Grievance Shocks and Coordination in Collective Action

Sofía Correa Gaétan Nandong Mehdi Shadmehr[1]

September 13, 2022

[1]Correa: Department of Industrial Engineering, University of Chile, scorread@uchile.cl. Nandong: Department of Politics, Princeton University, gnandong@princeton.edu. Shadmehr: Department of Public Policy, UNC Chapel Hill, mshadmeh@gmail.com. We are grateful for comments of Bocar Ba, Dan Bernhardt, Germán Gieczewski, Alex Horenstein, Pablo Muñoz, and seminar participants at UNC, SPSA, and MPSA. Sofía Correa acknowledges financial support from the Institute for Research in Market Imperfections and Public Policy, ICM IS130002.

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 the 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 grievances 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

Word Count: 9,687

Higher grievances and more political opportunities increase citizens' incentives to protest (Tilly, 1978; McAdam et al., 2001; Tarrow, 2011). But protest also involves coordination (Hardin, 1982; DeNardo, 1985; Lohmann, 1994; Wood, 2003; Chwe, 2013). For example, greater participation reduces the expected costs of repression for an individual, or one may derive more satisfaction from joining a larger movement. Social movement organizations (McAdam, 1982; Morris, 1984; Walker and Martin, 2018), communication technologies (Pierskalla and Hollenbach, 2013; Yanagizawa-Drott, 2014; Shapiro and Weidmann, 2015), social media (King et al., 2013; Roberts, 2018; Enikolopov et al., 2020), and informal networks (Diani and McAdam, 2003; Lawrence, 2017; González, 2020; Bursztyn et al., 2021) all help citizens coordinate their actions. There is a natural connection between political opportunities and coordination. For example, part of a political opportunity opening could be less censorship, which facilitates coordination among citizens. Conversely, if citizens could coordinate, they may expand political opportunities in a dynamic setting. It may seem, however, that there is little connection between grievances and coordination. At any level of grievances, citizens have a coordination problem. Conversely, coordination qua coordination does not change grievances. Indeed, the literature on coordination treats grievances and coordination as unrelated—higher grievances increase incentives to act whether there is one citizen or many citizens. This paper overturns this conventional wisdom. We present a formal model to argue that large sudden increases in grievances tend to coordinate citizen actions. The results uncover a strong form of path-dependence in the relationship between grievances and protest. We apply this framework to anti-government protests in Chile between 2014 and 2019, using a measure of grievances and protest data.

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.

We show 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. 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; Buechler, 2004), resource mobilization (McCarthy and Zald, 1977), and political process theories (Gamson, 1975; 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, rather than a series of smaller unexpected increases.

In Section 3, as a proof of concept, we provide a quantitative analysis of the relationship between anti-government grievances and protests in Chile between 2014 and 2019, using protest data from COES (2020) and government approval data from Cadem (2022). The analysis suggests that, controlling for the current period aggregate grievance level, there are more protests when the current grievance level is the result of a large shock to grievances. 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. 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 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.

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. To see the logic, consider the citizen M with the median grievance level. Suppose M will protest if they believe that at least 45% of others protest. When the aggregate grievance shock is very large, as discussed above, M will believe that about half the population, say, 49%, has higher grievances. Will M believe that some or all of them protest? Citizen M knows that those with higher grievances also believe that their grievance levels are about the population median. Moreover, all of them know that a (perhaps tiny) fraction of the population, say, 0.1% has such extreme grievances that they will protest regardless of others. Now, consider citizens with grievances slightly below these extremes, say, the next top 0.6% of the population. To protest, they only need to believe that a small fraction of the population will protest. But they believe that about half the population has higher grievances than themselves, and those with higher grievances are sure to protest. Thus, they will protest. This contagion-like logic now continues to those with slightly lower grievances, and so on. The contagion stops at some percentile of grievance levels below the median citizen M: by the above logic, M is reasonably sure that all those 49% with higher grievances will protest, because (i) they require even less than 45% threshold to protest, and (ii) they also believe that about half the population has more grievances than themselves. Thus, citizen M will protest.

Small shocks do not sustain the contagion because far fewer citizens will believe that about half the population has higher grievances than themselves.[1] This contagion logic is present even in standard settings where the distribution of aggregate grievances is thin-tailed, e.g., Normal. However, the contagion stops quickly in those settings. For example, when we get to the 3rd percentile of grievances, they protest if they believe that 10% of the population protest, but they can only be reasonably sure that those above them—i.e., a small fraction—will protest.

In standard settings, larger aggregate grievance shocks always *reduce* the fraction of citizens who can be reliably predicted to protest, i.e., protest in all equilibria.[2] This prediction is at odds with the J-curve theory of revolution (Davies, 1962, 1978, 1979). 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.[3] 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

[1] This logic is very different from the Granovetter (1978)'s model, which will have multiple equilibria in general. As we will discuss below, this contagion-like argument is common in many models. The key difference here is the structure of endogenous beliefs.

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

[3] 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).

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.

To resolve the dilemma between the standard models of coordination and protest and the J-curve theory, researchers must choose between dismissing the empirical observations and assuming the mythical boiling-frog behavior for humans. This paper provides an alternative. We argue that even though individuals are not like that boiling frog, society as a whole is. Such stark differences between the characteristics of individuals and the collective famously appear in the Condorcet Paradox. Our result has a similar flavor: when acting against the state at a given time, individuals care about their final grievance level and not about whether they arrive at those grievances in one sharp increase or a sequence of small increases in grievances. However, society as a whole will act *as if* it cares about the path of grievance accumulation.

In our theory, individuals are not automatons that respond to environmental stimuli with no agency of their own—with no strategic considerations or conscious concerns for costs and benefits of actions beyond the relief of their psychological strains. Thus, we contrast sharply with Davies's assumptions and explanation of the J-curve theory, which focused on "motives," ignoring "opportunities," like various relative deprivation theories that followed (Shadmehr, 2014). These theories put little weight on the individuals' assessments of the costs of action or strategic interactions. Instead, they treat unrest and violence as a therapy (McAdam, 1982, 10) that releases individuals' psychological tensions. Crisis leads to catharsis in the form of protest and revolt with little human agency. However, 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). Our explanation is based on the emergence of individuals' beliefs about each others' behavior, and our unexpected changes are shocks to aggregate grievances, encompassing cultural, social, or economic dimensions.

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 an online appendix.

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 that citizen's expressive payoff from revolting. Thus, a citizen i's 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 $\epsilon_i \sim iid\, F$ and $\eta \sim G$, independently from each other and other parameters, with corresponding cdfs f and g, and full support on $\mathbb{R}$. We make the following assumption.

Assumption 1 *G and F are single-peaked and symmetric around 0. Moreover, f is log-concave, and g 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.

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.

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 belief is 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.

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.

1.1 Discussion: Black Swans of Grievances

Familiarity with the Normal distribution and standard central limit theorems may lead one to think that heavy-tailed distributions are odd or unusual. However, 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,[4] the steady state distribution of aggregate grievances has power law tails, and hence is regularly varying (Kesten, 1973, Theorem 5) (Goldie, 1991,

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

Theorem 4.1)—such processes 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 given by:

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

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 threshold strategy $z_i = z$ must be indifferent between revolting and not 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 $R(k) = Pr(z_j < k|z_i = k)$ 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, including the use of asymptotic scale invariance is novel, as is the framing within a protest setting.

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, 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 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—we will soon compare this large aggregate shock with a series of small aggregate shocks. But we first state 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. One may expect that more people revolt in society B than in society A. Our paper shows that this seemingly common sense is inaccurate—because it does not consider the coordination aspects of revolt. How we arrive at the distribution of grievances matter. 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.

Given the banality of Normal distributions in the literature, one may be tempted to think that similar results must also hold when the distribution of aggregate shocks is Normal. 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.

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*

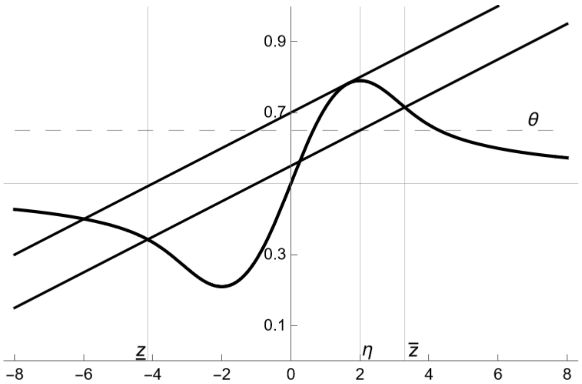

Figure 1: When $\theta_0 < \bar{\theta}_0 = 0.7$ and the common shock η is small, revolting and not revolting are rationalizable for the majority.

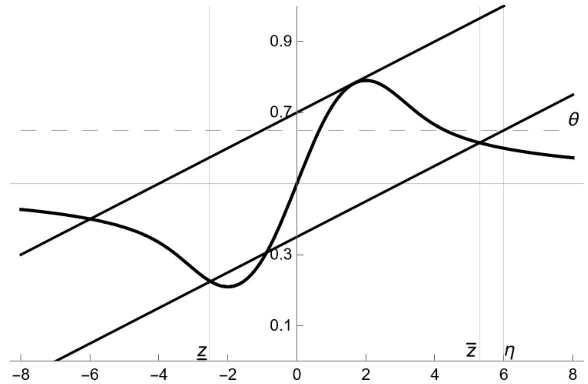

Figure 2: When $\theta_0 < \bar{\theta}_0 = 0.7$ and the common shock η is large, revolting is the unique rationalizable action for the majority.

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 the current aggregate grievance level θ is very high, a majority of citizens will always have a unique rationalizable action to revolt regardless of the magnitude of the aggregate grievance shock. 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 $\overline{\theta}_0$ such that if $\theta_0 \geq \overline{\theta}_0$ 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 $\theta_0 < \overline{\theta}_0$, 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. We now identify sufficient conditions under which when the same final distribution of grievances is the result of a consequence of smaller shocks, revolt is the unique rationalizable action for a strictly smaller fraction of citizens.

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. 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 citizen for whom revolt is the unique rationalizable action always remains smaller than p.*

Proposition 5 is our main theoretical contribution and there is no analogue to it in the literature. 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

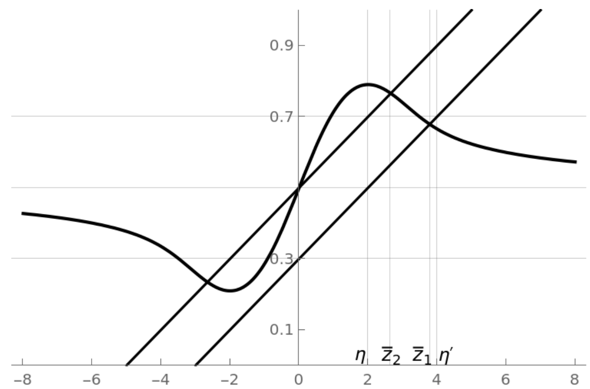

Figure 3: Protest behavior along two paths of increase in grievances. Parameters: $F = N(0, 1)$, $G = Cauchy(0, 0.5)$, $\sigma = 0.1$, $\theta = 0.7$.

$\theta = 0.7$, 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.

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.

3.1 Background

Grievances that underlie protests in Chile in recent decades are rooted in Chilean history. The 1973 coup replaced Allende's left-wing government by General Pinochet's dictatorship, known for repression of political dissidents and labor. Despite transition back to democracy, the dictatorship left long-term legacies: the 1980 constitution and a market-based economic system with private provision of education, health care, and retirement plans, which became the focus of protest demands in later years.

After a relatively calm decade following democratization, a wave of protests emerged in the mid-2000s sparked by secondary school students movement, known as *Revolución Pingüina* (Penguins Revolution) in reference to the students' uniforms.[5] Protests by secondary school, high school, and university students became a recurrent feature of Chilean social movements (e.g., in 2011-2013 and 2017). Workers' protests and strikes in public and private sectors 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 collective territorial and political rights (Bidegain, 2017), environmental protests such as *Patagonia Sin Represas* (Patagonia Without Dams) (Schaeffer, 2017), and protests against price hikes (BBC News, 2011) all featured in the last two decades. The largest protest wave occurred in the last quarter of 2019, and is known as *Estallido* (Outburst). 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 (The New York Times, 2019).

It is worth highlighting that protests in our time period involved episodes of police violence (González and Prem, 2022). The police force in Pinochet's dictatorship remained powerful even after democratization. While the Chilean police was a highly respected institution after democratization, this respect has been attributed in part to fear of the police (Bonner, 2013).

[5] Students mobilized against the private education system, demanding educational equality. Analyzing the 2006 students' movement, Donoso (2013) identifies three key contributing factors, corresponding to grievances, organizational resources, and political opportunities: (i) high grievances due to neo-liberal policies; (ii) a new, more horizontal movement organization that merged previously divided student organizations and created a shared identity; and (iii) the President Bachelet's "government of citizens" agenda.

3.2 Specification

To study the effect of large shocks to grievances, we estimate the following regression.

$$P_t = \beta_0 + \beta_1\ G_t + \sum_{k\in\{L,M,S\}} \beta_{2k}\ S_t^k + \epsilon_t, \tag{1}$$

where P_t and G_t are measures of protest activity and anti-government grievances in period t, respectively. Our variable of interest, S_t^L, is an indicator variable that equals 1 if there is a large unexpected increase in grievances (large grievance shock) and 0 otherwise. To show the distinct effect of large shocks, we also include indicator variables S_t^M, and S_t^S, corresponding to medium and small shocks, respectively. We recognize the endogeneity concerns and we emphasize that our empirical evidence should be understood as a proof-of-concept exercise to encourage further inquiries that focus on identification issues.

3.3 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.[6] 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 Relative Disapproval. To alleviate concerns about the speed at which grievances may translate into protest as well as the exact dates of surveys, we aggregate the measure at the monthly level by averaging the weakly Disapproval Rates for each month in the sample.

Grievance Shocks. Our measure of large grievance shock for each period t is an indicator variable S_t^L that takes value 1 when the increase in Relative Disapproval from the last period, $RD_t - RD_{t-1}$, is in the top 7% of such changes in the sample. This yields five shocks in our sample—see Figure 4. Our measure of medium (small) grievance shock for each period t is an

[6] 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.

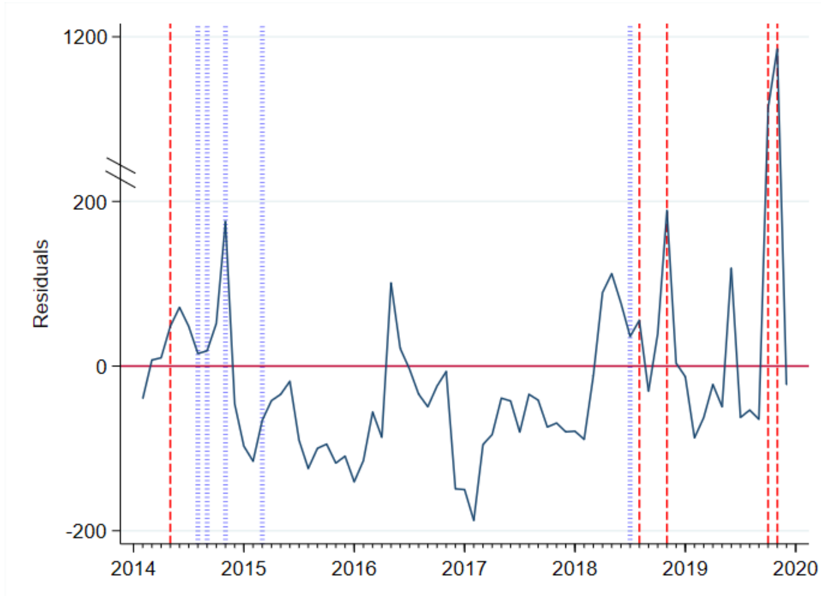

Figure 4: Grievance Shocks and Protests. Dashed red lines correspond to large shocks, and dotted blue lines correspond to medium shocks.

indicator variable S_t^M (S_t^S) that takes value 1 when the increase in Relative Disapproval is in the top 7% to 14% (14% to 21%) of such changes in the sample.

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 month constructed from this dataset.

3.4 Empirical Results

Figure 4 shows the location of the five large grievance shocks and five medium grievance shocks in our sample as well as the residuals of the regression of protests on the measure of grievance levels ($P_t - E[P_t|G_t]$). We first interpret these data based on our qualitative description of protest waves in the Online Appendix. First, consider large shocks. The first shock (May 2014) coincides with protests surrounding the government's implementation of education reforms. The second shock (Aug 2018) coincides with the Chilean feminist protest wave against gender violence, sexual harassment, and patriarchal system. The third (Nov 2018) coincides with private sector port and mining workers' strike for better working conditions and the public sector workers' protests against low raises. The forth and fifth (Oct-Nov 2019) correspond to the Outburst. Next, consider medium shocks. The shocks in 2014 coincides with public health workers'

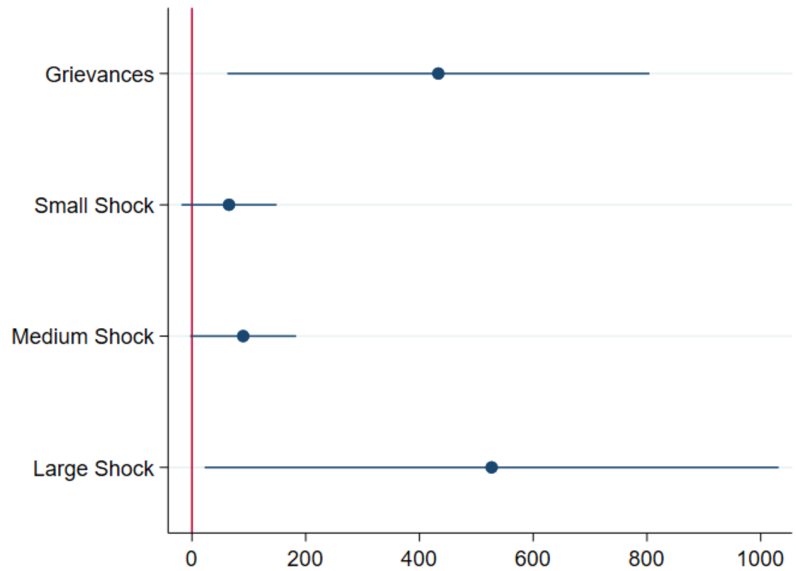

Figure 5: Coefficient Estimates and Confidence Intervals.

protests and strikes. The medium shock in 2015 does not seem to coincide with a period of high protest intensity, and the medium shock in 2018 coincides with the feminist protest wave.

According to our measure, there was no shocks in 2016, which featured large waves of protests and strikes, including protests against labor reforms, proposed raises, 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.[7] 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.

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

Figure 5 shows the estimated coefficients with 95% confidence intervals based on Equation (1). Table 1 in the Online Appendix shows the results when only one of the large, medium, or small shocks are considered. It also shows that results are robust to excluding the Outburst. Results seem consistent with the model's prediction that, fixing a level of grievances, more people will protest if that grievance level is the result of a large sudden increase in grievances. Based on these estimates, at the sample average of grievance levels, the number of protests is about 4.7 times larger in the presence of a large shock to grievances. Even if we exclude the last quarter of 2019 (i.e., the Outburst), at the sample average of grievance levels, the number of protests is about 1.95 times larger in the presence of a large shock to grievances.

4 Conclusion

In the Introduction, we discussed how even though individual humans do not act like the legendary boiling frog, the society as a whole does. 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 case 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.

We end with another analogy. Psychological shocks cause fight, flight, or freeze responses in individuals through physiological processes that work through sympathetic and parasympathetic nervous systems. In a sense, aggregate trauma causes societies to mount large or small protests, corresponding to fight or freeze responses, through collective action processes that work through higher-order belief systems—beliefs about the state of the world and other people's beliefs, and hence, their actions. Seen through this lens, we show that when people believe that the social trauma can be very large (heavy-tailed aggregate shocks), the society's response to trauma is to fight by mounting large protests. Even though individual humans may be shocked into inaction (freeze response) by psychological trauma, the society as whole is shocked into action by social trauma.

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