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Why Do People Protest? A Theory of Emotions, Public Policy, and Political Unrest*

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Abstract

We build a model of policymaking under the threat of unrest. A policymaker chooses how much effort to spend on a public good; effort is unobservable and the outcome is uncertain. A group of citizens protest if the outcome falls short of a reference point; the reference point is determined endogenously by rational expectations about the outcome and by the height of emotions. We show that emotions act as a bargaining tool; their effects are nonmonotonic and depend on the group's ability to inflict damage. Equilibrium may require the policymaker to randomize between providing some effort or no effort at all, in order to temper citizens' aspirations.

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1 Introduction

Protests, riots, and other forms of political unrest are ubiquitous. In October 2019, massive demonstrations erupted in Chile, triggered by a small increase in metro fares, but ultimately motivated as well by grievances about persistent inequality. In November 2022, thousands of people protested in China to show their dissatisfaction with the government zero-Covid policies.[1] In both episodes, like many others, demonstrations were a reaction to government policies perceived as failed by the protesters, who laid the blame on the insensibility or incompetence of the elites in power. In both cases as well, although the timing and extent of the protest was not anticipated, fear of upheaval had contributed to shape policies, and continued to do so afterwards.

Research in social psychology on protests and riots has long focused on the role of socially shared emotions such as anger at disappointing outcomes, and hope for change.[2] In this paper, we build a formal model capturing these motivations in a policy game, and explore equilibrium implications. In the model, a policymaker decides how much effort to invest on a policy that benefits citizens; for instance, the level of a public good. Effort is unobservable, and the return of effort is stochastic. Citizens protest if the policy outcome falls below a reference point, determined by rational expectations about the outcome and by emotions such as anger at receiving less than aspired to, and hope for change.

We show that in equilibrium the anticipation by the policymaker of citizens' emotional reactions acts as a bargaining tool. This tool is more effective the larger the group of potential protesters and its ability to inflict damage. When the group is small, it can be ignored by policymakers. In fact, strong emotions may be counterproductive, leading both to worse policy outcomes and more protests. As the group grows large, policymakers randomize between attending the demands of the group or not; randomization is necessary in order to temper the aspirations of the group. Intuitively, a group swayed by strong emotions reacts too strongly to disappointment if the group expects any positive policy with certainty. For large groups, policymakers may effectively concede, adopting policies that minimize the probability of protest.

[1] On Chile, see, e.g., Edwards [2023] and Scherman and Rivera [2021]. On China, see *Human Rights Watch*, January 26, 2023.

[2] See e.g., van Zomeren et al. [2004], Drury and Reicher [2009], Stürmer and Simon [2009], van Zomeren et al. [2012], Stott et al. [2020] and Drury et al. [2020], among others.

Although simple enough to be tractable, we believe our model captures important features of the episodes mentioned above. In democracies or non democracies alike, groups of the population may be left out of formal channels of political participation. Feelings of resentment, anger, and hope for change, may act as an implicit coordination device. Socially shared emotions enable groups excluded from power to excise concessions from government elites. These groups are bound to be ignorant of details of policymaking, hence their decision to protest may be relatively noisy from the viewpoint of the elites, whose policy intentions are not transparent for the excluded groups. Indeed, our analysis predicts that uncertainty about the policy intentions of the elites will keep the expectations of potential protestors in check.

Our model is a psychological game in the sense of Geanakoplos et al. [1989] and Battigalli and Dufwenberg [2022], since preferences of the potential protestors depend on beliefs about the outcome, which are determined in equilibrium. Our modeling of the aspiration level, in particular, follows Kőszegi and Rabin [2006]. Related work on the strategic use of emotions include Battigalli et al. [2019] work on anger and aggression and Winter et al. [2017] notion of mental equilibrium. As a general reference, Genicot and Ray [2020] offers a review of the growing literature on the consequences of endogenous aspirations in economics.

Economic literature on protests, for the most, has emphasized rational participation and the transmission of information to policymakers (see e.g., the seminal contribution of Lohmann [1993] and recent work by Battaglini [2017]), as well as the coordination problem of potential protestors (see, e.g., Bueno de Mesquita [2010] and Barbera and Jackson [2020], among others). Our focus and interests are different; we are interested in the effects of the anticipation of protest on policymaking, and on endogenous standards of fairness leading to protest.

Closer in spirit to our work is that of Passarelli and Tabellini [2017]. Like us, they embed a notion of fairness in a policy game. They, however, focus on an interior equilibrium in which the policymaker trades off at the margin between unrest provoked by groups pulling in different directions. We consider the relationship between one group and policymakers, explore all possible equilibrium configurations, and show that randomization and unilateral concession by the policymakers are inescapable for some parameter values. We also study the cross effects of group size and strength of emotional motivations, and derive implications for optimal emotions.

The ability of social media to coordinate expectations is becoming increasingly an object of attention in the empirical literature, see e.g., Enikolopov et al. [2020], Enikolopov et al. [2011], and Cantoni et al. [2023]. A version of our model with heterogenous aspirations shows that, in fact, coordination of expectations is not an unalloyed blessing for potential protesters from the viewpoint of expected policies.

The organizations of groups for collective action has been object of attention in recent economic literature. Levine and Mattozzi [2020] and Levine et al. [2022], for instance, explore optimal mechanisms for participation in elections and other environments. The manipulation of emotions such as anger and guilt is an element of those mechanisms; our results illustrate how their optimal use by groups varies with the strategic circumstances.

An early contribution to the study of the role of emotions in the fulfillment of contracts and promises is that of Hirshleifer [1987]. As Hirshleifer points out, in a similar spirit, "An income distribution that could be tolerable as an accidental or random event, for example, might lead to violent revolt if seen to be the result of conscious choice on the part of another economic agent. Common observation tells us that, whatever the textbooks assume, such behavior is in fact very important in the make-up of normal human beings [...] at least in certain circumstances, such non-utilitarian behavior makes ultimate utilitarian sense!"

Our work can also be related to Duggan and Martinelli's [2020] work on electoral accountability. In a Bayesian model in which an incumbent is interested in signaling to be of an above-average type, they show that a high enough electoral incentive induces a mixed strategy equilibrium in which the incumbent randomizes between choosing policies near their ideal point and mimicking above-average politicians by choosing high policies. In the equilibrium constructed in that paper, the cutoff employed by voters in order to reelect or not responds to the strategies of politicians as an aspiration level does in this paper.

The remainder of this paper is organized as follows. Section 2 describes the basic model and section 3 characterizes the equilibrium. Section 4 provides comparative statics results. Section 5 introduces a linear version of the model and discusses optimal emotions, and section 6 illustrates the results using a calculated example. Section 7 discusses extensions, relaxing some of the assumptions of the basic model. Section 8 returns to our motivating examples and gathers concluding remarks.

2 The protest game

We consider a sequential game played by a mass X of politically involved agents and a policymaker. We think of political involvement as reading partisan media sources, joining in a potential crowd, etc.; we take the size of the set of involved agents $x \in (0,1]$ as given.

At the beginning of the game, the policymaker chooses a policy $y \in Y = [0, \overline{y}] \subset \Re$; this is a public good that benefits agents at a cost to the policymaker. We can think of y as the magnitude of an adjustment to the status quo in a direction that is beneficial to agents, for instance adjusting the education and social security regimes in the Chilean example, or rolling back zero-Covid policies in the Chinese example. The policy induces an outcome $z = y + \epsilon$, where ϵ is a random variable with uniform distribution on $[-\overline{\epsilon}, \overline{\epsilon}]$ for some $0 < \overline{\epsilon} < \overline{y}/2$. Last, each agent $i \in X$ chooses an action in $p_i \in \{0, 1\}$, where 1 denotes an action that entails a cost to the policymaker; e.g. joining a violent protest.

The payoff to the policymaker is given by

$$-\Psi(y) - \delta p x,$$

where $\Psi : Y \to \Re$ is a strictly increasing, strictly convex and twice continuously differentiable function with $\Psi(0) = \Psi'(0) = 0$, representing the cost of the policy for the policymaker, $\delta > 0$ are damages caused by the protest (for instance, removal from office), and p is the fraction of agents who choose $p_i = 1$. Note that the inverse function $[\Psi']^{-1} : [0, \Psi'(\overline{y})] \to Y$ is well-defined and it is strictly increasing and continuous.

The payoff to each involved agent is

$$(a - z)p_i,$$

where $a \in [0, \overline{y}]$ is an aspiration level, to be determined in equilibrium as described later.

Strategies for the policymaker and for agents are given respectively by functions

$$\sigma^P : [0, \overline{y}] \to \triangle Y \quad \text{and} \quad \sigma^A : [0, \overline{y}] \times \Re \to \triangle\{0, 1\},$$

assigning a probability distribution over the set of possible actions for the policymaker for each aspiration level, and for agents for each aspiration level and each realization of the policy outcome. The strategy σ^A is assumed to be measurable with respect to realizations of the policy outcome, and we do not distinguish between strategies that are equivalent a.e. with respect to those realizations.

Let $z^e(\sigma, a)$ be the expected value of the policy outcome given the strategy profile $\sigma = (\sigma^P, \sigma^A)$ and the aspiration level a. Since ϵ has mean zero, $z^e(\sigma, a)$ is the expected value of y given the distribution $\sigma^P(a)$. We let $f : Y \to Y$ be a continuous function with $f(0) \geq 0$, $f(\overline{y}) \leq \overline{y}$, and $0 \leq f(y') - f(y) \leq y' - y$ for all $y, y' \in Y$ such that $y < y'$, indicating the responsiveness of agents' aspiration level to their expectations about the policy outcome. That is, the more agents expect, the more the aspire to get, but the aspiration level does not grow faster than the expected outcome.[3]

An *equilibrium* of the protest game is a strategy profile σ and an aspiration level a such that the strategy profile is a subgame perfect equilibrium given a, and the rational expectations condition

$$a = f(z^e(\sigma, a)).$$

A useful parametric example is the linear model $f(z^e(\gamma, a)) = \alpha z^e(\gamma, a) + \beta\overline{y}$, with $0 \leq \beta \leq 1$ and $0 \leq \alpha \leq 1 - \beta$. We interpret α as the importance of *anger* at receiving less than the expected policy in motivating politically involved agents; anger is released by protesting. Similarly, we interpret β as the importance of *hope*; this interpretation is fitting we consider explicitly the possibility of successful protests in section 7.1.

We say that f is *regular* if $0 < f(y') - f(y) < y' - y$ for all $y, y' \in Y$ such that $y < y'$. This slight strengthening of the maintained assumptions is useful for uniqueness results. Note that the inverse function $f^{-1} : [f(0), f(\overline{y})] \to Y$ is well-defined if f is regular.

3 Equilibrium of the protest game

For $x \in (0, 1]$, let

$$y^*(x) \equiv \min\left([\Psi']^{-1}(\delta x/2\overline{\epsilon}), \Psi^{-1}(\delta x), \overline{y}\right)$$

[3]The upper bound of the variation of f is not necessary for existence, but allows a sharp characterization of equilibrium. The bounds are satisfied if f is differentiable everywhere and $0 \leq f'(y) \leq 1$ for $y \in Y$.

and

$$\overline{a}(x) \equiv y^*(x) + \overline{\epsilon} - (2\overline{\epsilon}/\delta x)\Psi(y^*(x)).$$

Intuitively, $y^*(x)$ is the maximum policy that the policymaker is willing to provide given the level of involvement x, for any possible aspiration level, and $\overline{a}(x)$ is the maximum aspiration level such that the policymaker does not prefer strictly to provide cero rather than any positive policy. We allow $\overline{a}(x) > \overline{y}$; this indicates that 0 is not a best response policy for any feasible aspiration level $0 \leq a \leq \overline{y}$.

As we will see, $y^*(x)$ is determined by equating marginal cost and benefits ($y^*(x) = [\Psi']^{-1}(\delta x/2\overline{\epsilon})$), or by reducing the probability of protest to zero at the maximum aspiration level consistent with a positive policy ($y^*(x) = \Psi^{-1}(\delta x) = \overline{a}(x) + \overline{\epsilon}$), or set at the maximum possible ($y^*(x) = \overline{y}$).

Theorem 1. *There is an equilibrium. In equilibrium, agents choose 0 if $z > a$ and 1 if $z < a$, and the policymaker chooses*
(i) 0 *if* $f(0) > \overline{a}(x)$,
(ii) $y^*(x)$ *with probability h and* 0 *with complementary probability, where $h \in [0,1]$ is such that $f(hy^*(x)) = \overline{a}(x)$, if $f(y^*(x)) \geq \overline{a}(x) \geq f(0)$,*
(iii) $y^*(x)$ *if $\overline{a}(x) > f(y^*(x)) > y^*(x) - \overline{\epsilon}$, and*
(iv) $y \in Y$ such that $y - \overline{\epsilon} = f(y)$ if $y^*(x) - \overline{\epsilon} \geq f(y^*(x))$.
The equilibrium is unique if f is regular.

The best response behavior of agents follows trivially from their payoff. To prove the theorem, we first solve for the best response behavior of policymaker for a given aspiration level, and then impose the rational expectations condition on the aspiration level.

The following auxiliary result is useful.

Lemma 1. *(i) $\overline{a}(x) > \overline{\epsilon}$, (ii) $\overline{a}(x) \geq y^*(x) - \overline{\epsilon}$, with equality if and only if $y^*(x) = \Psi^{-1}(\delta x)$, and (iii) $\overline{a}(x)$ is strictly increasing in x.*

Proof. For part (i), using the definitions, we have

$$\overline{a}(x) - \overline{\epsilon} = y^*(x) - \frac{\Psi(y^*(x))}{\delta x/(2\overline{\epsilon})} \geq y^*(x) - \frac{\Psi(y^*(x))}{\Psi'(y^*(x))} > 0,$$

where the first inequality follows from $y^*(x) \leq [\Psi']^{-1}(\delta x/(2\overline{\epsilon}))$ (by definition), and the second inequality from $\Psi'(y^*(x))y^*(x) > \Psi(y^*(x))$, since by assumption Ψ is strictly convex and strictly increasing, with $\Psi(0) = 0$, and $y^*(x) > 0$ for $x > 0$.

For part (ii), we have

$$\overline{a}(x) - (y^*(x) - \overline{\epsilon}) = 2\overline{\epsilon}(1 - \Psi(y^*(x))/\delta x) \geq 0$$

with equality if and only if $y^*(x) = \Psi^{-1}(\delta x)$, since by definition $y^*(x) \leq \Psi^{-1}(\delta x)$.

For part (iii), the result follows from the definition of $\overline{a}(x)$ if $y^*(x) = \overline{y}$ or $y^*(x) = \Psi^{-1}(\delta x)$. If $y^*(x) = [\Psi']^{-1}(\delta x/2\overline{\epsilon})$, after a change in variables we have $\overline{a}(x) = \tilde{a}(y^*(x))$, where $\tilde{a}(y) \equiv \overline{\epsilon} + y - \Psi(y)/\Psi'(y)$ is strictly increasing in y since $\tilde{a}'(y) = \Psi''(y)/\Psi'(y) > 0$. □

We claim

Lemma 2. *The best response of the policymaker given* $a \in [0, \overline{y}]$ *and* $x \in (0, 1]$ *is*
(i) 0 *if* $a > \overline{a}(x)$,
(ii) any lottery over $\{0, y^*(x)\}$ *if* $a = \overline{a}(x)$,
(iii) $y^*(x)$ *if* $\overline{a}(x) > a > y^*(x) - \overline{\epsilon}$, *and*
(iv) $a + \overline{\epsilon}$ *if* $y^*(x) - \overline{\epsilon} \geq a$.

Proof. The problem of the policymaker is

$$\min_{0 \leq y \leq \overline{y}} H(y),$$

where, using the uniform distribution of ϵ,

$$H(y) = \Psi(y) + \delta x \min\left(\frac{\max(0, a + \overline{\epsilon} - y)}{2\overline{\epsilon}}, 1\right).$$

The function $H(y)$ is strictly increasing for $y < \min(a - \overline{\epsilon}, \overline{y})$ and for $\min([\Psi']^{-1}(\delta x/2\overline{\epsilon}), a + \overline{\epsilon}) \leq y < \overline{y}$, and strictly decreasing for $a - \overline{\epsilon} \leq y < \min\left([\Psi']^{-1}(\delta x/2\overline{\epsilon}), a + \overline{\epsilon}, \overline{y}\right)$. It follows that $H(y)$ has at most two local minima: at 0 (only if $a > \overline{\epsilon}$) and at

$$\hat{y}(x, a) \equiv \min\left([\Psi']^{-1}(\delta x/2\overline{\epsilon}), a + \overline{\epsilon}, \overline{y}\right).$$

Using the definition of $y^*(x)$ and lemma 1(ii),

$$\hat{y}(x, a) \begin{cases} \geq y^*(x) & \text{if } a > \overline{a}(x) \\ = y^*(x) & \text{if } a = \overline{a}(x) \\ = \min(y^*(x), a - \overline{\epsilon}) & \text{if } a < \overline{a}(x) \end{cases} . \quad (1)$$

If $a > \overline{a}(x)$, from lemma 1(i), $a > \overline{\epsilon}$, so $H(0) = \delta x$. Since $\hat{y}(x,a) \leq a + \overline{\epsilon}$,

$$H(\hat{y}(x,a)) - H(0) = \Psi((\hat{y}(x,a)) + \delta x \left(\min\left(\frac{a + \overline{\epsilon} - \hat{y}(x,a)}{2\overline{\epsilon}}, 1 \right) - 1 \right).$$

If $a \geq \hat{y}(x,a) + \overline{\epsilon}$, we get $H(\hat{y}(x,a)) - H(0) = \Psi(\hat{y}(x,a)) > 0$. If instead $\hat{y}(x,a) + \overline{\epsilon} > a > \overline{a}(x)$, we get

$$\begin{aligned} H(\hat{y}(x,a)) - H(0) &= \Psi(\hat{y}(x,a)) + \frac{\delta x}{2\overline{\epsilon}}(a - \overline{\epsilon} - \hat{y}(x,a)) \\ &> \Psi(\hat{y}(x,a)) + \frac{\delta x}{2\overline{\epsilon}}(\overline{a}(x) - \overline{\epsilon} - \hat{y}(x,a)) > 0, \end{aligned}$$

where the last inequality follows from $\hat{y}(x,a) \geq y^*(x)$ (by equation 1), $\Psi(y^*(x)) + \frac{\delta x}{2\overline{\epsilon}}(\overline{a}(x) - \overline{\epsilon} - y^*(x)) = 0$ (by definition of $\overline{a}(x)$), and $\Psi'(y) - \delta x/(2\overline{\epsilon}) \geq 0$ for $y \geq y^*(x)$ (by definition of $y^*(x)$). In either case, $\hat{y}(x,a)$ is strictly worse than the policy 0. Since the only two possible minima are 0 and $\hat{y}(x,a)$, it follows that 0 is uniquely optimal.

If $a = \overline{a}(x)$, we have $\hat{y}(x,a) = y^*(x)$ (by equation 1). Using the fact that, by definition, $\overline{a}(x) < y^*(x) + \overline{\epsilon}$, we get

$$H(y^*(x)) - H(0) = \Psi(y^*(x)) + \frac{\delta x}{2\overline{\epsilon}}(\overline{a}(x) - \overline{\epsilon} - y(x^*)) = 0.$$

Thus, the policymaker is indifferent between 0 and $y^*(x)$. Since these are the only two possible minima if $a \geq \overline{a}(x)$, it follows that any lottery over 0 and $y^*(x)$ is optimal.

If $a < \overline{a}(x)$, we have

$$H(y^*(x)) - H(0) < \Psi(y^*(x)) + \frac{\delta x}{2\overline{\epsilon}}(\overline{a}(x) - \overline{\epsilon} - y(x^*)) = 0,$$

so that 0 is not optimal. Thus, using equation 1, if $a > y^*(x) - \overline{\epsilon}$, we get that $y^*(x)$ is uniquely optimal, and if $a \leq y^*(x) - \overline{\epsilon}$, we get that $a + \overline{\epsilon}$ is uniquely optimal. □

Proof of Theorem 1. To prove the theorem, we consider in order the four possibilities (i)-(iv) in the statement of lemma 2. Suppose that there is an equilibrium in which $a > \overline{a}(x)$. Then from lemma 2(i) in such equilibrium the policymaker chooses $y = 0$ with probability 1, so that the aspiration level must be $f(0)$. Hence such equilibrium exists if and only if $f(0) > \overline{a}(x)$, as in case (i) of the theorem.

Suppose there is an equilibrium in which $a = \overline{a}(x)$. Then from lemma 2(ii) in such equilibrium the policymaker can choose any lottery over $\{0, y^*(x)\}$. The aspiration level induced by playing $y^*(x)$ with probability h and 0 with probability $1 - h$ is $f(hy^*(x) + (1 - h) \times 0) = f(hy^*(x))$, hence such an equilibrium exists if and only if $f(0) \leq \overline{a}(x) \leq f(y^*(x))$, and h must satisfy $f(hy^*(x)) = \overline{a}(x)$, as in the statement of case (ii) of the theorem. In particular, if f is regular, $h = f^{-1}(\overline{a}(x))/y^*(x)$ is unique.

Suppose there is an equilibrium in which $\overline{a}(x) > a > y^*(x) - \overline{\epsilon}$. Then from lemma 2(iii) in such equilibrium the policymaker chooses $y^*(x)$ with probability 1, so the aspiration level is $f(y^*(x))$. Hence such an equilibrium exists if and only if $\overline{a}(x) > f(y^*(x)) > y^*(x) - \overline{\epsilon}$, as in case (iii) of the theorem.

Suppose there is an equilibrium in which $y^*(x) - \overline{\epsilon} \geq a$. From lemma 2(iv) in such equilibrium the policymaker chooses $a + \overline{\epsilon}$ with probability 1, so that the aspiration level is $a = f(a + \overline{\epsilon})$; hence the equilibrium policy y must satisfy

$$y^*(x) - \overline{\epsilon} \geq a = y - \overline{\epsilon} = f(y).$$

If $y^*(x) - \overline{\epsilon} = f(y^*(x))$, this condition is satisfied by $y = y^*(x)$. If $y^*(x) - \overline{\epsilon} > f(y^*(x))$, then there is $\tilde{y} < y^*(x)$ such that $\tilde{y} - \overline{\epsilon} = f(\tilde{y})$, as required by equilibrium; this follows from continuity of f and $f(0) \geq 0$. In particular, if f is regular, the solution to $y - \overline{\epsilon} = f(y)$ is unique; this is because if $\tilde{y} - \overline{\epsilon} - f(\tilde{y}) = 0$, then for every $y > \tilde{y}$ we have $y - \overline{\epsilon} - f(y) = \tilde{y} - \overline{\epsilon} - f(\tilde{y}) + (y - \tilde{y}) - (f(y) - f(\tilde{y})) > 0$. Last, if $y^*(x) - \overline{\epsilon} < f(y^*(x))$, then for every $y < y^*(x)$ we have $y - \overline{\epsilon} - f(y) = y^*(x) - \overline{\epsilon} - f(y^*(x)) - (y^*(x) - y) + (f(y^*(x)) - f(y)) < 0$, so the equilibrium condition cannot be satisfied. Thus, there is an equilibrium in which $y^*(x) - \overline{\epsilon} \geq a$ if and only if $y^*(x) - \overline{\epsilon} \geq f(y^*(x))$, as in case (iv) of the theorem, and it is unique if f is regular.

Recall that from lemma 1(ii), we have $\overline{a}(x) \geq y^*(x) - \overline{\epsilon}$. Thus, the conditions for cases (i) to (iv) do not overlap and cover all possibilities. Hence an equilibrium exists, and from previous arguments, it is unique if f is regular. $\square$

4 Policy and protest in equilibrium

We can calculate the equilibrium expected policy using theorem 1. As it turns out, if the expected policy is positive, it is the minimum of the expected values in cases (ii), (iii) and (iv) of theorem 1. Thus, to find the equilibrium strategy of the policymaker we only need to compare those three values.

Let $\tilde{y} \equiv \{\max y \in Y : y - \overline{\epsilon} \leq f(y)\}$. Note that if f is regular, $\tilde{y}$ is equal to the unique solution to $y - \overline{\epsilon} = f(y)$, if there is any, or it is equal to $\overline{y}$.

Theorem 2. *If $f(0) > \overline{a}(x)$, the equilibrium expected policy is* 0 *and the probability of protest is* $\min(1, (f(0)+\overline{\epsilon})/2\overline{\epsilon})$. *If $f(0) \leq \overline{a}(x)$ and f is regular, the equilibrium expected policy is*

$$Ey(x) \equiv \min\left(f^{-1}(\overline{a}(x)), y^*(x), \tilde{y}\right),$$

and the equilibrium probability of protest is

$$1 - \min\left(1, \frac{f^{-1}(\overline{a}(x))}{y^*(x)}\right) \min\left(1, \frac{y^*(x) + \overline{\epsilon} - f(Ey(x))}{2\overline{\epsilon}}\right).$$

Proof. If $f(0) > \overline{a}(x)$, the result follows trivially from theorem 1(i). Suppose instead $f(0) \leq \overline{a}(x)$ and f is regular.

The expected policies in cases (ii), (iii), and (iv) of theorem 1 are respectively $f^{-1}(\overline{a}(x))$, $y^*(x)$, and $\tilde{y}$. The bound in case (ii) of theorem 1 implies $f^{-1}(\overline{a}(x)) \leq y^*(x)$. Using lemma 1(ii), $f(y^*(x)) \geq \overline{a}(x) \geq y^*(x) - \overline{\epsilon}$, which by definition of $\tilde{y}$ implies $y^*(x) \leq \tilde{y}$. Thus, in case (ii), $f^{-1}(\overline{a}(x)) = \min\left(f^{-1}(\overline{a}(x)), y^*(x), \tilde{y}\right)$. Other cases are dealt with similarly.

Note that if the policymaker plays the lottery described by case (ii), the probability of protest is 1 in the event that the policy is 0, since in that event

$$z = \epsilon \leq \overline{\epsilon} < \overline{a}(x) = f(f^{-1}(\overline{a}(x)),$$

where the strict inequality follows from lemma 1. Thus, the probabilities of protest in cases (ii), (iii), and (iv) of theorem 1 are respectively

$$1 - \frac{f^{-1}(\overline{a}(x))}{y^*(x)} \times \frac{y^*(x) + \overline{\epsilon} - \overline{a}(x)}{2\overline{\epsilon}}$$

(corresponding to playing $y^*(x)$ with probability $f^{-1}(\overline{a}(x))/\alpha y^*(x)$ and 0 with complementary probability),

$$\frac{f(y^*(x)) + \overline{\epsilon} - y^*(x)}{2\overline{\epsilon}} = 1 - \frac{y^*(x) + \overline{\epsilon} - f(y^*(x))}{2\overline{\epsilon}}$$

(corresponding to choosing $y^*(x)$ with probability 1), and 0 (corresponding to playing $\tilde{y} = f(\tilde{y}) + \overline{\epsilon}$ with probability 1). Note that if $\tilde{y} \leq y^*(x)$, as in case (iv), using lemma 1 and the definition of $\tilde{y}$, we have $\overline{a}(x) \geq y^*(x) - \overline{\epsilon} \geq f(y^*(x))$ so that $f^{-1}(\overline{a}(x)) \geq y^*(x)$. The expression in the statement of the theorem follows. □

Intuitively, the policymaker chooses $\tilde{y}$ if the aspirations of agents are so low, in comparison to the threat presented by protests, that the policymaker chooses to concede and preempt protests. The policymaker chooses the lottery described by theorem 1(ii) if, instead, the aspirations are so high that they need to be tempered in equilibrium by the policymaker choosing to ignore protests with positive probability.

In spite of equilibrium behavior encompassing such extreme events, the expected policy and the expected probability of protest change smoothly in equilibrium with the parameters of the model. Comparative statics follows from theorem 2 straightforwardly.

Corollary 1. *If f is regular, the equilibrium expected policy is weakly increasing in x. If in addition $f(0) \leq \overline{a}(x)$, the equilibrium expected policy is strictly increasing in x if and only if $y^*(x) < \min(\overline{y}, \tilde{y})$, or $y^*(x) = \overline{y}$ and $\overline{a}(x) < \min(f(\overline{y}), \tilde{y})$.*

That is, increasing potential participation in the protest delivers better policies for agents. Under mild assumptions, increasing potential participation delivers as well a smaller probability of protest. In particular, the probability of protest goes down with participation if Ψ is a power function and f is linear. We have

Corollary 2. *If $\Psi(y)/(y\Psi'(y))$ is nondecreasing and f is regular, then the equilibrium probability of protest is nonincreasing in x if $y^*(x) < \overline{y}$.*

Proof. If $Ey(x) = \tilde{y}$, from theorem 2 the probability of protest is equal to zero, and moreover, $Ey(x') = \tilde{y}$ for every $x' \geq x$ since $y^*(x)$ and $\overline{a}(x)$ are nonincreasing. If $Ey(x) = y^*(x)$, then the probability of protest is equal to

$$1 - \frac{y^*(x) + \overline{\epsilon} - f(y^*(x))}{2\overline{\epsilon}},$$

which is nondecreasing in x since $y - f(y)$ is increasing in y. If $Ey(x) = f^{-1}(\overline{a}(x))$ and $y^*(x) = [\Psi']^{-1}(\delta x/2\overline{\epsilon})$, then the probability of protest is equal to

$$1 - f^{-1}(\overline{a}(x))\frac{\Psi(y^*(x))}{y^*(x)\Psi'(y^*(x))},$$

which is nondecreasing if $\Psi(y)/(y\Psi'(y))$ is nondecreasing. Last, if $Ey(x) = f^{-1}(\overline{a}(x))$ and $y^*(x) = \Psi^{-1}(\delta x)$, then using lemma 1(ii), the probability of protest is $1 - f^{-1}(\overline{a}(x))/(\overline{a}(x) + \overline{\epsilon}) = 1 - y/(f(y) + \overline{\epsilon})$ for $y = f^{-1}(\overline{a}(x))$.

Since in this case $y^*(x) - \overline{\epsilon} \leq \overline{a}(x) \leq f(y^*(x))$, we have $y \leq y^*(x) \leq \tilde{y}$ and $f(y) + \overline{\epsilon} \geq y$. It follows that $y' > y$ implies $1 - y'/(f(y') + \overline{\epsilon}) \geq 1 - y/(f(y) + \overline{\epsilon})$, and since $\overline{a}(x)$ is increasing in x, the probability of protest is nonincreasing in x. $\square$

5 Linear emotions

In this section we use the linear model, $f(z^e(\gamma, a)) = \alpha z^e(\gamma, a) + \beta\overline{y}$, with $0 \leq \beta \leq 1$ and $0 \leq \alpha \leq 1 - \beta$, to investigate optimal emotional reactions. We have

Proposition 1. *In the linear model, there is an equilibrium, and the equilibrium is unique if* $0 < \alpha < 1$ *or* $\alpha = 0$ *and* $\beta\overline{y} \neq \overline{a}(x)$. *If* $\beta\overline{y} > \overline{a}(x)$, *the equilibrium expected policy is* 0 *and the probability of protest is* $\min(1, (\beta\overline{y} + \overline{\epsilon})/2\overline{\epsilon})$. *If* $\beta\overline{y} < \overline{a}(x)$ *and* $0 \leq \alpha < 1$, *or* $\beta\overline{y} = \overline{a}(x)$ *and* $0 < \alpha < 1$, *the equilibrium expected policy is*

$$Ey(x) \equiv \min\left((\overline{a}(x) - \beta\overline{y})/\alpha, y^*(x), (\overline{\epsilon} + \beta\overline{y})/(1 - \alpha)\right),$$

and the equilibrium probability of protest is

$$1 - \min\left(1, \frac{\overline{a}(x) - \beta\overline{y}}{\alpha y^*(x)}\right) \min\left(1, \frac{y^*(x) + \overline{\epsilon} - \alpha Ey(x) - \beta\overline{y}}{2\overline{\epsilon}}\right).$$

The proposition is a corollary of theorem 2 for the case $0 < \alpha < 1$; the proof for the case $\alpha = 0$ and $\beta\overline{y} \neq \overline{a}(x)$ is similar.[4]

As in the dual-self model of Fudenberg and Levine [2006], we can consider the decision to protest as done by the short-term self of each politically involved agent, while welfare evaluation is performed by a long-term self. In what follows, we assume that the welfare of agents is strictly increasing in the expected policy and strictly decreasing in the probability of protesting.[5]

As it happens, the optimal level of anger minimizes the equilibrium probability of protest, regardless of the relative importance of policy and protest. We have:

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[4] To save on notation, we let $\min(\overline{a}(x) - \beta\overline{y})/\alpha, y^*(x)) = y^*(x)$ and $\min(1, (\overline{a}(x) - \beta\overline{y})/\alpha y^*(x)) = 1$ if $\alpha = 0$. If $\alpha = 0$ and $\beta\overline{y} = \overline{a}(x)$, an implication of theorem 1(ii) is that any randomization by the policymaker between 0 and $y^*(x)$ is consistent with equilibrium.

[5] Passarelli and Tabellini [2017] assume a psychological reward of protest participation within a group. Thus, protesters always benefit from being more emotional. Instead, we ask what the optimal emotional reaction is if protests are costly to protesters as well as to the policymaker.

Corollary 3. *If $\overline{a}(x) \neq \beta\overline{y}$, the optimal level of anger is*

$$\alpha^*(x) = \max\left(0, 1 - \frac{\beta\overline{y} + \overline{\epsilon}}{y^*(x)}\right).$$

Moreover, if the optimal level of anger is positive, then the probability of protest at the optimal level of anger is zero, and the equilibrium expected policy is $y^*(x)$.

Proof. If $\overline{a}(x) < \beta\overline{y}$, the equilibrium policy is zero. Since increasing α leads to a larger probability of protest, the optimal anger is $\alpha = 0$, which minimizes the probability of protest (although this probability is strictly positive).

If $\overline{a}(x) > \beta\overline{y}$, from proposition 1, the expected policy is the minimum of $y^*(x)$, $(\overline{a}(x) - \beta\overline{y})/\alpha$, and $(\beta\overline{y} + \overline{\epsilon})/(1-\alpha)$, which are constant, decreasing, and increasing in α, respectively. If $\beta\overline{y} + \overline{\epsilon} \geq y^*(x)$, then $y^*(x) \leq (\beta\overline{y} + \overline{\epsilon})/(1-\alpha)$ for all α, so the best policy outcome $y^*(x)$ can be achieved by $\alpha = 0$, which minimizes the probability of protest (although the probability of protest is zero only if $y^*(x) = \beta\overline{y} + \overline{\epsilon}$).

Last, suppose that $\beta\overline{y} + \overline{\epsilon} < y^*(x)$. Using lemma 1(ii), we have $\overline{a}(x) > \beta\overline{y}$. We claim that the curves $y = (\beta\overline{y} + \overline{\epsilon})/(1-\alpha)$ and $y = y^*(x)$ cross for a smaller value of α than the curves $y = (\overline{a}(x) - \beta\overline{y})/\alpha$ and $y = y^*(x)$; this requires $y^*(x) \leq \overline{a}(x) + \overline{\epsilon}$, which follows from lemma 1(ii). Thus, the optimal anger $\alpha^*(x) = 1 - (\beta\overline{y} + \overline{\epsilon})/y^*(x)$ is found by solving $y = (\beta\overline{y} + \overline{\epsilon})/(1-\alpha) = y^*(x)$. The probability of protest is zero for the optimal anger since $y = \alpha y + \beta\overline{y} + \overline{\epsilon}$. □

From the corollary, as long as $\overline{a}(x) > \beta\overline{y}$ and $y^*(x) < \overline{y}$, optimal anger is strictly increasing in the level of participation, and it is constant in the level of participation if $y^*(x) = \overline{y}$. A larger group benefits from being more vindictive, at least until the expected policy reaches a maximum. Anger and hope are substitute motivations.[6]

6 An example

We illustrate the linear model using the following quadratic example: $\Psi(y) = y^2/2$, $\overline{\epsilon} = 1/4$, $\delta = 1$, $\overline{y} = 5/4$, $\beta\overline{y} = 1/3$, and $0 \leq \alpha \leq 2/3$. Figure 1

[6] If $\overline{a}(x) = \beta\overline{y}$, the expected policy is 0 for every $\alpha > 0$, and the probability of protest declines with α. If agents care lexicographically more about expected policy than the probability of protest, Corollary 3 extends to $\overline{a}(x) = \beta\overline{y}$, since every equilibrium for $\alpha = 0$ involves either a better (positive) expected policy, or a smaller probability of protest.

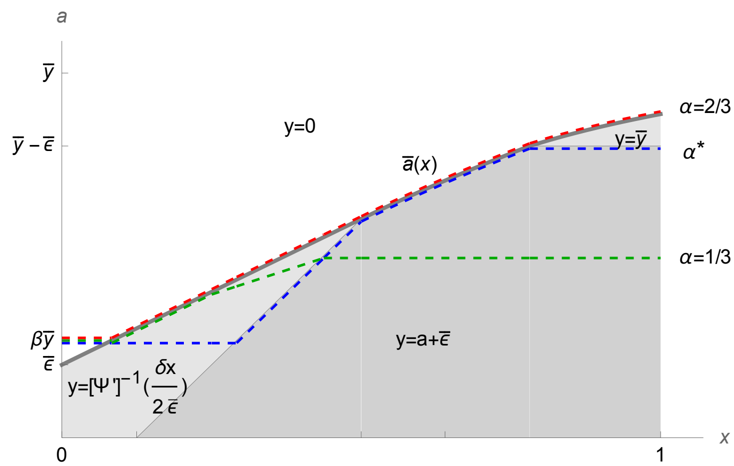

Figure 1: Policymaker's best response

represents $\overline{a}(x)$ and the best response for the policymaker for the different combinations of a and x, calculated using lemma 2. Above the gray area, the best response is the policy 0, in the light gray area to the left it is the interior solution given by first order conditions, in the light gray area to the right it is the maximum possible policy, and in the darker gray area it is to provide enough as to prevent protests.

The dashed red and green lines in figure 1 represent the equilibrium aspiration for different levels of participation if $\alpha = 2/3$ and $\alpha = 1/3$, respectively; we can think of these as representing "vindictive" and "forgiving" agents. If $\alpha = 2/3$, the equilibrium aspiration level is equal to $\overline{a}(x)$ whenever $\overline{a}(x) \geq \beta\overline{y}$. If instead $\alpha = 1/3$, the equilibrium aspiration level is strictly below $\overline{a}(x)$ for high enough participation. Equilibrium with vindictive agents requires that the policymaker randomize if providing positive policies, since vindictive agents are very responsive to expectations. With forgiving agents, the policymaker randomizes only for small participation, and otherwise adopts a pure strategy, satisfying first-order conditions for intermediate participation, and high enough policy to preclude protests for high enough participation.

The dashed blue line in figure 1 represents the equilibrium aspiration if $\alpha = \alpha^*(x)$, that is $\alpha = 0$ for low values of x and otherwise α as high as possible keeping the probability of protest equal to zero. For intermediate values of x, the aspiration level induced by optimal anger is equal to that

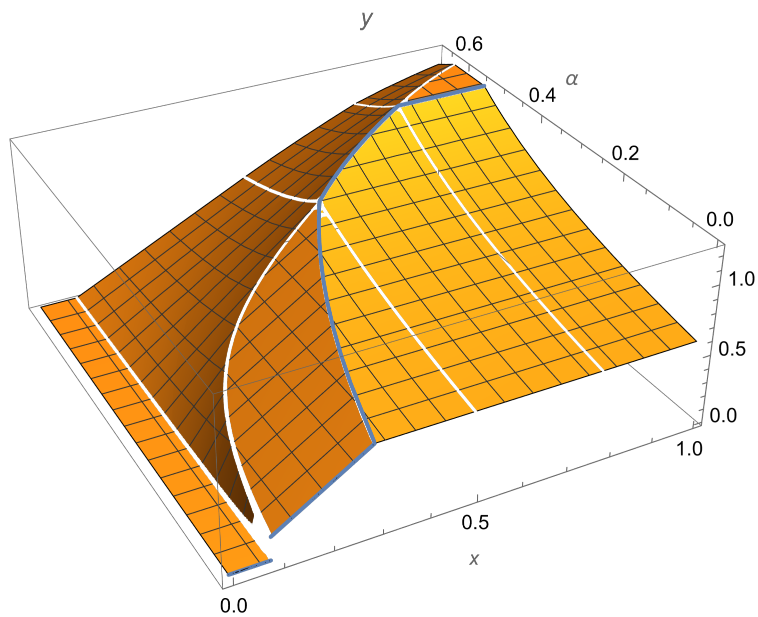

Figure 2: Participation, anger, and expected policy

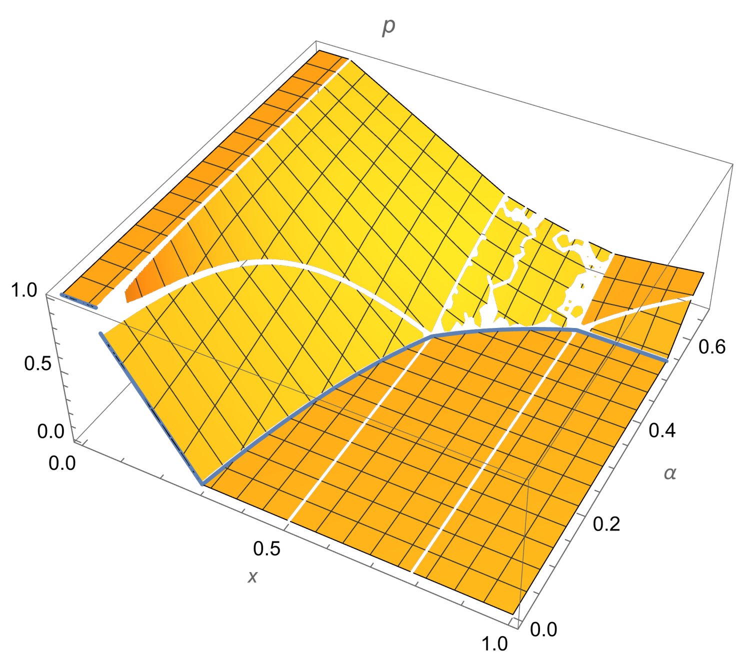

Figure 3: Participation, anger, and protest

induced by $\alpha = 2/3$, but the equilibrium policy lottery is different—it is $y^*(x) = \overline{a}(x) + \overline{\epsilon}$ with certainty if $\alpha = \alpha^*(x)$ and a non-degenerate lottery over $y^*(x)$ and 0 if $\alpha = 2/3$.

In figures 2 and 3, we show the expected policy and the probability of protest for values of $0 \leq \alpha \leq 2/3$ and $0 < x \leq 1$. The expected policy is weakly increasing in participation, and the probability of protest is weakly decreasing, except possibly if the expected policy is $\overline{y}$. The expected policy is constant or decreasing on anger for low participation, and single-peaked (or single-plateaued) for large enough participation. In particular, vindictive agents get worse policies when participation is low, and better policies when participation is high. Intuitively, when the policymaker randomizes, the policymaker must offer the policy $y^*(x)$ with larger probability to forgiving agents in order to attain the same aspiration level. Forgiving agents can be worse off than vindictive agents only if the policymaker offers them enough to reduce the probability of protest to zero, and participation is high, so that the lottery offered to vindictive agents has better expected value than the policy appeasing forgiving agents. For very high participation, forgiving agents are hurt by their own low expectations.

The blue line in figures 2 and 3 illustrates the expected policy and the probability of protest when evaluated at the optimal anger $\alpha^*(x)$.[7] As shown in the figures, the optimal anger maximizes the expected policy and minimizes the probability of protest.

7 Extensions

7.1 Revolutions

We can extend the linear model to consider explicitly the possibility that the protest is successful ex post and forces a policy change; i.e. it is a revolution. In particular, assume that if there is a protest with px participants, with some probability ρpx the policymaker is removed and the policy $\overline{y}$ is adopted, where $\rho \in (0, 1)$. We now let $\delta = d\rho$ and $\beta = b\rho$, where $d \in (0, 1)$ and $b \in (0, 1)$ so that both the policymaker's fear of protest and the agents' hopes are responsive to the probability of removal.

[7] The expected policy and probability of protest are discontinuous at $x = 1/12$ and $\alpha = 0$, since for those values there are multiple equilibria.

The analysis is similar as before; in particular, $y^*(x)$ and $\overline{a}(x)$ are increasing in ρ. Using theorem 2, we can obtain that the equilibrium expected policy (as adopted by the policymaker) is increasing in the probability of removal unless the expected policy is $(\overline{a}(x)-\beta)/\alpha$. This is the case in which the policymaker randomizes between $y^*(x)$ and 0. Intuitively, if d is near zero and b is near one, the increase in the aspirations of agents overwhelms the greater disposition to concede from the policymaker, and equilibrium requires a larger probability of the policy 0. Relying on the solution given by first-order conditions—that is, $y^*(x)$ with probability one—would not allow us to consider this possible trade-off between present expected policy losses versus better revolutionary prospects.

The level of anger $\alpha^*(x)$ derived in corollary 3 is now a lower bound for optimal anger. Intuitively, anger performs a double duty now; it disciplines the policymaker, but it also rallies agents to protest with a possible policy gain. A small increase in anger over $\alpha^*(x)$ still leads to an expected policy outcome of $y^*(x)$ from the policymaker, but leads to a positive probability of protest, which may be desirable for agents if the cost of protest is small enough compared to the probability of a successful revolution.

7.2 Heterogeneous emotions and coordination

To introduce heterogeneous aspiration levels in the model, suppose that idiosyncratic aspirations levels are given by $a_i = \alpha(z^e(\sigma, a) + \gamma_i) + \beta\overline{y}$, where γ_i is distributed uniformly over $[-\overline{\gamma}, \overline{\gamma}]$ for some $0 < \overline{\gamma} < \overline{y}/2$. Suppose for simplicity that $z = y$ so that there is no outcome uncertainty. The payoff for the policymaker is $-\Psi(y) - \delta px$, where

$$p = \min\left(\frac{\max(0, \alpha y^e + \beta\overline{y} + \overline{\gamma} - y)}{2\overline{\gamma}}, 1\right)$$

is now the intensity of the protest. The remainder of the analysis is the same as before, with the distribution of aspirations playing the role of the distribution of outcomes.

Improved coordination of expectations due, for instance, to social media, can be represented by a reduction in the support of idiosyncratic aspiration levels, that is a reduction in $\overline{\gamma}$. If equilibrium is given by first-order conditions—that is, if the expected policy is $[\Psi']^{-1}(\delta x/2\overline{\gamma})$ with probability one—then coordination makes agents strictly better off. If the expected policy is instead $\tilde{y} = (\overline{\gamma} + \beta\overline{y})/(1-\alpha)$, assuming linear emotions, then coordination makes agents strictly worse off. Intuitively, in the former case the policymaker wishes to reduce the intensity of the protest, while in the latter, the policymaker wishes to reduce the probability of protest to zero, so agents benefit of the existence of an avant-garde that is more prone to protest.[8]

7.3 Large uncertainty

For tractability, we have assumed that outcome uncertainty is uniform. Suppose instead that the the distribution of ϵ is normal, with mean at zero; in this case there is large outcome uncertainty in the sense that no matter the policy choice, there is a positive probability of underperforming with respect to the agents' aspiration level and triggering protests. The techniques of the main model can be applied as well, with $\overline{a}(x)$ and $y^*(x)$ being given, as in the uniform model, by the maximum aspiration consistent with a positive policy and the maximum positive policy that is a best response. In particular, for some parameter values, equilibrium involves policy lotteries between $y^*(x)$ and a policy $y_*(x)$ that is close to 0—offering something is better than offering nothing since the marginal cost of policy is zero. As in the accountability model of Duggan and Martinelli [2020], in equilibrium the policymaker mixes between "taking it easy" and "going for broke," to keep the agents' expectations in check.

8 Concluding remarks

Emotions such as anger provide a bargaining tool for groups of citizens who do not have access to other forms of political participation, and are uncertain about the effects of economic policy. We show that the effectiveness of the threat of unrest depends on the size of the group, and, in a nonmonotonic way, on the strength of emotions. If a group is small, or too demanding given its ability to inflict damage, best-responding policymakers will not be swayed by the threat of unrest. If the group grows larger or more disruptive, equilibrium may require policymakers to randomize between making concessions or not, in order to keep the expectations of the group in check. Anger, then, makes concessions less likely in equilibrium. For an even larger or more disruptive

[8]Substitability in protest participation has been note by Cantoni et al. [2019] in a recent field experiment.

group, best-responding policymakers may respond to a calculus involving the marginal cost of policy versus the marginal reduction in the cost of protest in a standard way. If a group is disruptive enough, the policymaker will prefer to make the least necessary policy adjustments to avoid protests altogether, so that anger, up to a point, is beneficial to the group.

The Chilean experience illustrates the relations between aspirations, policy, and characteristics of the dissenting groups. Chile grew rapidly since the market oriented-reforms of the mid 1980s. In spite of impressive gains in poverty reduction and other social indicators, persistent distributive conflicts remained in issues such as school and pension regime. Up until the 2019 riots, however, there was a broad consensus among political elites about public policy. Successive elected administrations since 1990 considered but rejected serious adjustments in areas of disagreement.[9] Early protests, in 2006, were circumscribed and had no impact on policy, in spite of limited aims. Later demonstration grew more massive, louder, and more ambitious.[10] Major political and legislative changes were only unleashed after the demonstrations of 2019. By then, aspirations of those protesting had grown loftier; a constitutional convention, dominated by activists, elaborated a text including more than a hundred social rights. Further political events, including the surprising rejection of the proposed new constitution, have contributed to cool off expectations.

Protests in China during the COVID-19 pandemic followed a different evolution. The zero-Covid measures adopted by the government since early in the pandemic included painful lockdowns and forceful quarantines in public buildings. As policy outcomes fell short of people's expectations, protests by initially small groups of politically involved citizens became inevitable. The potential for larger protests seems to have been a factor motivating the relaxation of zero-Covid policies by December of 2022; larger protests could be very damaging for a regime which partly relies on popular trust for competent policymaking.[11] In terms of our model, the limited aims of those protesting—a return to normalcy–would make it a best response to adjust

[9] See e.g., Edwards [2023].

[10] The dynamics of inequality and discontent is somewhat reminiscent of a classic essay by Hirschman [1973], who contends that inequality can be tolerated and even welcome at first when growth restarts in a stagnant economy as a signal that things start improving, before it sinks in for those who do not benefit as much that they have been left in a sluggish lane.

[11] See e.g., Huang and Han [2022].

policy enough to discourage protests.

Though we focus on the interaction between emotional motivations of potential protestors and rational calculation by policymakers, emotions may also be influential in the behavior of policymakers. Policymakers, for instance may abide by political promises out of guilt aversion (as in Charness and Dufwenberg [2006]) as much as out of fear of angry protests, or they may stubbornly refuse to adjust policies in spite of mounting evidence of failure. Such emotional reactions may be valuable as commitment devices, but, as noted by Schelling [1960], they can also misfire. Psychological game theory may allow to explore more formally these ideas using familiar equilibrium tools.

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