

# Service Provision and Authoritarian Control

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## Abstract

Popular uprisings present a serious challenge to authoritarian rule. To counter such threats, leaders rely on a combination of ‘carrots’—policy concessions, economic inducements—and ‘sticks’—repression, disappearances, torture—to suppress opponents and silence dissidents. The success of either strategy, however, requires information about citizens’ attitudes towards the regime. We construct a model in which leaders counter revolutionary threats by manipulating levels of public goods provision *and* mobilizing the state’s repressive apparatus. The model predicts that regimes will use public goods to collect information on citizens’ attitudes even when public goods are more expensive than other policies, but only when economic productivity is lower. Information collection increases in political polarization, while regime efficiency has competing effects. The model demonstrates that public goods can elicit credible signals of citizen attitudes towards the regime, allowing authoritarian leaders to more effectively repress and coopt citizens. Supporting evidence for a key empirical implication of the model is found using observational data.

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# 1 Introduction

Authoritarian leaders face domestic threats from one of two sources: elites or the masses. A growing literature on authoritarian rule and control elucidates the ways in which leaders coopt key elites and leading opposition figures to consolidate control and mitigate the risks of civil unrest. Despite these advances in our collective understanding of authoritarian accommodation and cooptation in the face of elite threats, the literature on coercive institutions—or the leader’s use of violence and repression to secure his rule—is much less developed (Thomson 2018). We address this gap in the literature with a specific focus on authoritarian efforts to counter collective social action, or *revolutionary threats* (Bueno de Mesquita and Smith 2009, 2010). Recent empirical work shows that non-violent civil resistance presents a serious threat to the stability of dictatorial regimes (Chenoweth and Stephan 2011) and, indeed, many of the classic works on authoritarianism focus on the revolutionary threat posed by popular uprisings and mass protest (Arendt 1973, Bratton and Van de Walle 1997, Friedrich and Brzezinski 1965, Marwell and Oliver 1993, Tilly 1978).

To examine these dynamics, we develop a model that extends the work of Smith (2008) and Bueno de Mesquita and Smith (2009, 2010) by allowing a leader to counter revolutionary threats with a combination of both carrots—private and public goods—and sticks—repression, disappearances, and physical intimidation. The model thus captures not only variation in levels of private and public goods provision, but also incorporates the trade-off that authoritarian leaders often face when choosing whether to repress or coopt regime opponents. The success of both cooptation and repression are contingent upon the leader acquiring quality information about citizens’ attitudes towards the regime, allowing the regime to strategically repress some in the population while buying off others. Unfortunately for autocrats, gathering accurate and timely information about citizen preferences is extremely difficult; because citizens fear repression by the state, ‘preference falsification’ is particularly acute in authoritarian settings (Greitens 2016, Kuran 1989). This presents leaders with a dilemma, since maintaining a strong repressive apparatus ensures that citizens will con-

tinue to feign support for the regime, thereby limiting the efficacy of both repression and cooptation. How do authoritarian regimes overcome these informational constraints?

From the model, we describe the equilibria of an incomplete-information game in which the regime lacks knowledge of the type of citizen it faces. Citizens are either dissenters or neutral toward the regime. Dissenters are more opposed to the regime than neutral citizens. The regime can choose to either coopt or repress citizens in order to quell mass unrest but, critically, lacks information about the true distribution of preferences towards the regime across citizens. Thus, in order to effectively employ either cooptation or repression, the regime needs to gather credible information on citizen types. In an effort to gather such information, the regime provides strategic public goods—what we term *human services*—that, when citizens participate in those goods, provide credible signals of citizen type. Following the classic literature on public goods, human services are both non-rivalrous and non-excludable; by examining human services, we are simply narrowing our analysis to focus specifically on public goods which by nature entail interpersonal interactions between citizens and agents of the regime.

For example, a number of state-run institutions such as schools and health clinics necessarily include significant interaction between regime representatives and the masses. This stands in contrast to those goods—such as road construction or refuse collection—that are public in nature but require little to no personal contact between the government and its citizens. We demonstrate that authoritarian regimes strategically embed state agents and informants in human services and rely on the sustained interaction between such agents and the broader populace to gather credible signals of citizen types. We show that this equilibrium holds when economic productivity is low, the cost of public goods is low, and when polarization between neutral citizens and dissenters is high. Further, the efficiency with which the regime is able to provide public goods and the extent to which the regime and citizens value the future exert competing effects on the regime’s willingness to provide public goods as an ‘information collection’ mechanism. After citizens reveal their types in response

to public goods, the regime is able to selectively provide public goods to neutral citizens and initiate repression against dissenters. More generally, we highlight a non-monotone relationship between economic productivity and public goods provision in authoritarian regimes, since at high levels of productivity regimes provide public goods for economic development. As the cost of public goods provision increases, regimes abandon the strategy entirely and use only a combination of private goods and repression to counter revolutionary threats.

Counterintuitively, our findings demonstrate that authoritarian leaders may benefit from ‘over-providing’ public goods, a seemingly inefficient response that increases the regime’s costs in the short term but provides greater long term stability. Citizen participation in human services can provide the regime with credible signals about citizens’ true preferences, allowing the leader to respond in the second round of the game with a selective, and more efficient, combination of repression and cooptation. After developing the model, we present evidence from cross-national data on authoritarian regimes which demonstrate one empirical implication of the model: a non-monotone relationship between economic productivity and public goods provision, specifically education expenditures.

This article makes a number of contributions to the literature. First, it addresses a central tension in the authoritarian repression and control literature, providing insights into how autocratic rulers overcome informational constraints that threaten their rule. Recent works on authoritarianism have focused almost exclusively on regime efforts to improve the exchange of information between rulers and other elites, but few works have addressed the unique informational challenges that arise when leaders must counter popular threats to their rule. Further, we contribute to a growing literature on governance and public goods provision in non-democratic regimes and demonstrate the intimate link between ‘good governance’ and repression in authoritarian settings. Finally, we contribute to the formal literature on the study of authoritarianism by developing a model of dynamic interaction between autocratic leaders and their citizens, which prior formal treatments have largely overlooked.<sup>3</sup>

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<sup>3</sup>Most formal treatments of mass protest focus on the coordination problem between citizens or citizens’ inability to gain accurate information about the regime (Kricheli, Livne and Magaloni 2011, Kuran 1989,

## 2 The Need for Information in Countering Dissent

Mass mobilization is often a key feature in transitions from authoritarian to democratic rule (Acemoglu and Robinson 2001, Boix 2003). Formal treatments of popular protest in authoritarian systems generally focus on informational constraints that impede citizen coordination of anti-regime activities (Little 2015, Tyson and Smith 2018). Kuran (1989) notes that preference falsification among the population makes it difficult for citizens to know the true extent of anti-regime sentiment; the very act of protest, however, can provide important signals about citizens' preferences towards the regime, and citizens' update their beliefs about anti-regime sentiment and regime strength (or weakness) in response (Bueno de Mesquita 2010, Casper and Tyson 2014, Lohmann 1993, 1994b, Meirowitz and Tucker 2013).

Less attention has been devoted to those information asymmetries between the regime and the population which constrain the state's ability to counter revolutionary threats. In the face of popular unrest, leaders require quality information (Wintrobe 2000).<sup>4</sup> in order to effectively apply *either repression or cooptation*. Without quality information, for instance, leaders turn to mass repression even though this strategy will inevitably "...eliminate citizens who are content with the status quo while letting the real enemies go free" (Gregory 2009). Stalin, for instance, repressed significant amounts of non-enemies because the regime was often unable to correctly identify opponents (Gregory 2009). This strategy, however, is extremely inefficient and costly for authoritarian regimes (Dallin, Breslauer et al. 1970, Friedrich and Brzezinski 1965), as an over-reliance on force can induce popular backlash against the government. Recognizing this, leaders attempt to optimize the use of repression, applying sufficient repression to contain dissent while not applying so much as to generate widespread counter-regime mobilization (Francisco 2005, Wintrobe 2000). Implicit in the successful use of selective violence, however, is successful intelligence gathering—"Intelligence enables precise, selective, lower-intensity violence, against the right people and only when

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Lohmann 1994a,c), rather than the regime's need to gain information about its own populace.

<sup>4</sup>We follow Gregory et al.'s 2011 definition here, where quality information is defined as "the ability to identify enemies correctly".

necessary. In the realm of domestic security, a regime with superior intelligence collection, analysis, and transmission will be able to identify the leaders of opposition activity, track their movements, and arrest them quietly before their actions escalate or become public” (Greitens 2016).<sup>5</sup> In short, in order for repression to be effective, authoritarian regimes need both a strong repressive apparatus and quality information.

On the other hand, in the face of ever-present budget constraints, leaders require quality information to successfully co-opt citizens.<sup>6</sup> In recent years, the institutional turn (Pepinsky 2014) in the study of comparative authoritarianism has emphasized the importance of institutions for ameliorating information asymmetries between autocratic leaders and other key elites. For instance, legislatures provide an effective forum for bargaining between the leader and opposition elites (Gandhi 2008, Gandhi and Przeworski 2006). Legislatures can also be used to secure opposition support for the regime through the targeted, selective allocation of spoils and sought-after government positions (Reuter and Robertson 2015, Roessler 2011). While these studies demonstrate the importance of quality information for successful co-optation of opposition elites, revolutionary threats pose a different challenge; namely, potential dissidents are unknown to the regime and, as a result, cannot be targeted with private spoils to secure their loyalty. At the same time, budget constraints mean that leaders are unable to effectively buy-off all citizens. As such, leaders require information about citizen types in order to efficiently and effectively employ strategies of either co-optation or repression.<sup>7</sup>

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<sup>5</sup>Kalyvas (2006) makes the same point in his evaluation of violence in civil war: “selective violence presupposes the ability to collect fine-grained information” (p. 173)

<sup>6</sup>In the words of Bueno de Mesquita and Smith (2010), “buy-off”. We use the terms interchangeably.

<sup>7</sup>Revolutionary threats are especially pernicious to authoritarian leaders precisely because the distribution of anti-regime sentiment within the broader population is unknown. While a robust literature addresses the threat posed to leaders by other elites, this is a qualitatively different challenge as leading opposition figures are known to the leader, unlike potential dissidents in the broader population.

### 3 The Problem of Noncredible Signals

To counter revolutionary threats, authoritarian leaders require quality information about citizen ‘types’, but the very nature of authoritarian governance makes gathering such information especially difficult—fearing repression, citizens often feign support for the regime, making it difficult to identify true preferences. Autocrats rely on a number of informational mechanisms in efforts to overcome this challenge. For instance, regimes often hold elections in order to gather information about the distribution of citizen attitudes within the polity (Brownlee 2007, Gandhi and Lust-Okar 2009, Magaloni 2006). Elections are noisy signals, however, as the need for victory in the election constrains the autocrat’s ability to gather robust, accurate information (Malesky and Schuler 2011). In addition to elections, regimes often rely on denunciations to identify opponents, encouraging individuals within the broader population to provide private information about dissenters and opponents of the regime. Denunciations, however, are inefficient as individuals opt to denunciate rivals—regardless of whether or not they oppose the regime—in order to settle personal vendettas and grievances (Bergemann 2017, Gellately 1996, Kalyvas 2006). During the Great Purges in the Soviet Union, for example, ‘noisy’ denunciations became so prevalent that the government actively discouraged citizens from making ‘false denunciations’ (Fitzpatrick 2005). In addition to denunciations, regimes often turn to physical violence, intimidation, and torture to elicit information, but these tactics also suffer from information falsification and misrepresentation (Rejali 2009).

Requiring quality information—but finding it exceptionally difficult to gather such information in an authoritarian context—how might leaders induce citizens to reveal their true type? We argue that authoritarian leaders provide seemingly inefficient levels of public goods (specifically, human services) in an effort to gain credible information about citizen types. Prior work on service provision in authoritarian settings takes one of three approaches. First, a number of studies examine regime provision of “coordination goods” such as freedom of speech or assembly (Bueno de Mesquita and Smith 2010, Bueno de Mesquita and Downs

2006, Spaniel and Ding 2018), arguing that providing such goods may increase support for the regime, but this comes at the cost of retaining optimal control over the populace. Others contend that goods are simply part of a bargain in which leaders buy-off potential revolutionaries (Bueno de Mesquita and Smith 2009, 2010, Desai, Olofsgård and Yousef 2009, Smith 2008) and reward regime supporters. From this perspective, goods provision is merely another means for patronage politics and the maintenance of clientelistic relationships. Finally, recent work on governance in non-democratic settings—primarily focused on the current political atmosphere in China—shows that institutions can ameliorate information asymmetries by providing an efficient method for aggregating citizen preferences, grievances, and evaluations of the government (Distelhorst and Hou 2017, Manion 2014, Truex 2016). Such information allows the government to more effectively respond to citizens’ demands and concerns, thereby reducing anti-regime sentiment and the threat of mass unrest. This logic is noted explicitly in Bueno de Mesquita and Smith’s *The Dictator’s Handbook*, where public goods are framed as “...improving the welfare of the citizens and diminishing their desire for revolutionary change” (Bueno de Mesquita and Smith 2010, 936).<sup>8</sup>

While the specific mechanisms vary, each of these arguments focuses on the desire of authoritarian leaders to buy-off citizens and diminish anti-regime sentiments through ‘better governance’ and enhanced public goods provision. Distinct from these arguments, we contend that human services, a particular subset of public goods, do more than simply buy-off citizens; they also provide credible signals of attitudes towards the regime among individuals outside the selectorate, precisely those citizens that leaders must consider when concerned about the possibility of mass uprisings. More specifically, we help to explain the provision of public

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<sup>8</sup>We should note that all regimes must provide some minimal level of public goods. “Though the size of the winning coalition is generally small in authoritarian regimes, even autocratic rulers will need to provide a basic level of public goods to their polity, including healthcare, education, and infrastructure. In short, even autocratic leaders rely—to varying degrees—on tax revenues and a basic level of social order, and public goods help to ensure the necessary stability” (Bueno de Mesquita and Smith 2011, 157). Smith (2008) specifically models goods provision as a function of autocrats’ funding sources; without significant external funding, leaders are forced to provide more public goods in order to increase economic productivity and create a larger tax revenue base. Our focus, however, is on the ‘over-provision of goods’ and attempts to explain cases in which authoritarian leaders provide public goods well beyond the absolute minimum required to stay in office.

goods beyond the selectorate even when the leader knows *ex ante* that the provision of such goods will *not* be able to buy-off citizens. Empirically, we might expect that regimes would provide varying levels of goods to different constituencies (Huber, Mustillo and Stephens 2008), but autocrats often provide seemingly inefficient levels of public goods, even rivaling the work of their democratic counterparts (Ross 2006). Why might leaders expend precious resources to provide public goods to citizens even when it is unlikely to reduce their appetite for revolution? We show that public goods provision can, under certain conditions, provide leaders with a seemingly counterintuitive method for gaining credible signals about citizen types, thus making subsequent waves of both repression and cooptation more efficient.<sup>9</sup>

To illustrate the logic of our model, consider an example from secondary education. This is a case of a pure public good, one which is both non-rivalrous and non-excludable. Critically, however, it is also an institution that facilitates sustained, near-daily interaction among both citizens and state agents. We follow Zeira (2018) by focusing not on the political content of educational institutions, but rather the organizational features of schools that facilitate the exchange of information among anti-regime ‘types’ (or, in the terminology of our model, dissenters). While schools provide young activists with a broader social network and a regular site of interaction and information exchange, these same properties also suggest that the covert, strategic placement of regime agents in administrative or instructional positions could provide the regime with credible signals of student types over time (Zeira 2018). The regime can then use this information to identify potential supporters (and potential dissidents) among the population and, subsequently, target repression and cooptation more precisely in the future.

For example, at the height of the African National Congress’s civil disobedience campaign in apartheid South Africa, the ruling National Party used school teachers to identify potential

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<sup>9</sup>We should note that providing public goods in order to ‘buy-off’ citizens is not mutually exclusive from providing goods with an aim to develop more efficient repressive tactics; rather, ‘goods-for-repression’ is an extension of cooptation, helping to explain autocrats’ ‘over-provision’ of public goods, or the provision of goods even when it is known that it will not suppress counter-revolutionary sentiments in the broader populace.

sympathizers among black youth in the Bantustans.<sup>10</sup> In an effort to sow divisions among anti-regime activists, the apartheid government worked tirelessly to stoke black-on-black violence by pitting supporters of the Bantustan policy (most notably the Inkatha Freedom Party) against the revolutionary ANC. As noted in reports from the country’s Truth and Reconciliation Commission, the apartheid government used school teachers in the Bantustans to identify black youths that could be encouraged to participate in a violent youth force, the Black Eagles, that committed targeted violence against ANC supporters. While the apartheid government used human services to identify potential supporters, Saddam Hussein used a similar mechanism to identify potential dissidents, constructing dossiers on young activists while they were still in secondary school (Blaydes 2018). After developing our model, we provide a quantitative test supporting the logic described in these examples.

## 4 A Model of Authoritarian Response to Mass Threats

### 4.1 Setup

We present a model of authoritarian response to revolutionary threat under incomplete information. There are two players: a regime  $G$ , and a representative citizen  $C$ . The citizen may be one of two types, which is unknown by the regime. The discrete citizen types are  $\theta \in \{Neutral, Dissenter\}$ . These are expressed in shorthand as  $\theta \in \{1, 2\}$ . The citizen type determines citizen preferences for the status quo.<sup>11</sup> There are two rounds, indexed by  $t$ . Citizen actions are  $a_t \in \{\text{Not Resist}, \text{Resist}\}$ . Not resisting means citizens engage in economic training in the first round and economic activity in the second round. Resisting means citizens join an anti-regime network. In the context of schools, Zeira (2018) suggests anti-regime resistance involves using school peer groups to communicate, coordinate, gather

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<sup>10</sup>Bantustans, or homelands, were areas that remained nominally under the control of traditional, black African authorities and were part of an apartheid-era scheme to create clearly denoted homelands, or reservations, for black Africans

<sup>11</sup>Alternatively, this can be thought of as support for the present regime.

information, and participate in networks in a way which leads to concrete behavioral changes detectable by the regime even if these behaviors fall short of outright rebellion. In general, neutral types benefit from economic activity but not from resisting, while dissenter types benefit from both economic activity and resisting. Citizens are dissenters with probability  $\pi < \frac{1}{2}$  and neutral with probability  $1 - \pi > \frac{1}{2}$ .<sup>12</sup>

The regime chooses policy in each round:  $a_t \in \{\text{Private Goods, Public Goods, Repression}\}$ . Private goods have cost  $\ell_t$ , through direct cash transfers to citizens. Public goods have cost  $p_t$ . Repression has cost  $c_t$  through a cash transfer of wages to security forces. Note because private goods and repression both involve cash transfers, the cost is the same:  $\ell_t = c_t$ . The policy decision is binary: the regime commits completely to one policy path in each round and does not divide resources between policies. The regime begins with an exogenous supply of rents  $R$ . We assume these rents are what remains in regime coffers after distributing private goods to its selectorate (Bueno de Mesquita et al. 1999). Public goods, private goods, and repression are all costly for the regime. However, if the citizen engages in economic activity *and* the regime has provided public goods, the regime receives the benefit of the citizen's production,  $\gamma \geq 0$ ,<sup>13</sup> but only according to its bureaucratic efficiency  $1 - \tau$ . This captures the argument that developmentalist regimes provide public goods because such goods bring positive economic spillovers (Manzano 2017). Note that if a citizen resists, the regime pays a cost through the guaranteed loss of that citizen's economic output  $\gamma_t$ . The regime's payoff, where  $\delta$  is the discount factor, is:

$$U^R = R - \ell_1 - p_1 - c_1 + (1 - \tau)\gamma_1 + \delta(-\ell_2 - p_2 - c_2 + (1 - \tau)\gamma_2)$$

If citizens engage in resistance, they receive a benefit from resistance according to the function  $g(c_t, x_\theta, x_R)$ , where  $x_{theta}$  is the policy ideal point of the citizen conditional on their

<sup>12</sup>Lichbach (1995) notes that 5% is the proportion of the population needed to mobilize for dissent such that the regime changes. Less than 50% is a theoretically grounded proportion.

<sup>13</sup>Intuitively, the regime benefits from citizen productivity through tax receipts and a more robust economic base.

type  $\theta$  and  $x_R$  is the policy ideal point of the regime. We assume  $x_\theta \neq x_R \quad \forall \theta \in \{1, 2\}$ . The function  $g$  decreases in the investment in state repression  $c$  and increases in type  $\theta$ . This represents the *material* and *ideological* components, respectively, of a citizen's preference for resistance. The value of the resistance function is  $-c_t + d(x_1, x_R)$  for neutral types ( $\theta = 1$ ), and  $-c_t + d(x_2, x_R)$  for dissenter types ( $\theta = 2$ ), where  $d$  measures policy polarization between the citizens and the regime, similar to Gandhi and Przeworski (2006). To capture the notion that dissenters are more motivated to resist, we assume that  $d(x_2, x_R) > d(x_1, x_R)$ . Increased state investment in repression linearly decreases the benefit of resistance for both types. The risk of detection and suffering personal integrity violations for participating in a resistance increases as the state invests more in repression. Dissenter types also have an ideological benefit to participation in resistance which increases in their policy polarization from the regime. This represents an expressive benefit to participating in resistance, whereby the citizen acts on their opposition to the regime rather than falsifying their beliefs by doing nothing (Kuran 1991).

If citizens engage in economic activity, they receive the benefit  $f(\gamma)$  which increases in productivity  $\gamma$  and decreases in type  $\theta$  (Bueno de Mesquita 2005). The value of the production function is  $\gamma$  for neutral types and  $\gamma$  for dissenter types. Put differently, increased productivity increases wages, which increases the benefits of economic activity (Smith 2008). Public goods are allocated through social programs and incur some deadweight loss  $\tau$ , where  $\tau < \pi$ .<sup>14</sup> Both types receive from public goods  $(1 - \tau)p_t$ . Those citizens engaging in economic activity may also receive a transfer from the of private goods,  $j(\ell_t)$ . Private goods are a direct cash transfer to the citizen, and there is no deadweight loss. Both types receive the private transfer  $\ell$  which we assume comes without conditions.

Therefore the payoff to the citizen in round  $t$  is as follows, for each possible action:

$$U_t^C(\text{Resistance}) = -c_t + d(x_\theta, x_R)$$

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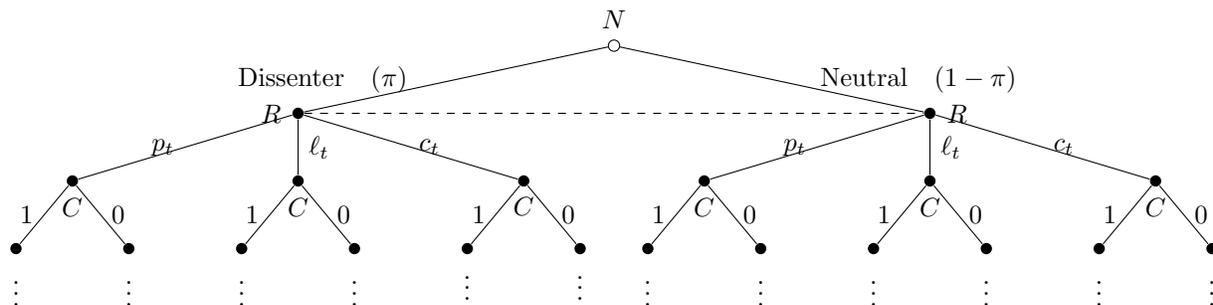
<sup>14</sup>That is the regime still values dissenter economic activity even if inefficiency is high.

$$U_t^C(\text{Not Resist}) = \gamma + \ell_t + (1 - \tau)p_t$$

The timing of the game is as follows:

1. Nature moves and assigns the citizen a dissenter type with probability  $\pi$  and a neutral type with probability  $1 - \pi$ .
2. The regime encounters a new citizen of unknown type. The regime chooses a policy.
3. The citizen observes the regime action and chooses to resist or not resist.
4. The regime chooses a policy for the second round.
5. Then the citizen – whose type may or may not be known to the regime after the first round – observes the regime action and chooses to resist or not resist.
6. The game ends and payoffs are awarded. Payoffs are awarded based on the outcome of each round with two important distinctions.
  - (a) All players' payoffs in the second round are modified by the discount factor  $\delta \in [0, \min\{\frac{1}{c_t-1}, \pi\}]$ , which reflects how much the regime and citizen value the future.
  - (b) The regime falls if the citizen resists in both rounds. The regime payoff in this case is normalized to zero.

The game is one of incomplete information. In particular, the regime does not know the type of the citizen it faces before it chooses a policy in the first round. The regime's prior belief about citizen types are correct: it believes that the citizen is a dissenter with probability  $\pi < \frac{1}{2}$  and a neutral type with probability  $1 - \pi > \frac{1}{2}$ . If the two types of citizens choose identical actions in the first round, *pooling* on resisting or not resisting, then the regime cannot update its prior belief about citizen types. The regime's belief after the first round remains distributed according to the distribution of dissenters and neutral types in the population. However, if the citizen types choose different actions in the first round, then the

**Figure 1: Game Tree Depicting First Round**

regime updates its beliefs and forms posterior beliefs about the type of citizen it faces with certainty. The posterior belief in this situation is either one or zero. Citizens are perfectly informed about their type, regime payoffs, and regime strategy.

To illustrate a sequence of play and information, a game tree is included below which shows the first round of the game: nature assigns the type of the citizen as a dissenter or a neutral type. The regime lacks information about the type of the citizen. The regime then decides to allocate resources to public goods, private goods, or repression. The citizen's choice regarding resistance is denoted by  $r \in \{0, 1\}$  with  $r = 1$  denoting resistance and  $r = 0$  denoting not resisting. The regime then moves again after the citizen action, and citizens move a second time after the second regime action. The available actions in the second round mirror the available actions in the first round.

A complete strategy for each player requires specifying all contingent actions the player would take across both rounds of the game. For the citizen, each type must have a specified response to each possible regime action. In solving the model, we consider strategy profiles of the following form: (1) the dissenting type will always resist in round  $t$  if the regime invests in repression in round  $t$  or  $t-1$ ,<sup>15</sup> (2) the neutral type never resists, and (3) the regime always represses in round  $t$  if the citizen resists in round  $t-1$ . These strategies restrict attention to a set of equilibria which reflect the empirical setting of information-gathering: the regime faces neither a mass threat which could lead to regime collapse ( $\gamma_1 = \gamma_2 = 0$ ), nor a mass

<sup>15</sup>We consider one equilibrium where this is not the case, and show how it falls outside the scope conditions of the model.

threat in which dissenters refuse to resist against repression. The regime knows citizens *can* behave differently based on type, and can gain information if citizen types separate.

## 4.2 Equilibrium

The equilibrium concept is a Perfect Bayesian Equilibrium (PBE) which requires that players possess both consistent beliefs and sequential rationality. We restrict our attention to pure strategy equilibria. In particular, we are interested in (1) pooling equilibria in which both neutral and dissenter types choose not to resist in the first period, and (2) separating equilibria in which neutral types do not resist and dissenter types resist in the first period. This focus allows us to identify *informative* (separating) and *uninformative* (pooling) equilibria for the regime. In short, certain constellations of cost of regime actions, economic productivity, and citizen policy polarization vis-a-vis the regime will induce the regime to undertake efforts to force citizen types to separate such that dissenters can be identified. Other constellations will not force separation. Off-path beliefs are simple to construct with the strategy restrictions imposed above. The regime always believes that conditional on observing resistance, the type of citizen it faces is a dissenter.

One note is warranted on equilibrium selection. In intervals of parameter values in which there are multiple possible equilibria, we choose the *most exclusive* equilibrium. That is, we choose the equilibrium in which the regime restricts resources it shares with other elites across both rounds. Given the regime has an interest in survival and would prefer to avoid empowering its security forces lest they stage a coup (Greitens 2016, Svobik 2012), this means the regime will prefer to offer private goods instead of delegating the management of mass threat to security forces. This equilibrium selection rule demonstrates a dynamic interaction between elite politics and authoritarian responses to mass threats.

## 5 Analysis

We begin by considering how and when regimes spend on public goods. In the *developmentalist* model, regimes provide public goods in order to bolster the economic outputs of all citizens. However, not all citizens choose to support the regime and the regime may find sustained investment in public goods to be too costly over the long term. In these cases, the regime uses public goods in limited amounts and *separates* citizen types in the first round. This allows the regime to respond more efficiently in the second round, repressing dissenters while targeting private goods to neutral types. This equilibrium is the focus of our analysis and provides a novel contribution to the study of authoritarian regime behavior. We show in the appendix conditions under which regimes provide private goods and repress as an alternative to public goods.

### 5.1 Public Goods as Economic Development

To establish a baseline for public goods provision, we first describe the equilibrium in which the regime provides public goods not for information (as our model describes), but for economic development. This equilibrium characterizes the most common explanation for public goods provision in the literature. In particular, an authoritarian regime provides public goods for one of two overlapping economic reasons. First, the regime provides public goods because such goods are cheap relative to average per capita income. Second—as is the case in left-wing dictatorships—the regime provides public goods because such goods are redistributive, increasing the earning potential of the poor while increasing taxes on the rich (Manzano 2017). There is an equilibrium in the model in which the regime invests in public goods to receive the economic benefit from citizens' labor outputs. We then compare this equilibrium with the equilibrium in which the regime invests in public goods as a mechanism for collecting credible information about citizen types.

Consider the following equilibrium, which we label the *developmentalist* equilibrium. The

regime provides public goods in the first round, and both types of citizen engage in economic activity. The regime provides public goods again in the second round, and both types of citizens likewise engage in economic activity. Under the following conditions, we expect a developmentalist regime.

**Proposition 1:** *There is a pooling equilibrium in which the regime offers public goods and neither type resists if:*

- $\gamma \geq d(x_2, x_R) - (1 - \tau)p_t$
- $\ell_t = c_t \geq p_t$

The two conditions are the most restrictive conditions on the productivity of labor under which the equilibrium is supported. The first condition constrains when dissenters participate in a developmentalist policy. Dissenters must prefer not to resist in the second round, sufficiently valuing their labor output. The second condition relates to the cost of goods provision—public goods must be cheaper for the regime to provide than either private goods or repression. This ensures the regime provides public goods instead of private goods in the second round.

Dissenters participate in a developmentalist regime economy only if the productivity of labor and benefit of receiving public goods exceed their negative preferences for the regime. If dissenters are radically opposed to the regime, or productivity is low, then dissenters forego economic activity to resist in the second round. The opportunity costs of resisting in the second round are lower than in the first round, because the regime punishes a dissenter who resists in the first round. In particular  $d(x_2, x_R) - (1 - \tau)p_t > \frac{d(x_2, x_R) - (1 - \tau)p_t - \delta(1 - \tau)p_t - \delta c_t + \delta d(x_2, x_R)}{1 + \delta}$ . If the dissenter contributes to the economy in the first round, accepts public goods, and the regime offers public goods again, the dissenter resists without the cost of punishment in the second round having avoided detection. The developmentalist equilibrium is only supported if dissenters earn enough from producing to resist

the temptation to resist in the final round. Any level of productivity which supports a non-resisting equilibrium for a dissenter also supports a non-resisting equilibrium for the neutral citizen, since  $d(x_2, x_R) > d(x_1, x_R)$ .<sup>16</sup>

Regime support for developmentalist policy is driven by the value of providing public goods even in the second period. This sets a high threshold for the effects of public goods provision. Recall if the regime provides public goods in the first round with the new citizen, it continues to receive the benefit of economic output from citizens  $(1 - \tau)\gamma$  in the second round *even if public goods are not invested in the round*. Further, the dissenter will not resist if the regime provides private goods in the second round. The effects of private and public goods provision are the same in the second round as in the first. Thus the regime could receive the same benefits by reducing public goods provision and substituting for private goods provision. Since private goods are a cash transfer rather than a capital investment, the set of cases in which the regime prefers to continue providing public goods are limited.

If the cost of public goods is lower than the cost of providing private goods or wages to security forces for repression, then the regime is likewise unwilling to deviate and provide private goods or repress in the first round. Repression in particular is costly because the regime sacrifices future economic output of the dissenter when the dissenter resists. Interestingly, the second condition in Proposition 1 is sufficient to support all regime behavior in the developmentalist equilibrium. There is no level of  $\pi > 0$ , the probability of facing a dissenter or  $\tau < 1$ , the regime's inefficiency, for which a regime will forego providing public goods. That is, even if the regime was certain it faced dissenters, and received very little from the economic output of citizens due to inefficiency, it would still provide public goods. This illustrates a baseline against which to compare the information-collection equilibrium. Under information collection, public goods are more expensive than private goods and repression, but the regime provides them because they separate dissenters from neutral citizens.

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<sup>16</sup>In other words, under these conditions the regime is able to buy-off all potential dissidents

## 5.2 Public Goods as Information Collection

Consider the following equilibrium of the game, which we label the *information collection* equilibrium: the regime provides public goods in the first round, dissenters resist while neutral citizens accept the public goods and engage in economic activity. In the second round, the regime provides private goods to the neutral citizens and invests in repression against dissenters. Neutral citizens accept the private goods and dissenters again resist. This describes the primary contribution of the paper: understanding when a regime uses public goods as a method of managing mass threat and identifying dissenters.

***Proposition 2:*** *There is a separating equilibrium in which the regime offers public goods and the dissenter resists if:*

- $d(x_1, x_R) - \ell_t \leq \gamma \leq d(x_2, x_R) - (1 - \tau)p_t - \delta c_t$
- $\gamma \geq \frac{p_t - c_t}{(1 - \tau)(1 - \pi)(1 + \delta)}$
- $\ell_t = c_t \leq p_t$

As before, the conditions are expressed in terms of the cost of public goods  $p_t$  and productivity of labor  $\gamma$ .<sup>17</sup> These are the most restrictive conditions on the parameters. The first condition requires that productivity be sufficiently large in the second round such that the neutral citizen prefers to engage in economic activity, while not being large enough to also encourage the dissenter to choose the same. The second condition requires that the regime gain enough from citizens' productivity to prefer public goods to repression in the first round. The third condition requires that the regime prefer to provide private goods to neutral citizens and repression against dissenters in the second round.

Dissenters must prefer to resist in the first round even after the regime offers public goods. If dissenters do not resist, they receive  $(1 - \tau)p_t + \gamma$  but incur the cost of their

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<sup>17</sup>Because these parameters are common to the payoffs of dissenters and the regime, the description of the equilibrium is tractable when expressed in their terms.

negative preferences for the regime. If dissenters resist, they gain positive valence from resisting the regime but give up public goods, economic productivity, and incur the cost of repression in the second round  $\delta c_t$ . Productivity cannot be so high such that the opportunity costs for resisting are too great for the dissenter. Yet if productivity is too low, the neutral citizen has little to lose from resisting in the second round. This is a strict condition for neutral citizens. Resisting in the second round would not incur repressive costs, since the regime has already observed their participation in the economy in the first round and offered them private goods for the second round. The neutral citizen has a *commitment problem* accepting private goods, and will only accept if the wages to be gained from economic activity in the second round are incentive-compatible. The regime cannot police the agreement to offer private goods.

Another way to consider the first condition is through the difference in anti-regime preferences between the neutral citizen and the dissenter. Given that  $-\ell_t \approx -(1 - \tau)p_t - \delta c_t$ , the range of  $\gamma$  over which the equilibrium is supported intuitively depends on the magnitude of  $d(x_2, x_R) - d(x_1, x_R)$ . The more polarized the citizen types, the more easily the regime induces separation between them. The magnitude of the difference increases if dissenters are strongly opposed to the regime, the neutral citizen is sympathetic toward the regime, or both. Conversely, if the neutral citizen and the dissenter are similar, the regime is less able to provide public goods such that the former accepts and the latter rejects. If the mass threat was small because both neutral citizens and dissenters were only mildly opposed to the regime, the regime would not need to separate types because neither are threatening. If the mass threat was large because both neutral citizens and dissenters were significantly opposed to the regime, the regime would not need to separate types because both are threatening. Thus we expect to observe the information-collection equilibrium more in regimes with a heterogeneous population, and discuss in detail this implication in the case illustration.

In the second condition, the regime must prefer public goods to repression in the first round. The regime faces a tradeoff with providing public goods, unlike in the developmental-

ist equilibrium in which public goods are weakly cheaper than private goods and repression. On one hand, public goods are more expensive, as specified in the third condition. As  $p_t - c_t$  increases the information-collection equilibrium is less likely to be supported. On the other hand, if the regime provides public goods in the first round rather than repressing, it gains economic output of the neutral citizen in the first round and in the second round. This benefit decreases in the regime's inefficiency  $\tau$ , meaning greater inefficiency in capturing gains from economic activity decreases the likelihood that the regime uses public goods for information collection. The benefit also decreases in the probability the regime faces a dissenter  $\pi$ , since the regime does not receive the benefit of its investment in productivity when the dissenter resists. The benefit increases in how much the regime values *future* return on public goods investment,  $\delta$ .

There are several characteristics of regimes in which we expect to find the information-collection equilibrium, based on the conditions in Proposition 2. Already discussed is a *heterogeneous population* in which the preference divergence between neutral citizens and dissenters is stark. While exogenous to the model, diverging preferences could be the product of an endogenous process by which in the past the regime has rewarded some citizens and punished others, creating an intergenerational transfer of preferences toward the regime (Lawrence 2017). Other characteristics are fiscal efficiency, such as a strong bureaucracy reflecting the “infrastructural power” of the state (Slater 2003), a low share of dissenters in the population, and a regime with a long time horizon that expects to survive until the new citizens of the first round have transitioned to the second round. Regimes which use information-collection strategies are relatively strong, stable, and well-governed but not so efficient or productive that public goods do not impose cost tradeoffs.

### 5.3 When Do Regimes Provide Public Goods?

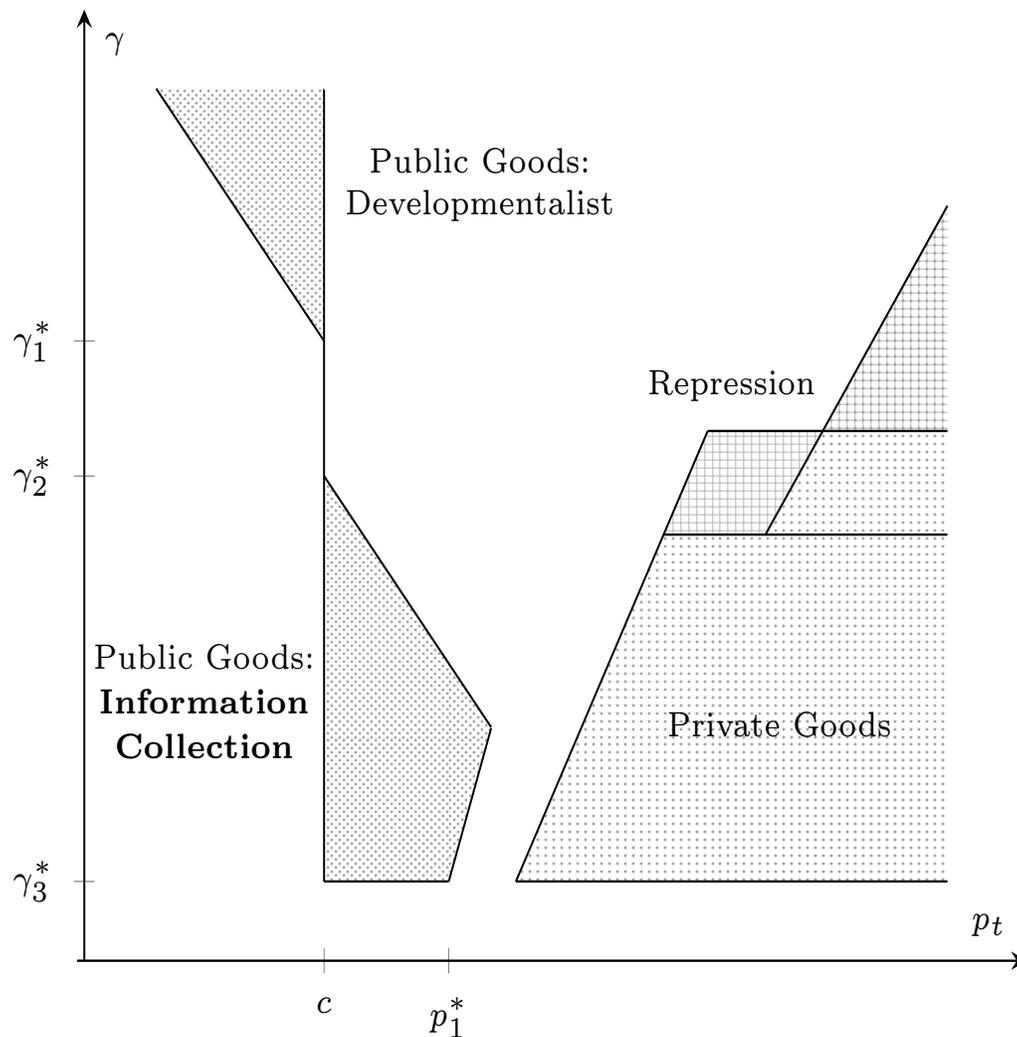
Figure 2 presents the equilibria described in the previous discussion, in addition to equilibria on private goods provision and repression which are discussed in the appendix. On the

horizontal axis is the cost of public goods  $p_t$ , and on the vertical axis is the productivity of citizens contributing to the economy,  $\gamma$ . The critical values marked with \* on each axis reflect the thresholds over which there are equilibria relating to regime provision of public goods. From these critical values we characterize the conditions under which we expect the regime to (1) provide public goods, and (2) provide public goods as a means of separating types of citizens. On the horizontal axis,  $p_1^* = (1 - \tau)(1 + \delta - \pi - \delta\pi) + c_t$  which is the maximum cost of public goods which support the information collection equilibrium when productivity is low. On the vertical axis,  $\gamma_1^* = d(x_2, x_R) - (1 - \tau)$  is the lowest value of productivity for which the developmentalist equilibrium exists;  $\gamma_2^* = d(x_2, x_R) - (1 - \tau) - \delta c_t$  is the highest value of productivity for which the information collection equilibrium exists; and  $\gamma_3^* = d(x_1, x_R) - \ell_t$  is the lowest value of productivity for which the information collection equilibrium exists.

The results illustrate five different testable implications for public goods provision in authoritarian regimes. First, and most intuitively, regimes provide public goods when their cost relative to cash transfers or repression is low. Second, the relationship between public goods provision and economic productivity is non-monotone. The regime provides public goods to collect information on citizens when productivity is sufficiently low such that neutral citizens accept the goods and dissenters do not. The regime provides public goods for economic development when productivity is sufficiently high that dissenters accept. Third, the use of public goods for information collection increases in the preference divergence between neutral citizens and dissenters; separating the types with an offer of public goods is easier, and the distance between  $\gamma_2^*$  and  $\gamma_3^*$  increases.

The final two conditions describe relationships implicitly defined in Figure 2. Fourth, regime inefficiency  $\tau$  has competing effects on the information collection equilibrium. As  $\tau$  increases,  $p_1^*$  decreases, requiring public goods be cheaper for the regime to be willing to provide them instead of repressing. Yet  $\gamma_1^*$  and  $\gamma_2^*$  both increase, increasing the support of the information collection equilibrium while decreasing the support of the developmentalist

Figure 2: Regime Strategies for Managing Mass Threat



*Note:*  $x$ -axis depicts cost of public goods,  $y$ -axis depicts productivity of labor. Regions are labeled by the equilibrium to which they correspond. Values with asterisks indicate cutpoints in the parameter space important to the analysis.

equilibrium. Dissenters resist over greater values of productivity, since they gain less from public goods. Conversely, dissenters do not resist over fewer values of productivity. Fifth, the time horizon  $\delta$  also has competing effects on the information collection equilibrium. Increasing  $\delta$  suggests the dissenter is more concerned about being punished in the future after resisting in the first round ( $\gamma_2^*$  decreases), decreasing their willingness to resist and shrinking support for the information collection equilibrium. On the other hand, the longer time horizon also means that the regime places a higher value on the economic contributions

of the neutral citizen in the second round.

A comment is warranted on the equilibria for private goods provision and repression. Private goods provision occurs when productivity is low and the cost of public goods are high. As with public goods, dissenters prefer the outside option of resisting when productivity is low and they have little to gain from participating in the economy. As productivity increases, dissenters prefer not to resist when private goods are an option, and so the regime represses. As productivity increases, the range of costs of public goods over which private goods and repression equilibria are supported decreases. This is because the regime would increasingly prefer to provide public goods to gain the benefits of increasing productivity. Yet this space to the left of the private goods and repression equilibria is not a public goods equilibrium because dissenters prefer to accept public goods. Finally, as mentioned in the introduction, note the region over which the regime is able to use repression to *separate* types—the lower left gridded region—is very limited.

## 6 Empirical Analysis

To apply the model, we consider the second testable implication above: that the relationship between productivity and the provision of public goods in dictatorships is non-monotone. In particular, the model predicts that at low levels of productivity, the regime provides more public goods because the offer of goods separate types. Dissenters choose not to participate in the economy while neutral citizens do. At high levels of productivity, the regime provides more public goods because the offer goods induces both types to participate in the economy. In between, productivity is low enough such that the provision of public goods is not worth the economic returns for the regime, yet high enough such that the dissenter participates in the economy if they received public goods. We conduct a preliminary test of this implication through cross-national data on dictatorships, and find some evidence of the predicted relationship. There is support for education spending, not healthcare spending.

## 6.1 Measuring Public Goods Provision in Dictatorships

The class of goods of interest in this paper are *human services* a regime provides, a subcategory of public goods. Human services, also described as welfare spending in the literature, are commonly operationalized as health and education spending (Huber, Mustillo and Stephens 2008, Ross 2006). Unlike previous work, the model does not compare spending on human services between democracies and dictatorships, but makes predictions about the variation of human services within dictatorships. We follow the procedural definition of dictatorship in Cheibub, Gandhi and Vreeland (2010) and included in the accompanying Democracy and Dictatorship (DD) dataset to identify regimes for inclusion in the analysis. These regimes lack either popular selection of the executive or legislature, multiparty electoral competition, or a lack of alternation of power. There are 128 regimes included in the data, with temporal coverage from 1960-2008.

To measure health and education spending in dictatorships, we collected data from the World Bank World Development Indicators (WDI) which measure the relative emphasis of human services spending. For education spending, we use the percentage of government spending allocated to education. For healthcare spending, we lack an identical to measure of that of education. Instead, the measure is the percentage of healthcare expenses which are publicly funded. This indicates the degree to which the regime is involved in the provision or financing of healthcare.<sup>18</sup> To measure productivity, a measure is constructed using WDI data using the formula of outputs divided by inputs. Outputs are measured as the log of GDP per capita (PPP) while inputs are measured as the adult labor force participation rate. This measure is coarse, but captures the concept of expected returns to labor in the model.

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<sup>18</sup>We choose proportions rather than GDP-dependent measures because (1) our measure of productivity depends on GDP, and (2) proportion spending indicates how the regime allocates spending given a budget constraint which reflects the assumptions of the model.

## 6.2 Estimation

To estimate the correlation between productivity and public goods provision in dictatorships, we test whether an increase in the productivity measure corresponds to changes in the provision of human services using linear regression (OLS). The model predicts a non-monotone relationship, meaning the independent variable is specified in the model as a second-order polynomial. The lower-order term is expected to be negative, while the higher-order term is expected to be positive, forming a “U”-shaped relationship. The estimating equation takes the following form for regime  $i$  in year  $t$ :

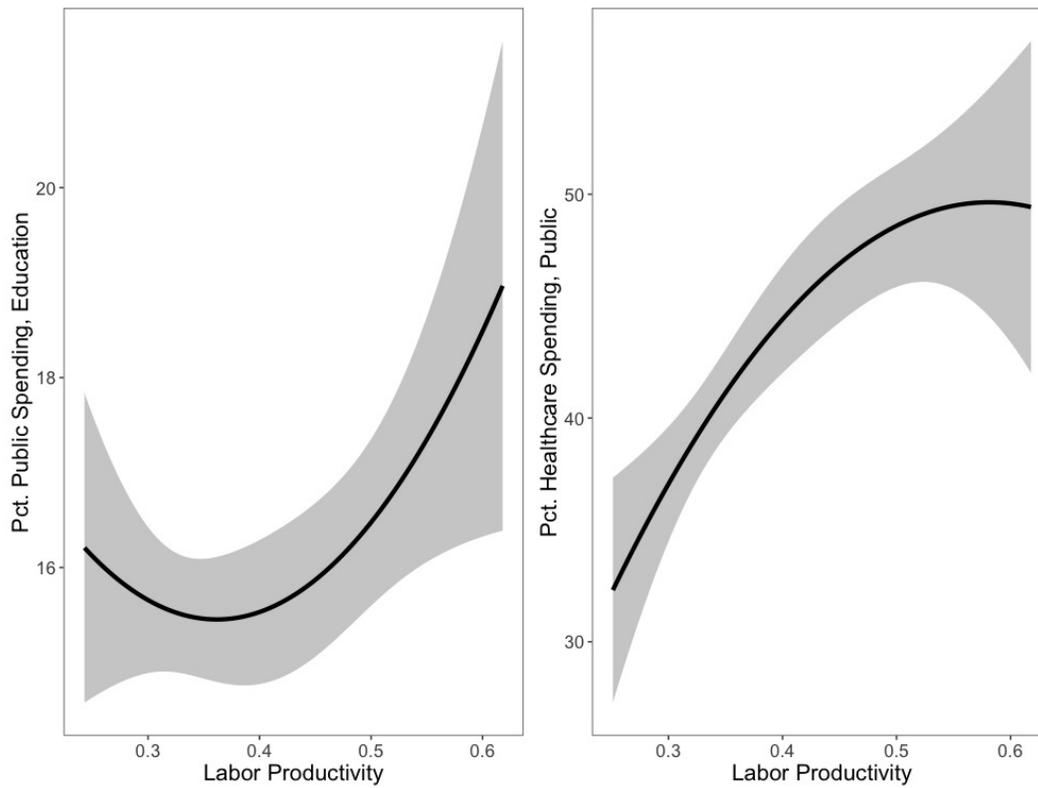
$$\text{Public Goods}_{i,t} = \alpha + \beta_1 \cdot \text{Productivity}_{i,t} + \beta_2 \cdot (\text{Productivity}_{i,t})^2 + \gamma \cdot X_{i,t} + \epsilon_{i,t}$$

The vector  $X_{i,t}$  is of control variables which could be correlated with the independent variable and the outcome variable: (1) whether the regime is a military dictatorship, as these regimes may focus more on repression than economic growth (Olson 1993), (2) the age of the regime in years, as longer-tenured regimes could be more economically successful, (3) whether the regime is communist, as left-wing regimes may spend more on public goods (Manzano 2017), and (4) legislative institutions, as these institutions have been hypothesized to be correlated with public goods expenditure (Gandhi 2008). We test the baseline specification of the model, a specification with control variables, and with year fixed-effects.<sup>19</sup>

## 6.3 Results

Figure 3 plots the predicted values of education and health spending by productivity in dictatorships, while full regression results are reported in the appendix. Consistent with the tested implication of the model, there is a non-monotone relationship between productivity and education spending: increased productivity first predicts a decrease and then an increase in education spending. The left panel in Figure 3 illustrates this relationship in expected

<sup>19</sup>Given the economic data used, there are likely to be time-varying confounders which affect GDP and spending. For this reason, we do not perform a specification with unit fixed-effects (Imai and Kim 2017).

**Figure 3: Dictatorships' Education and Health Spending by Productivity**

*Note:* Estimates are from Model 1 in Table 1. Dependent variable in the left panel is percent of government spending on education, dependent variable in the right panel is percent of healthcare expenditure which is public. Both panels show predicted values of dependent variable with 95% confidence intervals in gray.

“U” shape: regimes with the lowest levels of productivity are expected to spend more on education than regimes with middling levels of productivity. Substantively, the effect is significant. Moving from two to one standard deviations below the mean in the explanatory variable, productivity, corresponds to an expected decrease of over 1% in education spending. This is 0.18 of a standard deviation. Moving from one to two standard deviations above the mean in productivity corresponds to an expected increase of more than 1.4% in education spending, which is almost one-quarter of a standard deviation of the outcome variable. These results are robust to the inclusion of controls and time fixed-effects.

We find no corresponding results for healthcare spending, depicted in the right panel of Figure 3, suggesting the relationship we find here runs through education. This is consistent

with the cases of South Africa and Iraq in which schools were used for information collection. The evidence suggests further tests of model implications could yield results.

## 7 Discussion

Authoritarian regimes seek to counter mass threats to their rule. A problem these regimes face in countering mass threats is identifying who among the population is a regime opponents. In this paper, we propose a previously-unconsidered channel through which regimes collect information on the loyalties of citizens: public goods provision. In regimes such as apartheid South Africa and Saddam Hussein's Iraq, sites of service provision such as schools were routinely used to gather intelligence and separate loyal from disloyal citizens. We develop a model which identifies (1) that an equilibrium exists in which regimes provide public goods and citizens reveal their "type" through engaging with these public goods, and (2) under what conditions this equilibrium exists. The model generates multiple empirical implications, and one is tested: that there is a non-monotone relationship between the productivity of labor and public goods provision. Statistically and substantively significant results are found for the relationship between productivity and education expenditure, while no such relationship is found for healthcare expenditure.

The theoretical and empirical results complement the existing understanding of public goods provision: authoritarian regimes provide public goods for their economic spillovers (Manzano 2017) and because public goods may be part of satisfying the opposition (Gandhi 2008). However, the information-collection purpose of public goods provision is a novel contribution to the literature which works separately from the economic channel. Information-collection addresses the puzzle of why regimes "over-provide" public goods, specifically regimes for which the provision of public goods is economically inefficient. The results suggest authoritarian regimes provide public goods for different reasons than democracies, which offers an additional explanation for why the pattern of service provision varies between

regimes (Desai, Olofsgård and Yousef 2009, Huber, Mustillo and Stephens 2008, Ross 2006).

A logical extension to the model would be to convert it from a finite-horizon to an infinite-horizon game. In such a game, the regime and the citizen would receive infinite streams of payoffs discounted by  $\delta$  in each successive round. The regime could remain perpetually uninformed about the citizen's type, or could learn the citizen's type over time. Unlike learning models in which types reveal through the outcome of a probabilistic process such as conflict (Leventoglu and Metternich 2018, Slantchev 2003) or attempted resistance (Acemoglu and Robinson 2006), the citizen type here is revealed through *actions*. The regime may play a strategy to induce types to separate, and then play another strategy in perpetuity. Another extension of the model could be allowing the regime to set a level of public goods provision rather than whether to provide public goods. As the empirical analysis indicates, in practice public goods provision is a continuous choice by the regime subject to a budget constraint.

Empirical work could be extended by testing additional implications of the model. A challenge to empirical extensions is operationalizing preference divergence between dissenters and neutral citizens. Given the paucity of data on public opinion in authoritarian regimes, a proxy would need to be devised which could measure political polarization. One such possibility is using ethnic divisions within a dictatorship for polarization. However, ethnic divisions may remove the strategic tension in the model since the regime may not have an information problem identifying opponents if ethnicity strongly determines loyalty to the regime. Other variables such as efficiency and cost of public goods provision could be operationalized using existing economic data. Qualitative case study work is also essential to understanding the information-collection feature of public goods. Blaydes (2018) uses archival work to document this process in Iraqi schools. Primary-source evidence in other regimes could be used to trace the process by which regimes use schools or other service sites to collect information.

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## 8 Appendix

### 8.1 Complete Payoffs

These payoffs generalize the single-round functions enumerated in the model setup to account for both rounds.

$$U^C = \begin{cases} g(c_1, \theta, x) + \delta g(c_2, \theta, x), & \text{if } \textit{resist}, \textit{resist} \\ f(\gamma, \theta, x) + j(\ell_1, \theta, x) + h(p_1, \tau) + \delta[f(\gamma, \theta, x) + j(\ell_2, \theta, x) + h(p_2, \tau)], & \text{if } \neg\textit{resist}, \neg\textit{resist} \\ g(c_1, \theta, x) + \delta[f(\gamma, \theta, x) + j(\ell_2, \theta, x) + h(p_2, \tau)], & \text{if } \textit{resist}, \neg\textit{resist} \\ f(\gamma, \theta, x) + j(\ell_1, \theta, x) + h(p_1, \tau) + \delta g(c_2, \theta, x), & \text{if } \neg\textit{resist}, \textit{resist} \end{cases}$$

$$U^R = \begin{cases} 0, & \text{if } \gamma_1 = \gamma_2 = 0 \\ R_1 - \ell_1 - p_1 - c_1 + (1 - \tau)\gamma_1 - \delta(\ell_2 + p_2 + c_2) + \delta(1 - \tau)\gamma_2, & \text{otherwise} \end{cases}$$

### 8.2 A Note on Strategies

Recall that the regime may either repress, provide private goods, or provide public goods, and may do so across two rounds. One example of a complete contingent plan for the citizen is:

$$s^C = \begin{cases} (\textit{Resist}|c_1, \textit{NotResist}|\ell_1, \textit{NotResist}|p_1, \textit{Resist}|c_2, \textit{NotResist}|\ell_2, \textit{NotResist}|p_2), & \text{Neutral} \\ (\textit{Resist}|c_1, \textit{Resist}|\ell_1, \textit{Resist}|p_1, \textit{Resist}|c_2, \textit{Resist}|\ell_2, \textit{Resist}|p_2), & \text{Dissenter} \end{cases}$$

These strategies dictate that a neutral citizen resists if and only if the regime represses in either round. The dissenter always resists. Notice these are simplified strategies because the citizen's actions in the second round are conditional only on the regime's action in that round. Strategy profiles also exist in which the citizen conditions their second round response on the regime's action in the first round.

### 8.3 Proof of Proposition 1

The requirements for an equilibrium in which the regime provides public goods and both types of citizen pool on not resisting include that (1) the regime must prefer public goods to private goods and repression in the second round, (2) the regime must prefer public goods to private goods and repression in the first round, (3) the dissenter must prefer to not resist in the second round *and* first round, and (4) the neutral type must prefer to not resist in the second round and first round.

This equilibrium places the following restrictions on parameters:  $p_1 > 0$ ,  $p_2 > 0$ ,  $\ell_1 = \ell_2 = c_1 = c_2 = 0$ . That is, the regime provides public goods in both rounds. Similar restrictions apply to the dichotomous regime choice on each policy in the other equilibria.

1. For the regime to prefer public goods to private goods and repression in the second round, this requires, respectively:

$$\ell_2 \geq p_2 \quad \gamma \geq \frac{p_2 - c_2}{(1 - \tau)\pi}$$

2. For the regime to prefer public goods to private goods in the first round, this requires:

$$R - p_1 + (1 - \tau)\gamma - \delta p_2 + \delta(1 - \tau)\gamma \geq R - \ell_1 - \delta p_2 + \delta(1 - \tau)\gamma$$

$$\gamma \geq \frac{p_1 - \ell_1}{1 - \tau}$$

For the regime to prefer public goods to repression in the first round, this requires:

$$R - p_1 + (1 - \tau)\gamma - \delta p_2 + \delta(1 - \tau)\gamma \geq R - c_1 - (1 - \pi)\delta p_2 - \pi\delta c_2 + (1 - \pi)\delta(1 - \tau)\gamma$$

$$\gamma \geq \frac{c_1 - p_1 - \delta\pi(p_2 - c_2)}{(1 - \tau)(-\delta\pi - 1)}$$

Where the second round payoffs in each case are known to be preferred from (1) by backward induction, making each of these conditions in (2) implied by those in (1).

3. For the dissenter to prefer not to resist in the second round, this requires:<sup>20</sup>

$$\gamma \geq d(x_2, x_R) - (1 - \tau)p_2$$

4. For the neutral type to prefer not to resist in the second round, this requires:<sup>21</sup>

$$\gamma \geq d(x_1, x_R) - (1 - \tau)p_2$$

Note because  $d(x_2, x_R) > d(x_1, x_R)$ , the condition in (3) binds over the condition in (4).

Given that  $\ell_t = c_t$  by assumption, the only conditions which are required for equilibrium are:

$c_t = \ell_t \geq p_t$  and  $\gamma \geq d(x_2, x_R) - (1 - \tau)p_t$ . □

## 8.4 Proof of Proposition 2

The requirements for an equilibrium in which the regime provides public goods in the first round, the dissenter resists while the neutral type does not resist and the regime represses in the dissenter and provides private goods to the neutral type in the second round are: (1) the regime prefers to repress the dissenter given the dissenter resisted rather than provide private goods or public goods, (2) the regime prefers to provide private goods to the neutral type rather than provide public goods or repress, (3) the regime prefers public goods to private goods and repression in the first round, (4) the dissenter prefers to resist in both rounds, and (5) the neutral citizen prefers to not resist in both rounds.

1. For the regime to prefer to repress rather than provide public goods or private goods given the citizen resist, this requires:

$$p_2 \geq c_2 = \ell_2$$

2. For the regime to prefer to provide private goods rather than provide public goods or repres-

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<sup>20</sup>This condition is sufficient for the first round best response to be satisfied, as well.

<sup>21</sup>This condition is also sufficient for the first round best response.

sion given the citizen does not resist, this requires:

$$p_2 \geq c_2 = \ell_2$$

3. For the regime to prefer public goods to private goods in the first round, this requires:

$$R - p_1\pi\delta c_2 + (1 - \pi)((1 - \tau)\gamma - \delta(\ell_2 - (1 - \tau)\gamma)) \geq R - \ell_1 - \delta\ell_2$$

$$\gamma \geq \frac{\delta\pi(c_2 - \ell_2) + p_1 - \ell_1}{(1 - \tau)(1 + \delta - \pi - \pi\delta)}$$

For the regime to prefer to public goods to repression in the first round, this requires

$$R - p_1 + \pi\delta c_2 + (1 - \pi)((1 - \tau)\gamma - \delta(\ell_2 - (1 - \tau)\gamma)) \geq R - c_1 - \pi\delta c_2 + (1 - \pi)(-\delta\ell_2)$$

$$\gamma \geq \frac{p_1 - c_1}{(1 - \tau)(1 + \delta - \pi + \delta\pi)}$$

Given that  $c_t = \ell_t$  the conditions in (3) are identical.

4. For the dissenter to prefer to resist in the second round, this requires:

$$\gamma \leq d(x_2, x_R) - c_2$$

For the dissenter to prefer to resist in the first round, this requires:<sup>22</sup>

$$\gamma \leq d(x_2, x_R) - \delta c_2 - (1 - \tau)p_1$$

5. For the neutral type to prefer to not resist in the second round, this requires:

$$\gamma \geq d(x_1, x_R) - \ell_2$$

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<sup>22</sup>Given  $c_2 < \delta c_2 + (1 - \tau)p_1$  only the second condition binds.

For the neutral type to prefer to not resist in the first round, this requires:<sup>23</sup>

$$\gamma \geq d(x_1, x_R) - c_1 - (1 - \tau)p_1 - \delta\ell_2$$

Thus the only conditions required for equilibrium are (1), (3b), (4b), and (5a).  $\square$

## 8.5 Private Goods Provision and Repressive Regimes

To compare regime types, we consider equilibria in which regimes provide either private goods or repress in the first round. Finding these equilibria present a hard test for our findings on public goods as information collection. In particular, using the *most exclusive* equilibrium selection criterion means the regime would choose a strategy of providing private goods over a strategy of providing public goods. Given most regimes do not have an ideological preference to provide public goods to citizens who would benefit from the goods (Manzano 2017), we assume a self-interested regime uses a combination of private goods and repression when possible. The following proposition characterizes the equilibria in which the regime provides private goods:

**Proposition 3:** *The equilibria in which the regime provides private goods in the first round are:*

1. *A separating equilibrium in which the dissenter resists when the regime provides private goods and the neutral citizen does not resist.*

- $\gamma \leq \frac{p_t - \ell_t}{1 - \tau}$
- $d(x_1, x_R) - \ell_t \leq \gamma \leq d(x_2, x_R) - \ell_t - \frac{\delta c}{1 + \delta}$
- $\ell_t = c_t \leq p_t$

2. *A pooling equilibrium in which both types do not resist.*

- $\gamma \leq \frac{p_t - \ell_t}{(1 - \tau)(1 + \delta)}$

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<sup>23</sup>Only the first condition binds.

- $\gamma \geq d(x_2, x_R) - \ell_t - \frac{\delta c}{1+\delta}$

Notice how the conditions on these equilibria differ from those in public goods provision. In each case, the equilibria are more likely to be supported as regime inefficiency  $\tau$  increases. They are more likely to be supported as the difference in cost between public goods and private goods  $p_t - \ell_t$  increases. The separating equilibrium is less likely to hold as the regime values the future more, meaning  $\delta$  increases. These conditions characterize a regime which is less efficient, requires more resources to invest in public goods, and is more concerned about survival in the short term than the long term. This contrasts with the characterization of the regime which provides public goods either for economic development, information collection, or both. Finally, the following proposition characterizes the equilibria in which the regime represses in the first round:

**Proposition 4:** *The equilibria in which the regime represses in the first round are:*

1. *A separating equilibrium in which the dissenter resists when the regime represses and the neutral citizen does not resist.*

- $\gamma \leq \frac{p_t - c_t}{1 - \tau}$
- $d(x_1, x_R) - c \leq \gamma \leq d(x_2, x_R) - c$
- $\ell_t = c_t \leq p_t$

2. *A pooling equilibrium in which both types do not resist.*

- $\gamma \leq \frac{p_t - c_t}{(1 - \tau)(1 + \delta)}$
- $\gamma \geq d(x_2, x_R) - c$

The types of regimes which repress rather than provide public goods are similar to the regimes which provide private goods rather than public goods: they are less efficient, value the future less, and have an increased cost for public goods. The distinction between the two sets of equilibria comes in the decision of the dissenter. In the separating equilibria, for example, the dissenter has a higher threshold to participate in the economy—rather than resist—when the regime represses.

When the regime provides private goods, the dissenter gains those private goods from imitating the action of the neutral citizen and not resisting. The dissenter then resists over a smaller range of the value of productivity  $\gamma$ . Intuitively, dissenters are less willing to resist when they have the alternative option of receiving material benefits from the regime.

## 8.6 Proof of Proposition 3

The requirements for an equilibrium in which the regime provides private goods, the citizen types separate, and the regime provides private goods to the neutral citizen while repressing the dissenter in the second round are: (1) the regime prefers to provide private goods rather than public goods or repression in the second round given the neutral type does not resist, (2) the regime prefers to repress rather than private goods or public goods in the second round given the dissenter resists, (3) the regime prefers to provide private goods in the first round rather than providing public goods or repressing, (4) the dissenter prefers to resist in both rounds, and (5) the neutral type prefers not to resist in both rounds.

1. For the regime to provide private goods to the neutral type rather than public goods or repression:

$$\gamma \leq \frac{p_2 - \ell_2}{1 - \tau} \quad \ell_2 \leq c_2$$

2. For the regime to repress the dissenter rather than public goods or private goods:

$$c_2 = \ell_2 \leq p_2$$

3. For the regime to provide private goods rather than public goods or repression in the first round:

$$\gamma \leq \frac{p_1 - \ell_1}{(1 - \pi)(1 - \tau)(1 + \delta)}$$

4. For the dissenter to prefer resistance in both rounds:<sup>24</sup>

$$\gamma \leq \frac{2d(x_2, x_R) - \ell_1 - \delta c_2 - \delta \ell_2 + 2\delta d(x_2, x_R)}{1 + \delta} \quad \gamma \leq 2d(x_2, x_R) - c_2$$

5. For the neutral type to prefer not resisting in both rounds:<sup>25</sup>

$$\gamma \geq 2d(x_1, x_R) - \ell_1 - \delta \ell_2 \quad \gamma \geq 2d(x_1, x_R) - \ell_2$$

Given the assumption that  $\pi > \delta$ , (1a) is sufficient for (3), so the only conditions needed for equilibrium are (1a), (1b), (4a), (5b).

The requirements for an equilibrium in which the regime provides private goods, the citizen types pool, and the regime provides private goods again in the second round are: (1) the regime prefers to provide private goods rather than public goods or repression in the second round, (2) the regime prefers to provide private goods rather than public goods or repression in the first round, (3) the dissenter prefers to not resist in both rounds, and (4) the neutral type prefers to not resist in both rounds.

1. For the regime to provide private goods rather than public goods or repression:

$$\gamma \leq \frac{p_2 - \ell_2}{1 - \tau}$$

2. For the regime to provide private goods rather than public goods or repression in the first round:

$$\gamma \leq \frac{p_1 - \ell_1}{(1 - \tau)(1 + \delta)} \quad \ell \leq c \frac{1 + \delta\pi}{1 - \delta\pi}$$

3. For the dissenter to prefer to not resist in both rounds:

$$\gamma \geq \frac{2d(x_2, x_R) - \ell_1 - \delta c_2 - \delta \ell_2 + 2\delta d(x_2, x_R)}{1 + \delta} \quad \gamma \geq 2d(x_2, x_R) - \ell_2$$

<sup>24</sup>Only the first condition binds.

<sup>25</sup>Only the second condition binds.

4. For the neutral type to prefer to not resist in both rounds.<sup>26</sup>

$$\gamma \geq 2d(x_1, x_R) - \ell_1 - \delta\ell_2 \quad \gamma \geq 2d(x_1, x_R) - \ell_2$$

Note (2a) binds over (1), (2b) holds by assumption that  $\ell = c$ , and (3b) holds over (3a), (4a), and (4b). So (2a) and (3b) are the only restrictions for equilibrium.  $\square$

## 8.7 Proof of Proposition 4

The requirements for an equilibrium in which the regime represses, the citizen types separate, and the regime represses the neutral type and represses the dissenter are: (1) the regime prefers to repress the neutral type rather than provide private or public goods in the second round, (2) the regime prefers to repress the dissenter rather than provide private or public goods in the second round, (3) the regime prefers to repress rather than provide private or public goods in the first round, (4) the dissenter prefers to resist in both rounds, and (5) the neutral type prefers not to resist in both rounds.

1. For the regime to repress the neutral type in the second round:

$$\gamma \leq \frac{p_2 - c_2}{1 - \tau}$$

2. For the regime to repress the dissenter in the second round:

$$c_2 \leq p_2$$

3. For the regime to repress rather than provide public or private goods in the first round:

$$\gamma \leq \frac{p_1 - c_1}{(1 - \pi)(1 - \tau)(1 + \delta)}$$

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<sup>26</sup>Only the second condition binds.

4. For the dissenter to prefer to resist in both rounds:

$$\gamma \leq 2d(x_2, x_R) - c$$

5. For the neutral type to prefer to not resist in both rounds:

$$\gamma \geq 2d(x_1, x_R) - c$$

Note the condition in (1) binds over the condition (3) given the assumption that  $\pi > \delta$ . So conditions (1), (2), (4), and (5) are jointly sufficient for the equilibrium.

The requirements for an equilibrium in which the regime represses, the citizen types separate, and the regime represses again in the second round are: (1) the regime prefers to repress in the second round rather than provide public or private goods, (2) the regime prefers to repress in the first round rather than provide public or private goods, (3) the dissenter prefers not to resist in both rounds, and (4) the neutral type prefers not to resist in both rounds.

1. For the regime to repress in the second round:

$$\gamma \leq \frac{p_2 - c_2}{(1 - \tau)(1 - \pi)}$$

2. For the regime to repress in the first round:

$$\gamma \leq \frac{p_1 - c_1}{(1 - \tau)(1 + \delta)}$$

3. For the dissenter to prefer not to resist in both rounds:

$$\gamma \geq \frac{2d(x_2, x_R) - c_1 - \delta c_2 + 2\delta d(x_2, x_R)}{1 + \delta} \quad \gamma \geq 2d(x_2, x_R) - c_2$$

4. For the neutral type to prefer not to resist in both rounds:

$$\gamma \geq 2d(x_1, x_R) - c_t$$

Note that condition (2) binds over condition (1). Likewise, (3a) and (3b) are identical upon simplification. (3) is larger than (4). So the only conditions necessary for equilibrium are (2) and (3).  $\square$

## 8.8 Regression Results

The following table shows the results from estimation of a second-order polynomial relationship between productivity of labor and public goods provision as measured by relative allocation to education and health spending in authoritarian regimes.

**Table 1:** Public Goods Provision in Dictatorships

	<i>Dependent variable:</i>					
	Pct. Education Spending			Pct. Healthcare Public		
	(1)	(2)	(3)	(4)	(5)	(6)
Productivity	-38.723 (25.466)	-58.302** (26.856)	-62.343** (27.274)	184.898** (80.448)	106.108 (80.606)	104.602 (81.368)
Productivity <sup>2</sup>	53.519* (29.836)	78.274** (31.823)	82.377** (32.429)	-159.029* (94.836)	-66.447 (95.742)	-64.609 (96.699)
Military Regime		-1.002 (0.665)	-1.010 (0.683)		-12.318*** (1.604)	-12.317*** (1.612)
Regime Tenure		0.027* (0.016)	0.027* (0.016)		0.111*** (0.043)	0.113*** (0.044)
Communist		-0.526 (0.940)	-0.544 (0.960)		-5.415*** (1.977)	-5.417*** (1.993)
Leg. Institutions		1.183*** (0.297)	1.178*** (0.305)		-5.480*** (0.991)	-5.472*** (1.001)
Constant	22.457*** (5.219)	24.199*** (5.479)	25.200*** (6.092)	-4.101 (16.176)	20.516 (16.427)	21.864 (16.794)
Time Fixed Effects	No	No	Yes	No	No	Yes
Observations	490	490	490	628	628	628
Adjusted R <sup>2</sup>	0.008	0.044	0.036	0.045	0.193	0.183
F Statistic	3.048**	4.722***	1.757**	15.680***	25.967***	11.046***

Note:

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01