Mobilization, Repression, and Revolution: Grievances and Opportunities in Contentious Politics[1]

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[1]I wish to thank Dan Bernhardt, Justin Fox, Soroush Ghazi, Bing Powell, Milan Svolik, Jose Cheibub, Roger Koenker, Michael Peress, Alex Debs, Paulina A. Marek, Patrick Kuhn, Kerim Kavakli, seminar participants at UIUC departments of political science and economics, and 2010 MPSA Conference.

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Abstract

I develop a framework to study the interactions between dissidents and the state that reconciles between political process and grievance-based theories of protests, and provides insights into interpreting the conflicting empirical studies that sometimes support one theory and sometimes the other. I show that contrary to the theoretical predictions of the literature, the relationship between the magnitude of grievances (e.g., the level of income inequality or economic hardship) and the likelihood of repression is non-monotone, and given some assumptions, is U-shaped. That is, as the magnitude of grievances increases from low to high, the likelihood repression first decreases and then increases. Indeed, the data suggest a non-monotone, U-shaped relationship between the level of repression and income inequality. I also discuss the implications for the empirical studies of repression.

Word Count $\approx$ 8900.

1 Introduction

When do citizens rebel? And when is their rebellion repressed? The literature on the causes of collective action offers two broad theories: grievance-based theories and political process theories. Grievance-based theories state that grievance is the basic cause of rebellion so that more grievance breeds more protest (e.g., Buechler 2004; Gurr 1970; Muller 1985). In contrast, political process theories contend that "grievances...are a fairly permanent and recurring feature of historical landscape" (Obershall 1978, 298) and hence are irrelevant in explaining variations in the occurrence of protest. Instead, they attribute these variations to political opportunities and dissidents' organizational resources (e.g., McAdam et al. 2004; Tarrow 1998; Tilly 1978, 2004). While political process theories focus on the dissidents' expectations of the costs of protest and chances of success, grievance-based theories focus on citizens's discontent, predicting that higher grievances (e.g., high income inequality or bad economic conditions) lead to more protest and hence more repression (e.g., Weede 1987, 97). Similarly, recent economic models of democratization predict a monotone relationship between the level of income inequality and the likelihood of repression. For example, Acemoglu and Robinson's (2000b, 685) model "shows that repression is more likely to be used when inequality is higher."

However, empirical evidence for both theories is mixed. In his review of the literature, Meyer (2004, 131) argues that "the premises of the political process approach...generally do not perform well." A decade-long academic debate concluded that higher grievances (in particular, income inequality) do not translate into more violence as predicted by grievance-based theories of relative and absolute deprivation (Miller et al. 1977; Muller 1985, 1986; Muller et al. 1991; Muller and Seligson 1987; Muller and Weede 1990, 1994; Weede 1981, 1986, 1987; Wang and Dixon et al. 1993). Figure 1 illustrates a LOWESS estimation[1] of the relationship between income inequality and the level of repression in a pooled country-year data from 1981 to 2002.[2] Contrary to the theoretical findings of the literature, data suggests a non-monotone relationship between income inequality and repression.

This paper develops a framework to study the interactions between citizens and the state that provides insights into why there is mixed empirical support for both grievance-based

[1]A similar relationship emerges if one simply averages the level of repression for intervals of inequality.

[2]The estimation is over the range of inequality that includes about 90% of the data, consisting of 1445 data points. The repression measure is CIRI Physical Integrity Rights Index (Cingranelli and Richards 2010). It is an additive index constructed from the sum of four indicators of torture, extrajudicial killing, political imprisonment, and disappearance collected for each country-year. Each indicator takes on one of the three values of 0, 1, and 2, corresponding to frequent, occasional, and no occurrence of the relevant incidence respectively. I reverse the data so that our repression measure is an integer ranging from 0 (no violation of physical integrity rights) to 8 (the most frequent violation). The inequality data is from the University of Texas Inequality Project (UTIP-UNIDO). CIRI data is not available before 1981 and UTIP data is available up to 2002.

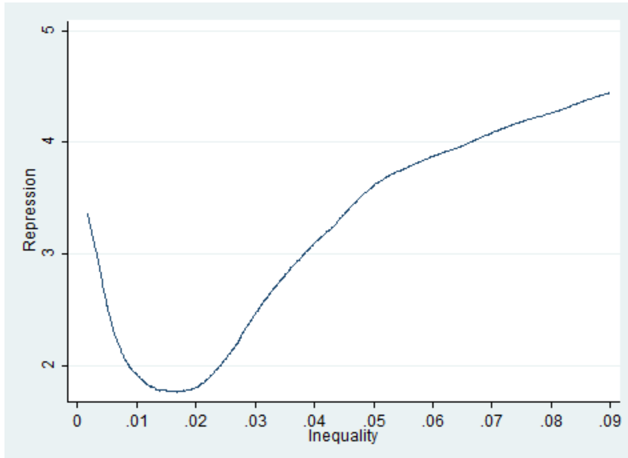

Figure 1: A LOWESS estimation of the relationship between repression and inequality.

and political process theories. It then investigates the relationship between the magnitude of grievances and repression, showing that this relationship can be non-monotone as data indicates (Figure 1). It also investigates the implications of this framework for the empirical studies of repression, repression-protest nexus, and the existing formal models of democratization.

The framework developed here combines the insights of grievance-based and political process theories. As grievance-based theories suggest, discontent is the main driving force for protest. However, as political process theories argue, grievances do not directly translate into collective action: dissidents also take into account the likely costs and benefits of protest.

The following simplified scenario highlights the key insight of the underlying mechanism. When dissidents' grievances are low, the state can address them with minor concessions, and hence it is unlikely to resort to costly repressive actions. Expecting a favorable response from the state, the dissidents mobilize, demanding that their grievances be satisfied. When grievances are high, the state would have to make major concessions to satisfy dissidents. Therefore, it is more likely to respond with repression. The dissidents expect such an aggressive response. However, the status quo is so bad that the expected gains of the unlikely success makes it worthwhile to risk repression. Thus, they hope for the best and mobilize. In contrast, at intermediate levels of grievance, the expectation of repression deters mobilization: the risk of repression is too high relative to the low-grievance case, while the expected gains from success are too low relative to the high-grievance case, and hence dissidents abstain from challenging the state to avoid repression.

This dissidents' mobilization behavior implies that the relationship between the magnitude of grievances and the likelihood of repression is U-shaped: when grievances are low, dissidents mobilize, but repression is unlikely. As grievances increase, the threat of repression deters mobilization and mitigates the need for repression. Therefore, as grievances increase from low to intermediate levels, the likelihood of repression *decreases*. As grievances increase further and become high, dissidents mobilize although they likely are repressed.

However, this simple description conceals that the subtle relationship between grievances and repression depends on how the value of the status quo and the likelihood of repression change *relative* to each other as the magnitude of grievances varies. Greater grievances have two conflicting effects: (1) they *increase* dissidents' incentives to mobilize by reducing the value of the status quo, and (2) they *decrease* dissidents' incentive to mobilize by increasing the likelihood of repression. Section 3 provides a formal model to investigate these confounding effects, and identifies the structure required to deliver the finding that dissidents mobilize when the grievances are high or low, but abstain from challenging the state when grievances are moderate. This dissidents' behavior then results in a U-shaped relationship between the magnitude of grievances and the likelihood of repression.

2 The Theoretical Framework and Its Implications

This section outlines a theoretical framework that captures the conflict between a group of citizens and the state who have divergent preferences over a one-dimensional policy space. The state seeks to maintain the status quo, while citizens would like to implement an alternative, e.g., a more progressive tax policy, democratic elections, more freedom of press, or changing the government for using repression against dissidents. The status quo corresponds to the state's ideal policy and the alternative corresponds to the citizens' ideal policy. The magnitude of the citizens' grievances is then measured by the distance between the ideal policies of the state and the citizens.

The logic I developed applies to *any* grievance factor over which the state and dissidents have conflicting interests. However, it helps to convey the arguments by placing them in a specific context. I choose the context of class conflict with income inequality as the salient grievance factor because: (1) The relationships between inequality, collective action, and violence, have been at the center of the debate between grievance-based and political process theories (see, e.g., Muller 1985, 1986; Muller and Seligson 1987; Weede 1981, 1986, 1987; Wang and Dixon et al. 1993); (2) Formal models of democratization consider income inequality as the main source of discontent under dictatorships that derives the demand for democratization (see, e.g., Acemoglu and Robinson 2001, 2006; Boix 2003; Leventoglu 2005); (3) Although this paper focuses on theory, available datasets for income inequality allow researchers to investigate the empirical implications of the theoretical results. In this context, the state defends the interests of a rich minority by maintaining the status quo allocation of resources, while poor citizens seek redistribution.

The citizens can challenge the status quo by collective action, demanding the implementation of an alternative policy. However, a serious challenge to the state requires extensive preparation: information about available resources and potential allies should be gathered, interpersonal and inter-organizational networks should be constructed, "collective action frames" should be formed, and "the strategy of protest" should be identified (Benford and Snow 2000; Diani and McAdam 2003; Gamson 1975; McAdam et al. 2004; Morris 1984; Tarrow 1998; Tilly 1978, 2004; Tilly and Tarrow 2007; Zald and McCarthy 2003). Such preparations do not happen instantly, but rather in several stages where dissidents prepare, innovate, and learn. Therefore, I divide the contentious process into two stages: an early stage where dissidents choose whether to mobilize (mobilization stage), and an advanced stage where they impose a serious threat to the state (revolution stage) (Tilly 1978).

Mobilization sets the stage for revolution, creating a tangible threat to the state. In response, the state can make concessions or resort to repression, where repression is any action by the state "which raises the contender's cost of collective action" (Tilly 1978, 100; see also Davenport 2000, 5-7). In the mobilization stage, the movement is weak and can be contained by repression. However, if the state response is "too little" or "too late", the movement expands and becomes strong enough to overthrow the state. Once hundreds of thousands of protesters pour into the streets, the fate of the state and its unpopular polices are in the hands of the dissidents, not the repressive apparatus of the state.[3] I call this stage the revolution stage.

However, even when the state can suppress unrest, repression is costly (Tarrow 1998, 83-5). The magnitude of these costs depends on factors such as state repressive capacity (Goodwin 2001; Tilly 1978, 2006; Tilly and Tarrow 2007), geography (Fearon and Laitin 2003), democratic institutions (Davenport 2007b, 2007c; Bueno de Mesquita et al. 2005), international pressure (Hafner-Burton 2005; Hathaway 2007; Vreeland 2008), and whether the state elite are divided (O'Donnel and Schmitter 1986; Tarrow 1998). The state has a vast bureaucratic apparatus to assess these costs, and hence state actors are informed about the (expected) costs of repression. However, dissidents are poorly informed about those costs, and consequently about the state response to mobilization. Dissidents assess the likelihood of different state responses based on their *beliefs* about the state repression costs. As McAdam et al. (2004, 139) argue, the dissidents and the state "read possibilities differently, because each has limited information concerning the other's resources, capabilities, and strategic plans". This

[3] As Mielke, the head of Stasi, has told Erich Honecker, the president of East Germany, in 1989: "Erich, we can't beat up hundreds of thousands of people".

asymmetry of information is the main driving force for the results.

Similarly, revolution is costly. To sustain mobilization and force the state to implement reforms consumes significant resources. Moreover, the chaos and the breakdown of law and order in the process of overthrowing the state disrupts the economy. The magnitude of these costs depends on dissidents' resources and capabilities. However, the state is less informed than the dissidents about these resources, and consequently about the costs of revolution, which in turn affect dissidents' behavior. Therefore, the state assesses the likelihood of the dissidents' reaction to a repression or concession policy based on expectations about these costs. Furthermore, in the early stages of protest, dissidents are not fully informed about their own potential resources and capabilities. Unlike the state, the dissidents lack an elaborate bureaucratic apparatus to assess potential and available resources. One function of early protest activities is to assess and estimate material resources, potential powerful allies, and the magnitude of support base (e.g., Lohmann 1994). However, if the movement sustains, the dissidents' knowledge of their resources improves, and consequently so does their information about the costs of revolution. That is, the protest process involves learning: in the mobilization stage, dissidents are much less informed about their resources and the costs of revolution than in the revolution stage.

In section 3, I characterize the relationship between the magnitude of grievances (formulated as the level of income inequality) and the likelihood of repression under the assumption that repression costs have a strict unimodal distribution.[4] I show that the relationship between the level of income inequality and the likelihood of repression can be U-shaped: when inequality is low, the likelihood of repression is low; when inequality is at intermediate levels, the likelihood of repression is negligible; and when inequality is high, the likelihood of repression is high.

The underlying logic is that the effect of inequality (and grievances in general) on the likelihood of protest and repression is mediated through the dissidents' expectations of the state response and the likelihood of success. Indeed, conditional on dissidents mobilize, the likelihood of repression monotonically increases with the magnitude of grievances as more grievances require more costly concessions, decreasing the opportunity cost of repression.[5] However, the unconditional effect of grievances on repression is mediated through the dissidents' decision whether to challenge the state, and hence is non-monotone because dissidents abstain from mobilization for intermediate levels of grievances.

[4]That is, the uninformed party has a most likely candidate for the value of the unknown parameter (e.g., costs of repression), and the likelihood of other values declines the further they are from the most likely candidate.

[5]Note that observing this *conditional* effect requires data about the dissidents' activities that impose a threat to the state, i.e., mobilization.

Reconciling Grievance-based and Political Process Theories. This theoretical framework reconciles grievance-based and political process theories of contentious politics. The grievance-based theory[6] states that grievance is the basic, instigating cause of protest and violence, and hence more grievances breed more protest. In particular, "monotonic linkage between the level of economic development or income inequality and violence seem to fit with [absolute or relative] deprivation approaches" (Weede 1987, 97). In contrast, political process approach contends that dissidents are rational actors who weigh the costs and benefits of their actions. "Rational people do not often attack well-fortified opponents when opportunities are closed"(Tarrow 1998, 7).[7] These costs and benefits are determined by the dissidents' organizational resources, political opportunity structure, and the dissidents' "framing" of their claims in the dynamic context of repeated interactions between "claimants" and their "object of claim", which features innovation, learning, and mutual feedbacks from environment that constrains contentious actions, and contentious actions that change the environment. In this view, variations in aforementioned determinants of cost-benefit calculus of collective action, rather than grievances, explain the variations in the incidents of contentious actions (McAdam 1999; McAdam et al. 1996; McAdam et al. 2004; McCarthy and Zald 1973, 1977; Muller et al. 1991; Tarrow 1998; Tilly 1978, 1986, 1996, 2004, 2006; Tilly and Tarrow 2007; Zald and McCarthy 2003).[8]

As discussed before, the empirical evidence sometimes support grievance-based theories and sometimes support political process theories. This paper suggests that these mixed empirical findings are the result of narrow interpretations of grievance-based and political process theories that view them as competing and substitutes, rather than complementary. In reality, both the magnitude of grievances and the opportunities for collective action matter. In some cases such as the African-American protests from 1930 to 1970 studied in the McAdam's (1999) seminal book, the salient feature of grievances were racial segregation and political rights, which remained relatively constant until the mid-1960s. In such cases, the variations

[6] Also known as "discontent perspective" (Muller 1985) and "strain theory" (Snow et al. 2005) and mostly associated with absolute and relative deprivation theories (Davies 1962; Gurr 1968, 1970; see Useem (1998) and Buechler (2004) for reviews).

[7] Opportunities refer to those consistent "dimensions of political environment that provide incentives for collective action by affecting people's expectations for success or failure (Gamson and Meyer (1996))" (Tarrow 1998, 76-7).

[8] *Interests and threats* were an integral part of Tilly's 1978 influential book, *From Mobilization to Revolution*, which could encompass grievances. However, in his later works, and in the literature in general, interests, threats, and grievances were pushed aside as it is clear in Tilly's 1986 book *The Contentious French*. The recent re-introduction of the concept of *threat* in political process theories can be interpreted as an attempt to bring grievances and interests back into these theories. In Meyer's (2004) words, "Kriesi et al. (1995) remind the reader that the state can invite action by facilitating access, but it can also provoke action by producing unwanted policies and political threats, thereby raising the costs of inaction" (Meyer 2004, 131). Goldstone and Tilly's (2001) concept of "current threat" can effectively be renamed as grievance.

in dissenting activities are stemmed from variations in resource mobilization, political opportunity structure, and other variables suggested by political process theory. However, in other cases such as Snow et al.'s (2005) study of homeless protests in US cities, grievances vary significantly, and explain the variations in outcomes. Assessments such as "discontent is ever-present"(Jenkins and Perrow 1977, 251) are true, however, what matters is the variations in the magnitude of such discontents. This paper calls for the unification of these two approaches: grievances provide the incentive to perform collective action, however, in their "calculus or protest", actors also account for the costs and likelihood of success, which are determined by factors such as available resources and political opportunity structure. That is, grievances *interact* with factors affecting the dissidents' expectations of state response to determine whether actors mobilize and perform collective action.

Empirical Studies of State Repression. That the effect of grievances is mediated through the dissidents' expectations of the costs and benefits of protest has important implications for the empirical studies of repression. This view confronts the implicit theme in the repression literature that grievances breed repression through increasing the likelihood of unrest. For example, in their seminal paper, Poe and Tate (1994) cite Mitchell and McCormick (1988, 478) to argue that "the poorest countries, with substantial social and political tensions created by economic scarcity, could be most unstable and thus most apt to use of repression in order to maintain control." To further strengthen this "straightforward" logic, they refer to Henderson (1991, 126) to contend that "it is only logical to think that, with a higher level of development, people will be more satisfied and, hence, less repression will be needed by the elites." More recently, Bueno de Mesquita et al. (2005, 447) argue that "when a state's level of economic development is low, citizens have a greater incentive to resort to conflict in order to improve their lot, and they have less to lose by doing so than when development is higher." Reviewing the literature, Davenport (2007c, 14) highlights a recurring rationale in the literature that "fewer resources enhance the need for coercive behavior by increasing societal grievances".

In fact, as section 3 illustrates, the interactions between the dissidents' grievances and their expectations about state response greatly complicates the dissidents' decisions about contentious actions (See Lemma 3 and Proposition 1). Ideally, one would estimate citizens' beliefs about state response that might vary over units and time. One might directly collect data about the citizens' beliefs, utilize past interactions between the state and dissidents to estimate these beliefs, or impose assumptions to simplify the interactions between dissidents' grievances and their expectations. Whichever approach one takes, positing a direct effect of grievances on mobilization, and hence on repression is an oversimplification that ignores the strategic interactions between dissidents and the state that has been emphasized in political process theories.

The Repression-Protest Nexus. The vast but inconclusive empirical literature on the effect of repression on protest provides a medium to illustrate the power of this framework. "Sometimes the impact of repression on dissent is negative (Hibbs 1973); sometimes it is positive (Francisco 1996, Lichbach & Gurr 1981, Ziegenhagen 1986); sometimes it is represented by an inverted U-shape (Muller 1985); sometimes it is alternatively negative or positive (Gupta and Venieris 1981, Moore 1998, Rasler 1996); and sometimes it is nonexistent (Gurr & Moore 1997)" (Davenport 2007c, 8; see also Francisco 2005, 2009 and Inclán 2009). With simple interpretations of the grievance-based and political process theories, these results are puzzling. According to grievance-based approach, repression increases grievances, and hence should increase protest. According to political process theory, repression contracts the political opportunity structure and increases the costs of collective action, which in turn decreases protest. In contrast, the theoretical framework developed here suggests that repression increases both grievances and the cost of collective action, both of which matter in the actors' decision-making process. The increase in grievances tends to increase incentives for collective action, while the increase in the costs of protests tends to decrease those incentives. Which effect dominates depends on the magnitude of marginal changes that vary from case to case, which can potentially explain the variations in observed outcomes (see also Muller and Seligson 1987; and Muller and Weede 1990, 1994).

Formal Models of Contentious Politics. Early formal models of contentious politics typically analyzed only one side of dissidents-state interactions. Lichbach (1987) provides a formal model that takes the state's behavior as given, and studies the dissidents' decision to perform violent or non-violent contentious actions.[9] In contrast, Moore (2000) takes the dissidents' actions as given, and analyzes the state response. Recent formal models of democratization, however, study mutual interactions between the state and the citizens (Acemoglu & Robinson 2000a, 2000b, 2001, 2006; Boix 2003; Leventoglu 2005, 2007; Rosendorff 2001). However, these modelsimply that more grievances (modeled as the extent of income inequality) (1) increase the citizens' incentives to revolt, which in turn increase the threat to the state, and (2) raise the cost of concession. Therefore, more grievances (more inequality) breed more repression.[10]

This finding, however, depends sensitively on how these models approach the dissidents'

[9] There is a vast literature that abstracts from the state's decision, but relaxes the unitary actor assumption on the side of the dissidents, and studies their interactions: collective action problem (Olson 1965; Lichbach 1995), contagion and network effects (Buenrosto et al. 2007; Chwe 2000, 2001; Lohmann 1994), and signaling and coordination problem (Boix and Svolik 2009; Bueno de Mesquita 2010; Edmond 2008; Lohmann 1993; Persson and Tabellini 2006; Shadmehr and Bernhardt 2011). For the role of state response, see Wilkinson (2009).

[10] Boix (2008) extends his original model (Boix 2003) such that first, the rich decide whether to establish an authoritarian regime or accept democracy; second, the poor decide whether to acquiesce or revolt; then, the rich decide whether to repress. Although this model could reveal the non-monotone relationship between inequality and repression, Boix's imposed conditions and information structure conceal the non-monotonicity.

calculus of protest. In particular, these models don't integrate the insights of political process theories that dissidents form expectations about and take into account the likely state response to protest (e.g., Guigni et al. 1998). In these models, the rich (who control the state) move *first* and decide whether to repress or to concede (redistribute or democratize) and hence the timing of these models does not allow the poor to strategically decide not to challenge the state in order to avoid repression, i.e., there is no "mobilization stage". By adding a mobilization stage in which citizens decide whether to challenge the state, the theoretical framework of this paper allows for a richer set of strategic interactions between the dissidents and the state that combines the insights of both grievance-based and political process theories. The implication is significant: the relationship between the magnitude of grievances and the likelihood of repression can be non-monotone, that is, as the magnitude of grievances increases, the likelihood of repression can decrease. As Figure 1 illustrates, this finding is consistent with the data.

3 Model

There is a continuum 2 of individuals distinguished by their income. A continuum 1 is rich, receiving a share $\theta > \frac{1}{2}$ of the income of the society, y, and a continuum 1 is poor, receiving the residual share $1-\theta$.[11] The poor can challenge the unequal distribution of income by mounting revolution. However, in order to revolt the poor must mobilize first. If they mobilize, the rich can contain the unrest with repression or concession. They can repress the mobilized poor, in which case the poor get 0, and mobilization ends. Alternatively, they can concede by redistributing their income via distortionary taxation. If the rich concede, the poor have the choice of expanding the mobilization to revolution or of ending the unrest. If the poor revolt, the revolution succeeds, the poor share the whole income and the rich get 0.[12] However, revolution and repression are costly.[13] Revolution destroys a fraction $\mu \in [0, 1]$ of the poor's income, and repression ruins a proportion $\omega \in [0, 1]$ of the rich's income. See Figure 2. The cost of repression, ω, is private information of the rich.[14] The poor have a prior that $\omega \sim F$. The cost of revolution, μ, is public, however, it only reveals after the rich's decision to repress or concede. The rich and the poor have a common prior that $\mu \sim G$. F and G are twice differentiable cumulative distribution functions. All aspects of the game are common knowledge. Appendix A includes two extensions of the model: one in which repression leads to backlash protests

[11] The equal size of the rich and the poor population has no substantive effect on the results, and is made merely to simplify the presentation of the model.

[12] The results are robust if one assumes that revolution attempts or repression attempts sometimes fail.

[13] The results are robust if one introduces a mobilization cost.

[14] With slight modifications, ω and μ can be interpreted as expected costs of repression and revolution, respectively.

and one in which repression is a continuous choice. The timing of the game is as follows:

1. The cost of repression, ω, is realized, and the rich are informed.
2. The poor decide whether to mobilize. If they do not mobilize, the game ends.
3. If the poor mobilize, the rich decide whether to repress or to distribute at their choice of tax-rate. If they repress, the game ends.
4. The cost of revolution, μ, is realized.
5. The poor decide whether to revolt; and payoffs are realized.

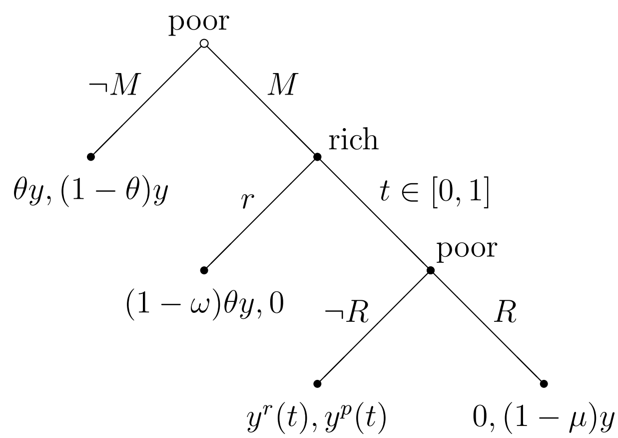

Figure 2: The game tree. M, r, and R stand for mobilize, repress, and revolt respectively. The first payoff is the rich's and the second is the poor's. $y^r(t)$ and $y^p(t)$ are after-tax incomes of the rich and the poor respectively.

Strategies and Equilibrium. The strategy of the poor is whether to mobilize and whether to revolt. More formally, the poor's strategy is a pair $\sigma^p = (\gamma_1,\ \gamma_2)$ consisting of a mobilization strategy γ_1, and a revolution strategy γ_2 . The mobilization strategy is an action $\gamma_1 \in \{0,\ 1\}$ with $\gamma_1 = 0$ and 1 corresponding to no mobilization and mobilization respectively. The revolution strategy is a function $\gamma_2(t, \mu) : [0,\ 1]^2 \to \{0,\ 1\}$, mapping the tax-rate and the cost of revolution to a decision whether to revolt, with $\gamma_2 = 0$ and 1 corresponding to no revolution and revolution respectively. The strategy of the rich is whether to repress, and at what tax-rate to redistribute. More formally, the strategy of the rich is an ordered pair $\sigma^r = (s, t) \in \{0, 1\} \times [0, 1]$, with $s = 0$ and 1 corresponding to not repress and repress respectively, and t is the tax-rate. The equilibrium concept is Perfect Bayesian Equilibrium (PBE), i.e. an equilibrium is a strategy profile, $(\hat{\sigma}^p, \hat{\sigma}^r)$, of mutual best responses at every subgame of the game, given the information available at each decision node.

I apply backward induction to solve the game. To decide whether or not to revolt, the poor compare their expected payoffs from revolt and not revolt given the tax-rate t set by the rich. The poor's payoff, if they do not revolt, is their after-tax income $y^p(t,\theta) = (1-t)(1-\theta)y + \frac{1}{2}ty$. The poor's expected payoff from revolution is $(1-\mu)y$. Thus, the poor revolt if and only if $y^p(t,\theta) < (1-\mu)y$. That is,

$$\gamma_2 = 1 \;\text{ if and only if }\; t < \frac{\theta - \mu}{\theta - \frac{1}{2}}. \tag{1}$$

Because the focus of this paper is on the role of inequality on protest and repression, I assume that in a fully equal society no one revolts. That is, when $t = 1$, the expected value of living under such an egalitarian status quo exceeds the expected payoff of revolution, i.e. $(1-\mu)y \leq\; y^p(1,\theta)$, which simplifies to $\frac{1}{2} \leq \mu$.

If the poor mobilize, the rich must decide how to respond to the threat of revolution. In their decision, the rich account for the expected behavior of the poor. If the rich believe that the cost of revolution is very high, they can infer that a mild redistribution prevents revolution. Otherwise, more serious actions may be required to avoid revolution. If the rich choose to redistribute, they choose a tax-rate that maximizes their expected payoff, $E[V^r(t)]$, which implicitly contains the expected behavior of the poor following the redistribution:

$$\begin{aligned} E[V^r(t)] &= Pr(revolt|t)\; 0 + (1 - Pr(revolt|t))\; y^r(t,\theta) \\ &= (1 - Pr(revolt|t)) \left((1-t)\theta + \frac{1}{2}t\right) y, \end{aligned} \tag{2}$$

in which $y^r(t,\theta) = (1-t)\theta y + \frac{1}{2}ty$ is the rich's payoff given inequality θ and tax-rate t, and $Pr(revolt|t)$ is the probability the poor revolt conditional on a tax-rate t. From equation (1),

$$Pr(revolt|t) = Pr\left(t < \frac{\theta-\mu}{\theta-\frac{1}{2}}\middle| t\right) = Pr\left(\mu < (1-t)\theta + \frac{1}{2}t\right) = G\left((1-t)\theta + \frac{1}{2}t\right). \tag{3}$$

Substituting equation (3) in (2), the tax-rate that maximizes the payoff of the rich solves

$$\max_{t\in[0,\ 1]} E[V^r(t)] = y \max_{t\in[0,1]} \left(1 - G\left((1-t)\theta + \frac{1}{2}t\right)\right)\left((1-t)\theta + \frac{1}{2}t\right). \tag{4}$$

Denote the income share of the rich by x, which implies that the income share of the poor is $1-x$. Therefore, the poor revolt if and only if $(1-x)y < (1-\mu)y$, and equation (1) becomes

$$\gamma_2 = 1 \;\text{ if and only if }\; x > \mu. \tag{5}$$

That is, the poor revolt if and only if the income share of the rich is sufficiently high that the gain from revolution, $y-(1-x)y = xy$, exceeds its cost, μy. At tax-rate t and inequality level θ,

$$x = (1-t)\theta + \frac{1}{2}t. \tag{6}$$

x is strictly decreasing in t, thus, $t \in [0,\ 1]$ implies $x \in [\frac{1}{2},\ \theta]$. The one-to-one relationship between x and t implies that the rich's tax-rate decision is equivalent to choosing their share of income. From equation (6), the optimization problem of the rich, expression (4), becomes

$$\max_{x \in [\frac{1}{2},\ \theta]} (1 - G(x))x \tag{7}$$

Lemma 1 characterizes the solution to the redistribution optimization of the rich, expression (7). To guarantee a unique solution, I assume the distribution of the revolution costs is log-concave, a weak assumption satisfied by most commonly used distributions such as normal, uniform, exponential, and logistic (Bagnoli and Bergstrom 2005).

Assumption 1 *$g(x)$ is log-concave on $(\frac{1}{2}, 1)$.*

Lemma 1 *The redistribution optimization of the rich, expression (7), has a unique solution $\bar{x}$ corresponding to the tax-rate $\bar{t}$ such that*

$$\bar{x} = \begin{cases} \theta & ; \theta \in [\frac{1}{2}, x^*] \\ x^* & ; \theta \in [x^*, 1] \end{cases} \quad \text{and} \quad \bar{t} = \begin{cases} 0 & ; \theta \in [\frac{1}{2}, x^*] \\ \frac{\theta - x^*}{\theta - 1/2} & ; \theta \in [x^*, 1], \end{cases} \tag{8}$$

where

$$x^* = \arg\max_{[\frac{1}{2}, 1]} (1 - G(x))x. \tag{9}$$

x is the income share of the rich, hence, $x = \theta$ corresponds to the original distribution of income, i.e., no redistribution. When inequality is low, $\theta \in [\frac{1}{2}, x^*]$, the poor have little incentive to revolt because the net benefit of revolting is low. Anticipating this behavior, the rich expect low probability of revolution, and do not redistribute. That is, the rich prefer taking the risk of revolution, $G(\theta)$, to redistributing their wealth. In contrast, when inequality is high, $\theta \in [x^*, 1]$, the poor have a greater incentive to revolt and the probability of revolution is high. Anticipating this, the rich implement limited redistribution to reduce the chance of revolution.

However, facing the threat of mobilized poor, the rich can also resort to repression. To decide whether to repress or to concede, the rich compare their expected payoff of repression, $(1 - \omega)\theta y$, to the highest expected payoff that can be achieved by redistribution, which, by Lemma 1, is $(1 - G(\bar{x}))\bar{x}y$. The following lemma characterizes the equilibrium behavior of the rich who are facing the mobilized poor.

Lemma 2 *Facing the threat of revolution from the mobilized poor, the rich repress the poor if and only if the cost of repression is less than a threshold, i.e., $\omega < \bar{\omega}$, where*

$$\bar{\omega} = \begin{cases} G(\theta) & ; \theta \in [\frac{1}{2}, x^*] \\ 1 - \frac{(1 - G(x^*))x^*}{\theta} & ; \theta \in [x^*, 1]. \end{cases} \tag{10}$$

Otherwise, the rich redistribute at a tax-rate $\bar{t}$ defined in Lemma 1.

When the cost of repression is sufficiently low, the rich respond by repression to the threat of revolution. Otherwise, they redistribute at a tax-rate that sufficiently mitigates the probability of revolution to maximize their expected payoff. The substitution between redistribution and repression that appears in the response of the rich to the poor's insurgency is a manifestation of the fact that repression and redistribution are two instruments available to the rich to keep the "poor threat" in check (Acemoglu and Robinson 2006; Boix 2003; Moore 2000).

The poor, when deciding whether to mobilize or not, take into account the likelihood that the rich respond by repression. The expected payoff of mobilization to the poor, $E[V^p(M)]$, depends on their expectation of the response of the rich, which depends on the cost of repression that is the private information of the rich. Therefore, the poor can only count on the expected behavior of the rich. If the rich repress, which happens with probability $Pr(repress)$, the poor get zero. Otherwise, their payoff depends on the redistribution policy of the rich and the cost of revolution, which is unknown to them in the mobilization stage. Formally,

$$E[V^p(M)] = (1-Pr(repress))\,[Pr(revolt)\,(1-E[\mu|revolt])\,y+(1-Pr(revolt))(1-\bar{x})\,y]. \quad (11)$$

When calculating their expected payoff of revolution conditional on mobilization, $(1-Pr(repress))$ $Pr(revolt)\,(1-E[\mu|revolt])y$, the poor account for the information contained in the incidence of revolution about the cost of revolution, $E[\mu|revolt]$. Although the poor do not know the cost of revolution in the mobilization stage, they recognize that they will be better informed in the revolution stage and then, if the cost turns out to be too high, they will not revolt.

From Lemma 1, the equilibrium behavior of the rich implies that if they do not repress, they redistribute at a tax-rate that makes poor's share of income equal to $1-\bar{x}$. Anticipating this in the mobilization stage, the poor expect to revolt if and only if $\mu < \bar{x}$ (expression (5)). Therefore, conditional on rich not repressing, the poor expect revolution with probability $Pr(\mu < \bar{x}) = G(\bar{x})$. Moreover, from Lemma 2, $Pr(repress) = Pr(\omega < \bar{\omega}) = F(\bar{\omega})$. Substituting these observations in equation (11) yields

$$E[V^p(M)] = (1 - F(\bar{\omega}))\ [G(\bar{x})(1 - E[\mu|\mu < \bar{x}]) + (1 - G(\bar{x}))(1 - \bar{x})]\ y,$$

in which $\bar{x}$ and $\bar{\omega}$ are defined in equations (8) and (10) respectively. Define $s(\bar{x}) = s(\theta,\ x^*)$ as the poor's expected share of income if they mobilize. That is,

$$s(\bar{x}) = s(\theta,\ x^*) \equiv (1 - F(\bar{\omega}))\ [G(\bar{x})(1 - E[\mu|\mu < \bar{x}]) + (1 - G(\bar{x}))(1 - \bar{x})], \qquad (12)$$

hence, $E[V^p(M)] = s(\theta,\ x^*)\ y$.

The poor mobilize if and only if their share of income under status quo, $1-\theta$, is less than their *expected* share of income from mobilization. That is, if and only if $1-\theta < s(\theta,\ x^*)$. The latter depends on the response of the rich and the cost of revolution both of which are unknown to the poor in the mobilization stage. Therefore, the poor have to decide based on their expectations. If the rich repress, mobilization is aborted and the poor become worse off, receiving a payoff of zero. This happens if and only if the cost of repression is sufficiently low, i.e. if $\omega < \bar{\omega}$, which happens with probability $F(\bar{\omega})$. Otherwise, the poor's payoff depends on the redistribution policy of the rich and the cost of revolution. If the cost of revolution is sufficiently low, i.e. if $\mu < \bar{x}$, which happens with probability $G(\bar{x})$, the poor mount a revolution and cultivate the whole share of income that survives the revolution. In the mobilization stage, this share is expected to be $1-E[\mu|\mu < \bar{x}]$. However, there is a chance, $1-G(\bar{x})$, that the cost of revolution will be so high that the poor are better off stopping mobilization short of revolution for the redistribution that the rich offer, and end up with a share $1-\bar{x}$ of income. Here, $\bar{\omega}$ and $\bar{x}$ correspond to the rich's decision whether to repress and how much to redistribute as discussed in Lemmas 1 and 2. The following lemma formally states these findings.

Lemma 3 *The poor mobilize if and only if* $1-\theta < s(\theta,\ x^*)$*, in which*

$$s(\theta,\ x^*) = \begin{cases} [1-F(G(\theta))]\ [G(\theta)(1-E[\mu|\mu<\theta]) + (1-G(\theta))(1-\theta)] & ;\theta \in [\frac{1}{2},\ x^*] \\ \left[1-F\left(1-\frac{(1-G(x^*))x^*}{\theta}\right)\right]\ [G(x^*)(1-E[\mu|\mu<x^*]) + (1-G(x^*))(1-x^*)] & ;\theta \in [x^*, 1]. \end{cases}$$

What types of distributions are likely to describe the players' beliefs in the real world? Challengers and defenders of the status quo form expectations about each others' resources and capabilities from repeated interactions. These past experiences and various other sources of information imply that although the challengers do not know the exact costs of repression, they expect some costs to be more likely than others. That is, they form expectations about most likely state responses. Therefore, I assume that the distribution of repression costs F is strictly unimodal.[15] With such priors, challengers believe that some value (the mode) of the uncertain variable is most probable, and although the realization of any value within the support is possible, the probability of a realization is lower the further it is from the most likely outcome. The costs of revolutions, however, are harder to assess and players have little information about these costs, and hence I assume that players' beliefs about revolution costs are uniform. I discuss the consequences of the violation of these assumptions at the end of

[15]A distribution is strictly unimodal if and only if there is a unique point, y^*, in its support such that its cumulative distribution function is strictly convex for $y < y^*$, and strictly concave for $y > y^*$.

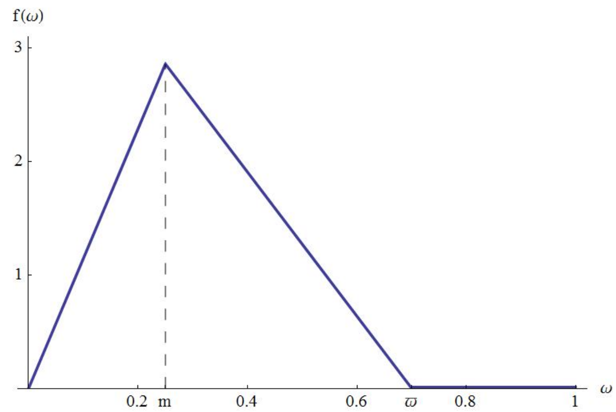

Figure 3: The probability density function for a unimodal distribution f, where $f(\omega) = \frac{2}{\bar{\omega}m}\ \omega$, if $\omega \in [0, m]$, and $f(\omega) = \frac{2}{\bar{\omega}(\bar{\omega}-m)}\ \max\{(\bar{\omega} - \omega), 0\}$, if $\omega \in [m, 1]$, with parameters $m = 0.25$ and $\bar{\omega} = 0.7$. Citizens believe that the most likely value (mode) of the repression cost ω is m. As ω becomes larger and larger or smaller and smaller than m, citizens believe that it is less and less likely.

this section. To simplify the exposition of results, I also assume $f(0) < 1$. This assumption is empirically innocuous because repression is never completely costless, and hence $f(0) = 0 < 1$. Proposition 1 characterizes the behavior of the poor and the rich in equilibrium.

Assumption 2 *The distribution of revolution costs $G(\mu)$ is uniform. The distribution of repression costs $F(\omega)$ is strictly unimodal with $f(0) < 1$.*

Proposition 1 *In equilibrium, the poor either always mobilize or there exist θ_1 and θ_2 with $\frac{1}{2} < \theta_1 < \theta_2 < 1$ such that the poor mobilize if and only if $\theta \in (\frac{1}{2},\ \theta_1) \cup (\theta_2,\ 1)$. That is, the poor mobilize when inequality is low or high, but not when it is intermediate, i.e. $\theta \in [\theta_1,\ \theta_2]$. When the poor mobilize, if $\omega < 1 - \frac{1}{2\theta}$, the rich repress; otherwise, they redistribute at a tax-rate $\bar{t} = 1$.*

When the cost of revolution is distributed uniformly, the rich fully redistribute their income if they choose not to repress, in which case the poor receive half of the income of the society, i.e. $\bar{x} = 1 - \bar{x} = \frac{1}{2}$. Redistribution decreases the income share of the rich, x, but it also decreases the probability of revolution, $G(x)$. Because the probability of revolution is $G(x) = 2x - 1$, the expected marginal cost of keeping a larger share of income, $\left|\frac{d(1-G(x))}{dx}\ x\right| = g(x)x = 2x$, always exceeds its expected marginal benefit, $(1 - G(x))\ \frac{dx}{dx} = 1 - G(x) = 2 - 2x$. Therefore, the rich are better off to fully redistribute their income should they decide not to repress. However, if the cost of repression is sufficiently low, i.e. when $\omega < 1 - \frac{1}{2\theta}$, mobilization is followed by repression, leaving the poor with payoff 0.

An increase in inequality has two conflicting effect: (1) it decreases the status quo payoff to the poor, $(1-\theta)y$, raising their incentive to revolt and to mobilize, and (2) it makes redistribution less attractive to the rich, and increases the probability of repression, $F(1-\frac{1}{2\theta})$, which decreases the poor's expected gain from mobilization, $(1-F(1-\frac{1}{2\theta}))\,\frac{1}{2}$. When inequality is high, the high reward of full redistribution, $1-\bar{x}y=\frac{1}{2}y$, together with the low value of status quo, $(1-\theta)y$, make it worthwhile for the poor to take the risk of repression, and hence they mobilize. In contrast, when inequality is low, the value of status quo is already high, and hence the net gain from mobilization, $(\frac{1}{2}-(1-\theta))y=(\theta-\frac{1}{2})y$, is small. However, the likelihood of repression is also low. When $f(0)<1$, this likelihood is so small that it is worthwhile for the poor to risk repression. As inequality further increases, if the risk grows fast enough, it exceeds the net gain at some level of inequality, deterring the poor from mobilization in the intermediate levels of inequality. But if the risk grows slowly with inequality, the expected gain from mobilization always surpasses its risk, and hence the poor always mobilize.

For repression to occur, dissidents should first challenge the state, i.e., they should mobilize. The probability of repression increases with inequality *given the poor mobilize.* However, anticipating repression, the poor may abstain from mobilization at certain levels of inequality. This strategic consideration implies a generally non-monotone relationship between inequality and mobilization, and hence between inequality and repression. Figure 4 illustrates.

Corollary 1 *The relationship between inequality and repression can be non-monotone such that the probability of repression is strictly increasing in inequality when inequality is low or high,* $Pr(repress)=F(1-\frac{1}{2\theta})$ *for* $\theta\in(\frac{1}{2},\ \theta_1)\cup(\theta_2,\ 1]$*, but repression does not occur when inequality is intermediate, i.e.* $\theta\in[\theta_1,\ \theta_2]$*. In particular, if the variance and the mode of repression costs are not too large, then there is an intermediate range of inequality in which the poor do not mobilize, and hence are not repressed.*

The condition that the most likely value (mode) of repression costs not be too large captures the fact that if the poor believe that repression costs are so high that the rich almost never repress, then they always mobilize.[16] Given this condition, when the poor are fairly confident that repression costs are around a value ω_m, then they do not mobilize in an intermediate range of inequality. This range is close to the maximum inequality level at which the rich choose redistribution over repression when the repression cost is ω_m, i.e., close to $\theta_m=\frac{1}{2(1-\omega_m)}$. Conversely, Corollary 1 implies that when the poor have little information about the likely cost of repression, i.e., when the variance of ω is high, they never abstain from mobilization, so that the likelihood of repression rises monotonically with the level of inequality.

[16] Recall that the rich use repression if and only if $(1-\omega)\theta y>\frac{1}{2}y$, i.e., if and only if $(1-\omega)\theta>\frac{1}{2}$. Therefore, because $\theta<1$, the rich never repress when $\omega>\frac{1}{2}$, and hence the poor always mobilize if they know that $\omega>\frac{1}{2}$.

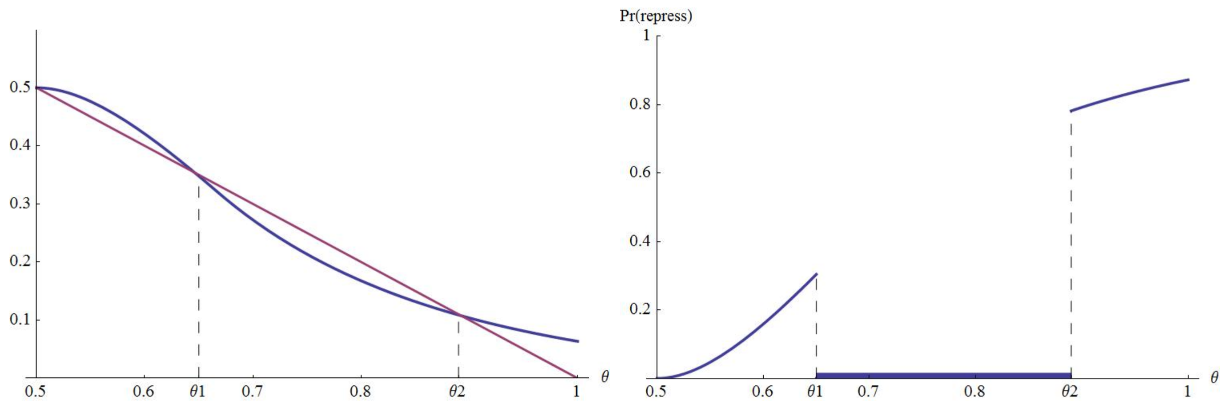

Figure 4: The poor mobilize if and only if $(1 - F(1 - \frac{1}{2\theta}))\frac{1}{2} > 1 - \theta$ (equation (18)). In the left graph, the straight line is $1 - \theta$ and the curve is $(1 - F(1 - \frac{1}{2\theta}))\frac{1}{2}$ for the unimodal distribution illustrated in Figure 3. The right graph illustrates the relationship that emerges between the probability of repression and inequality.

Corollary 1 hinges on the assumption that the distribution of repression costs is unimodal. One may wonder whether the non-linear relationship between inequality and the likelihood of repression can still hold with multimodal distributions. The answer is yes. In fact, if the peaks of the distribution are small, the behavior and the implied relationship are similar to the unimodal case. When the peaks are sufficiently large, the poor's mobilization behavior changes so that there can be more than one range in which the poor abstain from mobilizing. For example, a bimodal distribution of repression costs can divide the range of inequality into five regions (very low, low, intermediate, high, and very high) such that the poor mobilize when inequality is very low, intermediate, or very high, but abstain from mobilizing when inequality is low or high. What favors the unimodal distributional assumption are (a) predictions are robust to small deviations from unimodality, (b) its implications are consistent with the U-shaped pattern in the data (Figure 1), and (c) in many settings, the distribution of *expected* costs is single-peaked, even when the distributions of *realized* repression costs are non-unimodal.[17] One can also relax the assumption that revolution costs are uniform. By continuity, the results are qualitatively unchanged if G is not uniform, but the peaks are small. Alternatively, the results are robust if revolution costs are common knowledge (see Appendix A).

[17] To see this, suppose that realized repression costs are either low, $\omega = \omega_L$, if repression does not lead to a backlash, or high, $\omega = \omega_H$, if repression leads to a backlash. With probability α repression leads to a backlash, and with probability $1 - \alpha$ repression does not lead to a backlash. Suppose ω_L and ω_H are known, but the state is uncertain about the likelihood α of backlash. That is, suppose $\alpha \sim F$, where F is unimodal. Then, when deciding whether or not to repress, the state weighs the *expected* costs of repression, $E[\omega] = \alpha\omega_H + (1 - \alpha)\omega_L$, which has a unimodal distribution because $E[\omega] = \omega_L + (\omega_H - \omega_L)\ \alpha = A + B\alpha$, where A and B are constants. Thus, even when the realization of repression costs is multimodal (bimodal in this example), the distribution of expected repression costs can be unimodal.

However, absent any structure at all on the distributions of revolution and repression costs, clear predictions do not obtain for the poor's mobilization behavior, and hence for the relationship between inequality and repression. This suggests that more attention should be paid to estimate the dissidents' beliefs about the state's likely response to dissent.

4 Conclusion and Discussion

I develop a theoretical framework that reconciles grievance-based and political process theories: As grievance-based theories argue, grievances are the driving force for protests. However, as political process theories highlight, dissidents also account for the costs of protests and the likelihood of success. This unified approach has subtle implications because grievances and opportunities interact. In particular, the state response (and hence the "opportunity" of successful protest) depends on both the costs of repression and the magnitude of grievances: higher grievances require more concessions that are more costly to the state, and hence are more likely to incite repression. Therefore, greater grievances have conflicting effects: (1) they *increase* dissidents' incentives to mobilize by reducing the value of the status quo, and (2) they *decrease* dissidents' incentive to mobilize by increasing the likelihood of repression. I identify some assumptions under which the co-existence of these effects results in subtle strategic considerations by dissidents: they mobilize when their grievances are high or low, but abstain from challenging the state when grievances are moderate. This behavior implies a U-shaped relationship between the magnitude of grievances and the likelihood of repression.

To cast the abstract notion of grievances in a specific context and to facilitate comparison of my formal model with others (e.g., Acemoglu and Robinson, or Boix), I have chosen income inequality as the source of grievance in the formal model. I emphasize that the logic of the theoretical framework (and the model) is general and applies to other causes of grievances and drivers of revolution such as nationalism in anti-colonial revolutions, ethnic discriminations in inter-ethnic rebellions, and violations of moral economy expectations (Scott 1976).[18]

In this paper, I focused on repression as an instrument to contain dissent; when threatened by the dissidents' mobilization, the state can respond with repression (Davenport 1995; 2007c). As such, I abstracted from other important rationales of repression such as ensuring the loyalty of security forces. For example, in the El Salvadoran civil war, even after protests

[18] Although Scott's (1976) argument is partly at odds with the "rational actor models" (e.g., Popkin (1979); See Cumings (1981, p. 469-76) for a critique), the violation of some norms or values can be a source of grievances in my formal model. For example, Vietnamese peasants expected the elite to provide them with a certain level of subsistence, and the worse their conditions became relative to this norm, the higher became their grievances.

were contained, the state continued repression to ensure that security forces are complicit in such brutalities and to keep reformist elements in check (Stanley 1996). In Iran, the prison massacre of 1988 served the same purpose (Abrahamian 1999; See Padro i Miquel (2007) for a formal model that captures this rationale in ethnic conflicts).

To focus on the main mechanism, I abstracted from other mechanisms identified in the literature. The main limitations stem from two simplifying assumptions: unitary actors and limited time horizon. Modeling dissidents as a unitary actor does not allow addressing collective action problems (Olson 1965; Tullock 1971; Lichbach 1995, 1998), coordination problems (Boix and Svolik 2009; Bueno de Mesquita 2010; Edmond 2008; Persson and Tabellini 2006; Shadmehr and Bernhardt 2011) and the role of networks (Diani and McAdam 2003; Chwe 2000, 2001), coalition formation (Parsa 2000; Foran 2005), divisions among opposition groups (Lust-Okar 2005), scale shift (Tarrow and McAdam 2005), and mechanisms such as diffusion and contagion (Buenrosto et al. 2007), brokerage (Diani 2003), certification, and boundary action (McAdam et al. 2004; Tilly and Tarrow 2007). Modeling the state as a unitary actor pushes aside "the instability of current political alignments" among state actors, "the availability of influential allies or supporters for challengers" (Tarrow 1998; Tilly and Tarrow 2007), the interactions between the hard-liners and soft-liners (O'Donnell and Schmitter 1986), and factionalism (Goldstone et al. 2010). The limited horizon curbs our ability to endogenize the actors' beliefs based on their history of interactions, address repression-dissent nexus, and address short-term interactions as a part of the broader dynamics of the interactions between dissidents and the state that can lead to and include revolutions, civil wars, national disintegration, and democratization (Goldstone et al. 2010; McAdam et al. 2004). Integrating these aspects into formal models of contentious politics provides a rich area for future research.

Appendix A: Extensions

Repression and Backlash Protests. In the text, I assumed that repression always succeeds to maintain the status quo. However, there is a large literature showing that repression can deepen grievances and provoke further protests (e.g., see Rasler (1996) for the case of the 1979 Iranian Revolution, Fransisco (2004) for a cross-country study, and Davenport (2007c) for a review. 2013 protests in Turkey is a recent example.). Here, I extend the model to integrate such backlash protests: with probability $p \in (0, 1]$ the first attempt at repression succeeds at a cost of ω; however, with probability $1 - p$, repression leads to a backlash, bringing more people on streets and intensifying their demands. To simplify the exposition of results, I assume that repression deepens grievances so much that nothing short of a full concession contains the unrest.

Facing such radicalized dissidents, the best option of the rich is to attempt further repression. However, repression is more costly as protests has spread to a larger fraction of the population. Assuming that the costs of repression is proportional to the magnitude of protests, the second attempt to repress costs the rich a larger fraction $a\omega$ of their income, with $a > 1$. Of course, there is no guarantee that the second attempt at repression succeeds: with probability $1-q \in [0,1)$ repression fails, leading to a revolution and a payoff of 0 for the rich. Figure 5 shows the extension of the "repression branch" of the original game, which captures this scenario.

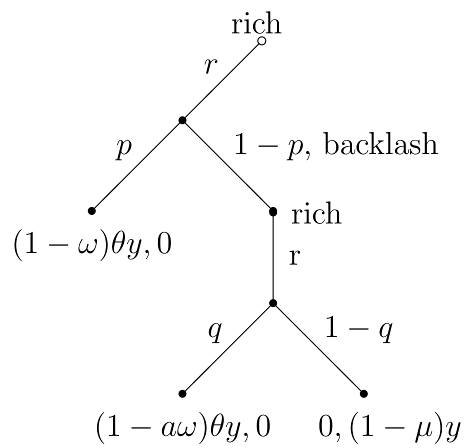

Figure 5: An extension of the game where repression can lead to backlash protests.

In the original game, if the rich repress, their payoff is $(1-\omega)\theta y$. However, with the possibility of backlash protests, their payoff from repression is more complicated:

$$p(1-\omega)\theta y + (1-p)q(1-a\omega)\theta y = [p + (1-p)q - (p + (1-p)qa)\omega]\theta y.$$

With probability p repression succeeds and the rich get $(1-\omega)\theta y$. However, with probability $1-p$, repression leads to backlash protests and more costly repression attempts, which succeed only probability q. Thus, the expected payoff of the rich if repression leads to backlash protests is $(1-p)q(1-a\omega)\theta y$. Letting $\lambda_1 = p + (1-p)q < 1$, $\lambda_2 = p + (1-p)qa$, and $\lambda = \frac{\lambda_2}{\lambda_1}$, the expected payoff of the rich from repression simplifies to:

$$(1-\lambda\omega)\lambda_1\theta y,$$

where $\lambda > 1$ because $a > 1$. As one expects, this payoff is smaller than the payoff from repression in the original game: $(1-\lambda\omega)\lambda_1\theta y < (1-\omega)\theta y$. From Lemma 1, $(1-G(\bar{x}))\bar{x}y$ is the expected payoff of the rich from concession. Thus, they repress if and only if $(1-\lambda\omega)\lambda_1\theta y > (1-G(\bar{x}))\bar{x}y$, i.e.,

$$\omega < \bar{\omega}_b \equiv \frac{1}{\lambda}\left(1 - \frac{1}{\lambda_1}\frac{(1-G(\bar{x}))\bar{x}}{\theta}\right), \tag{13}$$

which happens with probability $F(\bar{\omega}_b)$—when repression always succeeds, i.e., when $p = 1$, the extended model reduces to the original setup and $\bar{\omega}_b = \bar{\omega}$. Therefore, the essence of the strategic considerations of the players is similar to the original setup, and with appropriate assumptions on parameters p, q, and a, the relationship between repression and inequality follows similar patterns. To simplify the exposition of results and as another robustness check, I relax the assumption that the cost of revolution is uncertain. That is, I solve the extended model when μ is common knowledge. From equation (5), the poor revolt if and only if $\mu > x$. If the rich redistribute, they keep the maximum share of income that prevents revolution, i.e., $\bar{x} = \mu$, in which case the payoff of the rich becomes $\bar{x}y = \mu y$. Then, equation (13) becomes

$$\omega < \bar{\omega}_b \equiv \frac{1}{\lambda}\left(1 - \frac{1}{\lambda_1}\frac{\mu}{\theta}\right) = \frac{1}{\lambda_2}\left(\lambda_1 - \frac{\mu}{\theta}\right)$$

Thus, the poor mobilize if and only if

$$(1-\theta)y < F(\bar{\omega}_b)(1-p)(1-q)(1-\mu)y + (1 - F(\bar{\omega}_b))(1-\mu)y,$$

which simplifies to[19]

$$F(\bar{\omega}_b) < \frac{1}{1-(1-p)(1-q)}\frac{\theta-\mu}{1-\mu}. \tag{14}$$

Mirroring the proofs of Proposition 1 and Corollary 1, one can show that this set up yields the same patterns of relationship between inequality and the likelihood of repression. Figure 6 illustrates the case where the poor do not mobilize in the intermediate values of inequality. Of course, this needs not to be the case. For example, when p and q are small or a is large, the costs of repression to the rich are high, and hence the likelihood of repression is always sufficiently small that it is always worthwhile for the poor to mobilize and risk repression.

Continuous Repression Policy. I modeled repression as a binary choice: the rich either repress or not repress. Here, I allow for continuous repression policy so that they can decide *how much* to repress. The more they repress, the higher the likelihood that repression succeeds. However, more extensive repression costs more.

Define a new game that differs from our original game only in that the rich can also choose the *level* of repression. If the poor mobilize, the rich can choose a level of redistribution via distortionary taxation, $t \in [0,\ 1]$, and a level of repression, $r \in [0,\ 1]$. Higher levels of repression increase the probability $p(r) \in [0, \bar{p}]$ that the rich succeeds in suppressing the poor's mobilization, in which case the status quo prevails. For simplicity, I assume that revolution

[19] I assume $\theta > \mu$, so that there is always a threat of revolution. Theoretically, the costs of revolution can be so high that the threat of revolution almost never exists. When $\theta < \mu$, the poor do not mobilize because the turmoil of revolution destroys a large fraction of economic output, not to avoid repression—which is the focus of this paper.

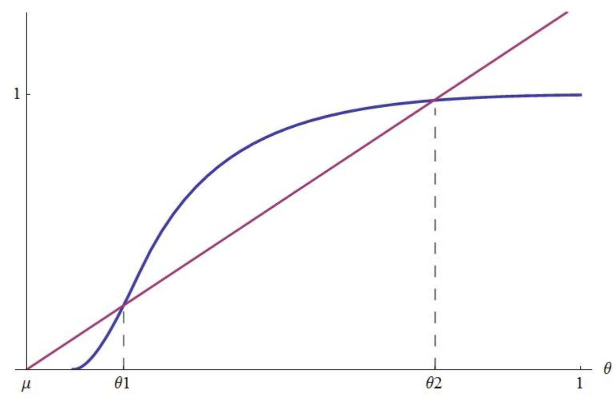

Figure 6: The poor mobilize if and only if $F(\bar{\omega}_b) < \frac{1}{1-(1-p)(1-q)} \frac{\theta-\mu}{1-\mu}$ (equation (14)). The straight line is $\frac{1}{1-(1-p)(1-q)} \frac{\theta-\mu}{1-\mu}$ and the curve is $F\left(\frac{1}{\lambda_2}\left(\lambda_1 - \frac{\mu}{\theta}\right)\right)$ for the distribution in Figure 3, and parameters $p = q = 0.5$, $\mu = 0.2$, and $a = 1.2$.

costs are sufficiently low that if repression fails, the poor revolt. Implementing a repression level r costs the rich a fraction $\omega(r) \in [0, \bar{\omega}]$ of their income. If repression and redistribution fail and revolution succeeds, the rich get zero, and the poor share the whole income that survives the revolution. The following assumptions on the probability of successful repression $p(r)$ and repression cost $\omega(r)$ guarantee a unique optimal repression level.

Assumption 3 *$p(0) = 0$, $p'(r) > 0$, and $p''(r) < 0$. $\omega(0) = 0$, $\omega'(r) > 0$, and $\omega''(r) > 0$.*

The rich either repress or redistribute, and hence the optimal redistribution policy of the rich does not change in the new setting. The expected payoff to the rich of a repression policy r is $p(r)\ (1 - \omega(r))\theta y$. The rich choose a repression policy, r^*, that maximizes this payoff:

$$r^* = \arg\max_{r \in [0,\ 1]}\ p(r)\ (1 - \omega(r)). \tag{15}$$

Lemma 4 characterizes the optimal repression policy of the rich r^* if they decide to use repression.

Lemma 4 *If $p'(1)(1 - \bar{\omega}) - \omega'(1)\bar{p} < 0$, there is a unique $r^* \in (0,\ 1)$ that satisfies $\frac{p'(r^*)}{\omega'(r^*)} = \frac{p(r^*)}{1-\omega(r^*)}$. Otherwise, $r^* = 1$.*

The rich repress if and only if their best expected payoff from repression, corresponding to r^*, exceeds that of redistribution, i.e. when $p(r^*)(1 - \omega(r^*))\theta y > (1 - G(\bar{x}))\bar{x}y$. The following lemma summarizes the equilibrium strategy of the rich.

Lemma 5 *Define $\bar{\omega}_c \equiv 1 - \frac{(1-G(\bar{x}))\bar{x}}{p(r^*)\theta}$. The rich repress at level r^* if and only if $\omega(r^*) < \bar{\omega}_c$. Otherwise, they do not repress, but redistribute at tax-rate $\bar{t}$. r^* is defined in Lemma 4. $\bar{x}$ and $\bar{t}$ are defined in Lemma 1.*

Lemma 5 shows that, similar to Lemma 2, the rich repress whenever the costs of repression is less than a threshold that is increasing in the level of inequality θ—note that r^* does not depend on θ. Therefore, the poor's mobilization strategy depends on their belief about the value of this threshold $\bar{\omega}_c$, and hence follows the same patterns that I analyzed in the Proposition 1.

Appendix B: Proofs

Proof of Lemma 1: $\theta \in (\frac{1}{2},\ 1)$, hence, the largest possible range of x is between $\frac{1}{2}$ and 1. Lemma 6 characterizes the shape of the objective function, $(1 - G(x))x$, for $x \in [\frac{1}{2},\ 1)$.

Lemma 6 *$(1 - G(x))x$ has a unique maximum at $x^* \in [\frac{1}{2}, 1)$.*

Proof of Lemma 6: $(1-G(\frac{1}{2}))(\frac{1}{2}) > (1-G(1))(1)$ because $G(1) = 1$, and by our assumption that $\mu \leq \frac{1}{2}$, $G(\frac{1}{2}) = 0$. Thus, the upper bound, $x = 1$, is not a maximand. Differentiating $(1 - G(x))x$ yields $D(x) \equiv 1 - G(x) - g(x)x$. The continuity of G guarantees at least one maximum on the compact set $[\frac{1}{2}, 1]$, and its differentiability implies $1 - G(x) - g(x)x = 0$ at each interior maximum. To prove uniqueness, rearrange the first order condition as

$$\frac{g(x)}{1 - G(x)} = -(Ln(1 - G(x)))' = \frac{1}{x}. \tag{16}$$

Logconcavity of g (Assumption 1) implies logconcavity of $1 - G(x)$ (Bagnoli and Bergstrom 2005), which implies that $(Ln(1 - G(x)))'$ is decreasing. Thus, the left-hand-side of equation (16) is increasing. The right-hand-side, x^{-1}, is strictly decreasing. Therefore, equation (16) has at most one solution. If $D(\frac{1}{2}) = 0$, there is no other local maximum, thus, $x^* = \frac{1}{2}$. If $D(\frac{1}{2}) < 0$, then either $x^* = \frac{1}{2}$ or there is an interior local maximum in which case there must be an interior local minimum, implying at least two solutions for equation (16), a contradiction. If $D(\frac{1}{2}) > 0$, there is a unique interior global maximum. □

From Lemma 6, $(1 - G(x))x$ is strictly increasing in $[\frac{1}{2}, x^*)$, and strictly decreasing in $(x^*, 1]$. The result for $\bar{x}$ follows immediately. The result for $\bar{t}$ is derived from equation (6). □

Proof of Lemma 2: If the poor mobilize, the rich can either repress or redistribute at a tax-rate $t \in [0, 1]$. To decide whether to repress or to redistribute, the rich compare their expected payoff of repression, $(1 - \omega)\theta y$, to the highest expected payoff that can be achieved by redistribution which, by Lemma 1, is $(1-G(\bar{x}))\bar{x}y$. Therefore, the rich repress if and only if

$$(1-\omega)\theta y > (1-G(\bar{x}))\bar{x}y = \begin{cases} y(1-G(\theta))\theta & ;\theta \in [\frac{1}{2}, x^*] \\ y(1-G(x^*))x^* & ;\theta \in [x^*, 1]. \end{cases} \tag{17}$$

Define

$$\bar{\omega} = \begin{cases} G(\theta) & ;\theta \in [\frac{1}{2}, x^*] \\ 1 - \frac{(1-G(x^*))x^*}{\theta} & ;\theta \in [x^*, 1]. \end{cases}$$

From expression (17), the rich repress if and only if $\omega < \bar{\omega}$. Otherwise, they redistribute at the tax-rate $\bar{t}$, defined in Lemma 1, that maximizes their expected payoff. □

Proof of Lemma 3: From equations (8) and (10), substitute for $\bar{x}$ and $\bar{\omega}$ in the expected value of mobilization to the poor, $E[V^p(M)] = s(\theta,\ x^*)y$, with $s(\theta,\ x^*)$ derived in equation (12). Therefore, $E[V^p(M)]$ becomes

$$\begin{cases} [1-F(G(\theta))]\ [G(\theta)(1-E[\mu|\mu<\theta]) + (1-G(\theta))(1-\theta)]\ y & ;\theta \in [\frac{1}{2},\ x^*] \\ \left[1-F\left(1-\frac{(1-G(x^*))x^*}{\theta}\right)\right]\ [G(x^*)(1-E[\mu|\mu<x^*]) + (1-G(x^*))(1-x^*)]\ y & ;\theta \in [x^*,\ 1]. \end{cases}$$

The result follows comparing this value to the value of status quo to the poor, $(1-\theta)y$. □

Proof of Proposition 1: When G is uniform $\bar{x} = x^* = \frac{1}{2}$, and the rich repress if and only if $\omega < 1 - \frac{1}{2\theta}$, which happens with probability $F(1-\frac{1}{2\theta})$. From Lemma 3, the poor mobilize if and only if $1-\theta <\ (1-F(1-\frac{1}{2\theta}))\frac{1}{2}$, or equivalently,

$$\text{the poor mobilize if and only if}\ \ F(1-\frac{1}{2\theta}) < 2\theta - 1. \tag{18}$$

Next, I prove the following Lemma.

Lemma 7 *If F is strictly unimodal, then $2\theta-1$ crosses $F(1-\frac{1}{2\theta})$ at most at two point in $(\frac{1}{2}, 1)$.*

Proof of Lemma 7: Suppose $2\theta - 1$ crosses F at three interior points of $(\frac{1}{2}, 1)$, say $\frac{1}{2} < \theta_1 < \theta_2 < \theta_3 < 1$. At $\theta = \frac{1}{2}$, $2\theta - 1 = F(1-\frac{1}{2\theta}) = F(0) = 0$. By Mean Value Theorem, there exist $\lambda_1 < \lambda_2 < \lambda_3$ such that $\frac{1}{2} < \lambda_1 < \theta_1 < \lambda_2 < \theta_2 < \lambda_3 < \theta_3 < 1$ *and* $(F(1-\frac{1}{2\lambda_i}))' = 2$ for $i = 1, 2, 3$. F is strictly unimodal, thus, has a unique inflection point, θ^*. $(F(1-\frac{1}{2\lambda_1}))' = (F(1-\frac{1}{2\lambda_2}))' = 2$ together with the strict unimodality of F implies that $\lambda_1 < \theta^* < \lambda_2 < \lambda_3$. Thus, $(F(1-\frac{1}{2\lambda_3}))' < (F(1-\frac{1}{2\lambda_2}))'$, a contradiction. □

The first-order Taylor expansion of $2\theta - 1 - F(1-\frac{1}{2\theta})$ around $\theta = \frac{1}{2}$ is

$$2\theta - 1 - F\left(1-\frac{1}{2\theta}\right) = 2\epsilon - F(0) - 2f(0)\epsilon + o(\epsilon^2) = 2(1-f(0))\epsilon + o(\epsilon^2) \tag{19}$$

If $2\theta-1$ does not cross $F(1-\frac{1}{2\theta})$ in an interior point of $(\frac{1}{2},\ 1)$, the poor always mobilize. Otherwise, from Lemma 7, the crossing happens at most twice. Because $f(0)<1$, $2\theta-1>F(1-\frac{1}{2\theta})$ for $\theta\in(\frac{1}{2},\ \frac{1}{2}+\epsilon)$ and some $\epsilon>0$. Therefore, crossing either never happens or happens exactly twice because by strict unimodality, at $\theta=1$, $F(1-\frac{1}{2})=F(\frac{1}{2})<1=2(1)-1$.

Suppose $2\theta-1$ crosses $F(1-\frac{1}{2\theta})$ at $\frac{1}{2}<\theta_1<\theta_2<1$, then $F(1-\frac{1}{2\theta})<2\theta-1$ in $(\frac{1}{2},\theta_1)\cup(\theta_2,1)$, and $F(1-\frac{1}{2\theta})>2\theta-1$ in (θ_1,θ_2). Thus, the poor mobilize when the inequality level is low, $(\frac{1}{2},\theta_1)$, or high, $(\theta_2,1)$, but do not mobilize when it is moderate, $[\theta_1,\theta_2]$. $\square$

Proof of Corollary 1: From Proposition 1, if $2\theta-1$ does not cross $F(1-\frac{1}{2\theta})$, then the poor always mobilize, and the probability of repression, i.e. $F(1-\frac{1}{2\theta})$, is strictly increasing in θ. If $2\theta-1$ crosses $F(1-\frac{1}{2\theta})$, say, at $\frac{1}{2}<\theta_1<\theta_2<1$, then the poor mobilize in $(\frac{1}{2},\ \theta_1)\cup(\theta_2,1)$ and they get repressed with probability $F(1-\frac{1}{2\theta})$ which increases monotonically with θ. However, the poor do not mobilize in $[\theta_1,\theta_2]$, and hence they do not get repressed, and the probability of repression becomes 0. In other words, the probability of repression increases monotonically in $(\frac{1}{2},\theta_1)$, drops discontinuously at θ_1 to 0 in $[\theta_1,\theta_2]$, jumps up discontinuously at θ_2, and increases monotonically in $(\theta_2,1)$.

To prove the second part, it suffices to show that $F(1-\frac{1}{2\theta})$ crosses $2\theta-1$ at some $\theta\in(\frac{1}{2},1)$. Let $\omega_m=Mode(\omega)$, $\theta_m=\frac{1}{2(1-\omega_m)}$ so that $\omega_m=1-\frac{1}{2\theta_m}$, and f_0 be the Dirac delta function that puts all the weight on ω_m, i.e., $f_0(\omega)=\delta(\omega-\omega_m)$. The corresponding CDF, F_0, is a step function jumping from 0 (below $2\theta-1$) to 1 (above $2\theta-1$) at $\omega_m=1-\frac{1}{2\theta_m}$. Moreover, F converges to F_0 as its variance goes to zero. Because F is continuous for any variance $v>0$, F must cross $2\theta-1$ from below. $\square$

Proof of Lemma 4: $p(r)(1-\omega(r))$ is continuous and $[0,1]$ is compact, thus, a maximum exists. Differentiating $p(r)(1-\omega(r))$ yields $d(r)\equiv p'(r)(1-\omega(r))-\omega'(r)p(r)$. The first-order condition for the maximization problem (15) is $\frac{p'(r^*)}{\omega'(r^*)}=\frac{p(r^*)}{1-\omega(r^*)}$. From Assumption 3, $p(r)(1-\omega(r))$ is strictly concave: $d'(r)=p''(r)\ (1-\omega(r))-2p'(r)\omega'(r)-\omega''(r)p(r)<0$. Moreover, $d(0)=p'(0)>0$ and $d(1)=p'(1)(1-\bar{\omega})-\omega'(1)\bar{p}$. Results follow. $\square$

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