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Centralized Institutions and Cascades

Jared Rubin

Chapman University, jrubin@chapman.edu

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1 Introduction

The Arab Spring of 2011 came as a surprise to most observers. What were once reasonably tranquil societies exploded in anti-government protests in the span of a few weeks. Such sudden, massive changes in anti-authority sentiment are hardly unique in history. In the 20th century alone, the Iranian Revolution of 1979, the Bolshevik Revolution of 1917, and the fall of Iron Curtain and Soviet governments were all similarly as sudden and as massive as the Arab Spring protests.¹ The frequency with which such events occur suggests that they are not idiosyncratic. This begs two questions: i) What are the mechanisms through which such massive changes arise?, and ii) Are there institutional or macroeconomic conditions that encourage such changes when present and discourage such changes when absent?

There is an extensive literature answering the first of these questions. Granovetter (1978) was amongst the first to argue that *cascades* can arise when individuals' preferences are interconnected - if enough people take some action it encourages others to do the same, which encourages more to do the same, and so on until a cascade results in a vastly different equilibrium. Kuran (1989, 1995a, 1995b) proposed a related mechanism, noting that small events can encourage individuals to publicly reveal their previously suppressed, privately held preferences; if a threshold level of preference revelation is passed, a cascade to a new equilibrium can arise.² These models have been employed to explain numerous phenomena, including the rapidly escalating protest movements that arose in many Communist countries in Eastern Europe around the fall of Communism (Kuran 1991, 1995a; Lohmann 1994).³

Cascade models differ significantly from the neo-classical view of collective action put forth by Olson (1971) and Tullock (1971, 1987), where individuals maximize their own utility independent of others. The interconnect- edness of preferences inherent to cascade models entails very different consequences from neo-classical models;

¹Historically, numerous other examples abound. This is no place for a complete list, but some examples include the Taiping Rebellion in China (1850-1864), the English Peasants' Revolt of 1381, and even the Protestant Reformation. The latter spread anti-papal sentiment in a manner unseen in previous Christian history (as most other movements were quickly repressed). Indeed, Rubin (2014) suggests that the mechanism proposed in the present paper played a key role in the Reformation, as the printing press facilitated the spread of the "shock" of Luther's initial works, leading to a cascade of revolt.

²Small events can also act as a signal in the decision process, leading to social learning phenomena such as herd behavior that encourages individuals to ignore their private information and follow the actions of others. These insights were first spelled out theoretically by Banerjee (1992, 1993) and Bikhchandani, Hirshleifer, and Welch (1992) - who argued that herding could result in inefficient and fragile equilibria - and confirmed in the lab by Anderson and Holt (1997). Sushil Bikhchandani, David Hirshleifer, and Ivo Welch have organized a website, <http://info-cascades.ivo-welch.info/>, which provides a literature review and links, as of 2004, to articles on information cascades.

³Experimental work has given further insight into the nature of cascades. For example, Kübler and Weizsäcker (2004) show that cascades can fail to emerge when predicted by theory due to limited reasoning ability. Goeree et al. (2007) show that cascades can self-correct, leading to different predictions than standard models. Others have delved into the theoretical determinants of cascades. Kuran and Sunstein (1999) argue that the availability of certain types of information - and the ability of some to manipulate which information is available - pushes societies towards certain equilibria. Oliver et al. (1985) and Yin (1998) stress the importance of the distributions of the production function and preferences in determining whether a revolution occurs. Watts and Dodds (2007) argue that cascades are driven by a critical mass of easily influenced people, and Macy (1991) argues that protest thresholds are endogenous. Oliver (1993) provides an overview of the sociological advances made in this literature in the 1980s and early 1990s. The present paper abstracts from these points by presenting a model with parsimonious and non-controversial assumptions regarding distributions, player types, and preference exogeneity.

the latter indicate that collective action is difficult to sustain in large groups, whereas it follows from the former that large-scale collective action can occur even in the absence of supporting organizations. The fact that the historical record points to numerous instances of large-scale collective action suggests that the cascade literature offers insight where the neo-classical model fails.

Yet, despite the existence of such an extensive literature on cascades, there is precious little theory addressing the second question asked in the opening paragraph: Are there *institutional or macroeconomic conditions* that facilitate the formation of cascades when present and discourage their formation when absent?⁴ The works which do study such institutional conditions focus primarily on the role that social or political sanctions play in suppressing private opposition to a regime (Kuran 1989, 1995a; Lohmann 1994; Rasler 1996; Slater 2009). By merely focusing on the political structures in which such phenomena arise, it is possible to overlook the general microeconomic settings under which these behaviors are facilitated.

This paper aims to fill this hole in the literature. To this end, I formulate a general model which applies to all types of sanctioning authority (economic, legal, political, social, or religious). The model's insights extend on the works cited above, suggesting that cascades which induce massive economic, social, or political changes may be a consequence of an institutional arrangement in which one type of authority has multilateral coercive power - that is, the ability to affect sanctions over numerous dimensions (religious, social, economic, etc.). I call this authority a *central authority*, with the degree of centralization increasing in the authority's (implicit) ability to impose multiple sanctions on the citizenry.⁵ On one extreme, a fully centralized regime is akin to a totalitarian system, where the ruler has total domination over all aspects of life (Arendt 1951). The other extreme is a well-functioning democracy, where rulers are subject to a variety of checks and balances and have little authority over most parts of one's life. The model analyzes both of these extremes - which rarely exist in their purest form in the real world - as well as departures from either extreme and the resulting consequences thereof.⁶

Specifically, the model analyzes the interactions between citizens and institutional authorities under the situation where their preferences are not aligned. Citizens derive intrinsic utility from their own actions and have sanctions imposed on them for publicly rejecting (i.e., protesting) the actions of the two institutional

⁴Ellis and Fender (2011) consider the role that information cascades play in revolutionary regime transition, but they model the two phenomena separately instead of integrating the two. Callander (2007) shows how bandwagons can arise in sequential voting schemes, such as U.S. presidential primaries, but does not explore more general institutional conditions.

⁵Throughout this paper, I use the term "centralized" to indicate the degree to which coercive power over sanctions affecting different aspects of one's life (e.g., political, religious, social) is concentrated in one authority. This is similar to the structure recently proposed by Slater (2009), who looks at the role that the separation between political elites and communal/religious elites plays in revolution mobilization. This is a broader definition than ones normally used in the political science and political economy literature, which frequently focus on federalism, administrative centralization, fiscal centralization, or democratic centralization (for example, see Rondinelli [1981] or Manor [1999]). Any of these forms of centralization fit into the model espoused in this paper, although my focus is the costs imposed by authorities, not the institutional structures themselves.

⁶I thank an anonymous referee for pointing out that the model is akin to a perfect competition model; while it rarely exists in the real world, it provides a nice framework for analyzing departures from the extreme case.

authorities. These actions could represent any number of phenomena in which the desires of some citizens diverge from those of institutional authorities, such as speaking or writing freely, having more than one child, or practicing a minority religion. Citizens' utilities are also interdependent with other citizens (as in Granovetter 1978; Oliver, Marwell, and Teixeira 1985; Marwell, Oliver, and Prahl 1988; Kuran 1995; Kim and Bearman 1997; Siegel 2009). That is, citizens derive disutility when their actions differ from endogenously determined social norms.⁷

The model's dynamics entail that there are two equilibria of concern (as in Granovetter 1978 and Kuran 1995a): a "low protest" equilibrium and a "massive protest" equilibrium.⁸ The model's primary insight is that the size of the shock necessary to jump from one equilibrium to the other is a *function of the type of regime*. More specifically, the model suggests that highly-centralized authorities are more insulated from pressures for change when exogenous shocks are small. There is less incentive for citizens to violate the dictates of highly-centralized authorities, as they incur more than one type of sanction from doing so. Consequently, the "tipping point" of the cascade is not reached, and those who privately share feelings of opposition to the authority do not protest (and implicitly punish those who do). As a result, the "low protest" equilibrium is more likely to remain after a small shock.

Yet, since citizens in a highly-centralized regime are more likely to stay silent (i.e., not protest), massive changes are more likely to result (relative to decentralized regimes) when a sufficiently large shock occurs. When a small portion of society transgresses the law (or norm, or custom, etc.), a cascade to a vastly new equilibrium arises; the actions of these citizens encourage more citizens to transgress the law, which encourages even more to evade the law, and so on. This occurs to a lesser extent when authority is decentralized, as authorities are more likely to accommodate the actions of the citizenry, and preferences are therefore less likely to be falsified prior to the shock. Hence institutional authorities with centralized, multi-lateral coercive power may *seem* insulated from upheaval when in fact they are quite vulnerable.⁹

⁷These norms may arise from the importance individuals place on social identity (Akerlof and Kranton 2000, 2005), social custom and reputation (Akerlof 1980; Romer 1984; Kuran 1989, 1998; Naylor 1990; Gould 1993; Kuran and Sunstein 1999), or status and conformity (Fershtman and Weiss 1993; Bernheim 1994; Fershtman, Murphy, and Weiss 1996; Akerlof 1997; Kuran and Sandholm 2008).

⁸The term "massive protest" could be seen as synonymous with "revolution", although the aim of this paper is to shed light on any type of massive and rapid equilibrium change. Yet, this paper does relate to the large economic, sociological, and political science literature in revolutions. The mechanism underlying revolutionary activity in the present paper is closest to Kuran (1989, 1995a, 1995b), who analyzes the implications of public revelations of private preferences. The present paper is not meant to accept or deny the validity of any of the arguments in the revolutions literature, but instead offers a complementary hypothesis. I do not account for the organizations or leadership that are often instrumental to revolutionary activity (or even civil war, as in Besley and Persson [2011]), but instead provide a mapping from broad institutional structure to massive social, political, and economic change. For overviews of the social analysis of revolutions, see Tanter and Midlarsky (1967), Shugart (1989), and Goldstone (1994, 2001).

⁹An additional implication of the model is that inefficiencies are less likely to be addressed in centralized societies, since central authorities do not have to compete with other authorities for constituents and revenue, and they are better able to suppress dissent resulting from government inefficiencies. Indeed, Hayek (1979) notes that the monopoly of the provision of government services held by centralized governments causes economic inefficiencies and restrictions of freedom that would not be found if more decentralized entities were forced to compete for constituents. With respect to the model presented here, the upshot is that highly-centralized authorities are eventually likely to disappoint their constituents, possibly resulting in a cascade. I do not consider this potentially

A familiar illustration of these dynamics has transpired in Korea since its partition in 1945. North Korea became one of the most highly centralized regimes in the world (per the definition used in this paper), as sanctioning power of all types was ostensibly held by the Supreme Leader (Kim Il-sung, Kim Jong-il, and Kim Jong-un). Meanwhile, South Korea is significantly more decentralized, and there is consequently much more political conflict (as is the case with most democracies). The conflict in South Korea has led to numerous marginal changes - particularly, expanded freedoms and democratization - as different ideologies and preferences rose and fell in popularity with the population. The North Korean government has been able to prevent such marginal changes from arising. However, an implication of the model is that if the North Korean regime eventually cracks, the institutional changes will be far larger than anything that has ever occurred in South Korea.¹⁰ The same could be said about the Communist Party in China, Zimbabwe under Robert Mugabe, and the autocratic Arab dictators (e.g., Mubarak, Qaddafi) who faced major protests in the Arab Spring of 2011 (although none of these states are as centralized as North Korea).¹¹

Although the examples listed above are all of repressive regimes, this is only one way in which the centralization of coercive power is manifested. That is, repressive regimes - most of whom derive their ability to repress through a stranglehold on the military - are a mere subset of the centralized regimes considered in the model. An important example of a different type of regime to which the model applies is theocracy, where authorities have influence over religious sanctions. A contemporary example of such a polity is Iran, where political, economic, and religious power is centralized in the religious establishment. It is costly for political or economic leaders to openly violate the dictates of religious authorities, which implicitly gives the religious authorities power over numerous types of sanctions. The model indicates that if a large shock ever occurs in Iran (perhaps a sharp and unexpected drop in the price of oil), a massive institutional change may result.

In Section 3 of this paper, I provide an empirical test of the model by analyzing the numerous austerity protests which occurred in the developing world since the 1970s. These protests provide a nice setting in which to test the implications of the model, since they were unexpected, varied in severity, generally occurred after a specific type of shock (IMF conditionality), and occurred in different types of regimes (centralized and decentralized). An econometric analysis of these protests from 1976-1992 is consistent with the implications of

endogenous nature of the shock in the model, however, as doing so would complicate the model without yielding much additional insight, since the results would merely be exacerbated.

¹⁰I thank an anonymous referee for pointing out how well the Korean example fits the intuition espoused in the model. The most obvious examples are of political institutions in unstable countries, but the mechanisms of the model can also apply within stable countries. Although these countries generally do not have "centralized" governments in the context employed in this paper (i.e., control over numerous aspects of one's life), there are generally lower-level institutions in these countries to which the model applies. For example, religious sects often control numerous aspects of members' lives and thus help shape their publicly-expressed opinions. The model suggests that the long-run vitality of these groups will be undermined if leaders express opinions which are too far out of line with members' privately held opinions (e.g., on gay marriage or abortion).

¹¹Indeed, none of the Arab Spring states fully controlled the religious establishment, which left an important lever of control out of their hands. Likewise, a certain level of decentralization of economic institutions has occurred in China over recent decades. Despite the government's attempts to censor inflammatory material, the spread of the internet and social networking websites like Weibo has made complete centralization nearly impossible.

the model. The main result is that protests were more severe under decentralized authorities if they followed small shocks, but were more severe under centralized authorities if they followed large shocks.

2 The Model

2.1 Setup

Consider a T period game, for some large T , with perfect information. There are $M + 2$ players (where M is large): M heterogeneous citizens and two institutional (social, political, economic, legal, or religious) authorities - a central authority (C) and a non-central authority (N).¹² An example of such a setting is a dictatorship where the central authority is the dictator and the non-central authority is a tribal leader, religious leader, major landowner, celebrity, judge, local political official, or anyone else whose actions influence the utility of the citizens yet are themselves subject to the actions of the dictator.

The institutional authorities choose from a continuous set of actions which the citizens can publicly accept or reject. The model analyzes situations in which the preferences of some citizens exogenously differ from those of the authorities, so actions could represent varying levels of freedom of speech, press, or religion, publicly expressed dissatisfaction with the government or religious authorities, or public opinion on social issues. The questions that the model sheds light on are, "Under what conditions do small shocks lead to a massive increase in protest by citizens?" and "How is the severity of protest affected by the centralization of authority?"

In the first period, the central authority chooses an action $a^C \in [0, 1]$. In the second period, the non-central authority chooses an action $a^N \in [0, 1]$. From periods 3 to T , citizens choose whether to publicly accept ($a_j = 0$) or reject ($a_j = 1$) C 's action. They make this decision once in each period and they do so simultaneously. Citizens are not bound to make the same decision in every period. A citizen who chooses to reject ($a_j = 1$) in period τ may choose to accept ($a_j = 0$) in period $\tau + 1$.

In some period $\bar{t} \in (3, \frac{T}{2})$, an exogenous shock is realized where fraction $\beta \in (0, 1)$ of those choosing $a_j = 0$ in period $\bar{t} - 1$ are encouraged to choose $a_j = 1$ in period \bar{t} . Meanwhile, all other citizens simultaneously choose to accept or reject C in period \bar{t} . The game continues as before until actions are chosen in the final period T .

The shock can be interpreted as an unexpected and unforeseen event which momentarily reduces the perceived costs or increases the benefits of publicly rejecting C . Historical examples of such a "shock" include the self-immolation of Mohamed Bouazizi (which ignited the Arab Spring of 2011), Martin Luther nailing the 95 Theses to the door of a Wittenberg church (sparking the Protestant Reformation), or the failed attempt of royal official to collect poll taxes sparking the English Peasant's Revolt of 1381. In all of these (and many other) cases, the "shock" affected only part of the population, who publicly displayed their displeasure simply because

¹²The inclusion of only two authorities allows for tractability. The intuition underlying the main results of the model holds in more realistic situations including numerous types of authorities.

they were displeased, not because they intended to ignite a cascade. The changes resulting from these shocks were only later transmitted to the rest of the population (through mechanisms highlighted in this model).¹³

Each citizen j derives utility from choosing actions, $a_j \in \{0, 1\}$, where the citizen publicly accepts C 's dictates if $a_j = 0$ and rejects them if $a_j = 1$. Citizens derive greater utility from rejecting C 's dictates when their own intrinsic "bliss point", b_j , is further away from zero.¹⁴ Each citizen is randomly assigned a bliss point from a normal distribution with mean μ and variance σ^2 .¹⁵ The citizens' utilities are interdependent; that is, they derive more utility by choosing actions that others choose.¹⁶ Citizens observe how many other citizens rejected C (chose $a_j = 1$) in the previous period, and they derive utility by acting in a manner similar to how others acted in the previous period. This underscores the idea that attending a protest is much more enticing if many others have protested in the past, but one does not know how large a protest will be in the present.

If the citizens choose to publicly reject the authorities' dictates, they also incur costs which are a function of the actions of the institutional authorities, a^C and a^N . These costs are increasing in the size of the violation (as in Romer [1984], Iannaccone [1988], Bernheim [1994], Kuran [1987, 1995a], Akerlof [1997], Kuran and Sandholm [2008]) and represent the costs (or punishments) associated with publicly breaking a religious dictate, breaking a law, violating a political norm, and the like, depending on the type of authority in question.

Citizen j 's preferences in period t are described in each period by the following utility function:

$$U_{j,t} = I\{a_{j,t} = 0\} \left[-m_1 (a_{j,t} - b_j)^2 + m_2 \frac{1}{M-1} \sum I\{a_{i,t-1} = 0\} \right] + I\{a_{j,t} = 1\} \left[-m_1 (a_{j,t} - b_j)^2 + m_2 \frac{1}{M-1} \sum I\{a_{i,t-1} = 1\} - m_3 (a_{j,t} - a^N) - m_4 (a_{j,t} - a^C) \right], \quad (1)$$

where m_1 , m_2 , m_3 , and m_4 are weighting parameters greater than zero and $I\{\cdot\}$ is an indicator function.

The non-central authority, N , is not directly affected by the actions of the citizenry - citizens revolt against C , not N . Instead, N weighs the intrinsic benefits of its action against the costs that C can impose for choosing actions contrary to C 's desires. N can therefore be thought of as a legitimizing agent of C (e.g., a religious

¹³The literature on revolutions provides numerous other types of "shocks" that could precipitate revolutions, such as sharp reversals in economic fortunes (Davies 1962; Tanter and Midlarsky 1967), rapid economic growth (Olson 1963), defeat in war, or sustained population growth (Goldstone 2001). In some cases, the type of policies taken by centralized governments exacerbate shocks to a greater extent than non-centralized governments (for a recent example, see Meng, Qian, and Yared [2010]; for more on centralization and distribution of public goods, see Lockwood [2002], Besley and Coate [2003], and Faguet [2004]). Where this is the case, the implications of the model for centralized governments are even greater.

¹⁴I assume that citizens derive no additional utility from a "successful" revolt (i.e., one where many citizens choose $a_j = 1$), as in Shadmehr and Bernhardt (2011). Incorporating this into the model would merely exacerbate the incidence of cascades, since it would lower the protest threshold level of each citizen.

¹⁵Normality is not a necessary feature of the analysis. Any type of distribution with two inflection points provides similar results. If there is a rightward skew in the distribution (which is to be expected, since there is a fatter tail of citizens in opposition to the central authority in most oppressive regimes), then the results hold over a larger portion of the parameter space than is considered in this paper.

¹⁶Interdependence captures the influence of social norms which may arise from the importance individuals place on social identity, social custom, reputation, status, or conformity. This specification assumes that individuals derive utility from conforming. Gintis (2003) suggests that "pro-social" behavior may be biologically determined, as humans improved their biological "fitness" by internalizing cultural norms. Also see Greif (2010) and Greif and Tadelis (2010).

authority legitimizing an autocrat or a legal authority legitimizing elected officials).¹⁷

For simplicity, I assume that the actions of the citizenry do not enter N 's utility function. While N 's actions do affect the citizenry, and the citizens' actions indirectly affect N 's utility (through their effect on C), this assumption is justified if we consider the cost imposed by C as the salient one affecting N 's actions. N derives utility from choosing actions close to its intrinsic bliss point, $b^N \in (0, \mu)$, and it faces a cost from choosing actions which differ from the central authority, C . The upper bound μ indicates that it has a stronger preference for no protests occurring than the average citizen. N 's preferences can be described as follows:

$$U_t^N = -n_1 (b^N - a^N)^2 - \gamma (a^N - a^C)^2, \quad (2)$$

where n_1 is a weighting parameter greater than zero. $\gamma \geq 0$ is the primary exogenous parameter of concern in the model. It denotes the degree to which the non-central authority incurs a cost from diverging from the action of the central authority.¹⁸ Although there are certainly endogenous elements to γ in reality - the degree to which one authority incurs costs from diverging from the other could be a function of the degree to which the citizens abide by its dictates - endogenizing this key variable unnecessarily complicates the model. This paper concentrates on massive equilibrium changes over a short period and how such changes arise rapidly. Broader institutional changes which endogenously effect the level of centralization may follow in the long run due to the interactions described in the model, but should not be affected in the short run by the rapid, massive change which is at the heart of this model.¹⁹

The centralization parameter enters N 's utility as a scalar which affects the cost N incurs for choosing an action different from C . At $\gamma = 0$, there is no such cost, at $\gamma \rightarrow \infty$ there is an infinite cost (if $a^N \neq a^C$), and at $\gamma \in (0, \infty)$ there is a positive cost that is increasing in γ . While it is possible (in reality, but not in the model) that C may also face costs from not conforming to N , the assumption of unidirectional centralization of coercive power allows for tractability.²⁰ It follows from this setup that at $\gamma \rightarrow \infty$, the two authorities are ostensibly the same actor: power over numerous dimensions is centralized in one authority (C). This extreme case is similar to Arendt's (1951) vision of totalitarianism, where rulers have "total domination" of all aspects of life. At large γ less than infinity, C has significant but not unlimited power over varying types of sanctions.

The central authority, C , derives utility from choosing actions close to its bliss point, $b^C \in (0, b^N)$. The upper bound b^N indicates that it has a stronger preference for no protests occurring than N . C wishes to

¹⁷For more on the economic effects of legitimizing agents, see Cosgel, Miceli, and Rubin (2012).

¹⁸For more on the centralization of coercive power, see Greif (2005) and Karaman (2009).

¹⁹Moreover, Rubin (2011) shows in a similar model that under a basic set of circumstances, endogenizing the degree of centralization merely exacerbates the effects seen under an exogenous parametrization, as the feedback between players is more enhanced.

²⁰In fact, the model can be interpreted as one of relative centralization, where γ is the cost incurred by N for not following C 's actions relative to the reverse situation (where C incurs costs). All that is needed for the results to hold is for N to have a greater cost than C .

minimize the average number of citizens who reject its dictates in period T .²¹ This specification reflects the idea that the central authority wants to minimize the scale of public rejection of its policy.²² C 's preferences can be described as follows:

$$U^C = -c_1 (a^C - b^C)^2 - \frac{1}{M} \sum I \{a_{i,T} = 1\}, \quad (3)$$

where c_1 is a weighting parameter greater than zero.

2.2 Solving the Model

2.2.1 Equilibrium Actions: Citizens and N

The model is solved using the subgame perfect Nash equilibrium concept, so I proceed using backwards induction. Equilibrium actions are denoted with superscript $*$.

I first solve for the equilibrium actions of the citizenry in periods 3 through T . A little algebra applied to equation (1) indicates that citizen j chooses to publicly accept C 's dictates in period t ($a_{j,t} = 0$) when:

$$b_j \leq \frac{1}{2m_1} \left[m_1 - m_2 \left(1 - \frac{2}{M-1} \sum_{i \neq j} I \{a_{i,t-1} = 0\} \right) + m_3 (1 - a^{N*}) + m_4 (1 - a^{C*}) \right]. \quad (4)$$

In each period, some citizen has the largest bliss point, denoted b_t^* , of all of the citizens choosing $a_{j,t} = 0$. If an interior solution exists, then citizen j chooses $a_{j,t} = 0$ when (denoting $F(\cdot)$ as the normal cdf with mean μ and standard deviation σ^2):

$$b_j \leq \frac{m_2}{m_1} F(b_{t-1}^*) + \frac{1}{2m_1} [m_1 - m_2 + m_3 (1 - a^{N*}) + m_4 (1 - a^{C*})]. \quad (5)$$

Next, solve for the optimal action of N in period 2. Its first-order condition provides the result:

$$a^{N*} = \frac{n_1 b^N + \gamma a^{C*}}{n_1 + \gamma}. \quad (6)$$

Plugging (6) into (5) entails that citizen j chooses $a_{j,t} = 0$ in period t when:

$$b_j \leq \frac{m_2}{m_1} F(b_{t-1}^*) + \frac{1}{2m_1} \left[m_1 - m_2 + m_3 \frac{n_1 (1 - b^N)}{n_1 + \gamma} + \left(m_3 \frac{\gamma}{n_1 + \gamma} + m_4 \right) (1 - a^{C*}) \right]. \quad (7)$$

²¹This is an indirect utility specification. We could think of C 's optimization problem as maximizing the probability of staying in power while also having some optimal policy (b^C). Minimizing the number of citizens choosing $a_{j,T} = 1$ is tantamount to maximizing the probability of staying in power.

²²If there is a massive rejection of C 's policy, it will be reflected by period T . See the rest of the model for details.

2.2.2 Stationary and Stable Equilibria

In this section, I consider stationary and stable equilibria of the game for a given level of a^{C*} . I start by defining the terms stationary equilibrium and stable equilibrium.

Definition 1: An equilibrium is **stationary** in period t if $b_t^* = b_{t-1}^*$.

Definition 2: A stationary equilibrium is **stable** in period t if, after one citizen mistakenly changes actions in period $t + 1$, the same stationary equilibrium in period t exists in some period $t^\circ \in (t + 1, T]$.²³

By definition, a stationary equilibrium arises when $b_t^* = b_{t-1}^*$, meaning that the same number of people choose $a_{j,t} = 0$ in period t as choose $a_{j,t-1} = 0$ in period $t - 1$. It follows that, if a stationary equilibrium exists in period t , then all citizens choose the same action in every period from t to T (in the absence of a shock).

In a stationary equilibrium, all citizens with bliss points b_t^* and below choose $a_{j,t} = 0$ in period t , while all citizens with bliss points greater than b_t^* choose $a_{j,t} = 1$. It follows that a stationary equilibrium exists when inequality (7) is satisfied for all $b_j \leq b_t^*$ but is not satisfied for all $b_j > b_t^*$. For large M , this logic indicates that an equilibrium is stationary in period t when:

$$b_t^* = \frac{m_2}{m_1} F(b_{t-1}^*) + \frac{1}{2m_1} \left[m_1 - m_2 + m_3 \frac{n_1(1 - b^N)}{n_1 + \gamma} + \left(m_3 \frac{\gamma}{n_1 + \gamma} + m_4 \right) (1 - a^{C*}) \right]. \quad (8)$$

Figure 1 maps b_t^* (the highest bliss point of all citizens choosing $a_{j,t} = 0$) on the horizontal axis and the right-hand side of Equation (8) on the vertical axis (in a manner similar to Granovetter [1978] and Kuran [1995]). This figure therefore provides insight into where a stationary equilibrium occurs: wherever the curve crosses the 45-degree line, the left-hand side and right-hand side of Equation (8) are equal and hence represent a stationary equilibrium.

The curve takes on the familiar S-shape because the distribution of bliss points is normally distributed, and the cumulative density function, $F(\cdot)$, is found in the right-hand side of Equation (8). Normality means that $F(\cdot)$ increases slowly for low values of b^* (at the left tail of the pdf), rises rapidly near the inflection point of $F(\cdot)$ (which is located at the mean bliss point), and then tapers off as b^* increases (the right tail of the pdf).

The S-shaped curve in Figure 1 has many important features. Most importantly, it indicates the possibility that *multiple* stationary equilibria exist. When the curve crosses the 45-degree line more than once - which is possible only when the slope of the curve is greater than one at its inflection point (bliss point μ) - multiple stationary equilibria exist. Moreover, Figure 1 shows that the three stationary equilibria (E1, E2, and E3) have

²³Citizens cannot make mistakes in the model. The stable equilibrium concept is merely employed to focus our attention on situations that are mistake-proof. The stable equilibrium concept is similar to the trembling-hand perfect concept, although it is slightly stricter. A stable equilibrium is not trembling-hand perfect because a "mistake" by one citizen could be offset by a "mistake" by another citizen in a trembling-hand perfect equilibrium, but not in a stable equilibrium.

different properties. E3 is a "good" stationary equilibrium from the central authority's perspective, since more citizens choose $a_j = 0$, while E1 is a "bad" stationary equilibrium.

For the remainder of the analysis, assume that multiple equilibria exist and that the pre-shock stationary equilibrium is E3.²⁴ That is, prior to period \bar{t} , the citizen with bliss point b_3 is the one with the highest bliss point amongst those choosing $a_{j,t} = 0$. After all, we are interested in situations where massive anti-authority movements emerge on what were quiet streets. We can interpret E3 as the "quiet streets" equilibrium, since most of the population publicly accepts C 's dictates despite privately disagreeing with C , while we can interpret E1 as the "massive protest" equilibrium.

E1 and E3 are *stable* while E2 is not. To see this, note that any point in which the curve is above the 45-degree line, such as bliss point Y in Figure 1, is one in which $LHS < RHS$ of (8). Inequality (7) indicates that for citizens with bliss point between Y and b_3 , the optimal action is $a_{j,t} = 0$. Hence, the citizen with bliss point Y cannot have the largest bliss point of all citizens choosing $a_{j,t} = 0$ in a stationary equilibrium; if it chooses $a_{j,t} = 0$ in period t , citizens with bliss points between Y and b_3 also have incentive to choose $a_{j,t+1} = 0$ in period $t+1$. This means that at equilibrium E3, if one (or a few) citizens deviates and chooses $a_{j,t} = 1$, the equilibrium will converge back to E3 in time. Conversely, this means that at equilibrium E2, if even *one* citizen deviates and chooses $a_{j,t} = 0$, the equilibrium will move to E3. Likewise, at any point in which the curve is below the 45-degree line, such as bliss point X, $LHS > RHS$ of (8). Inequality (7) indicates that at any bliss point between b_1 and X, the optimal action is $a_{j,t} = 1$. A similar logic to that espoused above indicates that if one (or a few) citizen deviates from E1 to choose $a_{j,t} = 0$, the equilibrium will converge back to E1 over time. Conversely, this means that at equilibrium E2, if even *one* citizen deviates and chooses $a_{j,t} = 1$, the equilibrium will move to E1 in time. This logic entails that equilibria E1 and E3 are stable. On the other hand, since it only takes one citizen deviating from E2 for a new equilibrium to emerge, E2 is not stable.

We are interested in finding the conditions under which the shock moves the economy from stable equilibrium E3 to stable equilibrium E1. When this occurs, the society moves from the "quiet streets" equilibrium to the "massive protest" equilibrium. It can be seen in Figure 1 that at equilibrium E3, if all of the citizens (plus one) with bliss points between b_2 and b_3 change their actions from public acceptance ($a_{j,t} = 0$) to public rejection ($a_{j,t} = 1$) of the central authority, E1 will emerge as the equilibrium outcome. All of the citizens with bliss points between b_1 and b_2 join the cascade to the new equilibrium. In other words, b_2 is the *threshold* bliss point - if citizens below bliss point b_2 choose $a_{j,t} = 1$, E1 will eventually emerge as a stable equilibrium, while E3 will

²⁴Multiple equilibria can only exist when μ is not too small. If μ is too small, the S-shaped curve arches upward prior to reaching the 45-degree line, and it crosses the 45-degree line only once (at the top of the S). A sufficient set of conditions for there to exist three equilibria are $\mu > \frac{m_1+m_3+m_4}{2m_1}$ and $\sigma < \bar{\sigma}$, which can be found by plugging in $F(\mu) = 0.5$, $\gamma \rightarrow \infty$, and $a^{C*} = 0$ into equation (8) (the values for γ and a^{C*} are chosen to provide sufficient conditions). When μ satisfies this condition, the S-shaped curve intersects the 45-degree line at E1, and there must exist some $\bar{\sigma}$ so that the curve also intersects the 45-degree line at E2 and E3 for all $\sigma < \bar{\sigma}$ (since a smaller value of σ indicates a steeper S-shaped curve around the mean).

re-emerge if citizens above b_2 choose $a_{j,t} = 0$.

Within the context of the model, this means that the shock may not end up affecting equilibrium actions at all. If the pre-shock equilibrium is E3 and $\beta < F(b_3) - F(b_2)$, then not enough citizens publicly disapprove after the shock (i.e., choose $a_{j,t} = 1$) to eventually move the equilibrium to E1. Instead, the equilibrium eventually moves back to E3, and all those who were affected by the shock go back to publicly accepting C 's dictates ($a_{j,t} = 0$). This is tantamount to some people taking to the streets following a shock, but upon doing so realize that public support for their cause is trivial, and they eventually go back inside and publicly abide by C 's dictates. On the other hand, when the shock is sufficiently large ($\beta > F(b_3) - F(b_2)$), the initial equilibrium unravels and the post-shock equilibrium is E1. In this case, enough people take to the streets after the shock that more people are encouraged to do so (since preferences are interconnected), which encourages more to do so, and so on until $1 - F(b_1)$ portion of the citizens publicly reject C .

2.2.3 Cascades and Centralization

In the model, there are two ways in which an economy can move from stable equilibrium E3 to E1 after a shock. First, if nearly all citizens are affected by the shock (β is large), then most citizens publicly protest and eventually E1 arises. This is a trivial result - it merely indicates that a large shock which encourages nearly everyone to change actions will change the equilibrium outcome. The second manner in which an economy moves from E3 to E1 is less obvious. It occurs when cascades of public dissent encourage individuals to reveal their preferences (in period t) after seeing others do so (in period $t - 1$). Cascades can arise when a small portion of the population is affected by the shock because the interconnectedness of preferences spreads the shock to much of the population. I focus on these outcomes for the rest of the paper; that is, I focus on cases of preference *revelation* rather than preference *change*. After all, it is under these conditions that seemingly quiet streets can erupt in protest after relatively small events trigger the spread of dissent.²⁵

I ignore the possibility that one citizen, knowing that they are the threshold citizen, triggers a movement from E3 to E1.²⁶ Instead, I focus on the case where any one citizen or group of citizens is willing to publicly display their anti-authority preferences *even if no one follows*. A recent and vivid example of such an action was the self-immolation of Mohamed Bouazizi, the Tunisian street vendor whose very public actions helped spark the Arab Spring of 2011. He undoubtedly could not have foreseen the effect that his actions would have;

²⁵Of course, in reality both preference change and preference revelation occur simultaneously. I focus on preference revelation because changes resulting purely from preference changes are trivial (i.e., large preference changes leading to large changes in equilibrium outcomes is not a novel insight).

²⁶This makes sense under any number of realistic assumptions on cognition and population size (M). This assumption merely implies that even if citizens have full information on the distribution of types (which is extremely unlikely in reality), they do not have the cognitive ability to calculate b^* . This assumption is made to allow the model to address the more realistic situation where a *group* of protestors creates a movement from E3 to E1, not an *individual* protestor. Indeed, how likely is it that anyone would actually believe "if I protest, this movement will change from 25 people to 2,500 people"?

he was simply fed up with government confiscations of his wares. Hence, the model focuses on decentralized equilibrium changes, not those intentionally triggered by individuals or organizations (if this is even possible). It also differs a bit from other models of cascades (e.g., Granovetter 1978; Lohmann 1994; Kuran 1995; Ellis and Fender 2011) in which people extract *information* from the previous, public actions of others. In those models, people infer something about other people's preferences by their actions, which in turn augments their own preferences and can lead to an information cascade. The present model is simpler (and more mechanical), assuming that people simply respond to the publicly-expressed actions of others (perhaps due to social identity, reputation, or conformity; see footnote 7 for citations). Indeed, introducing information extraction into the model would exacerbate its results, since information is all the more repressed in centralized regimes (and hence, the information revelation mechanism is more effective in triggering a cascade).

In order to focus on cascades of preference revelation, I define a cascade as occurring when more people who are *not* directly affected by the shock switch actions (from public acceptance to rejection) than those who are directly affected by the shock. Using the nomenclature from Figure 1, I formally define a cascade as follows:

Definition 3: A **cascade** occurs if both of the following conditions hold:

1. $F(b_3) - F(b_2) < \beta$: More than the threshold number of citizens change their actions after the shock, entailing that the stable equilibrium changes from E3 to E1.
2. $F(b_3) - F(b_2) < F(b_2) - F(b_1)$: The shock directly affects less than half of the citizens (who change their actions after the shock) but still precipitates an equilibrium change from E3 to E1.

The main purpose of the model is to highlight the relationship between centralization and cascades. To this end, note from (8) that changes in the centralization parameter (γ) or the central authority's action (a^{C*}) merely shift the curve in Figure 1. The curve shifts down as a^{C*} increases and shifts up as γ increases (since $a^{C*} < b^N$).²⁷ Hence, the first question that the model answers is "under which conditions (with respect to γ) does a 'good' equilibrium (E3) emerge after the shock?"

Consider the following intuition. In high- γ economies, citizens falsify their preferences to a greater extent. Hence, fewer citizens publicly reject C (choose $a_{j,t} = 1$) since preferences are interconnected. This entails that the bliss point of the "threshold citizen" (b_2 in Figure 1) is further away from b_3 as γ increases, and a greater shock is necessary to pass the threshold. Therefore, the range of shock sizes (β) over which the economy returns to the pre-shock stable equilibrium (E3) at some point after the shock is weakly increasing in centralization (γ), as noted in Proposition 1.

²⁷Since it is assumed that there are 3 equilibria for all values of a^{C*} , the analysis does not focus on C 's decision. C simply chooses some a^{C*} to balance the marginal deviation from its bliss point with the marginal increase in citizens choosing $a_{j,t} = 0$. C 's choice is monotonic in γ , so we do not need to explicitly solve for it to attain comparative statics.

Proposition 1: The parameter space over which the pre-shock stable equilibrium (E3) eventually re-emerges after the shock is weakly increasing in γ , *ceteris paribus*.

This result indicates that highly centralized economies are more insulated against public rejection of the central authority. However, in the event that a shock does trigger a cascade, it is worth asking: how *severe* is the change in the stable equilibrium actions after the shock? The following definition is useful in formalizing this analysis:

Definition 4: The **cascade magnitude** is the number of citizens who change actions from publicly accepting C in a stable equilibrium prior to the shock to publicly rejecting C in a stable equilibrium after the shock.

Cascades only arise when most citizens "disagree" with C . I focus on this case ($\mu > \mu^*$ for some μ^* defined in the proof of Proposition 2), which often arises in autocratic regimes when the interests of the autocrat and the citizens are not aligned. Indeed, it is in these situations where massive equilibrium changes occur; when a cascade occurs in a regime where the citizens disagree with the central authority, the change in expressed preferences is much greater than in a regime where most citizens agree with the central authority.

It was noted in Proposition 1 that centralized authorities are better able to suppress dissent and are thus more insulated from small shocks. Since centralized authorities can impose multiple sanctions on dissent, citizens are less likely to publicly reject C *despite* disagreeing with its dictate. This enables a situation where citizens "falsify their preferences" to a greater degree in centralized regimes. That is, citizens under centralized rule are more likely to disagree with C but not publicly reject C . Kuran (1995a, p. 3) defines preference falsification as "the act of misrepresenting one's genuine wants under perceived social pressures." When citizens falsify their preferences, they choose actions which differ from their bliss point for two reasons. First, perceived social pressures encourage them to choose actions similar to those chosen by others. Secondly, this outcome is exacerbated when institutional sanctions are severe (m_3 and m_4 are large) and the actions of the authorities diverge from the bliss point of the citizenry.

The major upshot of increased preference falsification is that if a sufficiently large shock occurs (i.e., one that is large enough that at least the threshold citizen changes actions), the cascade magnitude is larger the more centralized the regime is. Once some citizens act closer to their internal preferences by publicly rejecting C (choosing $a_j = 1$), others will find it more attractive to publicly reject C , *especially* since they disagreed with C in the first place. Since there are more citizens who privately disagree with C in centralized regimes, this information revelation mechanism is stronger. This logic is summarized in Proposition 2.

Proposition 2: If a cascade arises, the cascade magnitude is weakly increasing in γ , *ceteris paribus*.

When the citizens' bliss points are far away from the actions of C (μ is large, as it is in this case), larger cascades occur under highly centralized rule following shocks. Although highly centralized authorities are more insulated

from small shocks, citizens are relatively unhappy. This means that when a shock is large enough that some citizens publicly reject C , the cost of publicly rejecting C decreases, encouraging more citizens to publicly reject C , and so on. Relative to the pre-shock stable equilibrium - which may often seem tranquil - centralized regimes are subject to massive changes in public opinion despite having the appearance of public acceptance.

2.3 Discussion: Why Seemingly Tranquil Societies Implode

The intuition formalized in Proposition 2 offers two explanations for why *seemingly* tranquil, centralized societies can quickly undergo massive changes, especially when the centralized authority promotes policies that are detrimental to most citizens (μ differs substantially from a^C). One explanation, which is also offered by Granovetter (1978) and Kuran (1989, 1995a, 1995b), is that preference falsification encourages latent movements in social norms to emerge after a shock. That is, an economic, political, or social shock may move equilibrium actions by enough to encourage most citizens, even those who are not directly affected by the shock, to choose drastically different actions.

The other explanation, which is novel to this paper, sheds light on the role that institutional structures play in determining the effects of shocks. It suggests that a high degree of centralization discourages marginal changes to equilibrium actions after small shocks. Citizens have less incentive to publicly dissent, as they incur multiple institutional costs from doing so. The same citizens may be more encouraged to publicly dissent in less centralized societies, however, as they face less cost from doing so. This is why, as Proposition 1 notes, stable equilibria where there is little public dissent (E3) are more likely to re-emerge over time in highly centralized economies following a shock. Yet, when larger shocks materialize, large cascades towards vastly different equilibria are more likely to result in highly centralized economies. This occurs because citizens falsify their preferences to a greater extent in such economies, and thus large shocks encourage some citizens to change their actions, in turn making it more likely that the institutional laws will be much different in the post-shock equilibrium.

Kuran (1995a, 1995b) and Yin (1998) do suggest that unanticipated regime change is more likely to occur in politically repressive countries. Their hypotheses coincide with the one made in the present paper, though it is not clear that their hypotheses hold when other types of freedoms (religious, economic, legal) exist in politically repressive regimes. The essential difference between the present hypothesis and Kuran's and Yin's is that I stress the interdependence of institutions that are able to impose different types of sanctions. This leads to a similar conclusion as Kuran and Yin, as such institutional structures are often found in politically repressive regimes.

The model also provides insight for how central authorities can attempt to quash massive protest movements before a cascade arises, although such strategic considerations are not explicitly modeled. While a typical

response of autocrats is to capture and execute the leaders of a protest movement, the model suggests that an alternative strategy is to destroy a slice of the distribution of the citizenry, and this slice does not even need to be the most extreme slice.²⁸ By jailing or executing a sufficiently large slice of the population, the authority can “break the chain” of the cascade and prevent the “good” equilibrium (E3) from completely unraveling. In reality, this can be very difficult for a central authority to accomplish, in large part because he has little information on where people fall in the distribution of preferences. Instead, a more appealing (and less costly) mechanism often employed by central authorities is to suppress information - both about the shock and about the ensuing public disapproval. This can explain, for example, the extreme measures taken to suppress the internet in Iran and China.²⁹ Such tactics work well to suppress small shocks. However, this also works to further push the actions of the citizenry away from their intrinsic preferences, which may eventually cause a larger cascade and thus unintentionally sow the seeds of the authority’s demise.

In sum, the following testable predictions arise from this framework:

- Stable equilibria where little public dissent exists are more likely to arise in highly centralized economies.
- If a shock is large enough to cause a cascade, the change in pre- and post-shock stable equilibrium actions is greater the greater the degree of centralization.

3 Austerity Riots and Centralization

A primary implication of the model is that countries with centralized authorities are more insulated from change when shocks are small but are more susceptible to sudden, massive changes when shocks are large. In this section, I test this implication by analyzing the severity of austerity protests in the developing world between 1976 and 1992. Such protests were common in the developing world beginning in the mid-1970s in reaction to measures employed - almost always as a condition of IMF aid - to combat inflation and government debt.³⁰ I test the relationship between a series of “IMF pressure” variables and severity of protests over differing degrees of institutional centralization to shed light on the relationships espoused in the model. Although the data cannot speak to the microeconomic mechanisms highlighted in the model (namely, those related to internal and expressed preferences and cascades), it can shed light on the connections between macroeconomic events, institutional structures, and changes in publicly expressed opinions. This analysis underscores the determinants of protest severity (a macro concept) as well as sudden equilibrium changes (a micro concept), since the latter

²⁸I thank an anonymous referee for pointing out this implication of the model.

²⁹Makowsky and Rubin (2013) employ an agent-based model to analyze the effects of institutional centralization and information and communication technology (ICT) on protest thresholds. They find that the two are complements - societies with centralized institutions are more likely to experience revolutions when ICT is widely available.

³⁰The evolution of IMF conditionality, as well as arguments for and against conditionality, are summarized in Dreher (2004, 2009).

is realized in the former.

Modern austerity protests began in the mid-1970s, with the first one occurring in Peru in 1976. The protests were sparked by austerity measures which were almost always imposed by the IMF as a condition of assistance. Thus, unlike previous price and food riots that occurred from time to time in world history, these protests were targeted at internationally prescribed policies increasingly imposed by the IMF beginning in the mid-1970s.³¹ The stated aims of these measures were freeing up markets and cutting government spending in order to reduce government debt and curb massive inflation. These market-based measures, known by some as “shock treatment”, included currency devaluation, broad reduction of spending on the public sector, privatization of state-owned corporations, cuts in public subsidies for food and basic necessities, wage restraints, higher interest rates, and elimination of protectionism (Walton and Seddon 1994).³²

These policies sparked protests in many places where they were imposed. Such protests were defined by Walton and Seddon (1994) as “large scale collective actions including political demonstrations, general strikes, and riots, which are animated by grievances over state policies of economic liberalization implemented in response to the debt crisis and market reforms urged by international agencies.” The international agency most associated with these protests is the IMF, and hence Joseph Stiglitz called them “IMF riots”.

The “shock treatment” imposed by IMF conditionality presents a “shock” akin to the one described in the model. These were *not* slowly implemented policy adjustments that the public anticipated for a long time. Instead, Walton and Seddon (1994) describe them as “drastic, overnight price hikes resulting from the termination of public subsidies on basic goods and services, proclaimed by the government as regrettably necessary reforms urged by the IMF and international lenders as conditions for new and renegotiated loans.” These shocks generally occurred rapidly enough that, in terms of the model, the fraction of citizens protesting before the shock, $F(b_{t-1}^*)$, was not endogenous to the shock itself. Instead, a number of citizens, likely those most harmed by the shock, incurred a temporary adjustment of their preferences, and in some cases this adjustment was large enough to encourage them to protest.³³

The distributional implications of these policies are clear - most policies negatively affected the urban poor, at least in the short run (Walton and Ragin 1990; Walton and Seddon 1994). The protests were primarily urban in nature, often following a rise in a price for a specific good or an elimination of a subsidy. In some cases, the protests were relegated to one city and remained non-violent, such as organized strikes planned in Ecuador and Bolivia (Walton and Ragin 1990). On the other extreme, protests turned into deadly riots which spread throughout the country, as was the case of the Venezuelan protest of 1989, where a week of rioting spread from

³¹Indeed, the extended facility fund, which was established to assist debtor nations, was formed in 1974. This helps explain why there were no austerity protests of this nature prior to the mid-1970s.

³²For a scathing review of these policies in the developing world over the last half-century, see Klein (2007).

³³In other words, the shocks generally occurred rapidly enough that the curve in Figure 1 did not shift, since the right-hand side of equation (8) is unaltered. The left-hand side of equation (8) does change, however, resulting in a movement along the curve.

Caracas to 16 other cities.

What determined the differences in severity of these protests? This topic has received some attention from sociologists and political scientists, who have proposed a wide range of explanations. Walton and Seddon (1994) and Walton and Ragin (1990) provide evidence that over-urbanization (that is, a high level of urbanization relative to the level of economic development) plays a key role in both the presence and severity of the riots.³⁴ They suggest that the linkage between the two lies in the development of organizational infrastructure capable of mobilizing political action. Walton and Ragin (1990) also suggest that IMF pressure significantly affected protest severity but inflation and debt did not.³⁵

In this section, I analyze how changes in IMF involvement affected the likelihood of severe protest in a country. When IMF pressure is present, pressures to liberalize markets generally ensue and protests may follow. Propositions 1 and 2 of the model suggest that since austerity measures differ substantially from the bliss point of most citizens (μ is much different than a^C), when IMF pressure (the “shock” in the model) is small, centralized economies will better be able to suppress protests. However, significant IMF pressure is more likely to precipitate massive changes in centralized economies. In other words, the following prediction arises from the model:

Prediction 1: When there is a small amount of IMF pressure, austerity protests will on average be less severe in countries with more centralized institutions, all else being equal. However, when there is a large amount of IMF pressure, austerity protests will on average be more severe in countries with more centralized institutions.

3.1 Data

Data were gathered on austerity protests covering the same years as Walton and Seddon (1994): 1976-1992. The former date denotes the onset of the first modern austerity protest while the latter represents the time in which Walton and Seddon went to press.

As noted by Walton and Ragin (1990), obtaining a complete list of debtor countries that experienced international pressure to implement austerity measures can only be done indirectly, as the exact terms negotiated between the IMF and debtor countries is kept secret.³⁶ To this end, I employ three measures identified by Walton and Ragin as indicative of IMF pressure: 1) the country employed the “extended fund facility” (EFF), generally

³⁴Walton and Ragin (1990) measure over-urbanization as follows: “in cross-national studies of the degree to which less developed countries are excessively urbanized, the usual practice is to regress level of urbanization on GNP per capita and use the residuals as a measure of overurbanization ... Large positive residuals indicate that a country is excessively urbanized relative to its level of economic development.

³⁵On the other hand, Auvinen (1997) finds that poor economic performance (indicated by high inflation and large debt service) is associated with political demonstrations, riots, and strikes.

³⁶Of course, the terms will not be kept secret forever. When they are made public, a better test of the model’s implications can be conducted.

reserved for countries suffering a significant imbalance of payments relating to structural maladjustments in production and trade (IMF [various]), in a given year between 1976 and 1992;³⁷ 2) the country's ratio of IMF funds used to its IMF quota exceeded 125% in a given year between 1976 and 1992; 3) the country rescheduled or renegotiated its debt in a given year between 1976 and 1992.³⁸ 70 countries satisfied one of these three criteria between 1976 and 1992.³⁹ I form a panel that is restricted to years in which one of these criteria were satisfied in the country in question within one year (either before or after). A list of these countries and the years employed in the data is available in Appendix Table A1.

40 countries in the data experienced austerity protests between 1976 and 1992. A Lexis-Nexis search of news reports of the 70 countries listed in Table A1 (as well as any listed in Walton and Seddon [1994] that were not in Table A1) from 1976-1992 produced 116 separate instances of austerity protest. Protests and riots were *only* documented if they resulted from austerity measures or IMF pressure - other types of anti-government protests or strikes are not included in the data. Planned general strikes and small, non-violent, sector-specific strikes are also not included in the data (even if they resulted from austerity measures).⁴⁰

I subjectively coded each of these protests by severity using the following criterion, which are discussed further in Appendix B. An instance was scored 1 if it were a small (relative to population), confined (to one or two cities) protest. An instance was scored 2 if it were either prolonged but confined or widespread but not prolonged and 3 if the protest were prolonged and contained widespread riots. An example of a protest coded 3 occurred in Algeria in October 1988, when 159 protesters were killed in a few major Algerian cities over the span of week and thousands were injured and arrested. The government's response to the protests, including those which lead to deaths, was *not* taken into account when creating the severity measures. Where government action occurred, the index takes into account the reported events that the government was responding to, not the government response itself. The reason for this is that it is possible that centralized governments are more likely to respond with violence. Hence, including the government's response would bias the severity index in favor of the proposed hypothesis.

³⁷The IMF defines the extended fund facility as "an IMF lending facility established in 1974 to assist member countries in overcoming balance of payments problems that stem largely from structural problems and require a longer period of adjustment than is possible under a Stand-By Arrangement. A member requesting an Extended Arrangement outlines its objectives and policies for the whole period of the arrangement (typically three years) and presents a detailed statement each year of the policies and measures it plans to pursue over the next 12 months." (IMF)

³⁸Walton and Ragin split the last category into two: debt rescheduling and debt renegotiation. My reading of the data suggests that the line between these two is often blurred, so I have lumped them together. Data for EFF and IMF quota comes from various IMF Annual Reports; data for IMF funds used comes from the World Development Indicators database; data for debt rescheduling and restructuring comes from clubdeparis.org, Kuhn and Guzmán (1990), and Dillon et al. (1985).

³⁹Some countries were omitted from the data set due to lack of IMF or control data. These include: Angola, Barbados, Burma, Dominica, Equatorial Guinea, Grenada, Liberia, Somalia, Uganda, Western Samoa, Yemen, and Yugoslavia. Iran and South Korea did not satisfy any of these conditions but are included in the data since there was an austerity protest in each country.

⁴⁰All results are robust to inclusion of general strikes and industry-specific protests as severity 1 protests. These results are available in the Appendix. General strikes are not included in the base results because the model is intended to analyze changes in individual behavior (on a collective scale) resulting from shocks, not organized, institutionally-driven protests.

A reading of the articles reporting on the protests showed that most protests/riots easily fit into one of these three categories. The differences between protests coded 1 and other protests are especially stark. The difference between protests coded 2 and 3 are less obvious and thus more subjective, but this is not an issue in the analysis, since protests of these two severity levels are always lumped together. I also create an alternative index, found in Appendix B, for protests in which the severity level was not obvious. Table 1 shows the protests data broken down by continent.⁴¹

The intuition outlined in the model indicates that a good proxy for institutional centralization is one that accounts for one authority's ability to affect numerous types of sanctions. One such variable is spelled out in the Polity IV data set (Marshall and Jaggers 2008): constraint on the executive. This variable is defined as:

The extent of institutionalized constraints on the decision-making powers of chief executives, whether individuals or collectivities. Such limitations may be imposed by any "accountability groups." In Western democracies these are usually legislatures. Other kinds of accountability groups are the ruling party in a one-party state; councils of nobles or powerful advisers in monarchies; the military in coup-prone polities; and in many states a strong, independent judiciary.

This variable ranges from 1 to 7, with 1 equaling "Unlimited Authority" (no regular limitations on the executive's actions) and 7 equaling 'Executive Parity or Subordination' (accountability groups have effective authority equal to or greater than the executive in most areas of activity). This variable provides an ideal proxy for the degree of institutional centralization, as spelled out in the model, because it measures the degree to which political authorities can extend multifarious sanctions.

A weaker proxy of centralization is the Freedom House (2009) "degree of political freedom" variable. This variable ranges from 1 to 7, with 1 equaling "most free" and 7 equaling "least free". This is hardly an ideal measure of centralization, as defined in the model, since it does not directly underscore the ability of the central authority to impose numerous sanctions. However, centralized authorities generally also have the ability to restrict political freedoms. Nowhere do I claim that centralization has to be the driving force behind political freedom; I merely suggest that this is one way in which centralization manifests itself. For these reasons, regressions using this variable are regarded as robustness checks relative to the results employing constraint on the executive data.

Other controls are employed to account for phenomena which political scientists, economists, and sociologists consider as salient factors associated with protest activity. These include the urbanization rate, per capita GDP, population, and a measure of religious fractionalization.⁴² The religious fractionalization index is constructed

⁴¹Table A1 shows the protest data broken down by year and Table A3 shows the data broken down by country.

⁴²Data on urbanization, GDP, and population comes from World Bank (various). The measure of religious fractionalization is derived from data found in Barrett, Kurian, and Johnson (2001). The controls employed in these regressions are consistent with

like a Herfindahl index, equaling the sum of the proportion of each religion in the country squared. The summary statistics of all controls are reported in Appendix Table A4.

3.2 Analysis

3.2.1 Testing for the Presence of Protest

The data provide a chance to test the model’s primary prediction: countries with centralized political authorities should have smaller changes (relative to countries with decentralized authorities) in expressed public opinion (as seen in protests) when shocks are small, but larger changes when shocks are large. Yet, before we can test how shocks (proxied with IMF variables) affect the severity of protests, we must establish *whether* the proxies are good predictors of protest. In particular, the model suggests testing the following equation, where $Protest_{it}$ is a dummy equaling 1 if there is a protest in country i in year t , X is the set of control variables, and “CP” denotes the “centralization proxy”, where both the “constraint on the executive” and “political freedom” variables are transformed so that higher values indicate greater centralization. Note that regression equation (9) does not provide a test of the model’s hypothesis; instead, it provides a test of how well the IMF variables proxy for a “shock” *in the context* of the model.

$$Protest_{it} = \delta_0 + \delta_1 Shock_{it} + \delta_2 CP_{it} + \delta X_{it} + \varepsilon_{it}. \quad (9)$$

There are 3 different IMF variables that proxy for a shock: use of IMF funds, use of EFF funds, and the number of restructurings and reschedulings. The first two variables are deflated by the country’s IMF quota, which is based on its standing in the world’s economy. Walton and Ragin (1990) note that all three of these variables are good predictors of austerity protests, with the number of restructurings being the strongest predictor.⁴³ I also create variables for the greatest single-year level of the three IMF proxies over the previous two years.

The model indicates that the coefficient on the IMF “shock” variable, δ_1 , should be positive (and statistically significant). If it is not, then the variable in question is not a predictor of protests in general and thus should shed little light on how institutional centralization affects the *severity* of protests.

A probit model is used to test equation (9). The probit coefficients are reported in Table 2.⁴⁴ All regressions those pointed out by Auvinen (1997) as ones that traditionally have received attention in the political science, economics, and sociology literature related to political conflict. Inflation and government debt are not included as controls because they frequently *lead* to IMF involvement.

⁴³Walton and Ragin formulate an “IMF pressure index” which is the summation of the z-scores of all 4 IMF indicators. I do not do this for two reasons: 1) I find, like Walton and Ragin, that the number of restructurings and reschedulings is by far the best predictor; 2) the sum of the z-scores is dominated by the restructuring variable, which is not normally distributed, and hence converting it to a z-score is erroneous. I have analyzed the regressions reported in this paper using Walton and Ragin’s z-score variable and the results are similar - though not as strong - as the ones reported here. These results are available upon request.

⁴⁴Table A5 reports regressions where the IMF variables are taken over two years. Results are very similar to Table 2.

include continent dummies, and standard errors are clustered by continent.⁴⁵ The results indicate that the “use of IMF funds” and “EFF” variables are not good predictors of protests, but the “restructuring/rescheduling” variable is a good predictor. The coefficients on the IMF Pressure Index are statistically insignificant in all of the regressions where “use of IMF funds” and “EFF” variables are employed as the shock proxy and all other controls are included. However, the number of restructurings or reschedulings appears to be a strong predictor of protests (the coefficient is always positive and highly statistically significant), a result also found in Walton and Ragin (1990). Hence, for the remainder of the analysis I only employ reschedulings - not use of IMF funds or EFF - as a proxy for an IMF "shock".

3.2.2 Relating Centralization and Protest Severity

Since the rescheduling variable is a good predictor of protests, we can re-write Prediction 1 as the following:

Prediction 1A: All else being equal, a change to a more centralized economy should have a positive (negative) effect on the probability of a more severe protest occurring when the restructuring variable is large (small)

As in the model, Prediction 1A suggests that there is a non-linear relationship between centralization and the severity of protests. This relationship can be estimated with the regression model in equation (10). The dependent variable, $ProtestSeverity_{it}$, equals one if the most severe protest in country i and year t equals 2 or 3 and equals zero otherwise. Unfortunately, there are too few observations of protests of severity 3 to test the model using a dependent variable which equals one only if the protest is of severity 3.⁴⁶ This should not detract from the results, however, as the most significant differences in protest severity are between those coded 1, which are generally confined and short, and 2 and 3, which are more widespread and long in duration. As before, “CP” denotes the centralization proxy (either the constraint on the executive or political rights variable), while the shock variable is the number of reschedulings (over one or two years):⁴⁷

$$ProtestSeverity_{it} = \eta_0 + \eta_1 Shock_{it} + \eta_2 CP_{it} + \eta_3 Shock_{it} * CP_{it} + \eta X_{it} + \varepsilon_{it}. \quad (10)$$

⁴⁵Including country dummies would be ideal, but there is too little variation within countries over time for this to be a feasible approach, as all results are dependent on a small number of observations. Using non-clustered standard errors gives largely similar results, which are available upon request.

⁴⁶Nevertheless, the results are broadly robust (in terms of statistical significance) to an ordered probit specification.

⁴⁷There is the possibility that the regressions specified above suffer from an endogeneity problem. That is, it is possible that more centralized regimes are more (or less) able to access IMF funds and impose austerity. If this is true, the “shock” variable (rescheduling) is a function of the centralization proxy, and the regression model is misspecified. Moreover, Kohlscheen (2010) and van Rijckeghem and Weder (2009) find a negative relationship between constraints on the executive power (the centralization proxy) and sovereign debt default (which is related to IMF conditionality). However, the correlations between the shock variables and the centralization proxies are almost 0. Amongst the observations used in the regressions, $\sigma_{RESC,CE} = -0.0186$, $\sigma_{RESC,PR} = -0.0741$, where $RESC$ is the rescheduling variable, CE is the “Constraint on the Executive” variable, and PR is the “Political Rights” variable. Moreover, regressions with the rescheduling variables as the dependent variables and the centralization proxies and other controls on the right-hand side provides highly insignificant results on the centralization proxy coefficients. These results are available upon request.

Prediction 1A implies that η_2 should be negative and η_3 should be positive. In other words, protest severity should be decreasing in centralization when shocks are small (and hence the interaction term is small), while protest severity should be increasing in centralization when shocks are large. These predictions are mostly confirmed in Table 3, which reports the probit coefficients of an estimation of equation (10).⁴⁸

The coefficient on the centralization proxies (η_2) is negative in columns (2)-(4), though it is never statistically significant, while the coefficient on the interaction term is positive in all regressions and is statistically significant in columns (2)-(4). A much more instructive look is provided by Tables 4 and 5, which map the probability of a severe protest occurring over varying amounts of reschedulings and values of the centralization parameter. Again, the constraint on the executive has been transformed so that a value of 7 is the most centralized (least constraint) and the value of 1 is the least centralized (most constraint). These probabilities were derived using the coefficients in Table 3, taken at the average of the control variables.⁴⁹

A number of patterns emerge from these tables. First, in the lower panel of Table 4 and in both panels of Table 5, severe protests are less likely to occur as centralization increases when there are zero reschedulings. Although the last column suggests that this trend is not statistically significant, this is in line with what the model predicts: centralized regimes are more able to suppress dissent when shocks are weak or non-existent. It is not surprising that this result is not statistically significant - if there is no evidence of a shock, we would not expect a severe protest to occur in *any* economy, centralized or not. These comparative statics reverse, however, when reschedulings occur. In all four panels of Tables 4 and 5, the probability of severe protest is increasing in centralization when a rescheduling occurs, with the trend being stronger when multiple reschedulings occur. This trend is statistically significant in 5 of the 8 specifications. This result is consistent with the model: although centralized regimes are good at suppressing small shocks, they are susceptible to massive changes when larger shocks occur. Indeed, the probability of a severe protest occurring in the most centralized regimes is more than double that of the least centralized regimes in 5 of the 8 specifications where at least one rescheduling occurs.

In sum, this empirical exercise is meant merely to support the theoretical contribution of the model. Although the analysis does not speak to the micro mechanisms suggested in the model, it does confirm its testable predictions. Most importantly, it provides evidence that centralized authorities are able to suppress changes in publicly-expressed opinion when shocks are small, but are susceptible to massive changes in publicly-expressed opinion when shocks are large.

⁴⁸94 observations are dropped in Table 3 because the Asia dummy perfectly predicts failure (i.e., protest severity = 1), and thus all Asian observations are dropped. The only protest in Asia with severity greater than one, South Korea in 1980, is not included in the universe of observations because South Korea was never subject to IMF pressure.

⁴⁹The Africa dummy is set equal to 1 and all other continent dummies set equal to 0. The results are robust to setting other continent dummies equal to 1.

4 Conclusion

This paper provides insight into why cascades which result in vastly different equilibria occur in some institutional settings but not in others. Where the literature discusses the features of a society that can precipitate a cascade, it primarily focuses on the ability of the government to sanction opposition to the regime (e.g., Lohmann 1994; Kuran 1995a, 1995b; Rasler 1996; Yin 1998; Slater 2009; Ellis and Fender 2011). Yet, the literature is much less clear on whether it matters *how* political actors sanction opposition. Does it matter if they can only sanction through military or police force? Are the dynamics any different if the regime can impose religious, social, or economic sanctions?

This paper provides an answer to these questions. It focuses on the degree to which authorities are *centralized* - that is, the degree to which they have the ability to impose sanctions on multiple parts of their subjects' lives. This paper employs a simple economic model which suggests that authorities in centralized economies are relatively insulated from small shocks but are susceptible to cascades resulting in massive changes if shocks are large. The logic underlying this result is straight-forward. People living under centralized authorities are more likely to choose actions that differ from their intrinsic optima, since they face numerous costs from publicly stating their true beliefs. Hence, small shocks are unlikely to upset the equilibrium outcome under centralized rule, because individuals are unwilling to incur the numerous sanctions associated with transgressing the central authority's dictates. However, a large shock encourages some citizens to incur these costs and publicly display their anti-authority preferences. Since centralized rule encourages most citizens to falsify their publicly-expressed preferences, this setting is ripe for these protestors to trigger a cascade which results in a massive equilibrium change.

In other words, the primary insight of this paper is that the size of the shock necessary to precipitate a cascade is a *function of the regime type*. This insight sheds light on why cascades arise in some settings but not in others, even if the shock which ignited the cascade is felt ubiquitously. For example, small shocks to the world price of basic goods (e.g., food, oil) can have an impact on elections in decentralized regimes (one need look no further than the U.S., where the prices of gasoline and groceries are often an issue in national elections). But such small shocks are unlikely to affect political outcomes in centralized regimes, where rulers can weather the storm by either increasing subsidies or increasing repression. The opposite is true when sufficiently large shocks occur to the price of necessities. Indeed, many of the major austerity riots analyzed in Section 3 followed directly from centralized regimes removing subsidies on basic goods. Similarly large price changes in decentralized regimes (e.g., U.S. gas prices in the late 1970s) may make many unhappy, but massive rioting is unlikely to result.

More generally, the model applies to numerous historical and contemporary phenomena.⁵⁰ The most prominent recent example is the Arab Spring of 2011, where citizens who had quietly lived under oppressive, centralized regimes for decades revolted in massive numbers in Egypt, Tunisia, Libya, Syria, and Bahrain. Goldstone (2011) notes that the centralization of the sanctioning ability in a “Sultan” (Goldstone employs the term “Sultanistic governments”) was critical to these movements: “Sultanistic dictators ... generally amass great wealth, which they use to buy the loyalty of supporters and punish opponents ... Typically, the security forces are separated into several commands (army, air force, police, intelligence) - each of which reports directly to the leader. The leader monopolizes contact between the commands, between the military and civilians, and with foreign governments, a practice that makes sultans essential for both coordinating the security forces and channeling foreign aid and investment.” The multi-lateral coercive power that Goldstone describes in the context of Arab autocracies is precisely the “centralized” institutional condition analyzed by the model; and the Arab Spring is a vivid example of a consequence predicted by the model of such an institutional arrangement.

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⁵⁰For more on the broad effects of the centralization of coercive power throughout world history, see Greif (2005). Iyigun (2009) argues that there is a positive connection between monotheism and the length and breadth of dynastic power, as monotheistic religions have generally been complementary to centralized government (due to high fixed costs of starting a monotheistic religion). This argument is consistent with the one made in the present paper.

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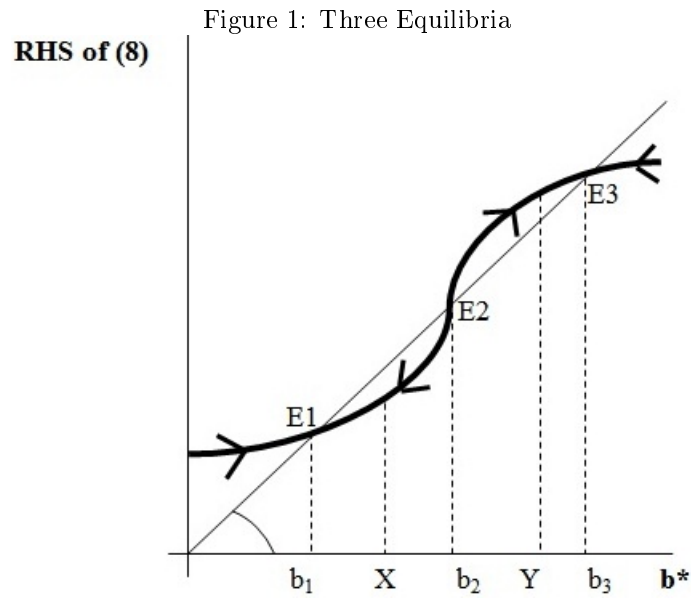


Table 1: Protests and Severity by Continent

Region	Mild Protests (1)	Moderate Protests (2)	Massive Protests (3)	Total Protests
Africa	9	9	3	21
Asia	10	0	1	11
Central America	16	8	1	25
Europe	7	0	2	9
Middle East	2	2	5	9
South America	17	23	1	41
Total	61	42	13	116

Table 2: Protest Presence (Probit Coefficients)

	Dependent Variable: Protest Presence (0/1)								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Use of Funds/Quota	-0.000 (0.089)	0.018 (0.092)	0.021 (0.091)						
EFF/Quota				0.075*** (0.027)	0.037 (0.036)	0.033 (0.037)			
# of reschedulings/ restructurings							0.389*** (0.099)	0.304*** (0.108)	0.303*** (0.110)
Constraint on Executive		-0.020 (0.023)			-0.020 (0.023)			-0.022 (0.024)	
Political Rights			-0.041** (0.018)			-0.037 (0.024)			-0.041 (0.025)
Urbanization Rate		0.913 (1.153)	0.877 (1.134)		0.870 (1.154)	0.838 (1.138)		0.698 (1.025)	0.656 (1.000)
Log of Real GDP		-0.188 (0.128)	-0.193 (0.141)		-0.180 (0.122)	-0.184 (0.137)		-0.180 (0.111)	-0.183 (0.126)
Religious Fractionalization		0.656 (0.640)	0.630 (0.644)		0.648 (0.670)	0.622 (0.672)		0.600 (0.645)	0.568 (0.654)
Log of Population		0.195** (0.087)	0.193** (0.085)		0.190** (0.084)	0.188** (0.082)		0.188** (0.086)	0.185** (0.084)
Number of Previous Protests		0.038** (0.018)	0.039** (0.017)		0.039** (0.018)	0.040** (0.016)		0.044** (0.018)	0.046*** (0.017)
Continent Dummies	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Observations	805	801	801	807	803	803	807	803	803
pseudo R-squared	0.000	0.108	0.109	0.006	0.109	0.110	0.026	0.122	0.123

Standard errors, clustered by region, in brackets; *** p<0.01, ** p<0.05, * p<0.1; A constant term included in each regression

Table 3: Presence of Severe Protest (Probit Coefficients)

Dependent Variable: Dummy = 1 if Protest 2 or 3				
	(1)	(2)	(3)	(4)
# of reschedulings	0.099 (0.148)	0.007 (0.115)		
Constraint on Executive	0.032 (0.035)		-0.033 (0.041)	
# of reschedulings* Constraint on Executive	0.024 (0.050)			
Political Rights		-0.023 (0.053)		-0.056 (0.052)
# of reschedulings* Political Rights		0.048* (0.027)		
# of reschedulings (over 2 years)			-0.246 (0.152)	-0.093 (0.076)
# of reschedulings (over 2 years)* Constraint on Executive			0.085** (0.035)	
# of reschedulings (over 2 years)* Political Rights				0.061** (0.024)
Urbanization Rate	0.959 (0.649)	1.013 (0.778)	1.032 (0.809)	1.065 (0.857)
Log of Real GDP	-0.294* (0.150)	-0.323* (0.168)	-0.312* (0.167)	-0.341* (0.179)
Religious Fractionalization	0.740 (0.587)	0.754 (0.581)	0.760 (0.543)	0.741 (0.523)
Log of Population	0.183 (0.138)	0.195 (0.130)	0.191 (0.134)	0.198 (0.127)
Number of Previous Protests	0.029 (0.032)	0.017 (0.032)	0.017 (0.036)	0.014 (0.032)
Continent Dummies	Yes	Yes	Yes	Yes
Observations	705	705	690	690
pseudo R-squared	0.124	0.122	0.123	0.118

Standard errors, clustered by region, in brackets;

*** p<0.01, ** p<0.05, * p<0.1; A constant term included in each regression

Table 4: Probability of Large Protest, varying shock and centralization levels

Pr(Protest = 2 or 3)								
Constraint on Executive =	1	2	3	4	5	6	7	$H_0 : (1) = (7)$ (p-value)
# of reschedulings = 0	0.023*** [0.004]	0.024*** [0.003]	0.026*** [0.003]	0.028*** [0.004]	0.030*** [0.006]	0.033*** [0.009]	0.035*** [0.012]	0.409
# of reschedulings = 1	0.030*** [0.005]	0.034*** [0.005]	0.039*** [0.005]	0.043*** [0.006]	0.049*** [0.007]	0.055*** [0.008]	0.061*** [0.010]	0.004
# of reschedulings = 2	0.040*** [0.015]	0.047*** [0.013]	0.055*** [0.014]	0.065*** [0.019]	0.076*** [0.028]	0.088** [0.040]	0.101* [0.055]	0.317
# of reschedulings = 0 (over 2 years)	0.040*** [0.012]	0.037*** [0.008]	0.035*** [0.005]	0.032*** [0.003]	0.030*** [0.003]	0.028*** [0.005]	0.026*** [0.007]	0.438
# of reschedulings = 1 (over 2 years)	0.028*** [0.003]	0.032*** [0.002]	0.035*** [0.002]	0.040*** [0.003]	0.044*** [0.003]	0.049*** [0.004]	0.055*** [0.004]	0.000
# of reschedulings = 2 (over 2 years)	0.019*** [0.005]	0.026*** [0.006]	0.036*** [0.006]	0.048*** [0.008]	0.064*** [0.011]	0.083*** [0.016]	0.106*** [0.023]	0.000

Standard errors, clustered by region, in brackets; *** p<0.01, ** p<0.05, * p<0.1

Estimates in the top 3 rows derived from Column 1 of Table 3 and estimates in the bottom 3 rows derived from Column 3 of Table 3

Table 5: Probability of Large Protest, varying shock and centralization levels

Pr(Protest = 2 or 3)								
Political Rights =	1	2	3	4	5	6	7	$H_0 : (1) = (7)$ (p-value)
# of reschedulings = 0	0.037** [0.017]	0.035*** [0.012]	0.034*** [0.009]	0.032*** [0.006]	0.030*** [0.005]	0.029*** [0.007]	0.027*** [0.009]	0.679
# of reschedulings = 1	0.042*** [0.015]	0.044*** [0.013]	0.047*** [0.011]	0.049*** [0.009]	0.052*** [0.008]	0.055*** [0.007]	0.058*** [0.008]	0.367
# of reschedulings = 2	0.047** [0.019]	0.055*** [0.021]	0.064*** [0.023]	0.073*** [0.026]	0.084*** [0.030]	0.096*** [0.034]	0.109*** [0.040]	0.025
# of reschedulings = 0 (over 2 years)	0.048** [0.020]	0.042*** [0.013]	0.038*** [0.008]	0.033*** [0.005]	0.029*** [0.004]	0.026*** [0.006]	0.023*** [0.008]	0.327
# of reschedulings = 1 (over 2 years)	0.045*** [0.015]	0.045*** [0.012]	0.046*** [0.009]	0.046*** [0.006]	0.046*** [0.004]	0.047*** [0.004]	0.047*** [0.006]	0.887
# of reschedulings = 2 (over 2 years)	0.042*** [0.012]	0.048*** [0.012]	0.055*** [0.012]	0.062*** [0.012]	0.071*** [0.014]	0.080*** [0.016]	0.090*** [0.020]	0.021

Standard errors, clustered by region, in brackets; *** p<0.01, ** p<0.05, * p<0.1

Estimates in the top 3 rows derived from Column 2 of Table 3 and estimates in the bottom 3 rows derived from Column 4 of Table 3