{2\sqrt{r}}$.*

Proof. If the government announces an institution path with $I_0 = B$ and one transition time point t_1, both players' payoffs decrease with t before t_1. This is because before t_1, the institution is fixed at $I_0 = B$. Hence both players accumulate political power at a fixed rate: player a's political power is simply $(1-\beta)t$ and player b's is βt. This means that they receive a fixed share of V (player a receiving $(1-\beta)V$ and player b receiving βV). Hence their payoffs simply decrease with t due to discounting before t_1. Once the game reaches t_1 and the institution changes to E, the situation changes for both players. From t_1 onward, player a's political power as a function of t is now $(1-\beta)t_1 + \frac{t-t_1}{2}$, and player b's is $\beta t_1 + \frac{t-t_1}{2}$. Correspondingly, player a's share of the prize V is now $\frac{(1-\beta)t_1 + \frac{t-t_1}{2}}{t} = \frac{1}{2} + \frac{t_1(\frac{1}{2}-\beta)}{t}$, which now increases in t. Substantively, at any $t \geq t_1$, the incremental rate of player a's power accumulation at t is larger than her cumulative share of power up to t. Hence for player a, delaying the rebellion from $t = 0$ to $t = t_1$ brings no benefit but only loss due to discounting. However delaying the rebellion from $t = t_1$ onward can potentially bring a benefit due to her increased relative political power. On the other hand, similar calculation shows that player b's share of V decreases for $t \geq t_1$. Hence player b always rebels at every t. Hence for a rebellion to not happen for some time after t_1, it must be that player a's utility increases for some t after t_1.

By the proof of Lemma 2.1, the transition time point t_1 must be smaller than $\frac{2\beta-1}{2r(1-\beta)}$. With a transition time point $t_1 < \frac{2\beta-1}{2r(1-\beta)}$ chosen, player a's payoff as a function of t is as follows: For $t \in [0, t_1)$, her payoff is $U_{at} = (1-\beta)Ve^{-rt}$, which decreases in t, and is maximized at $t = 0$ with a value of $(1-\beta)V$. For $t \geq t_1$, her payoff is $U_{at} = \frac{(1-\beta)t_1+\frac{1}{2}(t-t_1)}{t}Ve^{-rt}$, which is concave. For $t_1 < \frac{2\beta-1}{2r(1-\beta)}$, $\frac{(1-\beta)t_1+\frac{1}{2}(t-t_1)}{t}Ve^{-rt}$ increases up to a point $\overline{t_1} = t_1(\beta-\frac{1}{2}) + \frac{\sqrt{t_1(2\beta-1)(4+(2\beta-1)rt_1)}}{2\sqrt{r}}$, and then decreases. Hence player a rebels for all $t \geq \overline{t_1}$. Note that $\overline{t_1}$ increases with t_1.

It remains to have player a not rebel before $\overline{t_1}$. This means for all $t < \overline{t_1}$, we must have $U_{at} \leq U_{a,\overline{t_1}}$. Since U_{at} decreases on $t \in [0, t_1)$ and increases on $t \in [t', \overline{t_1}]$, it suffices to have $U_{a,\overline{t_1}} \geq U_{a0} = (1-\beta)V$. $U_{a,\overline{t_1}} = \frac{(1-\beta)t_1+\frac{1}{2}(\overline{t_1}-t_1)}{\overline{t_1}}Ve^{-r\overline{t_1}}$. Plugging in $\overline{t_1} = t_1(\beta-\frac{1}{2}) + \frac{\sqrt{t_1(2\beta-1)(4+(2\beta-1)rt_1)}}{2\sqrt{r}}$, we have:

$$U_{a,\overline{t_1}} = \frac{(2+rt_1(2\beta-1)-\sqrt{rt_1(2\beta-1)(4+(2\beta-1)rt_1)})e^{\frac{rt_1(1-2\beta)-\sqrt{rt_1(2\beta-1)(4+(2\beta-1)rt_1)}}{2}}}{4}V,$$

which is a function of t_1. Substantively, $U_{a,\overline{t_1}}$ is the maximum payoff player a can receive if $I_0 = B$ and the transition time point is set at t_1. Since player a rebels for all $t \geq \overline{t_1}$, and $\overline{t_1}$ increases with t_1, we need to identify the largest t_1 such that $U_{a,\overline{t_1}} \geq 1-\beta$.

Let $f_a(t_1) = \frac{U_{a,\overline{t_1}}-(1-\beta)V}{V}$. We have $\lim_{t_1\to 0} f_a(t_1) = \frac{1}{2}+\beta-1 > 0$, and $f_a'(t_1) < 0$ for all t_1. Hence $f_a(t_1) = 0$ has a unique solution t_a^*. In other words, t_a^* is the largest t_1 such that $U_{a,\overline{t_1}} \geq 1-\beta$. Plugging $t_1 = t_a^*$ into $\overline{t_1} = t_1(\beta-\frac{1}{2}) + \frac{\sqrt{t_1(2\beta-1)(4+(2\beta-1)rt_1)}}{2\sqrt{r}}$, we have the government's maximum survival time $T_a^* = t_a^*(\beta-\frac{1}{2}) + \frac{\sqrt{t_a^*(2\beta-1)(4+(2\beta-1)rt_a^*)}}{2\sqrt{r}}$. $\square$

Figure 2.3 graphically shows the intuition behind Lemma 2.2. In each panel, the red horizontal line indicates $(1-\beta)V$, player a's payoff from an immediate rebellion. The blue curve shows player a's payoff along the institution paths with different transition time points. The black vertical line indicates the length of government survival. As can be seen in all panels, her payoff decreases from the beginning of the path to the transition time point, and then increases to a peak, before decreasing again. Since player a will never proceed along

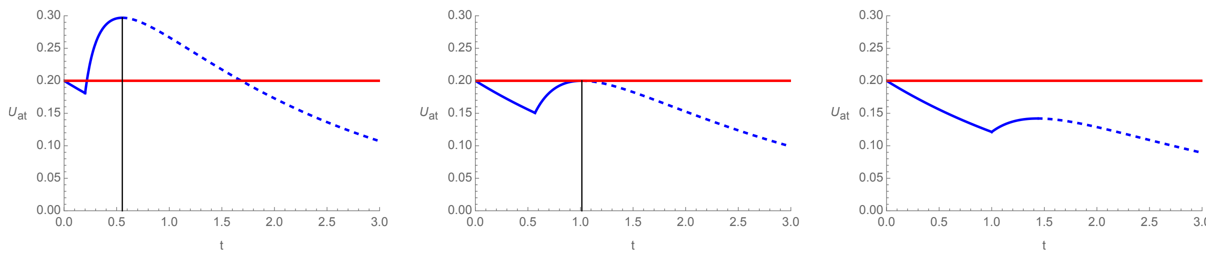

Figure 2.3: Player a's payoff on institution paths with different transition time points.
In this figure $\beta = 0.8$ and $r = 0.5$.
Left: Transition time point set too early, player a satiated too early.
Middle: Optimal transition time point.
Right: Transition time point set too late, player a does not have enough improvement.

the institution path past the peak after the transition time point, her payoff after the peak is plotted in dashed line. Besides, her payoff at the peak must be at least as high as the red horizontal line, i.e. her payoff at the beginning of the path. In the left panel, the transition time point is set too early. While this ensures that player a's payoff quickly increases past the red horizontal line, an early transition time point also leads to an early peak, which gives the government a short survival time. In the right panel, the transition time point is set too late, so that even though player a's payoff indeed increases after the transition point, it is not able to reach the red horizontal line. In this case, player a rebels immediately. In the middle panel, the optimal transition time point is chosen. The increase in player a's payoff after the transition time point is just enough to make her indifferent between rebelling immediately and rebelling at the peak.

Lemma 2.2 identifies the optimal transition time point t_a^* that leverages on player a's decision to delay a rebellion. Similarly, we can construct an institution path with $I_0 = E$ and a transition time point t_1 that appeals to player b. Lemma 2.3 characterizes such an optimal institution path.

Lemma 2.3. *If the government announces an institution path with $I_0 = E$, the optimal transition time point t_1 is the unique solution to a function $f_b(t_1) = 0$. Denote this transition time point as t_b^*. This optimal transition time point allows the government to survive for*

$T_b^* = \frac{t_b^*(2\beta-1)}{4\beta} + \frac{\sqrt{t_b^*(2\beta-1)(8\beta+(2\beta-1)rt_b^*)}}{4\beta\sqrt{r}}.$

Proof. Analogous to the proof of Lemma 2.2. □

Now that we have two institution paths with one transition time point, starting with $I_0 = B$ and $I_0 = E$ respectively, which should the government choose? Proposition 2.2 states that the institution path starting with $I_0 = B$ gives the government a longer time of survival.

Proposition 2.2. *If the government can only choose institution paths that has one transition time point, the optimal institution path has $I_0 = B$ and transition time point at t_a^*. This leads to a survival time of T_a^*.*

Proof. First, note that $\lim_{t_1 \to 0} f_a(t_1) = \lim_{t_1 \to 0} f_b(t_1) = \beta - \frac{1}{2}$. Then, note that both $f_a(t_1)$ and $f_b(t_1)$ is a specific form of the following function:

$$f(t_1, x) = \frac{(x+rt_1(2\beta-1)-\sqrt{rt_1(2\beta-1)(2x+(2\beta-1)rt_1)})e^{\frac{rt_1(1-2\beta)-\sqrt{rt_1(2\beta-1)(2x+(2\beta-1)rt_1)}}{x}}}{4} + \frac{x}{4} - 1.$$

If $x = 2$, $f(t_1, x) = f_a(t_1)$. If $x = 4\beta$, $f(t_1, x) = f_b(t_1)$. We have $\frac{\partial^2 f(t_1,x)}{\partial t_1 \partial x} < 0$. Since $4\beta > 2$, this means $f_b'(t_1) < f_a'(t_1)$ for all $t_1 > 0$. Since t_i^* is the unique solution to $f_i(t_1) = 0$, we have $t_b^* < t_a^*$, i.e. the institution path with $I_0 = E$ has an earlier transition time point.

Similarly, note that both T_a^* and T_b^* is a specific form of the following function:

$$T_i^*(t_i^*, x) = \frac{t_i^*(2\beta-1)}{x} + \frac{\sqrt{t_a^*(2\beta-1)(2x+(2\beta-1)rt_a^*)}}{x\sqrt{r}}.$$

If $x = 2$ and $i = a$, $T_i^*(t_i^*, x) = T_a^*$. If $x = 4\beta$ and $i = b$, $T_i^*(t_i^*, x) = T_b^*$. We have $\frac{\partial T_i^*(t_i^*,x)}{\partial x} < 0$. Since $4\beta > 2$, this means $T_b^* < T_a^*$ if $t_a^* = t_b^*$. However the previous paragraph shows that $t_b^* < t_a^*$. Furthermore, T_i^* increases with t_i^*. Hence we have $T_b^* < T_a^*$. □

Both institution paths described in Lemmas 2.2 and 2.3 involve one transition time point, but appeals to a different social group. Recall that in Section 2.2.1 we call player a the weaker social group due to her never having an absolute advantage over player b under any institution. Her weakness makes her a better target to appeal for the government, since she is more willing to delay a rebellion to wait for beneficial institution changes. Hence we come to an important takeaway: Institution paths that benefits the weaker social group in the future is better for the government's survival.

2.3.3 Institution paths with more than one transition time points

In the previous section the government is restricted to announce institution paths with only one transition time point. In this section, we examine whether the government can survive longer than T_a^* by announcing institution paths with more than one transition time points.

We first present a result that simplifies our analysis.

Lemma 2.4. *If the government announces more than one transition time points t_1, t_2 ... t_n, its survival time T cannot be in any interval $(t_{2i}, t_{2i+1}]$ for $i \in \mathbb{N}^+$. In other words, there must be an odd number of transition time points between $t = 0$ and the government's survival time T ($t_{2i} = T$ is allowed).*

Proof. Without loss of generality, let $I_0 = B$. The argument for $I_0 = E$ is analogous.

Assume that given an announcement of transition time points t_1, t_2 ... t_n, the government's survival time T falls in $(t_{2i}, t_{2i+1}]$ for some $i \in \mathbb{N}^+$.

We have that along this institution path, $\lim_{t\to 0} \frac{p_{at}}{t} = 1-\beta$, since the institution path begins with $I_0 = B$. We also have that at the time where the rebellion happens, i.e. at the survival time T, $\frac{p_{aT}}{T} = v_a > 1-\beta$, since during $t \in [t_{2i-1}, t_{2i})$ the institution is E, which allows player a to accumulate relatively more political power. We also have that for $t \in [t_{2i}, T]$, $\frac{p_{at}}{t}$ decrease in t, since during $t \in [t_{2i}, T]$ the institution is B (the institution is B after each even transition time point). This means that $\frac{p_{a,t_{2i}}}{t_{2i}} > v_a$. Since $\frac{p_{at}}{t}$ is continuous in t, there must exist a $t' < t_{2i}$ such that $\frac{p_{a,t'}}{t'} = v_a$. This is to say, a rebellion at t' gives player a (and player b) the same share of V as does a rebellion at T. Hence both social groups' payoff at t' is strictly higher than at T, meaning that they will rebel at t', preventing the government from surviving to T. $\square$

Lemma 2.4 means that if the government announces more than one transition time points, the institution immediately before the survival time T must be different from I_0. If instead the institution immediately before the survival time T is the same as I_0, then there must be a point $t' < T$ on the institution path where both social groups divide V the same way as they would do at T. This leads to an early rebellion at t' rather than at T. Hence, if the government announces more than one transition time points, the survival time T must fall in $(t_{2i-1}, t_{2i}]$ for some $i \in \mathbb{N}^+$. Figure 2.4 shows an example. This figure shows player a's share of V, i.e. $\frac{p_{at}}{t}$, under the following hypothetical institution path: $I_0 = B$ from $t = 0$ to $t = 1$, $I = E$ from $t = 1$ to $t = 2$, and $I = B$ from $t = 2$ to $t = 3$. We can see that at the end of this hypothetical institution path, player a's share of V is $\frac{11}{30}$. However, at $t = 1.5$, her share of V is also $\frac{11}{30}$. If both players rebel at $t = 1.5$, they will receive the same share of V as they will at $t = 3$, but receive a much higher utility due to less discounting. Hence the government cannot survive till $t = 3$ in this institution path, where the ending institution is the same as the initial institution.

With this knowledge, we present the final major result.

Proposition 2.3. *If the government announces more than one transitional time points t_1, t_2 ... t_n, its survival time T cannot be both in $(t_{2i-1}, t_{2i}]$ for some $i \in \mathbb{N}^+$ and be larger than T_a^* from Lemma 2.2 and Proposition 2.2. This is to say, the government cannot survive for $T > T_a^*$ by announcing an institution path with more than one transition time points.*

Proof. Without loss of generality, let $I_0 = B$. The argument for $I_0 = E$ is analogous.

Assume that given an announcement of transition time points t_1, t_2 ... t_n, the government's survival time T falls in $(t_{2i-1}, t_{2i}]$ for some $i \in \mathbb{N}^+$, and is larger than T_a^*. Denote $t' = \int_0^T \mathbb{1}\{g(t) = B\}$. By Lemma 2.1, the government's survival time $T < \frac{2\beta-1}{2r(1-\beta)}$, so

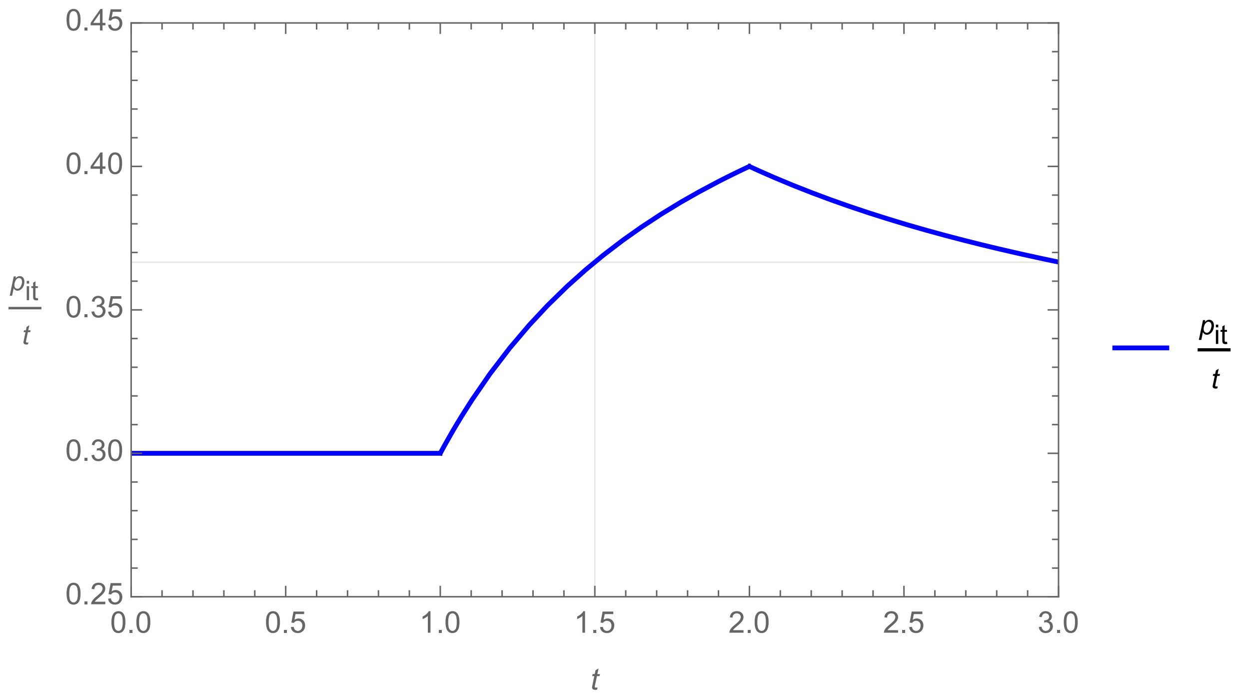

Figure 2.4: Player a's share of V, i.e. $\frac{p_{at}}{t}$.

$t' < \frac{2\beta-1}{2r(1-\beta)}$. Substantively, t' is the total amount of time along the institution path where the institution is B. Notably, since $T \in (t_{2i-1}, t_{2i}]$, i.e. the institution immediately before the rebellion is E, a marginal change in t within the interval $(t_{2i-1}, T]$ does not change the value of t'. Hence t' is not a function of t in this interval.

We have that for player b, $U_{b0} = \beta V$, and $U_{bT} = \frac{\beta t' + \frac{1}{2}(T-t')}{T} V e^{-rT} < U_{b0}$. Hence player b rebels at $t = 0$. Besides, for $t \in [t_{2i-1}, T)$, $U_{bt} = \frac{\beta t' + \frac{1}{2}(t-t')}{t} V e^{-rt}$. Since t' is not a function of t in this interval, we can treat t' as fixed and U_{bt} as a univariate function of t. Clearly for $t \in [t_{2i-1}, T)$, U_{bt} decreases in t, since player b must endure her less preferred institution E in this interval. Hence player b rebels for all $t \in [t_{2i-1}, T)$. Hence in order for the government to survive to T, we must satisfy two necessary conditions: i) player a does not rebel at $t = 0$, and ii) she does not rebel for all $t \in [t_{2i-1}, T)$.

We have that for player a, $U_{a0} = (1-\beta)V$, and $U_{at} = \frac{(1-\beta)t' + \frac{1}{2}(t-t')}{t} V e^{-rt}$ for $t \in [t_{2i-1}, T)$. Again, the latter can be treated as a univariate function of t. To satisfy the two necessary conditions, we must have i) $U_{at} \geq U_{a0}$ at $t = T$, and ii) U_{at} is non-decreasing for for $t \in [t_{2i-1}, T)$. This brings us to a situation similar to the proof of Lemma 2.2. With $t' < \frac{2\beta-1}{2r(1-\beta)}$, U_{at} is concave in t, and increases up to a point $\overline{t'} = t'(\beta - \frac{1}{2}) + \frac{\sqrt{t'(2\beta-1)(4+(2\beta-1)rt')}}{2\sqrt{r}}$. So for ii) to hold, i.e. for U_{at} to be non-decreasing for $t \in [t_{2i-1}, T)$, the maximum survival time T can only be as large as $\overline{t'}$. Note that $\overline{t'}$ as a function of t' has the exact same functional form as T_a^* as a function of t_a^* in Lemma 2.2. Hence if the government were to survive for $T > T_a^*$, we must have $\overline{t'} > T_a^*$, meaning $t' > t_a^*$. In other words, in an institution path with $I_0 = B$ and more than one transition time points, the cumulative time of institution B must be higher than t_a^*. However, similar steps as in the proof of Lemma 2.2 shows that if $t' > t_a^*$, $U_{a,\overline{t'}} < U_{a0} = (1-\beta)V$. This means that player a rebels at $t = 0$. This means if a $T > T_a^*$ satisfies condition ii), it must violate condition i). Hence the two necessary conditions for a survival time $T > T_a^*$ under an institution path with more than one transition points cannot hold simultaneously. Hence the government cannot survive for $T > T_a^*$ by announcing an institution path with more than one transition time points. $\square$

Proposition 2.3 show that the government cannot survive for any longer by announcing more than one transition time points. Hence the optimal institution path for the government's survival is the one described in Proposition 2.2.

Why institution paths with more than one transition time points cannot bring the government a longer survival time? Lemma 2.4 already showed that institution paths that involve an even number of transition time points before the survival time cannot achieve its intended survival time, because there exists a point halfway on the path where both social groups get to split V exactly the same as they would at the end. For institution paths that involve an odd number of transition time points before the survival time, the proof of proposition 2.3 shows that at the very beginning of the path and towards the very end of the path, both social groups face the same incentive constraints as they face in an institution path with with only one transition point. In the one-transition path, satisfying these incentive constraints gives a survival time of T_a^*. Hence in multiple-transition paths, satisfying these same incentive constraints cannot give a longer survival time. Furthermore, one-transition paths are structurally very simple, such that the incentive constraints at the very beginning and the very end of the path are not only necessary but also sufficient conditions for survival. This is not necessarily the case for multiple-transition paths.

2.4 The Role of Commitment

Section 2.2.1 briefly discusses that the game describes a government who can fully commit to an institution path by setting the entire path at the beginning of the game and quit. In this section we explicitly examine the consequence of commitment, by building a simple discrete-time 3-period model that is analogous to the main model, with a twist that the government instead chooses an institution per period.

Setup and Timing. We build a 3-period model with the same 3 players: The *G*overnment, player a and player b. In each period that G is alive, it chooses between two institutions: *E*galitarian and *B*iased. After G chooses the institution, player a and b independently decide whether to rebel against the government. A rebellion succeeds if and only if both social groups rebel. If the rebellion succeeds, the game ends. Otherwise the game proceeds to the next period.

Payoff. The government's payoff is simply the number of periods that it survives. The social groups' payoffs come entirely from a successful rebellion. If a rebellion succeeds, both social groups divide a fixed prize of V. In particular, they divide V according to their cumulative "political power" up to the point of the rebellion, which we will discuss immediately. Finally, both social groups have a common discount factor δ.

In each period, both social groups accumulate political power that is affected by the institution that the government chooses. Denote p_{it} as player i's political power in period t after the government has chosen an institution. The political power of social groups evolves in the following way: First, $p_{i0} = 0$, that is, at the beginning of the game, both social groups have 0 political power. Second, if the government chooses the Egalitarian institution in period t, then $p_{it} = p_{it-1} + \frac{1}{2}$ for both social groups, as the name of the institution "egalitarian" suggests. Third, if the government chooses the Biased institution in period t, then $p_{bt} = p_{bt-1} + \beta$, where $\frac{1}{2} < \beta \leq 1$, and $p_{at} = p_{at-1} + 1 - \beta$. That is, player b accumulates more political power under the biased institution. Hence, If a rebellion succeeds in period t, player i's payoff is simply $\frac{p_{it}}{p_{at}+p_{bt}} V = \frac{p_{it}}{t} V$.

Strategies and equilibrium concept. Since this is a game with complete information, the solution concept is of course SPNE. The strategy for the government is a 7-tuple $\sigma_G = \{I_\emptyset, I_E, I_B, I_{EE}, ..., I_{BB}\}$, where $I_h \in \{E, B\}$ indicates the government's choice of institution at history h. Similarly, the strategy for player $i \in \{a, b\}$ is a 14-tuple

$$\sigma_i = \{r_{i,E}, r_{i,B}, r_{i,EE}, ..., r_{i,BB}, r_{i,EEE}, ..., r_{i,BBB}\},$$

where $r_{i,h} \in \{0, 1\}$ is player i's rebellion decision at history h, with 0 being not rebel and 1 being rebel.

Proposition 2.4. *If* $\delta \geq \sqrt{\frac{6(1-\beta)}{4(1-\beta)+1}}$, *the game has an SPNE where the government survives for 3 periods. The equilibrium institution path for this SPNE is* BBE. *If* $\delta < \frac{3(1+2\beta)}{2(1+4\beta)}$, *the game has an SPNE where the government survives for 1 period. The equilibrium institution path for this SPNE is* B. *Specifically,* $\frac{3(1+2\beta)}{2(1+4\beta)} > \sqrt{\frac{6(1-\beta)}{4(1-\beta)+1}}$. *So for* $\sqrt{\frac{6(1-\beta)}{4(1-\beta)+1}} \leq \delta < \frac{3(1+2\beta)}{2(1+4\beta)}$, *the game has multiple SPNE where the government survives for different amount of periods, but both starting with* B.

Proof. See appendix. □

Proposition 2.4 shows that when the government cannot commit to an institution path at the beginning of the game, maximum survival is not guaranteed even if it is possible. If $\sqrt{\frac{6(1-\beta)}{4(1-\beta)+1}} \leq \delta < \frac{3(1+2\beta)}{2(1+4\beta)}$, even if the government chooses B in period 1, the social groups may not be convinced that the government will indeed choose BE to follow through. And indeed the government is indifferent in period 3 between E and B. If the social groups believe that the government will choose BB to follow B (together with off-equilibrium conjectures), the game will end in a one-period equilibrium, even if $\delta \geq \sqrt{\frac{6(1-\beta)}{4(1-\beta)+1}}$. However, if the government sets the institution path BBE at the beginning of the game and then simply quit, letting the social groups to play along, the government can guarantee surviving through period 3 as long as $\delta \geq \sqrt{\frac{6(1-\beta)}{4(1-\beta)+1}}$. Hence the lack of commitment proves to be an obstacle for the government to achieve maximum survival.

2.5 Conclusions

Our paper analyzes scenarios where the government faces survival threats from multiple challengers, who suffer from conflicts of interests over the distribution of post-rebellion benefits. We show that when the distribution of post-rebellion benefits is affected by pre-rebellion policies and institutions chosen by the current government, the government can strategically choose policies and institutions that leverages on such conflict to ensure survival. Specifically, the government should first identify the weaker challenger, who suffers from a larger disadvantage (or smaller advantage) under various institutions. Then, the government should choose an institution path that starts with the weaker challenger's less preferred institution, and then switch to her preferred institution at the optimal transition time point. The optimal transition time point is chosen so that the weaker challenger is not satiated too early, nor does she accumulate too much disadvantage to recover from. More complicated institution paths involving multiple transition time points cannot lengthen the government's survival. Finally, the government needs to be able to commit to the optimal institution path to ensure its survival.

Our paper opens some interesting routes for future work, specifically on the role of commitment. As discussed section 2.4, when the government cannot pre-commit to an institution path, but has to choose institutions along different time points, maximum survival is not guaranteed, as manifested in the multiple equilibria of the model. Yet this is exactly how governments choose institutions and policies in real world: They do it in real time rather than all at once. Without the ability to pre-commit to an institution path, how can the government "convince" the challengers to coordinate on the "correct" equilibrium becomes important. As a wealth of studies have shown, governments often use propaganda to compliment other mechanisms to ensure its survival, often via signaling (or signal-jamming) about its strength. Whether the government can use propaganda to signal its future institution choices is a natural path to follow our paper.

2.6 Appendix

Proof of Proposition 2.4 As in the main model, we assume that social groups play weakly undominated strategies. This means both social groups rebel at the end of period 3 regardless of histories. Hence the social groups' strategies can be simplified to a 6-tuple

$$\sigma_i = \{r_{i,E}, r_{i,B}, r_{i,EE}, ..., r_{i,BB}\}.$$

We also assume that a social group does not rebel if she is indifferent.

Consider an SPNE of the 3-period game where the government survives for 3 periods, with the equilibrium institution path being BBE. In this equilibrium we know 3 arguments of the government's strategy σ_G, which is $I_\emptyset = B$, $I_B = B$ and $I_{BB} = E$. Similarly, we can pin down 2 arguments of each social group's strategy σ_i, which is $r_{a,B} = r_{a,BB} = 0$, $r_{b,B} = r_{b,BB} = 1$. This is quite intuitive. Along the conjectured equilibrium path BBE, player a's relative political power increases, hence she is the only social group who has an incentive to delay a rebellion. In the following paragraphs, we first identify the conditions for player a to not rebel on the conjectured equilibrium institution path. Then we show that the no additional conditions off the equilibrium path is required for this SPNE to exist.

On the conjectured equilibrium path, if player a rebels in period 1, her payoff is $(1-\beta)V$.

If she rebels in period 2, her payoff is $(1-\beta)\delta V < (1-\beta)V$. If she rebels in period 3, her payoff is $\frac{2(1-\beta)+\frac{1}{2}}{3}\delta^2 V$, which is no less than $(1-\beta)V$ if $\delta \geq \sqrt{\frac{6(1-\beta)}{4(1-\beta)+1}}$.

If $\delta \geq \sqrt{\frac{6(1-\beta)}{4(1-\beta)+1}}$, player a has $r_{a,B} = r_{a,BB} = 0$. This means that if the government's strategy involves $I_\emptyset = B$, $I_B = B$ and $I_{BB} = E$, she can survive for 3 periods, earning the maximum payoff possible in the game. Importantly, no matter what strategies the players choose off the equilibrium path (i.e. $\{I_{BE}, I_E, I_{EB}, I_{EE}\}$ for the government, and $\{r_{i,BE}, r_{i,E}, r_{i,EB}, r_{i,EE}\}$ for the social groups), the government cannot increase her payoff by deviating from the equilibrium path. Hence $\delta \geq \sqrt{\frac{6(1-\beta)}{4(1-\beta)+1}}$ is the necessary and sufficient condition for an SPNE where the government survives for 3 periods, with the equilibrium institution path being BBE.

Now we construct an SPNE where the government only survives for 1 period, with the equilibrium institution path being B, and show that this equilibrium exists for $\delta < \frac{3(1+2\beta)}{2(1+4\beta)}$. The conjectured SPNE is:

$$\sigma_G\text{: } I_\emptyset = I_B = I_{BB} = I_{BE} = I_{EB} = B,\ I_E = I_{EE} = E.$$
$$\sigma_i\text{: } r_{i,B} = r_{i,E} = r_{i,BB} = r_{i,BE} = r_{i,EB} = r_{i,EE} = 1 \text{ for } i = a, b.$$

We check that this is indeed an SPNE by backward induction. Consider the history at period 2 where the institution path thus far is BB. The equilibrium conjectures that the government should choose B in period 3 if no rebellion happens in period 2. Clearly there is no reason for both social groups to delay for another period of B, since the previous institutions has been B only. Hence $r_{i,BB} = 1$ for both social groups. Similarly, $r_{i,EE} = 1$ for both social groups.

Then consider the history at period 2 where the institution path thus far is BE. The equilibrium conjectures that the government should choose B in period 3 if no rebellion happens in period 2. Anticipating B in period 3, player a rebels for sure in period 2, i.e. $r_{a,BE} = 1$. Only player b may have an incentive to delay for another period of B after BE. If she delays the rebellion, her payoff is $\frac{2\beta+\frac{1}{2}}{3}\delta^2 V$. If she rebels in period 2, her payoff is

$\frac{\beta+\frac{1}{2}}{2}\delta V$. She rebels in period 2, i.e. $r_{b,BE} = 1$, if $\delta < \frac{3(1+2\beta)}{2(1+4\beta)}$. Similarly, $r_{a,EB} = 1$, and $r_{b,EB} = 1$ if $\delta < \frac{3(1+2\beta)}{2(1+4\beta)}$.

Finally consider the history at period 1 where the institution path thus far is B. The equilibrium conjectures that the government should choose B in period 2, followed by a rebellion, as stated in the previous proof. Clearly there is no reason for both social groups to delay for another period of B, since the previous institutions has been B only. Hence $r_{i,B} = 1$ for both social groups. Similarly, $r_{i,E} = 1$ for both social groups.

Hence if $\delta < \frac{3(1+2\beta)}{2(1+4\beta)}$, the conjectured SPNE exists, where the government only survives for 1 period, with the equilibrium institution path being B.

CHAPTER 3

LONG-TERM RELATIONSHIPS AND CORRUPTION

3.1 Introduction

Bureaucrats engage in corruption in many ways. Sometimes they engage in a *quid pro quo*, exchanging policy services for private benefits on an ad hoc basis. Other times they engage their clients in more long-term relationships to facilitate corruption. Examples of the latter include having firms hire the relative of a bureaucrat (Szakonyi [2019]), bureaucrats holding shares in businesses (Jia and Nie [2017]), and preferential treatments of co-ethnics (Seim and Robinson [2019]). What are the effects of long-term corruption relationships versus *quid pro quo* corruption, and why do politicians not regulate them in some political settings?

Bureaucrats face varying probabilities of being able to engage in corruption over time. Engaging in corruption requires the bureaucrats and their clients to solve commitment and enforcement problems, since corruption is ultimately not contractable. However the ability of the bureaucrat and their clients to solve such problems may change. So bureaucrats face uncertainty about the ease of corruption in the future. Long-term relationships help guard the bureaucrats against the possibilities that corruption is harder to facilitate in the future. Hence when faced with corruption opportunities at present, bureaucrats have an incentive to "lock in" those opportunities, using long-term relationships to guarantee future benefits. This means that long-term corruption relationships can increase the payoff of the bureaucrats from corruption due to more certain future payoff. However this also reduces the payoff of the citizens since they will have to transfer more to the bureaucrats. Hence, absent other effects, benevolent politicians should implement policies that void such corrupt long-term relationships, so as to increase social welfare. Such policies can include shuffling the locations and positions of bureaucrats regularly, or audits that uncover unusual employment and share-holding behaviors involving bureaucrats.

However, in many institutional settings, corruption not only serves as a transfer from citizens to the bureaucrats, but also plays a role in the production and allocation of publicly provided goods and services. Clients involved in corruption have preferential access to these goods and services, which could potentially be distributed to others absent corruption. Depending on how much the clients value the goods and services compared to the rest of the society, corruption may increase or decrease the efficiency of distribution of such goods and services. If, for exogenous reasons, corruption directs such goods and services to those with higher valuations for them, a positive distribution effect may outweigh the loss of social welfare due to excessive bribes In such a case, even a benevolent politician wants to preserve corruption should it happen. In this case, long-term corruption relationships actually increase social welfare versus *quid pro quo* by preserving the more efficient distribution. Under *quid pro quo*, the clients who seeks access to goods and services may not be the same from time to time, and their valuation of such goods and services also vary. Hence, long-term corruption relationships, which is ex-ante welfare reducing due to excessive bribes, can be interim welfare enhancing with the realization of its distribution effect, where benevolent politicians no longer want to limit them.

This paper relates to the literature about elections and bureaucratic behaviors. Gehlbach and Simpser [2015] discuss situations where a politician's electoral performance hinges on the bureaucracy exerting effort to deliver public goods, leading the politician to manipulate the election, creating a popular image to incentivize the bureaucracy to exert effort. Similarly, Klašnja and Pop-Eleches [2022] discuss why anticorruption efforts may backfire in developing democracies, leading the corrupt elites to engage in electoral manipulation in order to curb anticorruption efforts. This paper discusses a somewhat similar situation where politicians compete over policy delivery, which is mediated by the (corruptive) behaviors of the bureaucrats.

This paper also relates to the discussion of bureaucratic "frictions", where governments strategically introduce inefficiencies in bureaucracies for political purposes. Chan and Fan [2021] use the example of China to explain that authoritarian leaders introduce friction in bureaucracies to to hinder bureaucratic coordination independent of the government's top-down control, systematically appointing bureaucrats to unfamiliar working environments. However, regions where such frictions create the most inefficiencies also see the most direct intervention from the government. This paper discusses a similar tradeoff of the government when regulation corruption (which is a form of friction). The government trades off between the loss from corruption without such friction and the loss of efficient provision of goods and services due to the friction.

This paper is organized as follows: Section 3.2 sets up the main model. Section 3.3 presents the main analysis and results. Section 3.4 concludes.

3.2 Model

Setup. I consider a two-period model with two politicians, a bureaucrat and a continuum of citizens with mass 1. In each period, the society has a stock of publicly provided private goods with mass $\frac{1}{2}$ to be distributed to citizens by the bureaucrat. Citizen i derives a payoff of y_i if she receives one unit of goods, and 0 otherwise. Half of the citizens have $y_i = \underline{y}$, and the other half of the citizens have $y_i = \overline{y} > \underline{y}$.

The goods is distributed to citizens via two channels. In each period t, a share $\beta_t < \frac{1}{2}$ get access to the bureaucrat, and are guaranteed a unit each of goods. The bureaucrat is corrupt, and collects a bribe $b < \underline{y}$ from these citizens. All other citizens (with mass $1 - \beta_t$) have an equal probability of receiving a unit of the remaining goods (with mass $\frac{1}{2} - \beta_t$). All citizens have the same probability of having access to the bureaucrat (with the exception of citizens engaged in implicit contracts, to be defined soon). However, in each period t, the "ease" of accessing the bureaucrat β_t can take one of two values with equal probability: $\underline{\beta}$ and $\overline{\beta} > \underline{\beta}$. The value of β captures how the exogenous environment facilitates corruption.

For example, a higher β can indicate that the bureaucrat has more intimate knowledge about the citizens (due to shared ethnicity or long service experience), and hence can better solve the commitment problems involved in exchanging bribe for goods.

In period 1, the bureaucrat can choose to offer one of two kinds of "corruption deals" to citizens with access to her. To simplify the analysis, I assume that she offers the same deal to all citizens. The first deal is a one-off transaction, where the bureaucrat allocates 1 unit of goods to the citizen in exchange for a bribe b in the first period only. In this case, the citizen is not guaranteed to have access to the bureaucrat in period 2. Rather, she simply has a probability of β_2 of having access to the bureaucrat, in which case she receives the goods for a bribe b via another one-off deal. The second deal is a two-period transaction, hereafter named "implicit contract". In an implicit contract, the bureaucrat allocates 1 unit of goods to the citizen in both periods, and the citizen pays b in both periods. In other words, in period 2, the β_1 citizens who are already engaged in an implicit contract are guaranteed to receive the goods for a bribe b, regardless of the realization of β_2.

In between period 1 and 2, two politicians A and B compete in an election. All the citizens, but not the bureaucrat, vote in the election. Each politician can announce one of the following two policies: To ban all the implicit contracts or not. If a politician does not ban the implicit contracts, all citizen in period 1 who are already engaged in an implicit contract is guaranteed to receive their goods in period 2. Furthermore, if in period 2 $\beta_2 > \beta_1$, (i.e. $\beta_2 = \overline{\beta}$ and $\beta_1 = \underline{\beta}$), then an additional $\overline{\beta} - \underline{\beta}$ citizens are granted access to the bureaucrat in period 2, and are guaranteed to receive a unit of goods for a bribe b via one-off deals. If a politician bans the implicit contracts, all citizens in period 2 returns to the scenario where they have the same probability β_2 of having access to the bureaucrat with one-off deals, regardless of whether they are engaged in an implicit contract in period 1 or not. Substantively, we can think of banning the implicit contracts as a measure to reduce collusion between the bureaucrats and the citizens, such as shuffling bureaucrats to different localities or positions, so that they are less familiar with the citizens.

Payoffs. A citizen's utility comes entirely from being allocated a unit of goods, which she values at $y_i \in \{\underline{y}, \overline{y}\}$, and having to pay the bribe b. To capture her voting decision during the election, denote $U_i(A)$ as citizen i's utility in period 2 if the she elects politician A, and $U_i(B)$ similarly. i votes for A if:

$$U_i(A) - U_i(B) - \phi_i - \theta \geq 0$$

where $\phi_i \sim U[-\frac{1}{2s}, \frac{1}{2s}]$ is an individual-specific shock, and $\theta \sim U[-\frac{1}{2h}, \frac{1}{2h}]$ is a common shock for the entire population. The bureaucrat's utility comes entirely from collecting the bribe b. Both politicians are office-motivated only, and hence maximizes the probability of winning. Players do not discount payoffs in period 2.

Timing. At the beginning of period 1, nature reveals the value of $\beta_1 \in \{\underline{\beta}, \overline{\beta}\}$ and randomly picks β_1 citizens to grant access to the bureaucrat. All players observe β_1, as well as the share of the β_1 citizens who derives a higher value (i.e. $y_i = \overline{y}$) from the goods. Denote this share as α. Then, the bureaucrat and the two politicians simultaneously take actions. The bureaucrat decides whether to offer a one-off deal or to offer an implicit contract. Both politicians decide whether to ban the implicit contracts in period 2. After these players take their actions, payoffs for the bureaucrat and all citizens in period 1 are realized. Finally, the citizens vote between the two politicians. The winner assumes office and the game proceeds to period 2.

At the beginning of period 2, nature reveals the value of β_2. If the bureaucrat has offered implicit contracts in period 1, and the winner in period 2 does not ban it, then all the β_1 citizens who are already engaged in an implicit contract are guaranteed to receive one unit of goods for a bribe b regardless of the realization of β_2. If $\beta_2 \leq \beta_1$, all other citizens have no access to the bureaucrat, and receives the remaining goods with equal probability. If $\beta_2 > \beta_1$, then nature randomly picks an additional $\overline{\beta} - \underline{\beta}$ citizens to grant access to the bureaucrat. The bureaucrat offers these citizens one-off deals, and they are also guaranteed to receive one unit of goods for a bribe b. The remaining citizens receiving the remaining goods with equal probability. If the bureaucrat did not offer implicit contracts in period 1, or if the winner in period 2 bans such contracts, then at the beginning of period 2, nature reveals the value of β_2 and randomly picks β_2 citizens to grant access to the bureaucrat. Then the game proceeds as in period 1. However, the bureaucrat only offers one-off deals. Payoffs for the bureaucrat and all citizens in period 2 are realized, and the game ends.

Strategy and equilibrium concept. Notice that after the election, no player has any strategic decision to make (bureaucrats are committed to all existing implicit contracts if they are not banned, and offers one-off deals to any citizen exogenously selected to have access to her). Hence all player's strategies describe their actions in period 1, up to the election.

Each politician has two strategies: Y and N, with Y denoting not banning the implicit contracts and N denoting banning them. The bureaucrat has two strategies: O and I, with O denoting offering one-off deals and I denoting offering implicit contracts. Finally, each citizen has two strategies: V_A and V_B, with V_A denoting voting for politician A and V_B denoting voting for politician B. The equilibrium concept is Sub-game perfect Nash equilibrium (SPNE). We restrict our analysis to pure strategy SPNEs.

3.2.1 Discussion of Setup

One major simplification of the model is that it does not specify the bargaining process involved in corruption. The model simply assumes that in each period t, a share β_t citizens simply have access to the bureaucrat and reaches a corruption deal for exogenous reasons. However, β_t varies exogenously, which captures the fact that different societies may have different underlying environments and norms that shapes how easily corruptions are facilitated.

In the model, corruption does not interfere with the production of goods, which I assume to have a fixed stock. Rather it affects the allocation of goods. The goods is scarce, meaning not every citizen is guaranteed to have access. Corruption guarantees some citizens access to the goods, leaving less for the other citizens to grab. Moreover, corruption can positively or negatively affect the efficiency of allocation of goods, depending on the y_i of those who are granted access to the bureaucrat. If most of these citizens have $y_i = \overline{y}$, corruption can lead to an increase in social welfare compared to random allocation, and vice versa.

3.3 Brief results

I solve the game by backward induction. As discussed above, on period 2 there are no strategic choices to make by any player. Hence the last strategic move of the game is the citizens' voting decisions.

Lemma 3.1. *If 1) both politicians announce the same policy, or 2) The bureaucrat offers one-off deals in period 1, all voters are indifferent between both politicians. Hence each politician wins with probability $\frac{1}{2}$.*

This is quite intuitive. If both politicians announce the same policy, then they are equivalent to all voters. On the other hand, even if they offer different policies, since the policies only relates to the banning of implicit contracts, the differences in policies only matter if implicit contracts exist in period 1. Hence if the bureaucrat does not offer them in period 1 to begin with, all voters are again indifferent between both politicians.

Lemma 3.2. *If $\beta_1 = \underline{\beta}$, the bureaucrat offers implicit contracts in period 1, and only one politician proposes to ban them, then the politician who proposes to ban them wins with a probability higher than $\frac{1}{2}$ if $\alpha < \underline{\alpha} = \frac{1}{2}$.*

Proof. Standard techniques of probabilistic voting show that the candidate whose policies offers a higher total utility for all citizens wins with a probability higher than $\frac{1}{2}$. If $\beta_1 = \underline{\beta}$

and the bureaucrat offers implicit contracts, the total utility of all citizens in period 2 if implicit contracts are not banned is:

$$
\begin{aligned}
U = {} & \underline{\beta}\alpha(\overline{y}-b) + \underline{\beta}(1-\alpha)(\underline{y}-b) \\
& + (\frac{1}{2}-\underline{\beta}\alpha)[\frac{1}{2}(\frac{\overline{\beta}-\underline{\beta}}{1-\underline{\beta}}(\overline{y}-b) + \frac{\frac{1}{2}-\overline{\beta}}{1-\underline{\beta}}\overline{y}) + \frac{1}{2}(\frac{\frac{1}{2}-\underline{\beta}}{1-\underline{\beta}}\overline{y})] \\
& + (\frac{1}{2}-\underline{\beta}(1-\alpha))[\frac{1}{2}(\frac{\overline{\beta}-\underline{\beta}}{1-\underline{\beta}}(\underline{y}-b) + \frac{\frac{1}{2}-\overline{\beta}}{1-\underline{\beta}}\underline{y}) + \frac{1}{2}(\frac{\frac{1}{2}-\underline{\beta}}{1-\underline{\beta}}\underline{y})]
\end{aligned}
$$

The first term in the first line is the utility of the $\underline{\beta}\alpha$ citizens who are engaged in implicit contracts" and have a high valuation of the goods. The second term in the first line is the utility of the $\underline{\beta}(1-\alpha)$ citizens who are engaged in implicit contracts" and have a low valuation of goods. They are guaranteed a utility of $y_i - b$. The second line is the utility of the $\frac{1}{2}-\underline{\beta}\alpha$ citizens who are not engaged in implicit contracts" and have a high valuation of the goods. With probability $\frac{1}{2}$, $\beta_2 = \beta_1 = \underline{\beta}$, and these citizens only have a probability $\frac{\frac{1}{2}-\underline{\beta}}{1-\underline{\beta}}$ of receiving the goods via luck. However with probability $\frac{1}{2}$, $\beta_2 = \overline{\beta} > \beta_1 = \underline{\beta}$, and these citizens have an additional $\frac{\overline{\beta}-\underline{\beta}}{1-\underline{\beta}}$ probability of having access to the bureaucrat and receiving the goods for a bribe. The third line is the utility of the $\frac{1}{2}-\underline{\beta}(1-\alpha)$ citizens who are not engaged in implicit contracts" and have a low valuation of goods. The construction is analogous to the second line.

The total utility of all citizens in period 2 if implicit contracts are banned is:

$$U' = \frac{\overline{\beta}+\underline{\beta}}{2}(\frac{\overline{y}+\underline{y}}{2} - b) + \frac{1-\overline{\beta}-\underline{\beta}}{2}\frac{\overline{y}+\underline{y}}{2}.$$

In this case, every individual has a probability $\frac{\overline{\beta}+\underline{\beta}}{2}$ of being granted one-off access to the bureaucrats, where they secure the goods, earning y_i while paying b. Every individual also has a probability $\frac{1-\overline{\beta}-\underline{\beta}}{2}$ of receiving the goods by luck. $U' > U$ if $\alpha <= \frac{1}{2}$. □

Since the stock of goods is fixed, the more it is offered via corruption, the more bribe citizens has to pay to the bureaucrats, and hence the lower their total utility. Since β_1 takes its lower value, the extent of corruption via implicit contracts is low. However, engaging in implicit contracts in period 2 does not limit the bureaucrat's ability of engaging in additional one-off corruption in period 2 if such opportunities arise (i.e. if $\beta_2 > \beta_1$). Hence, regardless of whether implicit contracts are banned, Ithe extent of corruption in period 2 will be $\frac{\overline{\beta}+\underline{\beta}}{2}$ in expectation. Hence if $\beta_1 = \underline{\beta}$, banning implicit contracts has no effect on corruption in period 2. However, banning implicit contracts affects the allocation of the goods, which also affects the utility of citizens. The more goods allocated to those with $y = \overline{y}$, the higher the welfare of the citizens is. Among all citizens who are engaged in implicit contracts in period 1, α of them have high valuation of the goods. If the implicit contracts are not banned, these citizens will continue to receive the goods in period 2. If the implicit contracts are banned, however, in expectation in period 2 half of the citizen with high valuation will receive the goods. Hence banning implicit contracts only increases the total utility of all citizens if $\alpha < \frac{1}{2}$, which gives the politician proposing it a higher winning probability.

Lemma 3.3. *If $\beta_1 = \overline{\beta}$, the bureaucrat offers implicit contracts in period 1, and only one politician proposes to ban them, then the politician who proposes to ban them wins with a probability higher than $\frac{1}{2}$ if $\alpha < \overline{\alpha} = \frac{1}{2} + \frac{(1-\overline{\beta})(\overline{\beta}-\underline{\beta})b}{\overline{\beta}(\overline{y}-\underline{y})}$.*

Proof. Analogous to the proof of Lemma 3.2. □

The tradeoff of banning implicit contracts in Lemma 3.3 is similar as that in Lemma 3.2, but with one key difference. If If $\beta_1 = \overline{\beta}$, the extent of corruption via implicit contract is high. If they are not banned, the extent of corruption in period 2 will remain high, since the bureaucrat is guaranteed to have access to more citizens. If the implicit contracts are banned, however, the extent of corruption in period 2 may decrease to $\beta_2 = \underline{\beta}$ for exogenous reasons. Hence if $\beta_1 = \overline{\beta}$, banning implicit contracts limits the scope of corruption in period 2, which increases the welfare of citizens. Since in this case banning implicit contracts increases the welfare of citizens via the channel of corruption, the total utility with banning implicit contracts can remain higher even if implicit contracts leads to a much more efficient distribution of goods (i.e. with some $\alpha > \frac{1}{2}$). However, if the implicit contracts in period 1 leads to an extremely efficient distribution of goods (i.e. very high α, banning them leads to a large efficiency loss that cannot be recovered by the reduction of corruption. Hence banning implicit contracts increases the total utility of all citizens for $\alpha < \overline{\alpha}$, where $\overline{\alpha} > \frac{1}{2}$.

With the citizens' voting decisions and electoral outcomes characterized, we can characterize the equilibrium policies of politicians and the equilibrium corruption behavior of the bureaucrat.

Proposition 3.1. *If $\beta_1 = \underline{\beta}$, and $\alpha \geq \frac{1}{2}$, then the game has an SPNE where the bureaucrat offers implicit contracts in period 1 and they are not banned by any politician in period 2. In all other SPNE, either the bureaucrat offers one-off deals in period 1, or she offers implicit contracts but both politicians ban them in period 2.*

Proof. See the appendix for complete characterization of SPNEs for $\beta_1 = \underline{\beta}$. □

If $\beta_1 = \underline{\beta}$, the bureaucrat is indifferent between offering one-off deals and implicit contracts. In either case, she receives $\underline{\beta} b$ in period 1, and expects to receive $\frac{(\overline{\beta}+\underline{\beta})b}{2}$. Hence offering implicit contracts is always a best response, regardless of the politicians' proposals. For implicit contracts to survive through period 2, it must be that at least one politician proposes not to ban them, and that she wins with positive probability. There are only two scenarios possible. The first is where both politicians proposes not to ban them. In this scenario both politicians wins with probability $\frac{1}{2}$. To prevent any politician from deviating to proposing banning the implicit contracts, it must be that proposing banning them leads to an electoral loss. Lemma 3.2 shows that when $\beta_1 = \underline{\beta}$, banning implicit contracts leads to an electoral advantage only when $\alpha < \frac{1}{2}$. Hence politicians have no incentive to deviate if $\alpha \geq \frac{1}{2}$. This produces an SPNE where no politician proposes to ban the implicit contracts, the bureaucrat offers them, and the election breaks even. The second scenario is where only one politician proposes not to ban the implicit contracts, and wins with positive probability. However in this scenario, as long as we are not in the knife-edge case of $\alpha = \frac{1}{2}$, one politician will win with probability less than $\frac{1}{2}$. This losing politician can deviate to mimic the other politician, increasing her winning probability to $\frac{1}{2}$. Hence the game does not have an SPNE where both politicians propose different policies and the bureaucrat nonetheless offers implicit contracts (except for the measure-0 case of $\alpha = \frac{1}{2}$.

Proposition 3.2. *If $\beta_1 = \overline{\beta}$ and $\alpha \geq \overline{\alpha}$, then the game has an SPNE where the bureaucrat offers implicit contracts in period 1 and they are not banned by any politician in period 2. In all other SPNE, either the bureaucrat offers one-off deals in period 1, or she offers implicit contracts but both politicians ban them in period 2.*

Proof. See the appendix for complete characterization of SPNEs for $\beta_1 = \overline{\beta}$. □

If $\beta_1 = \overline{\beta}$, the bureaucrat has an even stronger incentive to offer implicit contracts in period 1 to avoid the possibility of $\beta_2 < \beta_1$ should she offers one-off deals instead. This incentive is strict if she expects the implicit contracts to not be banned in period 2 (if they are banned in period 2, the bureaucrat is indifferent between offering them or not). Hence she strictly prefers to offer them if at least one politician proposes not to ban the implicit contracts and she wins with positive probability. Following similar arguments for Proposition 3.1, we can identify an SPNE where no politician proposes to ban the implicit contracts, the bureaucrat offers them, and the election breaks even, which exists when $\alpha \geq \overline{\alpha}$. Similarly, the game does not have an SPNE where both politicians propose different policies and the bureaucrat nonetheless offers implicit contracts.

Proposition 3.1 and Proposition 3.2 show that implicit contracts only exists in both periods in equilibrium when they lead to efficient distribution of goods relative to the extent of corruption. However, does the existence of such implicit contracts indeed maximize the total utility of the citizens from an ex-ante point of view? Ex-ante (before β_1 and α is realized in period 1) in each period half of the citizens who receive the goods have high valuation, regardless of the form of corruptive deals. Hence the ex-ante optimal policy is the policy that reduces the extent of corruption. If implicit contracts are banned, then in each period the bureaucrat expects to collect a total bribe of $\frac{(\overline{\beta}+\underline{\beta})b}{2}$, which, summing across periods, gives a ex-ante amount of total bribe of $(\overline{\beta}+\underline{\beta})b$. If implicit contracts are not banned, then the bureaucrat expects to collect a total bribe of $2\overline{\beta}b$ if $\beta_1 = \overline{\beta}$, and a total bribe of $(\underline{\beta} + \frac{\overline{\beta}+\underline{\beta}}{2})b$ if $\beta_1 = \underline{\beta}$. Since β_1 takes each value with equal probability, the ex-ante amount of total bribe with implicit contracts is $\frac{(5\overline{\beta}+3\underline{\beta})b}{4} > \frac{(\overline{\beta}+\underline{\beta})b}{2}$. This is because implicit contracts allows the bureaucrat to lock in favorable corruptive opportunities while not limiting her ability to seek for additional one-off deals when possible. Hence the ex-ante optimal policy is indeed to ban implicit contracts. However this optimality is based on the fact that ex-ante implicit contracts has no effect on the distribution of goods. Interim when high values of α is realized, politicians no longer want to ban implicit contracts to preserve its positive distribution effects. Hence we have a time inconsistency problem.

3.4 Conclusion

This paper shows that long-term corruption relationships allows bureaucrats to take the advantage of current environments that easily facilitates corruption and extend that advantage into the future, to guard them against risks where the future environments no longer easily facilitates *quid pro quo*. Since this increases the payoff of bureaucrats from corruption, it reduces the payoff of citizens due to excessive bribes, and hence is ex-ante welfare reducing. However, long-term corruption relationships also preserves the distribution effect of corruptions for longer periods of times, directing goods and services to certain clients longer rather than directing them to randomly selected individuals across time. Hence, in the event that the clients who are currently engaged in corruption have high valuation over goods, long-term corruption relationships actually help to preserve this relatively efficient distribution. Hence once long-term corruption relationship exist and demonstrates a large enough positive distribution effect, it becomes interim optimal for benevolent politicians to allow them to continue to exist. This paper highlights this difference between ex-ante optimality and interim optimality regarding policies regulating long-term corruption behaviors.

This paper certainly leaves some important related questions unaddressed, which calls for future research. This paper treats both the ease of engaging in corruption and the distribution effects of corruption as exogenous for simplicity of modeling. However both are likely to be affected by the characteristics of the bureaucrats and the citizens they serve, as well as broader political institutions. Hence unpacking the process under which the bureaucrats engages in corruption and conducts goods delivery is key to further understand the logic behind different types of corruption behaviors.

3.5 Appendix: Characterization for SPNEs of the game

Before characterizing all SPNEs of the game, I first discuss a few intermediate results that simplifies the process. Many of them are already discussed in the paper, which I shall formalize here.

Lemma 3.4. *The game cannot have an SPNE where only one politician proposes to ban implicit contracts, and the bureaucrat offers them in period 1.*

This is already discussed in the paper. If such an SPNE were to exist, one politician would win with probability less than $\frac{1}{2}$ (except for knife-edge cases). This politician can deviate to mimic the other politician and win with probability $\frac{1}{2}$.

Lemma 3.5. *If the bureaucrat does not offer implicit contracts in period 1 to begin with, the politicians are indifferent between banning them or not, and each politician wins with probability* $\frac{1}{2}$.

The politicians' policies can change the total utility of the citizens, and hence affect electoral outcomes, only via banning or not banning implicit contracts. If they do not exist in the first place, these policies have no electoral consequences. An implication of Lemma 3.5 is that to characterize an equilibrium where bureaucrat does not offer implicit contracts, we only need to check that doing so is indeed a best response for the bureaucrat given the politicians' policy announcements. The politicians do not have profitable deviations.

3.5.1 SPNEs when $\beta_1 = \underline{\beta}$

Lemma 3.6. *If $\beta_1 = \underline{\beta}$, the bureaucrat is indifferent between offering one-off deals and implicit contracts in period 1.*

Proof. If $\beta_1 = \underline{\beta}$, the bureaucrat's payoff in both periods is $\underline{\beta}b + \frac{(\overline{\beta}+\underline{\beta})b}{2}$, regardless of whether she offers implicit contracts or one-off deals. □

Lemma 3.6 means that the bureaucrat has no profitable deviation if $\beta_1 = \underline{\beta}$. Hence to check for SPNEs when $\beta_1 = \underline{\beta}$, we only need to check for deviations of the politicians.

Case 1.5. *No politician bans implicit contracts. The bureaucrat offers them in period 1.*

In this case both politicians win with probability $\frac{1}{2}$. To prevent any of them deviating to banning implicit contracts, it must be that banning them leads to an electoral loss. By Lemma 3.2, if $\beta_1 = \underline{\beta}$, banning implicit contracts leads to an electoral advantage if $\alpha < \frac{1}{2}$. Hence if $\alpha \geq \frac{1}{2}$, the politicians have no profitable deviation. Hence we have the following SPNE of the game:

SPNE 1.1. *Both politician A and B propose Y. The bureaucrat offers I in period 1. The election breaks even. All implicit contracts offered in period 1 continue to exist in period 2. This SPNE exists if $\alpha \geq \frac{1}{2}$.*

Case 1.6. *One politician bans implicit contracts. The bureaucrat offers them in period 1.*

This cannot be an SPNE by Lemma 3.4.

Case 1.7. *Both politician ban implicit contracts. The bureaucrat offers them in period 1.*

This is exactly the opposite case of case 1.5. In this case both politicians win with probability $\frac{1}{2}$. To prevent any of them deviating to not banning implicit contracts, it must be that not banning them leads to an electoral loss, i.e. banning them leads to an electoral advantage. By Lemma 3.2, if $\beta_1 = \underline{\beta}$, banning implicit contracts leads to an electoral advantage if $\alpha < \frac{1}{2}$. Hence if $\alpha < \frac{1}{2}$, the politicians have no profitable deviation. Hence we have the following SPNE of the game:

SPNE 1.2. *Both politician A and B propose N. The bureaucrat offers I in period 1. The election breaks even. All implicit contracts offered in period 1 are banned in period 2. This SPNE exists if* $\alpha < \frac{1}{2}$.

Case 1.8. *No politician bans implicit contracts. The bureaucrat does not offer them in period 1.*

By Lemma 3.4 we only need to check for deviations for the bureaucrat. By Lemma 3.6 the bureaucrat has no profitable deviation if $\beta_1 = \underline{\beta}$. Hence we have the following SPNE of the game:

SPNE 1.3. *Both politician A and B proposes Y. The bureaucrat offers O in period 1. The election breaks even. This SPNE always exists.*

Case 1.9. *One politician bans implicit contracts. The bureaucrat does not offer them in period 1.*

By Lemma 3.4 we only need to check for deviations for the bureaucrat. By Lemma 3.6 the bureaucrat has no profitable deviation if $\beta_1 = \underline{\beta}$. Hence we have the following SPNE of the game:

SPNE 1.4. *One politician proposes Y, and the other politician proposes N. The bureaucrat offers O in period 1. The election breaks even. This SPNE always exists.*

Case 1.10. *Both politician ban implicit contracts. The bureaucrat does not offers them in period 1.*

By Lemma 3.4 we only need to check for deviations for the bureaucrat. By Lemma 3.6 the bureaucrat has no profitable deviation if $\beta_1 = \underline{\beta}$. Hence we have the following SPNE of the game:

SPNE 1.5. *Both politician A and B proposes N. The bureaucrat offers O in period 1. The election breaks even. This SPNE always exists.*

3.5.2 SPNEs when $\beta_1 = \overline{\beta}$

Case 2.7. *No politician bans implicit contracts. The bureaucrat offers them in period 1.*

In this case the bureaucrat's payoff in both periods is $2\overline{\beta}b$. If she deviates to offer one-off deals, her payoff is $\overline{\beta}b + \frac{(\overline{\beta}+\underline{\beta})b}{2} < 2\overline{\beta}b$. Hence she has no profitable deviation. In this case both politicians wins with probability $\frac{1}{2}$. To prevent any of them deviating to banning implicit contracts, it must be that banning them does not lead to an electoral advantage. By Lemma 3.3, If $\beta_1 = \overline{\beta}$, banning implicit contracts leads to an electoral advantage if $\alpha < \overline{\alpha}$. Hence if $\alpha \geq \overline{\alpha}$, the politicians have no profitable deviation. Hence we have the following SPNE of the game:

SPNE 2.1. *Both politician A and B propose Y. The bureaucrat offers I in period 1. The election breaks even. All implicit contracts offered in period 1 continue to exist in period 2. This SPNE exists if $\alpha \geq \overline{\alpha}$.*

Case 2.8. *One politician bans implicit contracts. The bureaucrat offers them in period 1.*

This cannot be an SPNE by Lemma 3.4.

Case 2.9. *Both politician ban implicit contracts. The bureaucrat offers them in period 1.*

This is exactly the opposite case of case 2.7. In this case the bureaucrat's payoff in both periods is $\overline{\beta}b + \frac{(\overline{\beta}+\underline{\beta})b}{2}$, regardless of whether she offers implicit contracts or one-off deals. So she has no profitable deviation. In this case both politicians win with probability $\frac{1}{2}$. To prevent any of them deviating to not banning implicit contracts, it must be that not banning them leads to an electoral loss, i.e. banning them leads to an electoral advantage. By Lemma 3.3, if $\beta_1 = \overline{\beta}$, banning implicit contracts leads to an electoral advantage if $\alpha < \overline{\alpha}$. Hence if $\alpha < \overline{\alpha}$, the politicians have no profitable deviation. Hence we have the following SPNE of the game:

SPNE 2.2. *Both politician A and B propose N. The bureaucrat offers I in period 1. The election breaks even. All implicit contracts offered in period 1 are banned in period 2. This SPNE exists if* $\alpha < \overline{\alpha}$.

Case 2.10. *No politician bans implicit contracts. The bureaucrat does not offer them in period 1.*

This cannot be an SPNE. By Lemma 3.4 we only need to check for deviations for the bureaucrat. By the same logic of the discussion of case 2.7, if $\beta_1 = \overline{\beta}$ and no politicians bans implicit contracts, the bureaucrat's best response is to offer them. Hence the bureaucrat has a profitable deviation.

Case 2.11. *One politician bans implicit contracts. The bureaucrat does not offer them in period 1.*

This cannot be an SPNE. By Lemma 3.4 we only need to check for deviations for the bureaucrat. The bureaucrat's payoff in both periods is $\overline{\beta}b + \frac{(\overline{\beta}+\underline{\beta})b}{2}$ if she offers one-off deals. If she deviates to offer implicit contracts, her payoff is $\overline{\beta}b + P(Y)\overline{\beta}b + P(N)\frac{(\overline{\beta}+\underline{\beta})b}{2} > \overline{\beta}b + \frac{(\overline{\beta}+\underline{\beta})b}{2}$, where $P(Y)$ is the winning probability of the politician who does not ban implicit contracts, and $P(N) = P(Y) - 1$ is the winning probability of the other politician. Clearly for all $P(Y)$ the deviation is profitable.

Case 2.12. *Both politician ban implicit contracts. The bureaucrat does not offers them in period 1.*

By Lemma 3.4 we only need to check for deviations for the bureaucrat. In this case the bureaucrat's payoff in both periods is $\overline{\beta}b + \frac{(\overline{\beta}+\underline{\beta})b}{2}$, regardless of whether she offers implicit contracts or one-off deals. So she has no profitable deviation. Hence we have the following SPNE of the game:

SPNE 2.3. *Both politician A and B proposes N. The bureaucrat offers O in period 1. The election breaks even. This SPNE always exists.*

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