Strength in Numbers? State Capacity, Military Power and Repression in Authoritarian Regimes*

Tiberiu Dragu[†] **Germán Gieczewski**[‡]

March 2024

Abstract

Repressive capacity and military power are important explanatory variables in scholarly research on both domestic politics and the external relations of authoritarian governments. Despite their relevance, these concepts remain difficult to quantify, and in empirical research, security spending or personnel numbers are frequently used as proxy measures. We develop a formal model to demonstrate that higher security spending levels are associated with lower repressive capacity in the face of increased corruption and other agency problems within the security services. The findings offer insight into the complicated link between a regime's resources, budgetary allocations, and actual effectiveness of security forces, with important implications for our understanding of state capacity and the repressive strength of authoritarian regimes.

*We are grateful to Bruce Bueno De Mesquita, Xiaochen Fan, Adam Przeworski and David Stasavage for useful comments and suggestions. All errors are ours.

[†]Department of Politics, New York University

[‡]Department of Politics, Princeton University.

1 Introduction

Authoritarian regimes, notwithstanding their occasional veneer of democratic institutions, ultimately rely on force and repressive capacity as essential factors for their enduring stability. Although they may establish institutions that outwardly mimic democratic frameworks, such regimes place paramount importance on preserving control through coercion, oppression, and the suppression of dissent. This reliance on coercion has been extensively explored in empirical and theoretical studies examining political outcomes within authoritarian contexts, encompassing various phenomena such as authoritarian survival, democratization, protest repression, and political violence. Hence, repressive capacity emerges as a central explanatory variable in scholarly investigations of authoritarian regimes.

However, the concept of repressive capacity remains elusive, presenting significant challenges in gauging and measuring its extent. Situations in which authoritarian regimes must deploy their entire coercive force to maintain their grip on power, such as large-scale protests or wars, are relatively rare. As a result, accurately assessing the full scope and effectiveness of repressive capacity becomes a complex endeavor. Empirical studies often rely on a range of indicators to measure repressive capacity. Commonly employed indicators include military spending and security personnel per capita, which serve as proxies for the strength of coercive capacity and a regime's capability to suppress internal and external enemies (Hendrix (2010); Andersen, Møller, Rørbæk, and Skaaning (2014); Fortin-Rittberger (2014); Seeberg (2014); Hanson (2018); Hanson and Sigman (2021)).

The accuracy of using security spending and personnel numbers as measures of repressive capacity or military power is often called into question (Gupta, De Mello, and Sharan (2001); Greitens (2017); Carroll and Kenkel (2019)). This is because even regimes perceived to have formidable repressive capabilities had demonstrated significant weaknesses or even collapsed when their secret police forces and military were tasked with suppressing protests or engaging in warfare.

A striking example of this occurred with the invasion of Ukraine by Russian President Vladimir Putin on February 24, 2022. Before and shortly after the invasion, experts widely believed that Russia's military would swiftly overpower Ukraine's defenders. The prevailing notion was that Putin had successfully transformed the Russian army into an efficient and modern military force, second only to the United States, based on military budgets and expenditures. However, despite having superior equipment at the outset, Russia significantly underperformed expectations due to pervasive corruption and graft that had permeated the entire Russian military.

Similarly, throughout the 1980s, the Stasi, East Germany's notorious secret police, experienced substantial growth, solidifying its position as the largest secret police apparatus in the world, per capita. Despite this significant expansion and the allocation of abundant resources and personnel, the Stasi was plagued by corruption and other agency problems. These internal issues critically undermined the Stasi's ability to effectively suppress protests and dissent in 1989, ultimately playing a pivotal role in the collapse of the East German regime.[1]

The examples of East Germany and Putin's Russia highlight the disparity between military budgets, personnel numbers, and the actual effectiveness of security forces when tasked with wide-scale domestic repression or external warfare. It becomes evident that authoritarian regimes heavily rely on their security agents to carry out acts of repression in practice, and the accurate measure of repressive capacity lies

[1]On October 8, 1989, Erich Honecker and Erich Mielke, the Minister for State Security, ordered the Stasi to carry out "Plan X," which included arresting and detaining a large number of East Germans for an indefinite period of time while declaring a state of emergency to quell widespread protests. Mielke's directive to commence planned arrests was ignored by the local Stasi precincts (Koehler (2008)).

in what these security forces actually achieve rather than their strength on paper. There exists a fundamental agency problem underlying whether authoritarian regimes can effectively engage in repression and the use of force. To gain a comprehensive understanding of coercive capacity and when security budgets and personnel numbers can serve as proxies for it, we must delve into the intricate relationship between authoritarian leaders and their security agents.

To this end, we present a formal model that explores the dynamics of security provision between authoritarian rulers and their security forces. In our model, the ruler possesses a specific level of resources and allocates a budget for security provision. Based on this security budget, the security agent must make decisions regarding the allocation of funds, determining how much will be dedicated to actual protection and what fraction will be allocated for private consumption. The proportion of resources the agent appropriates for personal use indicates the prevalence of corruption and other agency problems that may affect the relationship between rulers and their security agents.

The presence of corruption suggests that not all budgetary resources would be allocated toward actual security measures. However, it is reasonable to assume that higher budgetary spending is at least correlated with a higher repressive capacity. Our model reveals that when corruption levels are higher, a negative relationship exists between budgetary spending and actual repressive capacity. In cases where corruption is more prevalent, higher levels of corruption lead to increased budgetary expenditures. Paradoxically, these increased funds are not proportionately allocated to enhance actual protection. As a result, higher corruption levels are associated with lower levels of resources dedicated to effective security measures. Consequently, security spending alone cannot be considered a reliable proxy for measuring repressive capacity in situations characterized by significant corruption within security forces.

These findings align with the examples of Russia and East Germany, where corruption and low morale among other problems undermined the effectiveness of security forces despite substantial budgetary allocations.

Furthermore, the model demonstrates that when the ruler has greater access to resources for security spending, an increase in the regime's overall wealth results in higher levels of both budgetary spending and the allocation of actual resources towards protection by security agents. As a result, if agency problems within security forces are constant, a regime's level of wealth may serve as a more valid proxy for measuring repressive capacity in empirical research when the variation in the data is primarily due to wealth inequalities.

This paper contributes to the extensive literature on state capacity (Skocpol (1979); Bellin (2004); Levitsky and Way (2010); Mann (2012); Hanson and Sigman (2021)). Coercive power is an essential component of state capacity, and it is a vital concept in analyzing a range of important outcomes in comparative political and international relations research. In comparative politics scholarship, repressive capacity is a fundamental and widely explored explanatory variable in scholarly investigations of authoritarian regimes (Tilly (2010); Svolik (2012); Greitens (2016)). Researchers have examined various dimensions of the relationship between repressive capacity and critical aspects, such as the suppression of protests and dissent, the prospects for democratization, and the survival rates of authoritarian regimes (Geddes, Wright, and Frantz (2014); Gandhi and Przeworski (2007); Davenport (2007); Wright, Frantz, and Geddes (2015)). In the empirical literature on the determinants and effects of state repression, repressive capacity is frequently measured by utilizing proxies such as security spending and security personnel counts (Henderson and Singer (2000);Walter (2006); Albertus and Menaldo (2012); Li and Elfstrom (2021)).

Additionally, military capacity is often considered an essential variable in studies focusing on the onset and duration of external wars or civil conflicts (Gurr (1988); Fearon and Laitin (2003)). It is also a key component of measuring state power in international relations, as numerous scholars consider power interactions between nations crucial for understanding global politics (Barnett and Duvall (2005); Baldwin (2016)). During the Cold War between the United States and the Soviet Union, for example, the discussion over which side was more powerful was a critical question. These discussions are based on complex challenges with defining and quantifying state power. In the quantitative IR literature, power is typically conceptualized as state capabilities of which military capacity (usually proxied by military spending) is an important component. This is evidenced by the widespread use of the Correlates of War project's Composite Indicator of National Capabilities (CINC) in the empirical international relations scholarship.[2]

Our research suggests that proxies such as security spending or security personal may be inaccurate indicators of repressive capacity or military power when significant corruption or other agency problems exist within security forces. Thus, it becomes crucial for empirical studies to incorporate controls for corruption when employing military spending and similar metrics as indicators of repressive or military capacity.

Our work also adds to the current theoretical literature on the interaction between authoritarian rulers and their security agents (Finer (2002); Geddes, Frantz, and Wright (2014); Nordlinger (1977); Wintrobe (2000); Bueno De Mesquita, Alaistair, Siverson, and Morrow (2003); Gehlbach, Sonin, and Svolik (2016)). Previous research has focused on analyzing the agency problems when those entrusted with protecting the regime can potentially threaten the political elites. Methodologically, scholars have investigated the moral hazard problem inherent in this dynamic, as

[2] Carroll and Kenkel (2019) point out that the majority of empirical IR research published in the top journals measures capability ratios between states using CINC scores.

well as adverse selection issues caused by insufficient information about prospective regime challenges. The literature has explored various aspects such as the determinants of military dictatorship (Acemoglu, Ticchi, and Vindigni (2010); Besley and Robinson (2010)), the delicate balance between stability and control (Chen and Xu (2017); Guriev and Treisman (2020); Di Lonardo, Sun, and Tyson (2020); Paine (2021)), military involvement in politics when uncertain about government policies (Svolik (2013)), the trade-off between loyalty and competence in dictatorial environments (Egorov and Sonin (2011); Zakharov (2016)), and coordination and commitment problems between political rulers and their agents (Wintrobe (2000); Myerson (2008); Tyson (2018); Dragu and Przeworski (2019); Dragu and Fan (2020)), to name a few topics.[3]

However, there has been little research into the relationship between other agency problems such as corruption and the efficacy of repression. We need to gain a better understanding of whether and under what conditions security spending can accurately signal repressive capacities. Our formal model provides a theoretical framework for investigating the efficiency of repressive capacity, its link to security spending, and other critical aspects of the ongoing agency challenges confronting authoritarian regimes and their security forces. Our findings expand our understanding of the principal-agent interaction between rulers and security agents, as well as the repressive underpinnings of authoritarian governments in general.

2 Model

We present a simple model of security provision that captures an agency problem between two key actors: the ruler and an agent representing the security service (e.g.,

[3]Additionally, the paper adds to a body of theoretical work that documents many principal-agent issues in political contexts; see Gailmard (2010) for a summary of the work in this field.

the military or the secret police). At the start of the game, the ruler possesses a certain amount of accessible wealth denoted as $W \leq 1$. The ruler allocates a budget B ($0 \leq B \leq W$) for protection. Subsequently, the agent is tasked with determining the actual amount S ($0 \leq S \leq B$) to be spent on security. The remaining portion of the budget, $B - S$, is diverted towards the agent's personal gains.

In our model, we assume that the ruler cannot detect or punish the agent's choice of S due to the inherently opaque nature of corruption within the security service. Consequently, the ruler must rely on the agent's inherent motivation to uphold the regime, trusting that this will incentivize the agent to allocate a significant portion of the budget toward security.

The security service's effectiveness in providing security can be captured by its "production function," denoted as $F_\alpha(S) = \alpha S$, where $F_\alpha(S)$ represents the probability of regime survival when an amount S is invested in security. The parameter $\alpha \in [0, 1]$ quantifies the security service's productivity or competence and is considered private information known only to the agent. To simplify the model, we assume that α can take on two possible values: $\alpha = \alpha_h$ with a probability of p, and $\alpha = \alpha_l$ with a probability of $1 - p$, where $0 < \alpha_l < \alpha_h \leq 1$ and $0 \leq p \leq 1$. Although the ruler knows the potential values of α and their associated probabilities, the actual realization of α remains unknown. Clearly, the value of α significantly influences the agent's decision on security spending, as a higher α corresponds to greater returns from investing in security.

The payoffs in this model are as follows: If the regime successfully endures, the ruler's payoff is the remaining wealth, $W - B$, while the agent's payoff is the diverted amount, $B - S$. However, if the regime collapses, the ruler's payoff becomes 0, and the agent's payoff is $(1 - \gamma)(B - S)$. Here, the parameter $\gamma \in [0, 1]$ represents the fraction of the agent's wealth tied to the ruler's survival. This fraction would be forfeited in the event of a regime change. Conversely, the remaining fraction, $1-\gamma$, remains insulated from the fate of the regime, possibly invested abroad or in other secure avenues. When γ assumes its extreme value of 1, the agent becomes entirely reliant on the ruler's continued reign, while $\gamma = 0$ signifies an agent with no leverage or dependence on the ruler.

In our scenario, the agent represents the military or secret police, and the ruler does not observe the agent's type or actions. The model aims to illustrate the inherent difficulty in assessing the effectiveness of military or repressive power in authoritarian regimes. Autocratic leaders often face inherent challenges when relying on large-scale force, as the effectiveness of this force is a multitasking and multidimensional aggregate effort that depends on the unseen actions of numerous security agents over time. Additionally, situations requiring authoritarian regimes to use their full coercive force, such as widespread protests or wars, are rare. If the security forces fail in these situations, the ruler is likely to lose power, and at that point, the leader is unable to address the poor performance of the security forces.[4]

Our findings remain robust even when there is only one type of agent, which means the ruler faces uncertainty solely regarding the agent's effort, not their ability. Our main model, featuring two possible agent types, illustrates that the fundamental logic of our analysis still holds even in the presence of both moral hazard and adverse selection. Furthermore, the uncertainty surrounding the agent's type introduces complexities into the ruler's decision-making about whom to incentivize. The ruler must

[4] Even when corruption, poor performance, or intelligence failures become apparent, governments must continue to rely on the same security forces to implement their policies. This was exemplified by Russia's recent inability to win the war with Ukraine quickly. Authoritarian leaders are constrained by their reliance on security forces and cannot dissolve them as punishment for failure, as the fate of the regime ultimately rests on their support. Additionally, subordinates are often reluctant to disclose failures in autocratic settings, fearing severe sanctions. This results in autocratic leaders receiving a steady stream of seemingly positive information, which proves useless when faced with a disastrous situation.

decide whether to extract sufficient effort regardless of the agent's type or focus on properly motivating only the high type while giving up on the low type.[5] Significantly, informational asymmetries are persistent in the dynamics of the principal-agent relationship between rulers and their security agents. Therefore, a model incorporating both moral hazard and adverse selection provides a stronger theoretical foundation for exploring the repressive mechanisms of authoritarian governments.

Our solution concept is Perfect Bayesian equilibrium.

3 Analysis

We proceed first by analyzing the agent's optimal spending on security S given the budget B set by the ruler. The agent chooses S by solving the following optimization problem:

$$\max_S (B - S)(1 - \gamma + \gamma F_\alpha(S)) = \max_S (B - S)(1 - \gamma + \gamma \alpha S),$$

subject to the constraint $S \in [0, B]$. In this context, $B - S$ can be interpreted as the agent's final wealth, while $1 - \gamma + \gamma\alpha S$ represents the fraction that she anticipates retaining, taking into account that a portion γ can only be preserved if the regime survives (with a probability of αS).

The agent's objective is concave[6] and therefore any interior solution to her problem's first-order condition (FOC) will maximize her payoff. For $S > 0$, the FOC

[5]These problems parallel similar ones found in more traditional screening problems, where the principal can commit to various levels of transfers based on outcomes.

[6]It is quadratic in S with negative leading coefficient.

is:

$$\frac{\partial U_A}{\partial S} = \gamma\alpha(B - S) - (1 - \gamma + \gamma\alpha S) = 0,$$

and the solution to this equation is

$$S = \frac{B}{2} - \frac{1-\gamma}{2\alpha\gamma}.$$

More generally, the optimal choice of S is

$$S^*(B; \alpha, \gamma) = \max\left(\frac{B}{2} - \frac{1-\gamma}{2\alpha\gamma}, 0\right). \tag{1}$$

It is evident that whenever the optimal security spending S^* is positive, it increases with γ. In other words, a security service that relies more heavily on the ruler for its survival will allocate more resources to security and, consequently, engage in less misappropriation. However, some resources will still be diverted even with a completely dependent agent with $\gamma = 1$. This is because the agent's motivation to spend on security is to safeguard her gains. If the agent were to allocate all her spending close to the budget limit B, she would have nothing to protect.[7]

Furthermore, it is worth noting that the optimal security spending S^* also increases with α: a more competent security service with higher productivity is motivated to invest more in security provision. To summarize:

Remark 1. The agent's optimal security spending S^* weakly increases in γ and α.

Consequently, a higher α offers a dual advantage to the ruler. Firstly, the agent

[7] In our simple model, the ruler does not provide any compensation directly to the agent. If an amount of w were to be paid as direct compensation, the solution would not substantially change. The agent's total compensation $B - S + w$ would remain constant in equilibrium, except if w were even higher than what the agent would like to keep to herself.

becomes more adept at providing security at a given level of spending. Secondly, the agent has a preference to allocate more resources toward security. This can be demonstrated by calculating the probability of regime survival as a function of α, considering the agent's optimal level of S:

$$F_\alpha(S^*(B;\alpha,\gamma)) = \alpha S^*(B;\alpha,\gamma) = \max\left(\frac{\alpha B}{2} - \frac{1-\gamma}{2\gamma}, 0\right).$$

Remark 2. The probability of regime survival $F_\alpha(S^*(B;\alpha,\gamma))$ is weakly increasing in both γ and α.

Next, we solve for the ruler's optimal security budget, denoted as B^*. The ruler's choice of budget must consider the agent's strategic best response, which we denoted by $S^*(B;\alpha,\gamma)$.

The ruler's objective function is straightforward: it is the remaining wealth, $W-B$, multiplied by the probability of survival, yielding:

$$EU_P = E\left[(W-B)F_\alpha(S^*(B;\alpha,\gamma))\right],$$

where the expectation is taken over α. Equivalently, the ruler maximizes:

$$\begin{aligned}
EU_P &= p(W-B)F_\alpha(S^*(B;\alpha_h,\gamma)) + (1-p)(W-B)F_\alpha(S^*(B;\alpha_l,\gamma)) \\
&= (W-B)\left[p\max\left(\frac{\alpha_h B}{2} - \frac{1-\gamma}{2\gamma}, 0\right) + (1-p)\max\left(\frac{\alpha_l B}{2} - \frac{1-\gamma}{2\gamma}, 0\right)\right].
\end{aligned}$$

Recall that the agent's optimal security spending $S^*(B;\alpha,\gamma)$ depends on the ruler's security budget, the security service's productivity (α), and the agent's level of dependency on the regime's survival (γ). Additionally, it is important to note that the ruler does not possess precise knowledge of the exact value of α but rather knows that it can take on two possible values: high (α_h) with probability p and low (α_l)

with probability $1-p$.

It is important to keep track of the threshold budget levels where the best response of each type of the agent becomes positive, since the agent's spending displays a kink at this point, and the slope change affects the ruler's incentives. Therefore, we define B_h as the minimum security budget B for which $S^*(B;\alpha_h,\gamma)$ becomes positive. In other words:

$$B_h = \frac{1-\gamma}{\alpha_h \gamma}.$$

Similarly, we define B_l as the minimum security budget B for which $S^*(B;\alpha_l,\gamma)$ is positive. It can be expressed as:

$$B_l = \frac{1-\gamma}{\alpha_l \gamma}.$$

In each of the intervals $[0, B_h)$, $[B_h, B_l)$, and $[B_l, +\infty]$, the ruler faces a distinct problem. For $0 \leq B < B_h$, neither type of agent allocates any resources to security, resulting in the overthrow of the regime. Only the high-type agent invests in security in the range $B_h \leq B < B_l$. Within this interval, the ruler's objective function is given by:

$$EU_P^h = p(W-B)\left(\frac{\alpha_h B}{2} - \frac{1-\gamma}{2\gamma}\right).$$

This expression is quadratic with a negative leading coefficient, hence strictly concave.

Its derivative with respect to B is

$$\begin{aligned}\frac{\partial EU_P^h}{\partial B} &= -p\left(\frac{\alpha_h B}{2} - \frac{1-\gamma}{2\gamma}\right) + \frac{p\alpha_h (W-B)}{2} \\ &= -p\alpha_h B + p\frac{1-\gamma}{2\gamma} + \frac{p\alpha_h W}{2},\end{aligned}$$

which crosses zero when $B = B_1^*$, defined by

$$B_1^* = \frac{1-\gamma}{2\alpha_h\gamma} + \frac{W}{2}.$$

For $B > B_l$, both types of agents allocate resources to security. Therefore, the ruler's objective function is given by:

$$\begin{aligned}EU_P^{h,l} &= (W-B)\left[p\left(\frac{\alpha_h B}{2} - \frac{1-\gamma}{2\gamma}\right) + (1-p)\left(\frac{\alpha_l B}{2} - \frac{1-\gamma}{2\gamma}\right)\right] \\ &= (W-B)\left[B\left(\frac{p\alpha_h}{2} + \frac{(1-p)\alpha_l}{2}\right) - \frac{1-\gamma}{2\gamma}\right],\end{aligned}$$

which is again quadratic with a negative leading coefficient and with derivative

$$\frac{\partial EU_P^{h,l}}{\partial B} = -\left(p\alpha_h + (1-p)\alpha_l\right)B + \frac{p\alpha_h W}{2} + \frac{(1-p)\alpha_l W}{2} + \frac{1-\gamma}{2\gamma},$$

which crosses zero at $B = B_2^*$, given by

$$B_2^* = \frac{1-\gamma}{2\left(p\alpha_h + (1-p)\alpha_l\right)\gamma} + \frac{W}{2}.$$

The problem is only interesting if the exogenous parameters allow the ruler to incentivize at least the high-type security agent to exert effort. In other words, we need $B_h = \frac{1-\gamma}{\alpha_h\gamma} < W$, which implies that $\gamma > \underline{\gamma} = \frac{1}{1+\alpha_h W}$. When this condition is not met, either the high type is too unproductive or the agent's dependence on the ruler is too low, such that the ruler cannot incentivize any spending on security, regardless of what she does. In this case, the ruler is indifferent between all actions, as she is guaranteed to be overthrown and receive a payoff of zero.

When $\gamma > \underline{\gamma}$, the optimal security budget B_1^* falls within the range (B_h, W). It is helpful to further distinguish between two cases. In case 1, where $B_l \geq W$, the ruler can only incentivize the high type to spend on security. In case 2, where $B_l < W$, the ruler can incentivize both the low and high types to spend on security by providing a sufficiently high budget.

In case 1, the optimal choice is $B = B_1^*$ within the interval $[B_h, B_l]$. This choice is feasible (specifically, $B_1^* \geq B_h$ and $B_1^* \leq W$), and it outperforms any choice $B \leq B_h$, which would result in the regime's guaranteed failure. No choice $B \geq B_l$ is feasible in this case. In case 2, the optimal choice could be B_h, B_1^*, B_l, B_2^*, or W. In the appendix, we demonstrate that the optimal choice, in this case, is either $B = B_1^*$ or $B = B_2^*$.

To complete the equilibrium analysis, we need to determine under which conditions the ruler prefers to incentivize both security agents or only the high type by providing a sufficiently high security budget as a function of the exogenous parameters. In the appendix, we establish that there exists a unique value γ^* such that if $\gamma \in [\underline{\gamma}, \gamma^*]$, the ruler's optimal choice is $B = B_1^*$, and if $\gamma \in [\gamma^*, 1]$, the ruler's optimal choice is $B = B_2^*$. Combining all these results, we can state the following proposition.

Proposition 1. *In the unique equilibrium, the ruler selects a budget B^*, and the agent responds to any budget B by choosing a level of spending $S = S^*(B; \alpha, \gamma)$ as given in (1).*

Furthermore, if $\gamma \in [\underline{\gamma}, \gamma^*]$, the equilibrium budget is $B = B_1^*$, and if $\gamma \in [\gamma^*, 1]$, the equilibrium budget is $B = B_2^*$, where γ^* is a unique value in the range $[\underline{\gamma}, 1]$. In the *case of $B = B_1^*$, only the high-type agent exerts effort, while in the case of $B = B_2^*$, both types exert effort.*

Given this equilibrium analysis, we can conduct comparative statics to examine how the main variable of interest, γ, influences the equilibrium budget and the actual level of security provision. To perform this analysis, we focus on two statistics: the expected spending, denoted as $E(S^*(B;\alpha,\gamma))$, and the expected security provision, denoted as $E(F_\alpha(S^*(B;\alpha,\gamma)))$. For simplicity, let us define $\overline{\alpha}$ as the expected value of α, given by $\overline{\alpha} = p\alpha_h + (1-p)\alpha_l$.

When $B = B_1^*$,

$$\begin{aligned} E(S^*(B_1^*;\alpha,\gamma)) &= pS^*(B_1^*;\alpha_h,\gamma) = \frac{pB_1^*}{2} - \frac{p(1-\gamma)}{2\alpha_h\gamma} \\ &= \frac{p}{2}\left(\frac{1-\gamma}{2\alpha_h\gamma} + \frac{W}{2}\right) - \frac{p(1-\gamma)}{2\alpha_h\gamma} = \frac{pW}{4} - \frac{p(1-\gamma)}{4\alpha_h\gamma} \end{aligned}$$

and

$$E(F_\alpha(S^*(B_1^*;\alpha,\psi)) = \frac{p\alpha_h W}{4} - \frac{p(1-\gamma)}{4\gamma}.$$

When $B = B_2^*$,

$$\begin{aligned} E(S^*(B_2^*;\alpha,\gamma)) &= pS^*(B_2^*;\alpha_h,\gamma) + (1-p)S^*(B_2^*;\alpha_l,\gamma) = \frac{B_2^*}{2} - \frac{p(1-\gamma)}{2\alpha_h} - \frac{(1-p)(1-\gamma)}{2\alpha_l\gamma} \\ &= \frac{W}{4} + \frac{1-\gamma}{4\overline{\alpha}\gamma} - \frac{p(1-\gamma)}{2\alpha_h\gamma} - \frac{(1-p)(1-\gamma)}{2\alpha_l\gamma} \end{aligned}$$

and

$$\begin{aligned} E(F_\alpha(S^*(B_2^*;\alpha,\gamma)) &= B_2^*\frac{\overline{\alpha}}{2} - \frac{1-\gamma}{2\gamma} \\ &= \left(\frac{1-\gamma}{2\overline{\alpha}\gamma} + \frac{W}{2}\right)\frac{\overline{\alpha}}{2} - \frac{1-\gamma}{2\gamma} = \\ &= \frac{\overline{\alpha}W}{4} - \frac{1-\gamma}{4\gamma}. \end{aligned}$$

Finally, to emphasize the main implications of this analysis, it is helpful to express the outcome variables S and F in terms of the corresponding security budget B, while varying the model parameters γ and W. Specifically, when $B = B_1^*$, we obtain the following expressions:

$$(B_1, S_1, F_1) = \left(\frac{W}{2} + \frac{1-\gamma}{2\alpha_h\gamma}, \frac{pW}{4} - \frac{p(1-\gamma)}{4\alpha_h\gamma}, \frac{p\alpha_h W}{4} - \frac{p(1-\gamma)}{4\gamma}\right).$$

And when $B = B_2^*$, we have the following:

$$(B_2, S_2, F_2) = \left(\frac{W}{2} + \frac{1-\gamma}{2\overline{\alpha}\gamma}, \frac{W}{4} + \frac{1-\gamma}{4\overline{\alpha}\gamma} - \frac{p(1-\gamma)}{2\alpha_h\gamma} - \frac{(1-p)(1-\gamma)}{2\alpha_l\gamma}, \frac{\overline{\alpha}W}{4} - \frac{1-\gamma}{4\gamma}\right)$$

The following proposition describes the impact of changes in γ on the ruler's equilibrium budget, the actual spending on security S^*, and the regime strength $E(F_\alpha(S^*))$.

Proposition 2. *For all $\gamma \neq \gamma^*$, a marginal decrease in the agent's dependence on the ruler (γ) increases the ruler's equilibrium budget B^*, but decreases both actual spending on security S^* and regime strength $E(F_\alpha(S^*))$.*

Proposition 2 demonstrates a negative association between the official security budget and the actual expenditure on security services when the agent's reliance on the ruler diminishes. This finding has a significant implication: In the event of increasing corruption within the security service over time, a higher observed security budget does not serve as a reliable indicator of actual security spending or the strength of the regime. In reality, both the actual security spending and regime strength tend to decline despite the seemingly inflated budgetary figures.

Proposition 2's implications go beyond theoretical analysis, serving as a stark reminder of the deceptive nature of appearances, especially within the opaque world of politics and corruption in authoritarian regimes. While a higher security budget might suggest strong protection and a formidable regime, the reality beneath the surface can be different. Corruption can silently undermine security, reducing spending on protective measures and weakening the ruling authority. This highlights the need for vigilance and a deeper understanding of security and governance within authoritarian regimes, cautioning against relying solely on numbers.

The following proposition describes the impact of changes in W on the ruler's equilibrium budget B^*, the actual spending on security S^*, and the regime strength $E(F_\alpha(S^*))$.

Proposition 3. *If the ruler's wealth W increases, the ruler's equilibrium budget B^*, security spending S^*, and regime strength $E(F_\alpha(S^*))$ all increase.*

Proposition 3 indicates that an increase in W leads to an increase in the ruler's equilibrium budget, as well as an accompanying increase in security spending and the strength of the regime.

Proxying for Repressive Capacity

As noted above, a major empirical implication of our model is that security spending may be a poor proxy for coercive and repressive power in the context of empirical work. Indeed, the relationship between the ruler's total wealth W, the budget allocated to the security forces B, actual spending on security S, and repressive power F depends crucially on which of the underlying covariates are moving. As Propositions 2 and 3 show, when the ruler's available wealth increases, all of these variables increase linearly. Hence, if the variation in the data comes primarily from differences in wealth, wealth itself (W) is just as good a proxy for F as is the military budget B.

On the other hand, when variation comes from the agent being less dependent on the ruler (a change in γ), which we may conceptualize as an increase in corruption, a decrease in the agent's dependence lowers S and F while increasing B, and W remains unchanged. Similar results arise if the underlying changes to the fundamentals involve changes in the agent's ability (i.e., changes to α_h, α_l, or p). In this scenario, using B as a proxy for F would actively mislead researchers, while using W would simply fail to pick up any changes in F related to the agency problem between ruler and security agents.

In this case, the ideal solution would be to find a good proxy that captures changes in γ, such as a direct control for changes in corruption over time. There are indicators of public sector corruption, such as the Corruption Perceptions Index. However, these indices are not objective measurements of corrupt practices; instead, they are perception-based. Developing accurate measures of the problem is nearly impossible due to the secrecy surrounding corrupt activities. It is challenging to collect objective statistics on corruption, and no measurement method has been established that reliably captures the true extent of corruption in a nation, let alone within the security service. Put differently, current perception-based indexes are not entirely reliable indicators of the actual levels of corruption within the security forces. If there is a correlation between the perceived amount of corruption in a country and the level of corruption within its security services, the existing indicators may be useful for restricted cross-country comparisons at a particular point in time. However, such indices are unlikely to be precise or reliable enough to detect changes over time in the level of corruption inside a specific country's security agencies.

If one cannot directly control for changes in γ, our model suggests, however, a better proxy for coercive power than either B or W. In case 1 in our analysis (when the ruler focuses on incentivizing the high type), we can verify that

$$F_1 = \frac{p\alpha_h}{2}(W - B_1).$$

Similarly, in case 2 (when the ruler incentivizes both types),

$$F_2 = \frac{\overline{\alpha}}{2}(W - B_2).$$

In other words, in either case, F^* is a multiple of $W - B^*$. This suggests that we can proxy for coercive power by the ruler's wealth (public sector budget, or perhaps simply GDP), and *discount* our estimate of military power for any country that has an unusually high military budget given its wealth. According to logic, such a large budget may not represent increased military might but rather serve to compensate for an incompetent or corrupt agent, and then only partially. Of course, our simple model does not account for the fact that various countries may have different security needs or objectives. Even if a country is not corrupt, it may choose to have higher military spending as a function of GDP if it is in a volatile security scenario (e.g., Israel) or wishes to maintain global military supremacy (e.g., the United States). However, enormous military budgets without a need should make researchers cautious.

While there are undoubtedly practical challenges to quantifying changes in the level of corruption or establishing better proxies for coercive power, the discussion above is intended to motivate further research in this area. The primary lesson from our theoretical research is that we should exercise extreme caution when using budgets or staff numbers as proxies for coercive authority in the context of increased corruption, low morale, or other agency issues inside the security services.

4 Conclusion

Repressive capacity and military power are critical to understanding the internal and external politics of authoritarian governments. As a result, our findings have important implications for how we interpret the coercive power of authoritarian regimes when we consider the fundamental interactions between rulers and their security agencies. The findings shed light on the complex relationship between a regime's resources, financial allocations, and the effectiveness of its security forces. Understanding these dynamics is crucial for informing substantive research and formulating effective policy responses to authoritarian governments.

The paper's findings also have policy implications, particularly in foreign policy towards non-democratic regimes. In the United States and other democratic nations, decisions regarding engagement with such regimes are often influenced by the perceived military and repressive strengths of these regimes. Military spending and budgets often serve as critical indicators of perceived military capacity, which can significantly affect democratic governments' foreign policy with substantial human rights and humanitarian implications.

A recent example exemplifies this point. The United States and other Western intelligence agencies based their predictions on perceived military strength, anticipating that Russia would swiftly overpower Ukraine without having a plan in place to assist the Ukrainian government in the event of a prolonged conflict. However, the actual strength of Russian military forces proved to be different. As acknowledged by several US intelligence professionals, the intelligence community needed to fully appreciate the extent of systemic corruption and incompetence in the Putin regime, particularly within the Russian army. The director of national intelligence, Avril Haines, said during a Senate Intelligence Committee hearing that the CIA did not foresee the military difficulties that Putin has faced with his own forces.[8]

This case underscores the importance of accurately assessing repressive and military capacities and considering the potential implications for policy decisions. Our analysis suggests that policymakers and intelligence agencies should consider factors such as corruption within security forces and other agency problems, which can significantly impact the actual effectiveness of repressive capabilities. By recognizing the limitations of relying solely on surface-level indicators, policymakers can adopt a more nuanced and comprehensive approach to understanding the actual capacities of non-democratic regimes. This approach will enable more informed and effective decision-making that perhaps better aligns with humanitarian principles and promotes the well-being of affected populations.

[8]For a detailed discussion of the US intelligence community to account for corruption when assessing the strength of the Russian army, see James Risen and Ken Klippenstein, "The CIA Thought Putin Would Quickly Conquer Ukraine. Why Did They Get It So Wrong?," The Intercept, October 22, 2022.

References

Acemoglu, D., D. Ticchi, and A. Vindigni (2010). A theory of military dictatorships. *American Economic Journal: Macroeconomics 2*(1), 1–42.

Albertus, M. and V. Menaldo (2012). Coercive capacity and the prospects for democratization. *Comparative politics 44*(2), 151–169.

Andersen, D., J. Møller, L. L. Rørbæk, and S.-E. Skaaning (2014). State capacity and political regime stability. *Democratization 21*(7), 1305–1325.

Baldwin, D. A. (2016). *Power and international relations: A conceptual approach.* Princeton University Press.

Barnett, M. and R. Duvall (2005). Power in international politics. *International organization 59*(1), 39–75.

Bellin, E. (2004). The robustness of authoritarianism in the middle east: Exceptionalism in comparative perspective. *Comparative politics*, 139–157.

Besley, T. and J. A. Robinson (2010). Quis custodiet ipsos custodes? civilian control over the military. *Journal of the European Economic Association 8*(2-3), 655–663.

Bueno De Mesquita, B., S. Alaistair, R. Siverson, and J. Morrow (2003). *The Logic of Political Survival.* Cambridge, MA: MIT Press.

Carroll, R. J. and B. Kenkel (2019). Prediction, proxies, and power. *American Journal of Political Science 63*(3), 577–593.

Chen, J. and Y. Xu (2017). Information manipulation and reform in authoritarian regimes. *Political Science Research and Methods 5*(1), 163–178.

Davenport, C. (2007). State repression and political order. *Annu. Rev. Polit. Sci. 10*, 1–23.

Di Lonardo, L., J. S. Sun, and S. A. Tyson (2020). Autocratic stability in the shadow of foreign threats. *American Political Science Review 114*(4), 1247–1265.

Dragu, T. and X. Fan (2020). Self-enforcing legal limits: Bureaucratic constraints on repression under emergency powers. *The Journal of Politics 82*(2), 687–699.

Dragu, T. and A. Przeworski (2019). Preventive repression: Two types of moral hazard. *American Political Science Review 113*(1), 77–87.

Egorov, G. and K. Sonin (2011). Dictators and their viziers: Endogenizing the loyalty–competence trade-off. *Journal of the European Economic Association 9*(5), 903–930.

Fearon, J. D. and D. D. Laitin (2003). Ethnicity, insurgency, and civil war. *American political science review 97*(1), 75–90.

Finer, S. E. (2002). *The man on Horseback: The role of the military in politics. New Brunswick.* NJ: Transaction Publishers.

Fortin-Rittberger, J. (2014). Exploring the relationship between infrastructural and coercive state capacity. *Democratization 21*(7), 1244–1264.

Gailmard, S. (2010). Politics, principal–agent problems, and public service motivation. *International Public Management Journal 13*(1), 35–45.

Gandhi, J. and A. Przeworski (2007). Authoritarian institutions and the survival of autocrats. *Comparative political studies 40*(11), 1279–1301.

Geddes, B., E. Frantz, and J. G. Wright (2014). Military rule. *Annual review of political science 17*, 147–162.

Geddes, B., J. Wright, and E. Frantz (2014). New data set: autocratic breakdown and regime transitions. *Perspectives on Politics 12*(2), 313–331.

Gehlbach, S., K. Sonin, and M. W. Svolik (2016). Formal models of nondemocratic politics. *Annual Review of Political Science 19*, 565–584.

Greitens, S. C. (2016). *Dictators and their secret police: Coercive institutions and state violence*. Cambridge University Press.

Greitens, S. C. (2017). Rethinking china's coercive capacity: an examination of prc domestic security spending, 1992–2012. *The China Quarterly 232*, 1002–1025.

Gupta, S., L. De Mello, and R. Sharan (2001). Corruption and military spending. *European journal of political economy 17*(4), 749–777.

Guriev, S. and D. Treisman (2020). A theory of informational autocracy. *Journal of public economics 186*, 104158.

Gurr, T. R. (1988). War, revolution, and the growth of the coercive state. *Comparative political studies 21*(1), 45–65.

Hanson, J. K. (2018). State capacity and the resilience of electoral authoritarianism: Conceptualizing and measuring the institutional underpinnings of autocratic power. *International Political Science Review 39*(1), 17–32.

Hanson, J. K. and R. Sigman (2021). Leviathan's latent dimensions: Measuring state capacity for comparative political research. *The Journal of Politics 83*(4), 1495–1510.

Henderson, E. A. and J. D. Singer (2000). Civil war in the post-colonial world, 1946-92. *Journal of Peace research 37*(3), 275–299.

Hendrix, C. S. (2010). Measuring state capacity: Theoretical and empirical implications for the study of civil conflict. *Journal of peace research 47*(3), 273–285.

Koehler, J. O. (2008). *STASI: The untold story of the East German secret police.* Basic Books.

Levitsky, S. and L. A. Way (2010). *Competitive authoritarianism: Hybrid regimes after the Cold War.* Cambridge University Press.

Li, Y. and M. Elfstrom (2021). Does greater coercive capacity increase overt repression? evidence from china. *Journal of Contemporary China 30*(128), 186–211.

Mann, M. (2012). *The sources of social power: volume 2, the rise of classes and nation-states, 1760-1914*, Volume 2. Cambridge University Press.

Myerson, R. B. (2008). The autocrat's credibility problem and foundations of the constitutional state. *American Political Science Review 102*(1), 125–139.

Nordlinger, E. A. (1977). *Soldiers in politics: military coups and governments.* Englewood Cliffs, N.J.: Prentice-Hall.

Paine, J. (2021). The dictator's power-sharing dilemma: Countering dual outsider threat. *American Journal of Political Science 65*(2), 510–527.

Seeberg, M. B. (2014). State capacity and the paradox of authoritarian elections. *Democratization 21*(7), 1265–1285.

Skocpol, T. (1979). *States and social revolutions: A comparative analysis of France, Russia and China.* Cambridge University Press.

Svolik, M. W. (2012). *The politics of authoritarian rule*. Cambridge University Press.

Svolik, M. W. (2013). Contracting on violence: The moral hazard in authoritarian repression and military intervention in politics. *Journal of Conflict Resolution 57*(5), 765–794.

Tilly, C. (2010). *Regimes and repertoires*. University of Chicago Press.

Tyson, S. A. (2018). The agency problem underlying repression. *The Journal of Politics 80*(4), 1297–1310.

Walter, B. F. (2006). Building reputation: Why governments fight some separatists but not others. *American Journal of Political Science 50*(2), 313–330.

Wintrobe, R. (2000). *The political economy of dictatorship*. Cambridge University Press.

Wright, J., E. Frantz, and B. Geddes (2015). Oil and autocratic regime survival. *British Journal of Political Science 45*(2), 287–306.

Zakharov, A. V. (2016). The loyalty-competence trade-off in dictatorships and outside options for subordinates. *The Journal of Politics 78*(2), 457–466.

A Proofs

Proposition 1. If $B_l \geq W$ (case 1), we shown in the main text that the optimal choice is $B^* = B_1^*$.

If $B_l < W$ (case 2), the optimal choice could in principle be B_h, B_1^*, B_l, B_2^* or W. It cannot be B_h or W since $EU_P = 0$ at these values of B. It could be B_l only if $\lim_{B \nearrow B_l} \frac{\partial EU_P}{\partial B} \geq 0$ and $\lim_{B \searrow B_l} \frac{\partial EU_P}{\partial B} \leq 0$. Taking the difference of these conditions, we obtain $-(1-p)lB_l + \frac{(1-p)lW}{2} + \frac{(1-p)(1-\gamma)}{2\gamma} \leq 0$, or $-B_l + \frac{1-\gamma}{2\gamma l} + \frac{W}{2} \leq 0$, which implies $B_l \geq W$, contradicting that we are in case 1.

Hence the optimal choice in case 1 is either B_1^* or B_2^*. Moreover, it must be B_1^* if $EU_P^h(B_1^*) > EU_P^{h,l}(B_2^*)$ and B_2^* in the opposite case. Why? Clearly this is true if $B_1^* \in [B_h, B_l]$ and $B_2^* \in [B_l, W]$. Moreover, $B_2^* \geq B_1^*$ and $B_2^* \leq \frac{B_l+W}{2} \leq W$. So the other possible cases are: $B_1^*, B_2^* \in [B_h, B_l]$ or $B_1^*, B_2^* \in [B_l, W]$. If $B_1^*, B_2^* \in [B_h, B_l]$ then clearly the optimal B is B_1^*, as B_2^* is out of bounds, but it must also be that $EU_P^h(B_1^*) > EU_P^{h,l}(B_2^*)$, as $EU_P^h(B_1^*) > EU_P^h(B_2^*)$ (by the optimality of B_1^* over $[B_h, B_l]$) and $EU_P^h(B_2^*) \geq EU_P^{h,l}(B_2^*)$ (because the difference between $EU_P^{h,l}$ and EU_P^h is a term that turns negative for $B < B_l$). Similarly, if $B_1^*, B_2^* \in [B_l, W]$ then B_2^* is optimal, and it must also be that $EU_P^h(B_1^*) < EU_P^{h,l}(B_2^*)$, as $EU_P^{h,l}(B_1^*) < EU_P^{h,l}(B_2^*)$ by the optimality of B_2^*, and $EU_P^h(B_1^*) \leq EU_P^{h,l}(B_1^*)$ because the difference between $EU_P^{h,l}$ and EU_P^h is a term that turns positive for $B < B_l$.

Denote $\overline{\alpha} = ph + (1-p)l$, $\psi = \frac{1-\gamma}{\gamma}$, and

$$U_1 = EU_P(B_1^*) = \frac{p\alpha_h}{2}\left(\frac{W}{2} - \frac{1-\gamma}{2\gamma\alpha_h}\right)^2 = \frac{ph}{8}\left(W^2 - 2W\frac{\psi}{\alpha_h} + \frac{\psi^2}{\alpha_h^2}\right) = \frac{p}{8}\left(W^2\alpha_h - 2W\psi + \frac{\psi^2}{\alpha_h}\right)$$
$$U_2 = EU_P(B_2^*) = \frac{p\alpha_h + (1-p)\alpha_l}{2}\left(\frac{W}{2} - \frac{1-\gamma}{2\gamma(p\alpha_h + (1-p)\alpha_l)}\right)^2 = \frac{\overline{\alpha}}{8}\left(W - \frac{\psi}{\overline{\alpha}}\right)^2 = \frac{1}{8}\left(W^2\overline{\alpha} - 2W\psi\right.$$

So $U_2 > U_1$ iff

$$
\begin{aligned}
W^2\overline{\alpha} - 2W\psi + \frac{\psi^2}{\overline{\alpha}} >& p\left(W^2 h - 2W\psi + \frac{\psi^2}{h}\right) \\
\iff (1-p)lW^2 + \psi^2\left(\frac{1}{\overline{\alpha}} - \frac{p}{\alpha_h}\right) >& 2\psi(1-p)W \\
\iff \psi^2\left(\frac{1}{\overline{\alpha}} - \frac{p}{\alpha_h}\right) >& (2\psi W - \alpha_l W^2)(1-p)
\end{aligned}
$$

Note that $U_2 > U_1$ for all $\psi \in [0, \frac{\alpha_W}{2}]$, as the right-hand side is negative while the left-hand side is positive. In addition, the condition $B_l < W$ is equivalent to $\frac{\psi}{\alpha_l} < W$, or $\psi < \alpha_W$. For ψ close to α_W, $U_2 > U_1$ iff

$$
\begin{aligned}
\alpha_l\left(\frac{1}{\overline{\alpha}} - \frac{p}{\alpha_h}\right) &> 1-p \\
\iff \alpha_l(\alpha_h - \overline{\alpha}p) &> (1-p)\overline{\alpha}\alpha_h \\
\iff \alpha_l\alpha_h &> \overline{\alpha}(\alpha_h - p\alpha_h + p\alpha_l) \\
\iff \alpha_l\alpha_h &> (\alpha_l + p\alpha_h - p\alpha_l)(\alpha_h - p\alpha_h + p\alpha_l),
\end{aligned}
$$

which is always false for $p \in (0,1)$. So $U_2 < U_1$ for ψ close enough to $\alpha_l W$.

Moreover, the log derivative of $\psi^2\left(\frac{1}{\overline{\alpha}} - \frac{p}{\alpha_h}\right)$ with respect to ψ is $\frac{2}{\psi}$, while the log derivative of $(2\psi W - \alpha_l W^2)(1-p)$ with respect to ψ is $\frac{2}{2\psi - \alpha_l W}$, a higher value for $\psi \in \left(\frac{\alpha_l W}{2}, \alpha_l W\right)$. So U_1 crosses U_2 once from below at some ψ^* between $\frac{\alpha_l W}{2}$ and $\alpha_l W$.

For $\psi \in (0, \psi^*)$, $B = B_2^*$ which is increasing in ψ, hence decreasing in γ, and U_2 is decreasing in ψ, hence increasing in γ. For $\psi \in (\psi^*, \alpha_l W)$, $B = B_1^*$ which is also increasing in ψ, hence decreasing in γ, and U_1 is decreasing in ψ, hence increasing in γ. So we obtain a negative relationship between B and EU_P in both regions. However, when ψ crosses over ψ^* from below, B switches discontinuously to B_2^* to B_1^*, which is lower. Meanwhile EU_P cannot have a discontinuity at ψ^*, and it decreases smoothly in ψ both to the left and right of ψ^*. So we have a positive relationship at the point of discontinuity.

The intuition is that, the lower γ is—that is, the less dependent the agent on the ruler's survival—the higher the budget the ruler must provide to incentivize a reasonable amount of spending from the agent. But the deterioration of the agent's incentives still dominates, so overall spending still decreases—the increased budget only partly compensates for the change in the agent's incentives. However, around ψ^*, the agent is becoming independent enough that the ruler no longer finds it worthwhile to provide the low type with any incentives to spend on security. Instead the ruler writes off the case in which the agent's type is low, and focuses only on choosing a budget that is optimal in case the agent's type is high. Because high-type agents do not require such large budgets to perform, the ruler's preferred budget actually drops at the point where she gives up on the low type agent. □

Proposition 2. When $B = B_1^*$, we have

$$(B_1, S_1, F_1) = \left(\frac{W}{2} + \frac{\psi}{2\alpha_h}, \frac{pW}{4} - \frac{p\psi}{4\alpha_h}, \frac{p\alpha_h W}{4} - \frac{p\psi}{4}\right).$$

The sign of derivative of these expression with respect γ are as follows:

$$\frac{\partial(B_1, S_1, F_1)}{\partial\psi} = \left(\frac{1}{2\alpha_h}, -\frac{p}{4\alpha_h}, -\frac{p}{4}\right) = (+, -, -)\,,$$

which shows that then the ruler's equilibrium budget increases, but actual spending on security and regime strength decline when γ decreases.

And when $B = B_2^*$, we have

$$(B_2, S_2, F_2) = \left(\frac{W}{2} + \frac{\psi}{2\overline{\alpha}}, \frac{W}{4} + \frac{\psi}{4\overline{\alpha}} - \frac{p\psi}{2\alpha_h} - \frac{(1-p)\psi}{2\alpha_l}, \frac{\overline{\alpha}W}{4} - \frac{\psi}{4} \right)$$

The sign of derivative of these expression with respect γ are as follows:

$$\frac{\partial(B_2, S_2, F_2)}{\partial\psi} = \left(\frac{1}{2\overline{\alpha}}, \frac{1}{4\overline{\alpha}} - \frac{p}{2\alpha_h} - \frac{1-p}{2\alpha_l}, -\frac{1}{4} \right) = (+, -, -)\,,$$

which shows that then the ruler's equilibrium budget increases, but actual spending on security and regime strength decline when γ decreases. □

Proposition 3. When $B = B_1^*$, we have

$$(B_1, S_1, F_1) = \left(\frac{W}{2} + \frac{\psi}{2\alpha_h}, \frac{pW}{4} - \frac{p\psi}{4h}, \frac{p\alpha_h W}{4} - \frac{p\psi}{4} \right).$$

The sign of derivative of these expression with respect W are as follows:

$$\frac{\partial(B_1, S_1, F_1)}{\partial W} = \left(\frac{1}{2}, \frac{p}{4}, \frac{ph}{4} \right) = (+, +, +),$$

which shows that then the ruler's equilibrium budget increases, actual spending on security and regime strength, all increase when W increases.

And when $B = B_2^*$, we have

$$(B_2, S_2, F_2) = \left(\frac{W}{2} + \frac{\psi}{2\overline{\alpha}}, \frac{W}{4} + \frac{\psi}{4\overline{\alpha}} - \frac{p\psi}{2\alpha_h} - \frac{(1-p)\psi}{2\alpha_l}, \frac{\overline{\alpha}W}{4} - \frac{\psi}{4} \right)$$

The sign of derivative of these expression with respect W are as follows:

$$\frac{\partial(B_2, S_2, F_2)}{\partial W} = \left(\frac{1}{2}, \frac{1}{4}, \frac{\overline{\alpha}}{4} \right) = (+, +, +)\,,$$

which shows that then the ruler's equilibrium budget increases, actual spending on security and regime strength, all increase when W increases. $\square$