Grievance Shocks and Coordination in Collective Action

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Abstract

When grievance shocks have heavy tails, large sudden increases in grievances coordinate behavior far more effectively into protests than a sequence of small grievance shocks that generate the same final distribution of grievances in society. That is, society as a whole behaves like the legendary boiling frog, even though each individual does not. An implication is a strong form of path-dependence in collective action. To assess a society's potential for protest, it is not enough to know the current distribution of anti-regime sentiments; we also need to know how they came about: suddenly or gradually. The theory also provides a rationale for the classic J-curve theory of revolution. We provide a quantitative analysis of the relationship between grievance shocks and protests in Chile in 2014-2019. Consistent with the theory, results suggest that, even after controlling for grievance levels, large grievance shocks increased the number of protests.

Keywords: Protest, Coordination, Path Dependence, J Curve, Heavy Tails

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We present a formal model, showing that large sudden increases in grievances tend to coordinate citizen actions. An implication is that the relationship between protest and grievances is path-dependent. That is, to assess a society's potential for protest, it is not enough to know the current distribution of grievances and anti-regime sentiments; we also need to know how these grievances came about: suddenly or gradually. We apply this framework to anti-government protests in Chile between 2014 and 2019, using a measure of grievances and protest data.

As a thought experiment, consider two hypothetical countries (or one country in two time periods) with identical distributions of anti-regime grievances in the population. Further, suppose all else is equal in these countries, so that resources, capacities, and cultures of the state, society, and oppositions are also identical across them. If the size or the frequency of protests are systematically different across these two countries, it will be puzzling for the literature. Grievance-based (Gurr, 1968, 1970; Muller, 1985; Useem, 1998), resource mobilization (McCarthy and Zald, 1977), and political process theories (Tilly, 1978; McAdam, 1982; Tarrow, 2011) as well as theories that emphasize culture, emotions, memories, identities, and the dynamic nature of conflict (Snow et al., 1986; Lohmann, 1994; Rasler, 1996; Petersen, 2001; Wood, 2003; Chenoweth and Stephan, 2011; Lawrence, 2017; Pearlman, 2018; Aytaç and Stokes, 2019), all predict that these two countries will have very similar protest profiles regarding the size and frequency of protests—once we control for the current distribution of grievances, resources, capacities, and culture (i.e., the implications of all else equal). The insight of this paper overturns this common sense view by arguing that how the distribution of grievances came about will matter for citizen coordination and hence for protest. Fixing the current distribution of anti-regime grievances and sentiments—as well as all the other factors discussed above—the size of the protest is larger when this distribution of anti-regime grievances results from a large unexpected increase in grievances, rather than a series of smaller unexpected increases that add up to the same final distribution of grievances.

Citizens in our model choose whether to protest. A citizen has more incentives to protest when that citizen has higher anti-regime grievances or believes that a larger number of other citizens also protest. Naturally, citizens have different, but correlated degrees of grievances. Individual grievances are distributed around the average grievances in the society, which we call *aggregate grievances*: their grievances are the sum of aggregate and idiosyncratic grievances. Citizens know their own grievance level, but do not know the exact grievance level of others, e.g., how exactly others feel about recent government policies. They form beliefs about others' grievances, which inform their expectations about the protest decisions of others. We show that a large sudden increase in aggregate grievances in the society will lead to protest by at least a majority of citizens. However, a series of smaller sudden increases, which add up to the same final aggregate grievance level, can lead to a series of smaller protests. That is, large sudden increases in grievances have a stark way of coordinating citizens to protest.

Our analysis suggests that, controlling for aggregate grievance levels, there are more protests when a grievance level is the result of a large shock to grievances. In Section 3, as a proof of concept, we provide a quantitative analysis of the relationship between protests and anti-government grievance shocks in Chile between 2014 and 2019, using protest data from COES (2020) and government approval data from Cadem (2022). The literature provides several explanations for protest waves in Chile. Palacios-Valladares (2017) attributes grievances to neo-liberal policies during and after the dictatorship. Somma and Medel (2017) argue that unresponsive politicians generated disappointment and frustration and made mobilization the primary tool for policy changes. According to Rhodes-Purdy and Rosenblatt (2021), protests in Chile reflect the "primal outburst of rage and frustration" (p.8) caused by the "elitist" Chilean political structure, which has stifled "participatory opportunities." Araujo (2019) views the root of protests in structural conditions of the Chilean system that gave rise to unmet economic expectations and frustrations. While this literature focuses on the long-term sources and nature of grievances and causes of protests, we focus on how sudden unexpected increases in grievances can intensify protests by facilitating coordination.

A key assumption and point of departure from the literature on coordination and protest (Bueno de Mesquita, 2010; Shadmehr and Bernhardt, 2011; Boix and Svolik, 2013; Casper and Tyson, 2014; Chen and Suen, 2017; Tyson and Smith, 2018; Shadmehr, 2019; Nandong, 2020) is that we follow Morris and Yildiz (2019) in assuming that the distribution of aggregate grievances has heavy tails.[1] In Section 1.1, we discuss how heavy tails in aggregate grievances can naturally arise from three processes: citizen uncertainty about how the world works (model uncertainty), spillover from other heavy-tail variables generated in economic processes, and multiplicative processes that routinely arise in networks. When individuals believe that aggregate grievances have heavy tails, a large shock to aggregate grievances has a very different implication for the distribution of individuals' *beliefs about others' grievances* than a sequence of small shocks. In particular, after a large shock to aggregate grievances, individuals who

[1]We maintain the standard assumption that the distribution of idiosyncratic differences in the citizens' grievance levels is thin-tailed.

feel a very high level of anti-regime grievances and sentiments will *not* believe that they are outliers—as would be the case with a thin-tailed distribution. In fact, they will believe that their anti-regime grievances and feelings are close to the median of the population: they think that about half of the people feel even more resentment toward the state and hence are even more inclined to act. As we detail in the text, the effect of large shocks on belief formation implies that a large shock to aggregate grievances will result in larger protests than a small shock that generates the identical final distribution of grievances.

In standard coordination models of protest,[2] larger aggregate grievance shocks *reduce* the fraction of citizens who can be reliably predicted to protest, i.e., protest in all equilibria.[3] This prediction is at odds with the J-curve theory of revolution (Davies, 1962, 1978). The J-curve theory states that "Revolutions are most likely to occur when a prolonged period of objective economic and social development is followed by a short period of sharp reversal" (Davies, 1962, 5). The critical immediate cause of revolt in the J-curve theory is an unexpected, large negative change. If the *same* final condition emerges through *gradual* change, people do not revolt.[4] A literature across multiple disciplines applies the J-curve theory to study a wide range of historical cases, including the 1952 Egyptian Revolution (Davies, 1962), the 1979 Iranian Revolution (Keddie, 1983; Mossavar-Rahmani, 1987), and the Irish protests of the mid-2010s (Powers, 2018). There is also a large quantitative literature on the J-curve theory and the closely related relative deprivation theory. For example, Gasiorowski (1995) and Knutsen (2014) provide quantitative evidence suggesting that economic crises are associated with regime change.

Davies's core explanation is that people "subjectively fear that ground gained with great effort will be quite lost; their mood becomes revolutionary" (Davies, 1962, 5). He asserts that a slow reversal of fortunes does not generate enough frustration, anger, and, more generally, grievances to cause protest. In contrast, a sharp reversal of fortunes does: in the J-curve theory, individual humans act like the mythical boiling frog who jumps out if thrown into a pan of boiling water, but remains in the pan if the temperature increases slowly from temperate to boiling. Like various relative deprivation theories that followed it, J-curve theory focused on

[2]Examples include the standard global game (Morris and Shin, 2003) model of Persson and Tabellini (2009), or the model of this paper with normal distribution of aggregate grievance shocks. Similarly, in Bueno de Mesquita (2010)'s coordination model, fixing the aggregate grievances, there is a unique equilibrium with no protest with a sufficiently large aggregate grievance shock. See the Online Appendix C for details.

[3]As we will show, this corresponds to having a uniquely rationalizable action to revolt.

[4]Crisis (i.e., an unexpected, large negative change) is essential in the J-curve theory, but not in the broader relative deprivation literature. This is evident, e.g., in the contrast between Hirschman's views and the J-curve theory (Hirschman, 1981, 48).

"motives," ignoring "opportunities" (Shadmehr, 2014), treating unrest and violence as a therapy (McAdam, 1982, 10) that releases individuals' psychological tensions. Tilly's critique of the J-curve theory also highlighted the mobilization capacity of the grieved, which would enable them to translate their grievances into collective action. In *From Mobilization to Revolution*, Tilly (1978) argued that the J-curve theory predicts that "a population which experiences a long period of satisfaction...and then experiences a rapid decline...tends to mobilize and to strike out at once", but "the quick response to decline is only characteristics of highly mobilized groups" (p. 141). In our theory, individuals are highly strategic and cognizant of "opportunities" and cost-benefit calculus of their actions. Our analysis suggests that even a group of such strategic individuals that is not "highly mobilized" and lacks organizations or established leaders is able "to mobilize and to strike out at once" following large shocks, because such shocks substitute a key aspect of social movement organizations, namely, coordinating beliefs and actions. Thus, in contrast to Tilly (1978), our approach agrees with a critical element of the J-curve theory: large unexpected changes (shocks) can be fundamentally different from a sequence of small unexpected changes (shocks). However, in contrast to Davies (1962), our explanation is based on the emergence of individuals' beliefs about each others' behavior.

To further highlight the paper's contribution, we emphasize what our results do not say or rely on. When the final anti-regime grievances increase, all else equal, one expects larger protests and higher chances of success, at least weakly. This is not our point. Instead, our theory compares the outcomes of arriving at a given distribution of grievances via different paths: through a sudden significant change versus through a series of small unexpected changes. Moreover, when anti-regime grievances increase some groups are more able to translate them into collective action due to their resources, including social movement organizations (McAdam, 1982; Morris, 1984; Walker and Martin, 2018), communication technologies (Pierskalla and Hollenbach, 2013; Shapiro and Weidmann, 2015), social media (King et al., 2013; Roberts, 2018; Enikolopov et al., 2020), and informal networks (Lawrence, 2017; González, 2020; Bursztyn et al., 2021). For example, in Manacorda and Tesei (2020)'s adaptation of Jackson and Yariv (2007)'s model, by assumption, "individuals with mobile phones...are more likely to participate when the economy deteriorates" and "they are more responsive to changes in their neighbors' propensity to participate" (537; see also (A.9)-(A.10) in their online appendix). It follows that more mobile phone coverage increases protests instigated by worse economic conditions. As we highlighted in the above thought experiment, in our theory, it is the intensity of grievance shocks itself, not the variation in a group's resources that influences a group's coordination. In contrast, in Manacorda and Tesei (2020), conditional on a given final distribution of anti-regime grievances and mobile phone coverage in two regions (as well as other payoff relevant variables such as opportunity costs), it is irrelevant whether those grievances came about due to a large shock or a sequence of small shocks.

As another benchmark, let us contrast our assumptions and results with the protest model of Passarelli and Tabellini (2017), which "draws on Granovetter (1978)" (p. 909) and theories of reference-dependent preferences (Sugden, 2003; Kőszegi and Rabin, 2006). In contrast to our paper, in Passarelli and Tabellini (2017), the size of a revolt depends only on the final level of grievances, not on the path of grievances.[5] Thus, in Passarelli and Tabellini (2017), conditional on the level of grievances, the protest size is independent of how grievances came about (e.g., the size of the grievance shocks).

More broadly, fixing the final level of grievances, individual preferences in our model do not directly depend on the size of grievance shocks. If each individual, by assumption, somehow cared about the path through which their grievances have increased, then their collective behavior would naturally reflect this. We do not make such an assumption partly because we take the general approach of directly integrating grievances and sentiments. Nor do we make assumptions about the source of grievances in society, e.g., economic, political, or social conditions. As another thought experiment, instead of considering grievances directly, let us consider economic downturns, assuming that the disutility of economic downturns automatically translate into anti-government grievances. In particular, let us take a reference-dependent approach, so that the last period's economic condition is the reference point, and that the further economic conditions deteriorate from that reference point, the more anti-government grievances arise in the society. These assumptions immediately yield that, fixing the final level of *economic conditions* (not grievance levels), if we arrive to that final level by a larger negative economic shock, there will be more revolt; this will hold without reference to the convexity of losses in the Prospect Theory or its variation in convexity assumptions of Passarelli and Tabellini (2017). In this setting, a larger negative *economic shock*, by direct assumption, will generate a larger

[5] Using their notation, the size of the protest by group i is the size of the whole group, λ^i, times the equilibrium probability of protest for group i. Then, equation (4) of their paper shows that the equilibrium probability of revolt by an individual in group i depends *only* on the current level of grievances a^i, and *not* on how we have arrived at a^i. As they highlight, because (i) there is no strategic interactions between different groups in terms of protest, and (ii) each group consists of a continuum of agents, we can focus on their characterization of the equilibrium probability of protest for a group i.

anti-government sentiment. Critically, in contrast to our model, in this setting, if we fix the final anti-government grievances in the society, the size of the *grievance shock* is irrelevant.

We next present the model and discuss our assumption about the heavy-tailed distribution of aggregate grievances. We then present the analysis. We provide some empirical evidence for the theory's predictions in the context of protests in Chile. A conclusion follows. Proofs are in the Online Appendix A.

1 Model

We adopt and apply the incomplete information coordination model of Morris and Yildiz (2019) to protest settings. A continuum 1 of citizens, indexed by $i \in [0, 1]$, simultaneously decide whether to revolt. A citizen's payoff from not revolting is normalized to 1. A citizen i's payoff from revolting is $x_i + A$, where A is the fraction of other citizens who revolt and x_i is citizen i's expressive payoff from revolting. Thus, citizen i's net payoff from revolting versus not revolting is:

$$u_i = x_i + A - 1.$$

We will refer to x_i as citizen i's anti-regime grievance level or sentiments. Various interpretations fit this formulation. For example, normalize a citizen's payoff from not revolting to 0 and suppose the expected costs of participation is $(1 - A)c$. Thus, a citizen i's net payoff from revolting versus not revolting becomes $x_i - (1 - A)c$. Normalizing c to 1 yields the same net payoff as above.

Naturally, grievances are heterogeneous, but correlated among citizens. In particular,

$$x_i = \theta_0 + \sigma(\eta + \epsilon_i),$$

where θ_0 is commonly known, η is an unknown common shock, and ϵ_i is an unknown idiosyncratic shock. The parameter σ captures the sensitivity of grievances to these shocks.

A citizen observes her own grievance level x_i, but she remains uncertain about other citizens' grievance levels: for a given θ_0, a large x_i could be due to her large idiosyncratic shock ϵ_i, or due to a large common shock η to all citizens' grievance levels. Citizens share common priors that $\epsilon_i \sim iid\, F(\cdot)$ and $\eta \sim G(\cdot)$, independently from each other and other parameters, with corresponding cdfs $f(\cdot)$ and $g(\cdot)$, and full support on $\mathbb{R}$. We make the following assumption.

Assumption 1 *$G(\cdot)$ and $F(\cdot)$ are single-peaked and symmetric around 0. Moreover, $f(\cdot)$ is log-concave, and $g(\cdot)$ is a regularly varying distribution (e.g., Student's t distribution).*

An interpretation is that citizens have correlated, heterogeneous grievances, $x_i = \theta + \sigma\epsilon_i$, and there is aggregate uncertainty about the average level of grievances. In particular, citizens share a prior that $\theta \sim \theta_0 + \sigma\eta$, where θ_0 is the expected aggregate grievances in the society. Assumption 1 then implies that this common prior has heavy tails, but the distribution of idiosyncratic grievance shocks and hence heterogeneity among citizens has thin tails.

The timing of the game is as follows. Nature draws the common shock η and idiosyncratic shocks ϵ_is. Citizens observe their private signals x_is and simultaneously decide whether to revolt.

Assumption 1 states that the distribution of the aggregate grievance level in the society is a regularly varying distribution, so that it has heavy tails. A random variable η has a regularly varying distribution when $Pr(\eta > a) = L(a)/a^\rho$, where $\rho > 0$ and $\lim_{a\to\infty} L(ab)/L(a) = 1$ for all $b > 0$. That is, regularly varying distributions behave asymptotically like power law distributions and are scale-invariant, so that the shape of the tail does not change, up to a constant, when we change the unit of measurement. The class of regularly varying distributions include Pareto (power law), Student's t, and Cauchy, as well as any distribution that has power law tails (Nair et al., 2022, Ch. 2). A central feature of such heavy-tail distributions relative to Normal and other log-concave distributions is that the probability of rare events is far higher.

When predicting behavior, we take a conservative approach to protest, and posit that an individual protests if and only if protesting is the sole rationalizable action for that individual. A citizen's strategy is rationalizable when it is optimal given some belief about other agents' behavior, with the minimal restriction that beliefs are consistent with agents not using (iteratively) dominated strategies (Bernheim, 1984; Pearce, 1984). For example, in a one-shot Prisoner's Dilemma game, it is not reasonable that an agent holds the belief that his opponent will play the dominated strategy of cooperation. Importantly, rationalizability is weakly less demanding than the commonly used concept of Nash equilibrium. All Nash equilibrium actions are rationalizable. However, not all rationalizable actions are necessarily part of a Nash equilibrium. For example, in the matching pennies game, there is no pure strategy Nash equilibrium, whereas all pure strategies are rationalizable.

1.1 Discussion: Black Swans of Grievances

Heavy-tail distributions appear in a wide range of phenomena, including the distribution of wealth, growth rate, stock return, city population, earthquake magnitude, social network connections, and government budget changes (Jones et al., 2009; Gabaix, 2016). Moreover, if the finite mean and variance conditions of standard CLTs are relaxed, then a normalized sum of infinite random samples can converge to a regularly varying distribution (Nair et al., 2022, Theorems 5.8 and 5.9)—a result known as the Generalized Central Limit Theorem. We now provide three reasons for why heavy tails arise naturally in our setting:

1. Model Uncertainty. Heavy-tails can arise in the people's beliefs when they are uncertain about how the world works. Consider a simple scenario where the common shock is distributed normally, but people do not know its variance. This is a natural assumption, because a mean is easier to estimate than the expected squared deviation from the mean. Now, if the variance follows an inverse χ^2 distribution, then people will believe that the common shock will follow a Student's t distribution, a regularly varying distribution. This is an example of "model uncertainty", which Morris and Yildiz (2019) highlight as a mechanism for the emergence of heavy-tailed distributions. In fact, model uncertainty plays a key role in Chen and Suen's models of revolt (Chen and Suen, 2016, 2017). For example, in Chen and Suen (2016), revolution is far less likely in one worldview than another. Thus, if revolution happens in another country, it will greatly impact those who believe in the "tranquil world", contributing to a contagion and clustering of revolts. However, distributions in these papers are thin-tailed as not all forms of model uncertainty lead to heavy tails.

2. Spillover. The distribution of grievances can inherit heavy-tails, for example, from aggregate economic variables. Protests in response to inflation and economic downturns have been a common feature of societies (Tilly, 1975, 1995; Gasiorowski, 1995; The Economist, 2022). But many economic variables exhibit heavy-tails. As Acemoglu et al. (2017) show, even in the large U.S. economy with various sectors, the aggregate growth rate has heavy tails. In a similar vein, Weitzman (2007) shows that seemingly puzzling established patterns in macroeconomic data (e.g., the infamous equity premium puzzle) are resolved if one recognizes that economic agents have model uncertainty about economic growth—see Warusawitharana (2018) for an empirical study. In particular, while standard models assume that consumption growth ($\log(C_{t+1}/C_t)$) is distributed Normally with known variance, Weitzman observes that, when there are shocks to that variance, even with large data, agents will believe that the growth rate has heavy tails. Finally, a long tradition of empirical literature establishes that the change in stock prices ($\log(p_{t+1}/p_t)$) has a power law distribution (Fama, 1963; Gabaix et al., 2003).

3. Multiplicative Processes. Heavy tails in grievances can naturally arise due to multiplicative processes such as proportional growth processes. Suppose the aggregate grievance level

θ_t changes both proportionally and additively, so that $\theta_{t+1} = a_t\theta_t + \gamma b_t$, where $a_t, b_t \in \mathbb{R}$ are random variables, capturing various random shocks, and $\gamma > 0$ captures the weight of additive shocks. Under quite general conditions,[6] the steady state distribution of aggregate grievances has power law tails, and hence is regularly varying (Kesten, 1973, Theorem 5) (Goldie, 1991, Theorem 4.1)—such processes also underlie heavy tails in many networks.

2 Analysis

We first find conditions under which revolting is the *unique* rationalizable action for at least a fraction p of citizens. In general, this is a difficult task. However, our game belongs to the class of Bayesian games of strategic complementarities, which greatly simplifies the task of finding rationalizable actions. Van Zandt and Vives (2007) show that the largest and the smallest Bayesian Nash equilibria of such games are in monotone strategies. Moreover, in such games, all rationalizable strategies are within the bounds of these largest and smallest equilibria (Milgrom and Roberts, 1990). In our setting, order strategies so that a larger strategy prescribes revolt after a larger set of signals, and take a signal for which the largest Bayesian Nash equilibrium of the game prescribes "no revolt". Then, no rationalizable strategy prescribes "revolt" for that signal. Conversely, no rationalizable strategy prescribes "no revolt" for a signal for which the smallest Bayesian Nash equilibrium of the game prescribes "revolt". These two results allow us to fully identify rationalizable actions. The first step is to find the largest and smallest Bayesian Nash equilibria of the game in monotone strategies; not because we aim to use Bayes Nash solution concept, but, instead, to characterize the citizens' rationalizable actions.

In an equilibrium monotone strategy, a citizen revolts if and only if her signal is above a threshold. Because the game is symmetric, the largest and smallest equilibria are also symmetric. Letting $z_i = \eta + \epsilon_i$, a citizen revolts if and only if $z_i > z$ for some $z \in \mathbb{R}$. Given the strategy of other citizens z and his private signal z_i, the citizen i's expected net payoff from revolting versus not revolting is:

$$E[u_i|z_i] = \theta_0 + \sigma z_i + E[A|z_i] - 1 = \theta_0 + \sigma z_i - Pr(z_j \leq z|z_i),$$

which is increasing in z_i (Morris and Yildiz, 2019, Lemma 2).

Let $R(z) = Pr(z_j \leq z|z_i = z)$ be citizen i's belief of his rank in the population. In equilibrium, the marginal citizen with signal $z_i = z$ must be indifferent between revolting and not

[6] A key condition is the existence of a $\kappa > 0$ such that $E[|a_t|^\kappa] = 1$.

revolting. Thus, the equilibria are characterized by the following indifference condition:

$$\theta_0 + \sigma z = R(z).$$

Let $\underline{z}$ be the smallest solution to this indifference condition and let $\overline{z}$ be the largest solution. These will characterize the largest and smallest equilibria of the game. As we described above, all rationalizable strategies are bounded between these smallest and largest equilibria. This means, in *any* rationalizable strategy, a citizen whose signal is above $\overline{z}$ will revolt, and a citizen whose signal is below $\underline{z}$ will not revolt. In contrast, when a citizen's signal is in between $\underline{z}$ and $\overline{z}$, there is a Bayesian Nash equilibrium in which that citizen revolts (and hence revolting is rationalizable), and there is a Bayesian Nash equilibrium in which that citizen does not revolt (and therefore not revolting is rationalizable). Moreover, if revolting is uniquely rationalizable for a citizen with a signal z_i, then it is also uniquely rationalizable for all citizens j with higher signals $z_j > z_i$.

2.1 Citizen Beliefs: Am I an Outlier?

How a citizen perceives her grievance level relative to others is key in assessing what fraction of other citizens will revolt. For example, when a citizen has a very high grievance level, she will be more inclined to revolt if she believes that many others have even more grievances. But if she believes that she is an outlier and her high grievance level is due to her unusual idiosyncratic situation, she will be less inclined to revolt, because she believes that most others have less grievances than her and are less inclined to revolt. Indeed, the indifference condition, $\theta_0 + \sigma z = R(z)$, shows that the rank function $R(z)$ plays a critical role in identifying rationalizable actions. We now examine the key properties of the rank function. The full support of z_i implies that $R(z) \in (0, 1)$. Moreover,

Lemma 1 *The rank function $R(k) = Pr(z_j \leq k | z_i = k)$ that identifies the fraction of citizens with less grievances than a citizen with a grievance level $\theta_0 + \sigma k$ has the following properties: (1) $R(z) = 1 - R(-z)$, so that $R(0) = 1/2$. (2) If $R(z) > 1/2$, then $R(z') > 1/2$ for all $z' > z$. (3) $\lim_{z\to\infty} R(z) = 1/2$.*

For example, suppose $\epsilon_i \sim iidN(0, 1)$, and citizens share a common prior that $\eta \sim Cauchy(0, 0.5)$. The rank function $R(z)$ is illustrated in Figure 1. In this example, in addition to the above properties, the rank function is also unimodal on $z \geq 0$. The content of Lemma 1 is analogous to Lemma 1 of Morris and Yildiz (2019). However, the development of the intuition that follows here and in the Online Appendix B, including the use of asymptotic scale invariance is novel.

In standard models with thin-tailed distributions of aggregate shocks (e.g., Normal), $R(z)$ has the first two features. However, it is monotone increasing and $\lim_{z\to\infty} R(z) > 1/2$. For example, if $\eta, \epsilon_i \sim iidN(0,1)$, then $R(z) = \Phi(\alpha z)$, for some $\alpha > 0$. Thus, the key consequence of the heavy-tailed distribution of aggregate shocks is that a citizen with a very high grievance level (i.e., a very high signal z) believes that her grievance level is about the median of the population, so that about half of the population has even higher grievance levels (signals). Because this feature of citizen beliefs is a key building block of our arguments, we now discuss its intuition in detail.

The logic is intuitive but subtle. To assess other citizens' grievances a citizen must infer what part of her grievances is due to a common problem (and hence is shared by others) and what part of her grievances is due to her idiosyncratic situation (and hence is unique to her own). For example, if she believes that her grievances are due to an unusually large idiosyncratic shock, then she knows that few people will have larger grievances than her. In the Normal setting, when a citizen's grievances are higher, she also believes fewer people have higher grievances than her. In particular, a citizen with a very high grievance level will believe that she is an outlier: $R(z) = \Phi(\alpha z) \approx 1$ for large z.

In contrast, when the distribution of common (aggregate) grievance shocks has heavy tails and the distribution of idiosyncratic grievance shocks has thin tails, a very large grievance level is far more likely due to a very large common shock. Importantly, a citizen with a very high grievance level will not make much inferences about the *relative* size of her idiosyncratic grievances in the population: she has little information about her rank in the population, so she believes that she is equally likely to be in any percentile of grievance levels in the society. The underlying reason is the scale invariance property. We say that $g(\cdot)$ is asymptotically scale-invariant whenever $\lim_{x\to\infty} g(kx)/g(x) = h(k)$ for some continuous function $h(\cdot) > 0$. When $g(\cdot)$ is asymptotically scale-invariant, from the perspective of a citizen with a very high grievance level,

$$\frac{pdf(\epsilon'|z)}{pdf(\epsilon|z)} = \frac{g(z-\epsilon')}{g(z-\epsilon)}\,\frac{f(\epsilon')}{f(\epsilon)} \approx \frac{h(z)g(1-\epsilon'/z)}{h(z)g(1-\epsilon/z)}\,\frac{f(\epsilon')}{f(\epsilon)} = \frac{g(1-\epsilon'/z)}{g(1-\epsilon/z)}\,\frac{f(\epsilon')}{f(\epsilon)} \approx \frac{f(\epsilon')}{f(\epsilon)}.$$

This intuition is in line with our common sense: when a very large common shock is added to small idiosyncratic shocks, it should wipe out the effects of those small shocks. But this common sense misses a key link between this observation and its consequences for citizen beliefs about their rank—recall that $R(z) \approx 1$ for large z in Normal settings. The key link is scale invariance: when we change the scale to a very large z, the effect of small shocks disappear, because we know that ϵ/η is very large, so that $\epsilon/z \approx 0$; if, in addition, we have scale invariance, this re-scaling does not change the shape of the distribution. In the Online Appendix B, we will provide further intuition and an example with normal and power law distributions.

2.2 Coordinating Effect of Radical Change

Our goal is to establish that, fixing the current distribution of anti-regime grievances, the size of the protest is larger when this final distribution of anti-regime grievances is the result of a large sudden increase rather than a series of smaller unexpected increases in grievances. We first show that when the final distribution of grievances is the result of a large shock, revolt is the unique rationalizable action for a fraction $p > 1/2$ of citizens.

Proposition 1 *Fix a current aggregate grievance level $\theta = \theta_0 + \sigma\eta > 1/2$, so that the current distribution of grievances in the population is also fixed. Let $p_\theta = 1 - F(\frac{1/2-\theta}{\sigma})$, so that $p_\theta > 1/2$ and p_θ is strictly increasing in θ. For any $p \in [0, p_\theta)$, if the common shock η is sufficiently large, then revolting is the unique rationalizable action for at least a fraction p of citizens.*

Proposition 1 extends the content of Proposition 2 and Corollary 1 of Morris and Yildiz (2019), which focus on $p \in [0, 1/2]$. It is a formalization of (but not identical to) the ideas in the discussion that follows their Corollary 1.

We now offer an intuition. For concreteness, consider the citizen who has the median grievance level in the population, so that her grievance level is exactly the aggregate grievance level: $med(x_i) = \theta_0 + \sigma \; med(z_i) = \theta_0 + \sigma\eta = \theta > 1/2$. This citizen revolts if she believes that more than half of the population does so, because $med(x_i) = \theta > 1/2 > 1 - A$. If this is the only belief that she can "reasonably" hold, then revolting will be uniquely rationalizable for her. What prevents her from believing, e.g., that no one else will revolt? She knows that some citizens will have such extremely high grievances that they will revolt regardless of what others do: these "extremists", trivially, have a unique rationalizable action to revolt. But then, some other citizens with grievances just below those "extremists" will also have a unique rationalizable action to revolt. How far does this contagion logic continue? It covers all citizens with grievance levels higher than the smallest monotone Bayesian Nash equilibrium: if i has a unique rationalizable action to revolt, then she must revolt in any Nash equilibrium. Thus, this reasoning leads our median citizen to conclude that at least all those with grievances larger than the smallest Bayesian Nash equilibrium cutoff will have a uniquely rationalizable action to revolt. How many are these citizens from the perspective of our median citizen? Her grievance level is $med(x_i) = \theta > 1/2$ and (when the aggregate grievance shock is very large) she believes that almost half of the population has even larger grievances. But she has a strict incentive to revolt even if she believes that a fraction $1-\theta < 1/2$ will revolt. Thus, the marginal citizen who is indifferent between revolting and not revolting should have an even lower grievance level than her. As a result, she believes that at least half the population will have a unique rationalizable action to revolt.

In Proposition 1, we fixed the final distribution of grievances and studied the effect of arriving at that distribution via a large aggregate grievance shock. The next result states another stark implication of our arguments.

Proposition 2 *Suppose $R(z)$ is single-peaked on $z \geq 0$. Let $\overline{R}$ be the maximum value of the rank function, $\overline{R} = \max_z R(z)$, and fix $\theta, \theta' \in (1/2, \overline{R})$, with $\theta' > \theta$. If we arrive at the aggregate grievance level θ through a sufficiently large aggregate grievance shock η, then revolt is the unique rationalizable action for a fraction $p \in (1/2, p_\theta)$ of the population. However, there is a smaller aggregate grievance shock η' such that if we arrive at the larger aggregate grievance level θ' through this smaller aggregate grievance shock, then the fraction of citizens for whom revolt is the unique rationalizable action is smaller than p.*

Consider two societies A and B with the distribution of grievances $x_A \sim N(\theta_A, 1)$ and $x_B \sim N(\theta_B, 1)$, where $\theta_A < \theta_B$, so that grievances are higher in society B in the first order stochastic dominance sense. Proposition 2 identifies conditions under which if we arrive at the relatively low grievances of society A via a large aggregate grievance shock, but arrive at the relatively high grievances of society B via a smaller aggregate shock, the fraction of citizens who will have a uniquely rationalizable action to revolt will be higher in society A. In contrast to current theories and models (discussed in the Introduction), how we arrive at the distribution of grievances matters due to the coordination aspects of revolt.

These results do not hold when the distribution of aggregate shocks is Normal (or thin-tailed). In fact, the results will be akin to the opposite. Recall that when both idiosyncratic and aggregate grievance shocks have Normal distributions, the rank function takes the simple form $R(z) = \Phi(\alpha z)$ for some $\alpha > 0$, where $\Phi(\cdot)$ is the cdf of the standard Normal distribution.

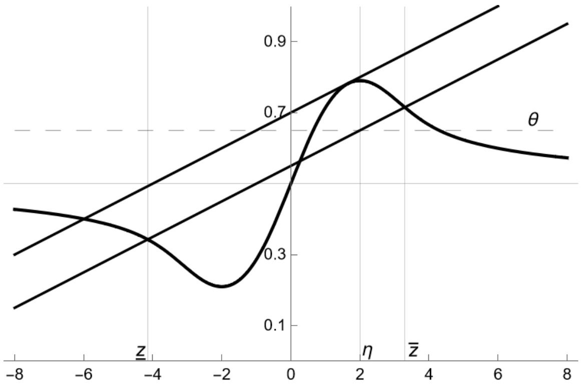


Figure 1: When $\theta_0 < \bar{\theta}_0 = 0.7$ and the common shock η is small, revolting and not revolting are rationalizable for the majority.

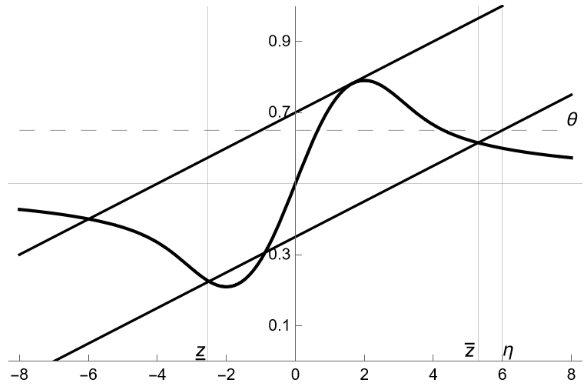


Figure 2: When $\theta_0 < \bar{\theta}_0 = 0.7$ and the common shock η is large, revolting is the unique rationalizable action for the majority.

Proposition 3 *Suppose aggregate and idiosyncratic grievance shocks are normally distributed, $G = N(0, \sigma_\eta)$ and $F = N(0, \sigma_\epsilon)$, and consider $\theta \in (1/2, 1)$. Then, increases in the aggregate grievance shock always reduce the fraction of citizens, $p(\eta)$, for whom revolt is the unique rationalizable action. Moreover,* $\lim_{\eta \to -\infty} p(\eta) = \Phi(\theta/\sigma\sigma_\epsilon) > \lim_{\eta \to +\infty} p(\eta) = 1 - \Phi((1-\theta)/\sigma\sigma_\epsilon)$.

It is worth emphasizing that a large shock is not always necessary for a large revolt. Rather, the results identify conditions for its sufficiency. Indeed, when $\theta > \overline{R}$, at least a majority of citizens will have a dominant (and hence uniquely rationalizable) strategy to revolt regardless of the initial level of aggregate grievances: $E[u_m|z_m] = \theta - R(z_m) \geq \theta - \overline{R} > 0$, where m is the median citizen's index. Moreover, given any current aggregate grievance level larger than 1/2, when the old aggregate grievance level is sufficiently high, again, a majority of citizens will always have a unique rationalizable action to revolt. The following proposition, based on Propositions 1 and 3 of Morris and Yildiz (2019), formalizes these observations.

Proposition 4 *(1) If $\theta > \overline{R}$, then revolt is the unique rationalizable action for a majority of citizens. (2) There exists a $\bar{\theta}_0$ such that if $\theta_0 \geq \bar{\theta}_0$ and $\theta > 1/2$, then revolt is the unique rationalizable action for a majority of citizens.*

These features are shared between our model and the standard setting with thin tails. Although Proposition 4 may have limited substantive import, it reveals the importance of large shocks. In particular, even when $\theta < \overline{R}$ and $\theta_0 < \bar{\theta}_0$, Proposition 1 shows that large shocks alone suffice to make revolt the unique rationalizable action for at least a majority as long as the aggregate grievances $\theta > 1/2$. Figures 1 and 2 illustrate.

2.3 Impotence of Gradual Change

In the previous section, we showed that when the final distribution of grievances is the result of a large shock to aggregate grievances, revolt is the unique rationalizable action for some fraction of citizens. This leave open the question of whether revolt is the unique rationalizable action for a strictly smaller fraction of citizens when we arrive at the same final distribution of grievances from the same initial distribution of grievance, but through a consequence of smaller shocks. We now study this question.

Suppose we start at the aggregate grievance level θ_0. In one scenario, this aggregate grievance level increases from θ_0 to θ in one period. This is the game that we studied in previous sections. In the second scenario, the aggregate grievance level increases over $N > 1$ periods. Suppose $\theta_t = \theta_{t-1} + \sigma\eta_t$, $\eta_t \sim iid\ G$, $t = 1, \cdots, N$, and consider the following realization of aggregate grievance levels $\theta_0 < \theta_1 < \cdots < \theta_N = \theta$. Thus, along this path, in period t, the aggregate grievance level increases from θ_{t-1} to θ_t. In period t, citizens observe the previous period's aggregate grievance level, θ_{t-1}, and engage in the same game that we analyzed in previous sections. That is, in period t, citizens observe θ_{t-1} and their private signals $x_{it} = \theta_{t-1} + \sigma(\eta_t + \epsilon_{it})$ and then simultaneously decide whether to protest. Thus, the only distinguishing feature of these two scenarios is the size of the aggregate grievance shocks.

The results will be analogous in an infinite horizon game in which the state evolves according to $\theta_t = \theta_{t-1} + \sigma\eta_t$, $t = 1, \cdots$, and $\eta_t \sim iid\ G$. In each period t, citizens observe the last period's state, θ_{t-1} (as in, e.g., Bueno de Mesquita and Shadmehr (2022) and Angeletos and La'O (2010)), and their private signals $x_{it} = \theta_{t-1} + \sigma(\eta_t + \epsilon_{it})$, where $\epsilon_{it} \sim iid\ F$ and independent of η_ts. Note that because there is continuum of citizens, a citizen's action has negligible effect on current or future outcomes, so that the only link between periods is information (see Angeletos et al. (2007)). In this setting, we would be comparing the change along two different finite sequence of the realizations of η_ts.

Proposition 5 *Fix a $p \in (1/2, p_\theta)$, and a current aggregate grievance level $\theta = \theta_0 + \sigma\eta \in (1/2, \overline{R})$, so that the current distribution of grievances in the population is also fixed. Then there exists $\theta_0 < \overline{\theta}_0$ such that when aggregate grievances increase suddenly from θ_0 to θ, revolt is the unique rationalizable action for a fraction p of citizens. However, there is a more gradual increase in aggregate grievances from θ_0 to θ over $N > 1$ periods such that the fraction of citizens for whom revolt is the unique rationalizable action remains smaller than $1/2$ in every period.*

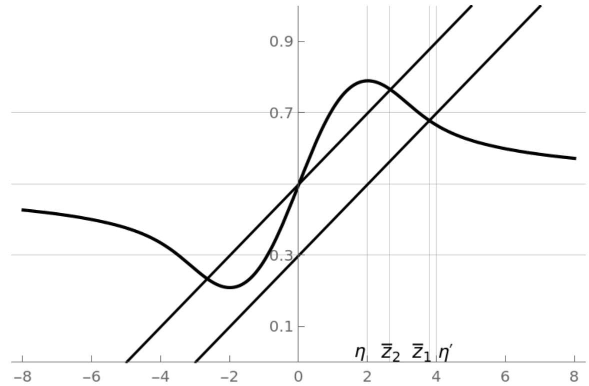


Figure 3: Protest behavior along two paths of increase in grievances. Parameters: $F = N(0, 1)$, $G = Cauchy(0, 0.5)$, $\sigma = 0.1$, $\theta = 0.7$.

Proposition 5 is our main theoretical contribution, and there is no analogue to it in the literature. The condition that $\theta < \overline{R}$ is necessary. When $\theta > \overline{R}$, at least a majority of citizens always have a uniquely rationalizable strategy to revolt, independent of the path through which grievances arrive at that level (Proposition 4). Figure 3 demonstrates the difference in the majority's behavior for two paths of increase in grievances. In one path, grievances suddenly and sharply increase from $\theta_0 = 0.3$ to $\theta = 0.7$, so that the common shock is large: $\eta' = 4$. Because $\eta' > \bar{z}_1$, the majority has a unique rationalizable action to protest. In another path, grievances increase more gradually, first from 0.3 to 0.5, and then from 0.5 to 0.7. In each step the common shock is smaller: $\eta = 2$. Because $\eta < \bar{z}_1, \bar{z}_2$, the majority also has a rationalizable action not to protest.

We emphasize that Proposition 5 does not say that small aggregate grievance shocks always generate smaller protests (a smaller fraction of citizens for whom revolt is the unique rationalizable action) than large shocks. For example, suppose $\theta \in (\overline{\theta}_0, \overline{R})$ and we arrive at θ from $\theta_0 = \theta - \epsilon$ for a small ϵ. Then the difference between $\bar{z}$, which is necessarily negative, and η, which is necessarily positive, could be quite large. In fact, it could be larger than $p_\theta - \epsilon$, the fraction of citizens with uniquely rationalizable action to revolt, which is obtained when the aggregate grievance shock is very large. This example also highlights the challenges of proving this result. However, Proposition 5 does imply as a corollary that, under the general conditions specified above, for every large aggregate grievance shock that makes revolt the unique rationalizable action for a fraction $p > 1/2$ of citizens, we can find a smaller aggregate grievance shock that generates the exact grievance distribution in the population, but makes revolt the unique rationalizable action for a strictly smaller fraction of citizens.

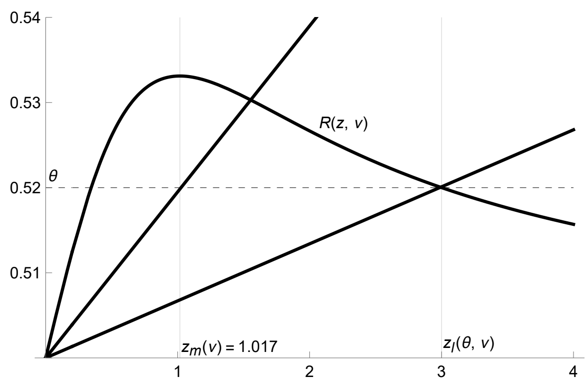


Figure 4: $R(z,\nu)$ from equation (1), for $\nu = 0.2$ and $\theta = 0.52$, so that $z_m(\nu) = 1.017 > 1$ and $z_l(\theta,\nu) = 3.001$.

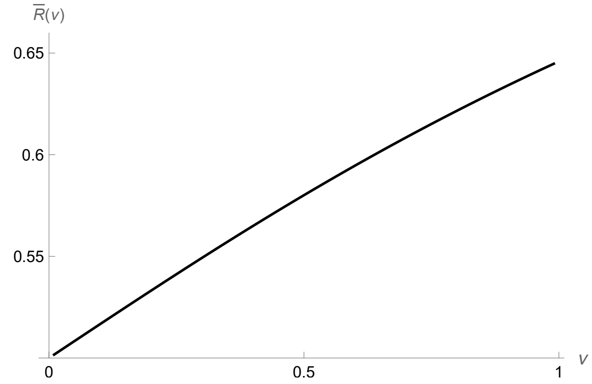


Figure 5: $\overline{R}(\nu) = R(z_m(\nu),\nu)$. The region under the curve satisfies the sufficient conditions in Proposition 6.

Proposition 5 compares protest participation in each period along a path in which the aggregate grievance level increases gradually with protest participation when it increases suddenly from the initial to the final grievance levels of that path. We next provide conditions under which even the sum of protest participation across all periods in a gradual path remains lower than protest participation when the aggregate grievance level increases suddenly from the initial to the final level of that path.

Suppose $F = U[-\nu,\nu]$ and $R(z)$ is (strictly) single-peaked on $[0,\infty)$, so that it has a unique maximum. For a given $\theta \in (1/2, \overline{R}(\nu))$, define

$$z_l(\theta,\nu) = \max\{z \ s.t.\ R(z,\nu) = \theta\} \quad \text{and} \quad z_m(\nu) = \arg\max_{z\geq 0} R(z,\nu).$$

Both $z_l(\theta,\nu)$ and $z_m(\nu)$ exist and $z_m(\nu) < z_l(\theta,\nu)$. Moreover, define $\sigma_l(\theta,\nu) = \frac{\theta-1/2}{z_l(\theta,\nu)}$ and $\sigma_m(\theta,\nu) = \frac{\theta-1/2}{z_m(\nu)}$, so that $\sigma_l(\theta,\nu) < \sigma_m(\theta,\nu)$. Figure 4 illustrates for the case of $F = U[-\nu,\nu]$ and $G \sim Cauchy(0,1)$.

Proposition 6 *Suppose $F = U[-\nu,\nu]$ and $R(z)$ is (strictly) single-peaked on $[0,\infty)$. If (i) $\theta \in (1/2, \overline{R}(\nu))$, and (ii) $\nu < z_m(\nu)$, then there exists θ_0 sufficiently small such that for all $\sigma \in (\sigma_l(\theta,\nu), \sigma_m(\theta,\nu))$, we have $S_1 + S_2 < S$, where S is the size of protest when we move from θ_0 to θ in one step, S_1 is the size of protest when we move from θ_0 to $1/2$, and S_2 is the size of protest when we move from $1/2$ to θ.*

The following example demonstrates the content of Proposition 6 in a setting in which $R(z,\nu)$ has a closed form.

Example. If $F = U[-\nu, \nu]$ and $G \sim Cauchy(0,1)$, direct integration yields

$$R(z,v) = \frac{1}{2v}\left(v + z - \frac{1}{2}\frac{\log\left(1+(v+z)^2\right) - \log\left(1+(z-v)^2\right)}{\tan^{-1}(v+z) - \tan^{-1}(z-v)}\right). \tag{1}$$

Then, $z_m(\nu) \geq 1$ for $\nu \in (0,1)$, and condition (ii) in Proposition 6 is satisfied for all $\nu < 1$. Because $R(z;\nu)$ is single-peaked for $z \in [0,\infty)$, it suffices to show that $R'(z=1;\nu) > 0$ for $\nu \in (0,1)$. But $R'(z=1;\nu) > 0$ if and only if

$$L(\nu) = \frac{d}{dz}\frac{\log\left(1+(v+z)^2\right) - \log\left(1+(z-v)^2\right)}{\tan^{-1}(v+z) - \tan^{-1}(z-v)}\Bigg|_{z=1} < 2.$$

Graphing $L(\nu)$ reveals that $L(\nu) < 2$ for all $\nu \in (0,1)$. Figure 5 illustrates the subset of parameters that satisfy the sufficient conditions (i) and (ii) in Proposition 6 for this example.

3 Empirical Evidence: The Case of Chile

We now provide empirical evidence for the coordinating effect of large unexpected increases in grievances against the government. We focus on Chile between 2014 and 2019, which featured several waves of anti-government protests and for which we have data to construct measures of both grievances and protests.

Grievances that underlie protests in Chile in recent decades are rooted in the 1980 constitution and the distributional consequences of neo-liberal policies with private provision of education, health care, and retirement plans. A wave of protests emerged in the mid-2000s sparked by secondary school students movement, known as *Revolución Pingüina*. Student protests became a recurrent feature of Chilean social movements (e.g., in 2011-2013 and 2017). Workers' protests and strikes is another recurrent feature of contentious politics in Chile (e.g., in 2010, 2014-2016, and 2018). In recent years, the Chilean feminist wave also included large protests (e.g., in 2018). In addition, protests by the Mapuche people for the recognition of their territorial and political rights, environmental protests such as *Patagonia Sin Represas*, and protests against price hikes, all featured in the last two decades. The largest protest wave occurred in late 2019, and is known as *Estallido*. It began in response to an increase in subway fare, but protests and demands rapidly expanded to include reforms in education, health, and retirement systems, culminating in a referendum for a new constitution.

3.1 Research Design

Following Ganong et al. (2022) and Rivera and Ba (2022), we use an interrupted time-series design to explore the effect of large grievance shocks on protests, after controlling for the level of grievances.[7] There are T periods indexed by $t \in \{1, \cdots, T\}$. Let P_t be a measure of protest activity and G_t be a measure of anti-government grievances in period t. First, we residualize P_t by regressing it on G_t:

$$P_t = \beta_0 + \beta_1\ G_t + \epsilon_t. \tag{2}$$

Letting $E[P_t|G_t]$ be the predicted level of protest activity, the residualized protest measure in period t is $e_t = P_t - E[P_t|G_t]$. For a given large grievance shock in period t_s, we compare the average residuals in τ periods before period t_s to $\tau - 1$ period after it:

$$\Delta_{t_s} = \frac{1}{\tau - 1} \sum_{t=t_s+1}^{t_s+\tau-1} e_t - \frac{1}{\tau} \sum_{t=t_s-\tau}^{t_s-1} e_t.$$

We exclude period t_s to avoid confounding the untreated and treated periods. Let $S = \{t_1, \cdots, t_n\}$ be the periods with a large grievance shock. Next, we compare the mean of the sample $\{\Delta_t\}_{t\in S}$ with the mean of a placebo sample $\{\Delta_t\}_{t\in T\setminus S}$, consisting of periods without a large grievance shock. We report the p-values of this placebo test.

Our empirical evidence should be understood as a proof-of-concept exercise to encourage further inquiries that focus on identification issues.

3.2 Data

We now describe our data sources and variables.

Grievances. Our measure of grievances is based on public opinion data from Cadem (2022). Each survey consists of a sample of about 700 individuals interviewed by phone.[8] Respondents are asked: "Regardless of your political position, do you approve or disapprove the way [insert name of president] is running the government?" Survey results are reported for 300 weeks from 2014 W3 to 2019 W52. Using the approval and disapproval rates in each survey, we define Relative Disapproval (RD) as the ratio of the rate of disapproval to the sum of approval and disapproval in that survey. Our measure of grievances is this weekly Relative Disapproval.

[7]We are grateful to Bocar Ba who generously read our empirical analysis and suggested this research design.

[8]The sample is selected through probabilistic sampling with random individual selection. Centro de Estudios Publicos CEP (2022) also provides public opinion data, but only at a quarterly level and with data being reported for only 24 quarters in 2009-2019.

Grievance Shocks. Let $M_t = (RD_t + RD_{t-1})/2$ be the 2-week moving average of the Relative Disapproval variable. For our main analysis, we say that there is a shock in period t whenever $M_t - M_{t-1}$ is in the top 5% of such changes in the sample. This yields fifteen shocks in our sample. Online Appendix E shows the evolution of grievances and the location of these shocks.

Protest Events. We use the protest data from the Observatory of Conflicts of the COES (2020). The data are coded manually based on media reports from local- and national-level newspapers, and include the occurrence, date, and location of protests. Our measure of protest is the total number of protests in a given week constructed from this dataset.

The prediction of the model is about the effect of large grievance shocks on the size of protests after controlling for the level of grievances. Because we do not have reliable data on the size of protests, we use the number of protests in a given period as a proxy.

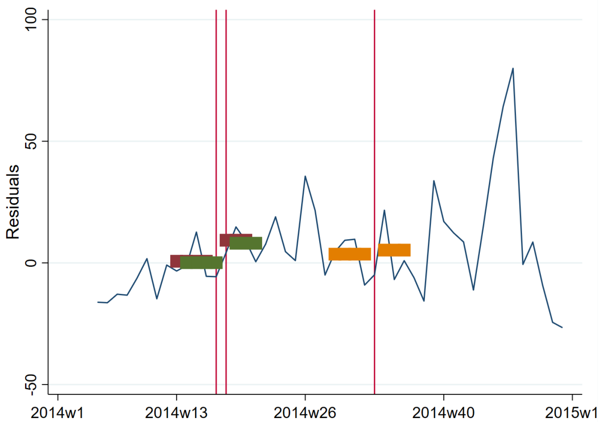
3.3 Empirical Results

The four panels in Figure 6 show the time series of the residualized measure of protest activity $e_t = P_t - E[P_t|G_t]$ and the time periods with large grievance shocks, identified by the vertical lines. The horizontal bands show the average of residuals before and after each shock for $\tau = 4$. The difference between these two bands correspond to Δ_t, for $t \in S$.

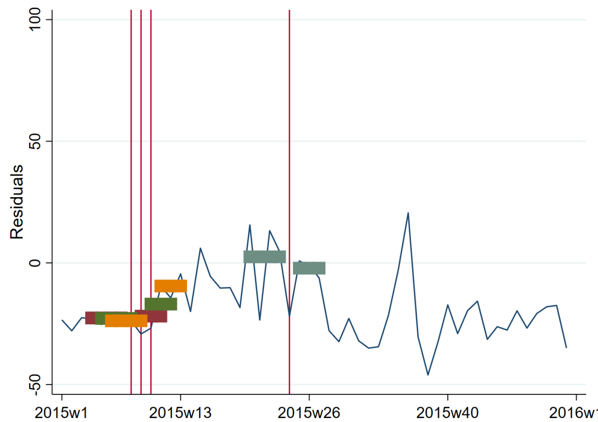
We first interpret these data based on our qualitative description of protest waves in the Online Appendix D. First, consider Figure 6a, which focuses on 2014. The first two shocks in 2014, which occurred around May, coincided with protests surrounding the government's implementation of education reforms. The third shock coincided with public health workers' protests and strikes. In 2015 (see Figure 6b) there are four shocks. The first three occurred in March and preceded the student protests, starting in April. The last shock occurred in June and coincided with Teachers and students strikes against Bachelet's educational reform.

Figure 6c illustrates five shocks that occur in 2018. The first three shocks occurred at the end of July 2018, coinciding with the Chilean Feminist Wave. The fourth and fifth shock occurred at the end of October and the third week of November, respectively, and they coincided with strikes for better employment conditions. Finally, Figure 6d shows the three shocks occurring in 2019, which coincided with the Chilean Outburst.

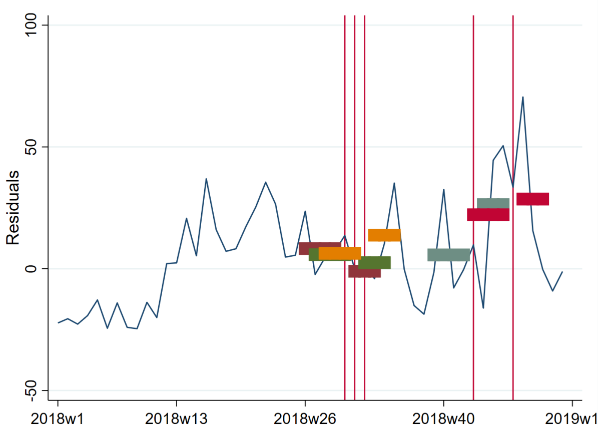
According to our measure, there were no shocks in 2016 and 2017. The year 2016 featured large waves of protests and strikes, including protests against labor reforms, proposed raises,



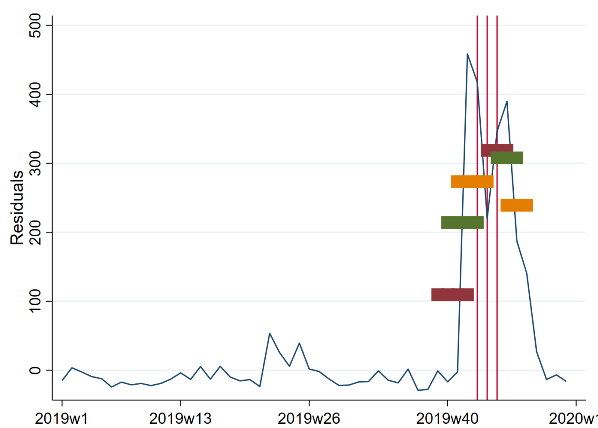
(a) 2014



(b) 2015



(c) 2018



(d) 2019

Figure 6: Residuals, Shocks, and Differences for years with Shocks

Note: Time series correspond to residuals of a regression of protests on grievances (Equation (2)). Vertical lines mark the shocks obtained using the top 5% changes in grievances in the entire sample. Color bars illustrate average residuals during the four weeks preceding each shock and the three weeks after the shock.

Table 1: Change in residualized protest activity before and after shocks and placebo periods for different defining thresholds of shocks (top 3%, 5% and 7%) and $\tau = 4$.

	placebo	shocks	p-value
3%	0.05	33.70	0.11
5%	-0.02	21.64	0.09
7%	-0.14	17.05	0.08

and the retirement system. Notably, workers were organized and led by The Workers United Center of Chile (CUT), Mesa del Sector Público (Public Sector Table), and the 4×4 coalition (Ahumada, 2021). Similarly, our measure does not register a shock in the middle of 2019. In the second quarter of 2019, school teachers, organized and led by the Colegio de Profesores, went on strike as a response to the failure of a year-long negotiation with the government about working conditions and the payment of the Historical Debt.[9] Similarly to the 2016 workers' protests, this strike featured a strong organization. The Colegio de Profesores, established in 1974, is one of the strongest workers' associations in Chile, with more than 100,000 affiliated teachers. These waves highlight our earlier discussion that, while large shocks to grievances help coordinating protests, they are not necessary for collective action. As the literature has established, effective organizations can facilitate coordination. It is notable that the two periods with large anti-government activities, but no significant grievance shocks are exactly the periods in which protests and strikes were organized by strong organizations.

To compare the mean of Δ_ts in the sample of weeks with shocks and without shocks (placebos), we test whether the average of the first sample exceeds the second. Table 1 reports the results for different defining thresholds of grievance shocks. Online Appendix F reports results for our main definition of grievance shocks when we use different windows (τs), include quarter dummies in the regression (equation (2)), and when we combine consecutive shocks into one shock. The p-values range from 0.08 when we use $\tau = 4$ and quarter dummies to 0.17 when we combine sequences of shocks and use $\tau = 5$.

[9] See the Teachers' Association website: https://www.colegiodeprofesores.cl/que-es-la-deuda-historica/.

4 Conclusion

Large grievance shocks have a way of coordinating behavior that may not be reproduced by a sequence of small grievance shocks that add up to the exact same final distribution of grievances in the society. We showed that the difference lies in the different effects of large and small shocks on individual beliefs about each others' behavior. Our study of anti-government protests in Chile between 2014 and 2019 seems consistent with the theory's prediction. Given the potential for endogeneity and limited data, our empirical results should be interpreted as suggestive, aimed to demonstrate the potential empirical implication of the theory and encourage more thorough empirical analysis.

Two directions for future research stand out. In our analysis, we took grievances as exogenous, abstracting from the government's strategic behavior; we also abstracted from social movement organizations (SMOs), which could provide information and private (material or psychological) incentives, enabling their members to act in cohesion. In contrast to an individual, an SMO is a large player whose lone decisions have non-negligible influence over the outcomes in coordination settings (Corsetti et al., 2004). A direction for future research is to integrate into this framework a strategic government that trades off the speed of implementing its unpopular policies and the risk of regime change. Another direction is to study how SMOs influence the outcomes.

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Online Appendix: Grievance Shocks and Coordination in Collective Action

Sofía Correa Gaétan Nandong Mehdi Shadmehr

Contents

A Proofs

Proof of Lemma 1: Part 1. Using Bayes rule,

$$R(z) = Pr(z_j < z | z_i = z) = \int_{-\infty}^{\infty} Pr(z_j < z|\eta) pdf(\eta|z_i = z) d\eta = \frac{\int_{-\infty}^{\infty} F(z-\eta) f(z-\eta) g(\eta) d\eta}{\int_{-\infty}^{\infty} f(z-\eta) g(\eta) d\eta}.$$

Thus,

$$R(-z) \quad = \quad \frac{\int_{-\infty}^{\infty} (1 - F(z+\eta)) f(z+\eta) g(-\eta) d\eta}{\int_{-\infty}^{\infty} f(z+\eta) g(-\eta) d\eta} = 1 - R(z),$$

where we used symmetry: $F(-z-\eta) = 1 - F(z+\eta)$, $f(-z-\eta) = f(z+\eta)$, and $g(\eta) = g(-\eta)$.

Part 2. Let H be the cdf of z_i, with the corresponding pdf h, and observe that $h(z) = h(-z)$ by the symmetry of f and g.

$$\begin{aligned}
R(z) - R(-z) &= \frac{\int_{-\infty}^{\infty} F(z-\eta) f(z-\eta) g(\eta) d\eta - \int_{-\infty}^{\infty} F(-z-\eta) f(-z-\eta) g(\eta) d\eta}{h(z)} \\
&= \frac{\int_{-\infty}^{\infty} F(\gamma) f(\gamma) g(z-\gamma) d\gamma - \int_{-\infty}^{\infty} F(\gamma) f(\gamma) g(-z-\gamma) d\gamma}{h(z)} \quad \text{(change of variables)} \\
&= \frac{\int_{-\infty}^{\infty} F(\gamma) f(\gamma) (g(z-\gamma) - g(z+\gamma)) d\gamma}{h(z)} \quad \text{(symmetry of } g\text{)} \\
&= \frac{\int_{-\infty}^{0} F(\gamma) f(\gamma) (g(z-\gamma) - g(z+\gamma)) d\gamma + \int_{0}^{\infty} F(\gamma) f(\gamma) (g(z-\gamma) - g(z+\gamma)) d\gamma}{h(z)} \\
&= \frac{\int_{0}^{\infty} F(-\gamma) f(-\gamma) (g(z+\gamma) - g(z-\gamma)) d\gamma + \int_{0}^{\infty} F(\gamma) f(\gamma) (g(z-\gamma) - g(z+\gamma)) d\gamma}{h(z)} \\
&= \frac{\int_{0}^{\infty} (F(\gamma) - 1) f(\gamma) (g(z-\gamma) - g(z+\gamma)) d\gamma + \int_{0}^{\infty} F(\gamma) f(\gamma) (g(z-\gamma) - g(z+\gamma)) d\gamma}{h(z)} \\
&= \frac{\int_{0}^{\infty} (2F(\gamma) - 1) f(\gamma) (g(z-\gamma) - g(z+\gamma)) d\gamma}{h(z)}.
\end{aligned}$$

Thus, for $z > 0$, $R(z) - R(-z) > 0$, because (1) $2F(\gamma) - 1 > 0$ by the symmetry of F around 0, and (2) $g(\cdot)$ is symmetric and single-peaked. Thus, for any $z > 0$, $R(z) - R(-z) = R(z) - (1 - R(z)) = 2R(z) - 1 > 0$ and hence $R(z) > 1/2 > R(-z)$.

Part 3. Using a change of variables $y = z - \eta$, for any $\gamma \in (0, 1)$, we have:

$$\begin{aligned}
R(z) &= \frac{\int_{-\infty}^{\infty} F(y) f(y) g(z-y) dy}{\int_{-\infty}^{\infty} f(y) g(z-y) dy} \\
&\leq \frac{\int_{-\infty}^{-\gamma z} F(y) f(y) g(z-y) dy + \int_{-\gamma z}^{\gamma z} F(y) f(y) g(z-y) dy + \int_{\gamma z}^{\infty} F(y) f(y) g(z-y) dy}{\int_{-\gamma z}^{\gamma z} f(y) g(z-y) dy}.
\end{aligned}$$

Thus, for any $z > 0$, we have:

$$\begin{aligned}
R(z) &\leq \frac{g((1+\gamma)z)\int_{-\infty}^{-\gamma z} F(y)f(y)dy + g((1-\gamma)z)\int_{-\gamma z}^{\gamma z} F(y)f(y)dy + g((1-\gamma)z)\int_{\gamma z}^{\infty} F(y)f(y)dy}{g((1+\gamma)z)(F(\gamma z) - F(-\gamma z))} \\
&= \frac{g((1+\gamma)z)\ (F(-\gamma z))^2}{2g((1+\gamma)z)(F(\gamma z) - F(-\gamma z))} + \frac{g((1-\gamma)z)\ (F(\gamma z) - F(-\gamma z))(F(\gamma z) + F(-\gamma z))}{2g((1+\gamma)z)(F(\gamma z) - F(-\gamma z))} \\
&\quad + \frac{g((1-\gamma)z)(1 - F(\gamma z))(1 + F(\gamma z))}{2g((1+\gamma)z)(F(\gamma z) - F(-\gamma z))} \\
&= \frac{(F(-\gamma z))^2}{2(F(\gamma z) - F(-\gamma z))} + \frac{1}{2}\frac{g((1-\gamma)z)}{g((1+\gamma)z)}\left((F(\gamma z) + F(-\gamma z)) + \frac{(1 - F(\gamma z))(1 + F(\gamma z))}{(F(\gamma z) - F(-\gamma z))}\right).
\end{aligned}$$

Thus,

$$\lim_{z\to\infty} R(z) \leq \lim_{z\to\infty} \frac{1}{2}\frac{g((1-\gamma)z)}{g((1+\gamma)z)}. \tag{1}$$

We recognize that if $g(\cdot)$ was, for example, the pdf of the Normal distribution, then the right hand side would be infinity, and the upper bound on $R(z)$ would be trivial. However, because $g(\cdot)$ is a regularly varying function,

$$\lim_{z\to\infty} \frac{g((1-\gamma)z)}{g((1+\gamma)z)} = \left(\frac{1-\gamma}{1+\gamma}\right)^{-\beta}, \text{ for some } \beta > 0, \text{ independent of } \gamma. \tag{2}$$

Combining (1) and (2),

$$\lim_{z\to\infty} R(z) \leq \frac{1}{2}\left(\frac{1-\gamma}{1+\gamma}\right)^{-\beta}, \text{ for some } \beta > 0, \text{ independent of } \gamma. \tag{3}$$

Because this is true for any $\gamma \in (0,1)$, inequality (3) implies

$$\lim_{z\to\infty} R(z) \leq \frac{1}{2}. \tag{4}$$

But, by part 2 of the Lemma, we know that $R(z) > 1/2$ for all $z > 0$. This together with (4) implies $\lim_{z\to\infty} R(z) = 1/2$. □

Proof of Proposition 1: Recall that θ and σ are fixed. For a given η, let $z_{p,\eta}$ be the signal at the pth percentile of signals $(z_i)_{i\in[0,1]}$, so that $p = 1 - F(z_{p,\eta} - \eta)$, i.e., $z_{p,\eta} = \eta + F^{-1}(1-p)$. Because $R(z) > 1/2$ for $z > 0$ and $\lim_{z\to\infty} R(z) = 1/2$, we have $\lim_{\eta\to\infty} R(\overline{z}_\eta) = 1/2$. Thus,

$$\lim_{\eta\to\infty} R(\overline{z}_\eta) = \lim_{\eta\to\infty} \theta_0(\eta) + \sigma\overline{z}_\eta = 1/2. \tag{5}$$

In contrast,

$$\begin{aligned}
\lim_{\eta\to\infty} \theta_0(\eta) + \sigma z_{p,\eta} &= \lim_{\eta\to\infty} \theta_0(\eta) + \sigma\eta + \sigma F^{-1}(1-p) = \theta + \sigma F^{-1}(1-p) \\
&> \theta + \sigma F^{-1}(1-p_\theta) = \theta + \sigma F^{-1}\left(F\left(\frac{1/2-\theta}{\sigma}\right)\right) \\
&= 1/2. \qquad (6)
\end{aligned}$$

Combining (5) and (6) implies that for sufficiently large η, we have: $z_{p,\eta} > \overline{z}_\eta$. □

Proof of Proposition 2: Define $M_\theta = \max\{z \ s.t. \ R(z) = \theta\}$. Because $R(z)$ is single-peaked, $M_{\theta'} < M_\theta$. Choose $\eta' = M_{\theta'}$, so that $\bar{z}(\theta', \eta') = M_{\theta'} = \eta'$. Thus, exactly half of the population has a uniquely rationalizable action to revolt.

From Proposition 1, there exists a $\bar{\eta}_\theta$ such that for all $\eta > \bar{\eta}_\theta$, a fraction $p > 1/2$ of the population has a uniquely rationalizable action to revolt. Choose any such η. Moreover, we show that $\bar{\eta}_\theta \geq M_\theta$. Suppose not, so that $\bar{\eta}_\theta < M_\theta$. Then we could choose $\eta = M_\theta$, in which case exactly a fraction $p = 1/2$ of the population would have a uniquely rationalizable action to revolt. Thus, $M_\theta \leq \bar{\eta}_\theta < \eta$. Thus, $\eta' = M_{\theta'} < M_\theta < \eta$. □

Proof of Proposition 3: The first part is immediate. For the second part, fix $\theta \in (1/2, 1)$. For a given η, let $\overline{z}_\eta$ be the largest solution to $R(z) = \theta_0 + \sigma z$, and let $p(\eta)$ be the proportion of agents for whom revolt is the uniquely rationalizable action. Note that $1 - p(\eta) = \Phi\left(\frac{\overline{z}_\eta - \eta}{\sigma_\epsilon}\right)$.

Recall the rank function is monotone, with $\lim_{z\to\infty} R(z) = 1$ and $\lim_{z\to-\infty} R(z) = 0$. Thus, $\lim_{\eta\to\infty} \theta_0(\eta) + \sigma\overline{z}_\eta = 1$. Substituting from $\overline{z}_\eta$ from above, we have:

$$\lim_{\eta\to\infty} \theta_0(\eta) + \sigma(\eta + \sigma_\epsilon \Phi^{-1}(1 - p(\eta))) = 1, \text{ so that } \lim_{\eta\to\infty} p(\eta) = 1 - \Phi\left(\frac{1-\theta}{\sigma\sigma_\epsilon}\right).$$

Similarly, $\lim_{\eta\to-\infty} \theta_0(\eta) + \sigma\overline{z}_\eta = 0$. Thus, $\lim_{\eta\to-\infty} p(\eta) = 1 - \Phi(-\theta/\sigma\sigma_\epsilon) = \Phi(\theta/\sigma\sigma_\epsilon)$. □

Proof of Proposition 4: *Part 1.* The median's signal is $med(z_i) = \eta$. We show if $\theta > \overline{R}$, then $\eta > \overline{z}$. Suppose not, so that $\eta < \overline{z}$. Then, $\theta_0 + \sigma\eta < \theta_0 + \sigma\overline{z} = R(\overline{z})$. But the assumption that $\theta > \overline{R}$ means $\theta_0 + \sigma\eta > \overline{R} \geq R(\overline{z})$. A contradiction. Thus, $med(z_i) = \eta > \overline{z}$, which implies that half of citizens have signals that are above $\overline{z}$.

Part 2. Let $\overline{\theta}_0$ be the maximum θ_0 such that $\theta_0 + \sigma z = R(z)$ has a solution in $[0, \infty)$. If $\theta_0 \geq \overline{\theta}_0$, then $\theta_0 + \sigma z \geq R(z)$ for all $z \geq 0$. Thus, $\theta_0 + \sigma\overline{z} = R(\overline{z}) \leq 1/2 < \theta = \theta_0 + \eta$, which implies $\overline{z} < \eta$. □

Proof of Proposition 5: Fix $\theta \in (1/2, \overline{R})$ and $p \in (1/2, p_\theta)$. From Proposition 1, there is a threshold on $\hat{\theta}_0$ such that if $\theta_0 < \hat{\theta}_0$, then going from θ_0 to θ will make revolt the unique rationalizable action for a fraction p of the population. Pick one such $\theta_0 < \min\{\hat{\theta}_0, 1/2\}$, so that $\theta_0 < 1/2 < \bar{\theta}_0$.

We will show there exists $\{\theta'_i\}_{i=1}^N$, $N > 1$, with $\theta_0 < \theta'_1 < \cdots < \theta'_N = \theta$, such that going from θ'_{i-1} to θ'_i, $i = 1, \cdots, N$, will make revolt the unique rationalizable action for *at most* a fraction $p' = 1/2$ of the population.

Let $m_\theta = \min\{z : R(z) = \theta\}$, and note that m_θ is increasing in θ for $\theta \in (1/2, \overline{R})$. Let $\theta_1 = \theta - \sigma m_\theta$, i.e., the intercept of a line with slope σ that goes through $(m_\theta, \theta) = (m_\theta, R(m_\theta))$. Now, consider θ_1 as the initial aggregate grievance level in the one-period game. The largest equilibrium threshold will be $\bar{z}_{\theta_1} \geq m_\theta$, with equality only if the above line is tangential to $R(z)$.

Going from θ_1 to θ corresponds to the aggregate shock $\eta_{\theta_1,\theta} = \frac{\theta - \theta_1}{\sigma} = m_\theta$. Because $\eta_{\theta_1,\theta} = m_\theta \leq \bar{z}_{\theta_1}$, revolt is the uniquely rationalizable action for at most a majority. This also implies that $\theta_1 \geq \hat{\theta}_0 > \theta_0$.

Suppose $\theta_1 \leq 1/2$. Clearly, going from θ_0 to θ_1 will make revolt the uniquely rationalizable action for at most a fraction $p' < 1/2$. Thus, neither going θ_0 to θ_1, nor going from θ_1 to θ will make revolt the uniquely rationalizable action for a fraction $p > 1/2$ of the population.

Next, suppose $\theta_1 > 1/2$. Repeat the above process until $\theta_n \leq 1/2$ for some $n > 1$, if such n exists, so that $\theta_{i+1} = \theta_i - \sigma m_{\theta_i}$, $i = 1, 2, \cdots$. The path then will be $\theta_0 < \theta_n < \cdots < \theta_1 < \theta$. If such n does not exists, so that for all n, $\theta_n > 1/2$, then we must have (i) $\{\theta_i\}_{i=1}^{\infty}$ will converge to $1/2$ from above, and (ii) $R'(0) > \sigma$. Again, going from $\theta_0 < 1/2$ to $1/2$ will make revolt the uniquely rationalizable action for at most a fraction $p' < 1/2$ of the population. Moreover, (i) and (ii) imply that there exists a large enough i, which we call n, such that going from $1/2$ to θ_n will make revolt the uniquely rationalizable action for at most a fraction $p' < 1/2$ of the population. To see this, let $\eta_{1/2,\theta_n}$ be the aggregate shock that corresponds to moving from $1/2$ to θ_n, so that $\eta_{1/2,\theta_n} = \frac{\theta_n - 1/2}{\sigma}$. From (i) and (ii), by choosing θ_n close enough to $1/2$, we will have $1/2 + \sigma\eta_{1/2,\theta_n} < R(\eta_{1/2,\theta_n})$. Thus, $1/2 + \sigma z = R(z)$ has a solution strictly larger than $\eta_{1/2,\theta_n}$. We have constructed a desired path, $\theta_0 < 1/2 < \theta_n < \cdots < \theta_1 < \theta$. □

Proof of Proposition 6: Let $\eta(\theta, \sigma_m(\theta, \nu), \theta_0)$ and $\bar{z}(\theta, \sigma_m(\theta, \nu), \theta_0)$ be the common shock and the largest equilibrium threshold, respectively, when the aggregate grievances change from θ_0 to θ and $\sigma = \sigma_m(\theta, \nu)$. To ease exposition, we drop θ from the arguments of $\sigma_m(\theta, \nu)$, writing it as $\sigma_m(\nu)$.

$$\begin{aligned}
\nu < z_m(\nu) &= \frac{\theta - 1/2}{\sigma_m(\nu)} \\
&= \frac{\theta_0 + \sigma_m(\nu)\eta(\theta, \sigma_m(\nu), \theta_0) - 1/2 + \sigma_m(\nu)\bar{z}(\theta, \sigma_m(\nu), \theta_0) - \sigma_m(\nu)\bar{z}(\theta, \sigma_m(\nu), \theta_0)}{\sigma_m(\nu)} \\
&= \eta(\theta, \sigma_m(\nu), \theta_0) - \bar{z}(\theta, \sigma_m(\nu), \theta_0) + \frac{\theta_0 + \sigma_m(\nu)\bar{z}(\theta, \sigma_m(\nu), \theta_0) - 1/2}{\sigma_m(\nu)} \\
&= \eta(\theta, \sigma_m(\nu), \theta_0) - \bar{z}(\theta, \sigma_m(\nu), \theta_0) + \frac{R(\bar{z}(\theta, \sigma_m(\nu), \theta_0), \nu) - 1/2}{\sigma_m(\nu)}.
\end{aligned}$$

Thus,

$$\nu \leq \lim_{\theta_0 \to -\infty} \left(\eta(\theta, \sigma_m(\nu), \theta_0) - \bar{z}(\theta, \sigma_m(\nu), \theta_0) + \frac{R(\bar{z}(\theta, \sigma_m(\nu), \theta_0), \nu) - 1/2}{\sigma_m(\nu)} \right). \tag{7}$$

Because $\lim_{z \to \infty} R(z, \nu) = 1/2$ and $\lim_{\theta_0 \to -\infty} \bar{z}(\theta, \sigma_m(\nu), \theta_0) = \infty$, from (7) we have

$$\nu \leq \lim_{\theta_0 \to -\infty} \left(\eta(\theta, \sigma_m(\nu), \theta_0) - \bar{z}(\theta, \sigma_m(\nu), \theta_0) \right).$$

Thus, for sufficiently small θ_0 we have $\nu < \eta(\theta, \sigma_m(\nu), \theta_0) - \bar{z}(\theta, \sigma_m(\nu), \theta_0)$; that is, if we move from θ_0 to θ in one step almost all citizens will protest. It follows that almost all citizens will protest for any given $\sigma < \sigma_m(\nu)$. The result follows from observing that (i) arriving at $\theta_1 = 1/2$ from the same θ_0 will cause strictly less than half the citizens to protest, and (ii) if $\sigma \in (\sigma_l(\theta, \nu), \sigma_m(\theta, \nu))$, then arriving at θ from $1/2$ also will cause strictly less than half the citizens to protest. □

B Further Discussion of the Rank Function

Example. Suppose $\theta_0 = 0$ and $\sigma = 1$, so that a citizen i's grievance level becomes $z_i = \eta + \epsilon_i$. Let the tail of idiosyncratic grievance shocks be Normal and that of common aggregate shocks be a power law: $f(\epsilon_i) \propto e^{-(\epsilon_i)^2}$ and $g(\eta) \propto \eta^{-\rho}$, for some $\rho > 1$. When a citizen feels a very high grievance level (i.e., z_i is very high), what does she learn about the relative location of her idiosyncratic grievances ϵ_i in the population?

$$\frac{pdf(\epsilon'|z)}{pdf(\epsilon|z)} = \frac{g(z-\epsilon')}{g(z-\epsilon)}\frac{f(\epsilon')}{f(\epsilon)} \propto \begin{cases} e^{(z-\epsilon)^2-(z-\epsilon')^2}\frac{f(\epsilon')}{f(\epsilon)} & ; \text{Normal tail} \\ \left(\frac{z-\epsilon}{z-\epsilon'}\right)^{\rho}\frac{f(\epsilon')}{f(\epsilon)} & ; \text{power law tail.} \end{cases}$$

This simple calculation shows that when the distribution of aggregate grievances has power law tails, a citizen with a very high grievance level will learn very little from her grievance level about her *relative* grievance level in the society. From her perspective, her grievance level provides almost no information about the relative likelihoods of different idiosyncratic grievance shocks. Thus, she believes the chances that her particular idiosyncratic situation is better or worse than another random citizen is the same. With power law tails, the likelihood ratio behaves as if the distribution of aggregate grievances $g(\eta)$ is uniform in the tails, i.e., $\frac{g(z-\epsilon')}{g(z-\epsilon)} \approx 1$ for large z.

A related intuition builds on beliefs about the aggregate grievance shock. In particular, a citizen with a very high grievance level will believe that the distribution of the aggregate grievance shock is almost uniform in the vicinity of that high level—moving very far from that vicinity is irrelevant from the citizen's perspective because idiosyncratic shocks are log-concave and vanish at a rate faster than exponential. Such a citizen will have very little information about the aggregate grievance shock in a range that is relevant from her perspective. But if the aggregate grievance shock (η) is distributed uniformly so that a citizen has no prior information about it, then she believes that her grievance level is at the median of the population ($R(z) = 1/2$). To see the intuition, suppose the distribution of idiosyncratic shocks F is uniform on $[-1, 1]$. What does a citizen with a very high grievance level k believe about the distribution of aggregate grievance shock? It is straightforward to show

$$Pr(\eta \leq a | z_i = k) = \begin{cases} 1 & ; a \geq k+1 \\ \frac{G(a)-G(k-1)}{G(k+1)-G(k-1)} & ; k-1 \leq a \leq k+1 \\ 0 & ; a \leq k-1. \end{cases}$$

Thus, from the perspective of a citizen with grievance shock $z_i = k$, the "relevant" range of the aggregate grievance shock is $[k-1, k+1]$. Although this stark range is the result of the uniform distribution of idiosyncratic shocks, it is easy to see that a similar argument will hold when the tails of the distribution of those shocks vanish fast enough, e.g., are faster than exponential as in log-concave distributions. Critically,

Remark. Suppose $F = U[-1,1]$ and G is asymptotically scale-invariant, i.e., is a regularly varying distribution. For large k, the distribution of the aggregate grievance shock η conditional on a grievance level $z_i = k$ is uniform on $[k-1, k+1]$:

$$\lim_{k\to\infty} \frac{G(a) - G(k-1)}{G(k+1) - G(k-1)} = \frac{a-(k-1)}{2}, \quad k-1 \le a \le k+1.$$

Proof of Remark. Let $a(k) = k - 1 + 2\delta$ for $\delta \in (0,1)$,

$$\begin{aligned}
\lim_{k\to\infty} \frac{G(a(k)) - G(k-1)}{G(k+1) - G(k-1)} &= \lim_{k\to\infty} \frac{g(a(k))G(k-1) - g(k-1)G(a(k))}{g(k+1)G(k-1) - g(k-1)G(k+1)} \quad \text{(by the L'Hopital rule)} \\
&= \lim_{k\to\infty} \frac{\frac{g(a(k))}{G(a(k))}\frac{G(k-1)}{g(k-1)} - 1}{\frac{g(k+1)}{G(k+1)}\frac{G(k-1)}{g(k-1)} - 1} \frac{G(a(k))}{G(k+1)} \quad \text{(factoring out } g(k-1)G(a(k))\text{)} \\
&= \lim_{k\to\infty} \frac{\frac{k-1}{a(k)}\frac{g(1)}{G(1)}\frac{G(1)}{g(1)} - 1}{\frac{k-1}{k+1}\frac{g(1)}{G(1)}\frac{G(1)}{g(1)} - 1} \frac{G(a(k))}{G(k+1)} \quad \text{(by scale invariance)} \\
&= \lim_{k\to\infty} \frac{-2\delta}{k-1+2\delta} \frac{k+1}{-2} \frac{G(k-1+2\delta)}{G(k+1)} \quad \text{(substituting for } a(k)\text{)} \\
&= \delta = \frac{a-(k-1)}{2},
\end{aligned}$$

for $k-1 \le a \le k+1$. □

In contrast, we do not obtain this uniform distribution when the aggregate shock does not have power law tails. For example, when $\eta \sim N(0,1)$, a citizen with a very large grievance level will believe that η is about $k-1$. In terms of conditional expectations, for large k,

$$E[\eta | k-1 \le \eta \le k+1] \approx \begin{cases} k-1 & ; G = N(0,1) \\ k & ; G = Cauchy(0,1). \end{cases}$$

C Standard Models

There is a continuum of citizens, indexed by $i \in [0,1]$, simultaneously deciding whether to protest. The protest succeeds whenever the measure of protesters l exceeds a threshold $T \in (0,1)$. Figure 1 shows two different payoff structures, the left panel corresponds to a quintessential global game model (Morris and Shin 2003; Persson and Tabellini 2009). The right panel corresponds to the coordination model in Bueno de Mesquita (2010) or a private-value variation of Shadmehr and Bernhardt (2011). Similarly to our main model, x_is capture a citizen i's level of anti-government grievances or sentiments. Citizen grievances are correlated with aggregate uncertainty: $x_i = \theta_0 + \sigma(\eta + \epsilon_i)$, $\sigma > 0$, $\eta \sim N(0, \sigma_\eta)$, $\epsilon_i \sim iid\ N(0, \sigma_\epsilon)$, and η and ϵ_is are independent from each other. The aggregate grievances is $\theta = \theta_0 + \sigma\eta$. Let $z_i = \eta + \epsilon$. We focus on symmetric monotone strategies, so that a citizen protests if and only if $z_i > z^*$. It follows that the protest succeeds if and only if $\eta > \eta^*$, where

	$l > T$	$l \leq T$
protest	x_i	$x_i - c$
no protest	0	0

$l > T$	$l \leq T$
$x_i - c$	$-c$
0	0

Figure 1: Payoff structures

$$Pr(z_i > z^* | \eta = \eta^*) = T. \tag{8}$$

In the left panel, the citizen with the marginal signal $z_i = z^*$ must be indifferent between protesting and not in equilibrium, so that

$$\theta_0 + \sigma z^* = Pr(\eta \leq \eta^* | z_i = z^*) c. \tag{9}$$

Let $\Phi(\cdot)$ be the cdf of the Standard Normal distribution. Substituting $\eta^* = z^* - \sigma_\epsilon\ \Phi^{-1}(1-T)$ from equation (8) into equation (9) and using the properties of the Normal distribution yields

$$\theta_0 + \sigma z^* = c\ \Phi\left(\frac{(1-b)z^* - \sigma_\epsilon\ \Phi^{-1}(1-T)}{a}\right), \tag{10}$$

where $b \in (0,1)$ and $a > 0$ are constants. Observe that the right hand side of equation (10) is strictly increasing in z^*. It follows that the result from Proposition 3 applies.

In the right panel, there is always an equilibrium in which no citizen protest. Mirroring the above steps, in any cutoff equilibrium with finite cutoff z^*,

$$\theta_0 + \sigma z^* = \frac{c}{1 - \Phi\left(\frac{(1-b)z^* - \sigma_\epsilon\ \Phi^{-1}(1-T)}{a}\right)}. \tag{11}$$

Again, the right hand side of equation (11) is strictly increasing. But now it approaches c as $z^* \to -\infty$, and it approaches ∞ as $z^* \to \infty$. Applying the l'Hopital rule, its derivative approaches ∞ as $z^* \to \infty$. Thus, for a given θ, if η is sufficiently large, there is a unique equilibrium in which no citizen protests.

D Qualitative Description of High Protest Periods

We provide a brief description of protests in high protest periods. High protest periods are defined as quarters in which the number of protests in at least one month is above the sample monthly average, calculated without the Outburst.

- (2014 Q2) **Students' Protests and Teachers' Strike.** Students protested, demanding that the government keeps its promises of education reform. With the support of students and The Workers United Center of Chile (CUT) (BBC News, 2014; El Mostrador, 2014), teachers also went on strike and protested against the government's approach to these reforms.

- (2014 Q3 and Q4) **Public Health Workers' Protest and Strike.** The main group was the association of workers in municipal health care, demanding employment stability, better working conditions, and ending works without contracts (Trafilaf, 2014).

- (2015 Q2) **Students' and Health Workers' Protests.** Healthcare workers protested, demanding better working conditions (La Tercera, 2015). Moreover, in April, students protested against the reforms proposed by Michelle Bachelet's government. In May, in the context of the government's public account, protests turned violent and two students were killed by another youth (BBC News, 2015). Another student got seriously injured when hit by a Police water cannon. This led to further protests against the police.

- (2016 Q2 and Q3) **Protests Against Government Reforms.** Students protested against education reforms, complaining that they were kept out of the process. Led by the Public Sector Table, public workers protested labor reforms, asking the Congress to include them in this process. Later in the year, workers also protested the government-proposed 3.2% annual raise. Secondary-school and university students supported the workers' protest. In the third quarter, the organization "No Más AFP" organized protests against the retirement system, which dated back to the dictatorship (The Guardian, 2016).

- (2017 Q2 and Q3) **Students' Protest.** In the second quarter, university students protested against the Credit with State Guarantee (CAE) (Soledad, 2017), a state-backed loan system managed by private banks established in 2005 to allow students from middle- and low-income families to pay for their education. Students demanded that the government reduces the interest rate and forgive the debt. There were also protests against the closure of ARCIS University, which had closed due to bankruptcy (El Mostrador, 2017). In the third quarter, secondary school students protested, demanding the end of the municipal administration of education.

- (2018 Q2 and Q3) **The Chilean Feminist Wave.** The Chilean Feminist Wave began with a series of protests against gender violence and sexual harassment, demanding structural transformations that end machismo and the patriarchal system (Bartlett, 2018). Moreover, students protested the Constitutional Court ruling against policies that end for-profit education.

- (2018 Q4) **Workers' Protests.** Private sector port and mining workers went on strike, demanding better employment conditions (El Mostrador, 2018). Public sector workers protested against low salary raises.
- (2019 Q2) **Teachers' Strike.** Teachers went on strike, claiming that the government had been unresponsive and "closed the door" to their demands in negotiations since 2018. Their demand focused on the payment of the "Historical Debt" owed to them and on ending the double-evaluation process. The Historical Debt has its origin in the municipalization process that began in 1981 under the dictatorship. After years of strikes and protests, in 2009, Congress approved the payment of this debt, but teachers still had not received the payment.[1]
- (2019 Q4) **The Chilean Outburst.** Students protested against an increase in the subway fare. Protests rapidly spread and various organizations (e.g., those involved in the feminist movement as well as workers' associations) joined. This was the largest protest wave since the end of the dictatorship, and it was called *Estallido* (outburst) (The New York Times, 2019). Protesters demanded reforms in the retirement, health, and education systems, and the end of Pinochet's constitution. In mid-November, an agreement was made for a referendum on a new constitution (Krygier, 2019).

[1] See the Teachers' Association website: https://www.colegiodeprofesores.cl/que-es-la-deuda-historica/.

E Time Series

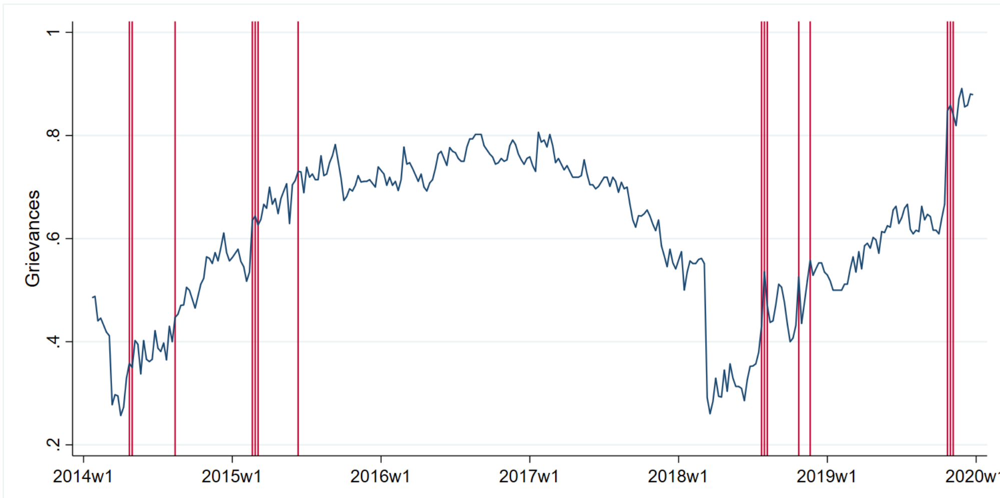


Figure 2: Grievances, 2014 - 2019

F Robustness

Time interval τ. We study the robustness of the results to variations on the interval τ. Columns (1)-(3) in Table 1 show the averages and p-values for the corresponding mean comparison test using $\tau \in \{3, 4, 5\}$.

Within-year Seasonality. To account for the possibility of seasonality, we compute residuals from the following regression

$$P_t = \beta_0 + \beta_1 \; G_t + \sum_{s=2}^{4} \beta_2^s Q_s + \epsilon_t, \tag{12}$$

where Q_s is dummy variable taking value 1 at quarter s of a given year. Columns (4)-(6) in Table 1 show the averages and p-values for the corresponding mean comparison tests.

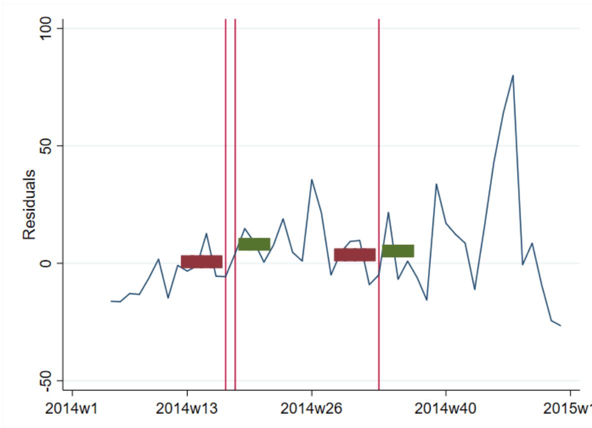
Consecutive Shocks. Some shocks occur in consecutive weeks. In such cases, some observations are used to compute average residuals both after some shocks and before others. We consider two alternatives. First, we explore visually what happens if, for each sequence of consecutive shocks, we compare the outcome before the first shock with the outcome after the last shock. We obtain eight events, which now can include one, two, or three consecutive weeks. Figure 3 illustrates the level of residuals before and after each of these events, showing that seven out of the eight differences are positive.

To complement this exercise, we consider an alternative scenario in which we keep only the first shock in the sequence. This leads to 8 shocks in the baseline case. Columns (7)-(9) in Table 1 show the results for each value of τ.

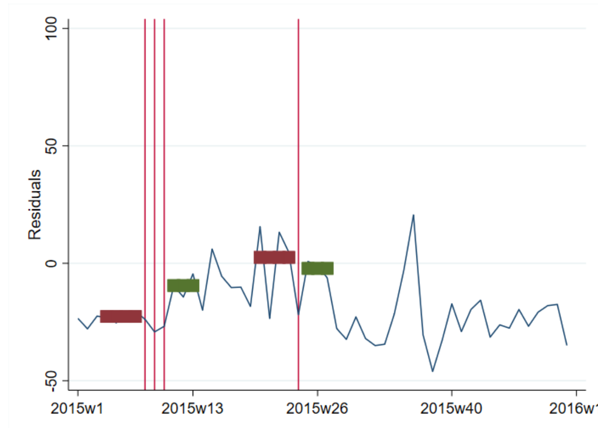
Table 1: Test Results (5% shocks)

	Main Specification			Quarter Dummies			Consecutive Shocks		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
τ	placebo	shocks	p-value	placebo	shocks	p-value	placebo	shocks	p-value
3	-0.45	12.73	0.15	-0.95	13.75	0.12	-0.31	19.52	0.14
4	-0.02	21.64	0.09	-0.61	21.80	0.08	0.32	28.03	0.16
5	1.41	21.41	0.10	0.77	20.14	0.09	1.73	27.36	0.17

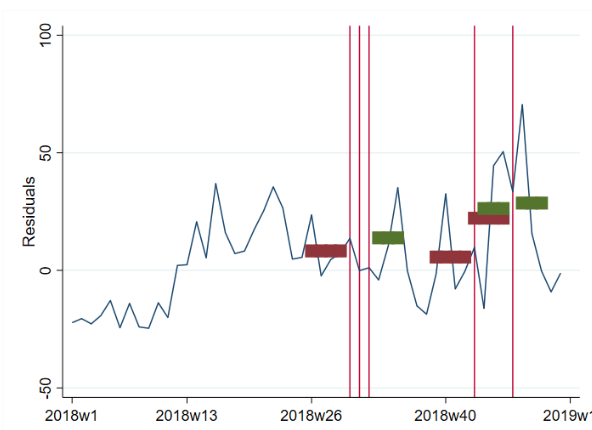
Notes: Columns (1)-(3) show the results of the mean comparison test for our main specification. Columns (4)-(6) show the results of the tests when residuals are computed with grievance levels and quarter dummies. Columns (7)-(9) show the results which we only consider the first shock of any sequence of consecutive shocks. We report results for different windows τ.



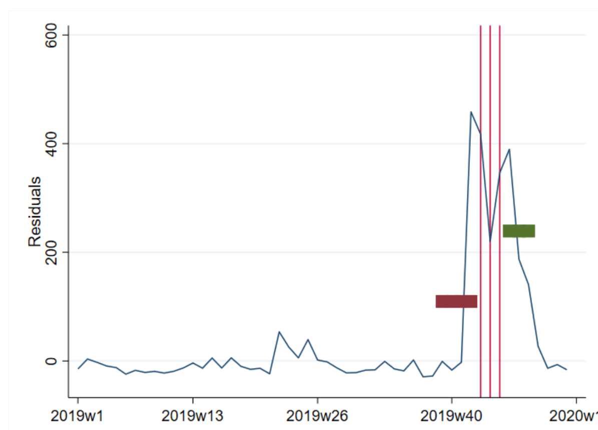
(a) 2014



(b) 2015



(c) 2018



(d) 2019

Figure 3: Residuals, Shocks, and Differences for years with Shocks

Note: Time series correspond to residuals of a regression of protests on grievances. Vertical lines mark the shocks obtained using the top 5% changes in grievances in the entire sample. Red bars illustrate average residuals during the four weeks preceding the first shock in each sequence. Green bars show average residuals during the three weeks after the last shock in the sequence.

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