CIVIL LIBERTIES AND SOCIAL STRUCTURE*†

Selman Erol ‡1 and Camilo García-Jimeno §2

[1]Tepper School of Business, Carnegie-Mellon University
[2]Federal Reserve Bank of Chicago

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Abstract

Governments use coercion to aggregate distributed information relevant to governmental objectives –from the prosecution of regime-stability threats to terrorism or epidemics–. A cohesive social structure facilitates this task, as reliable information will often come from friends and acquaintances. A cohesive citizenry can more easily exercise collective action to resist such intrusions, however. We present an equilibrium theory where this tension mediates the joint determination of social structure and civil liberties. Segregation and unequal treatment sustain each other as coordination failures: citizens choose to segregate along the lines of an arbitrary trait only when the government exercises unequal treatment as a function of the trait, and the government engages in unequal treatment when citizens choose to segregate based on the trait. We characterize when unequal treatment against a minority or a majority can be sustained, and how equilibrium social cohesiveness and civil liberties respond to the arrival of widespread surveillance technologies, shocks to collective perceptions about the likelihood of threats or the importance of privacy, or to community norms such as codes of silence.

Keywords: Civil liberties, socialization, segregation, information aggregation, surveillance.

JEL Codes: D23, D73, D85.

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‡Erol: mailto:erol@cmu.edu, 5000 Forbes Avenue, Pittsburgh, PA 15213.

§García-Jimeno: cgarcia@frbchi.org, 230 S. LaSalle Street, Of. 11-226, Chicago, IL 60603.

1 Introduction

Governments often have objectives such as the containment of regime stability threats, or the prosecution of terrorism or epidemic outbreaks. Their pursuit requires aggregating information that is distributed across the citizenry, and governments can exercise coercion to collect this information. Common institutional expressions of this are the intelligence agencies and secret police services of most contemporary states. More recently, many states have begun using digital surveillance tools over their citizens. Courts of law also fulfill this role. Social scientists agree that civil liberties are a key buffer protecting the rights and well-being of the citizenry from these kinds of governmental action.

In this paper we study how concerns about state intrusion, and the limits imposed on it by civil liberties, shape individual socialization choices, and consequently features of the social structure such as the density and distribution of social ties across citizens. Understanding this problem requires a general equilibrium perspective because the social structure in turn shapes the government's ability to aggregate information. In our model, social structure and civil liberties are jointly determined. Our premise is that the government's information aggregation capacity partly depends on the underlying social structure. For example, cohesive societies where individuals are well informed about their acquaintances allow governments to search for information more effectively. Searching for information over a fragmented citizenry, in contrast, makes following clues and extracting accurate information harder.

A variety of scholars have pointed out that governmental coercion and repression result in an erosion of social ties, as citizens respond to the government's exercise of coercion by reshaping their social networks.[1] Discussing the French Revolution, DeTocqueville (1856, p. 5) argued that "Despotism... deprives citizens of... all necessity to reach a common understanding... It immures them... in private life. They were already apt to hold one another at arm's length. Despotism isolated them. Relations between them had grown chilly; despotism froze them." In a similar vein, discussing the Soviet experience Jowitt (1993, p. 304) argued that "The Leninist Legacy in Eastern Europe consists largely... of fragmented, mutually suspicious societies..." By constraining the government's ability to collect information, civil liberties can reshape the underlying social structure. Governments thus face a trade-off: weaker civil liberties standards facilitate information collection but also weaken the underlying social fabric, undermining the quality of the information.

This logic, however, is incomplete. It ignores that civil liberties are an equilibrium outcome dependent on the ability of citizens to get organized, and that a cohesive citizenry

[1] Acemoglu et al. (2017) study network formation when agents have privacy concerns vis-a-vis each other –rather than vis-a-vis a government–. The resulting networks exhibit clustering and homophily.

can more easily exercise such collective action. Besides mediating the effectiveness of the government's information aggregation efforts, the social structure shapes civil liberties by determining the citizens' effectiveness at collective resistance. The recent rise and diffusion of social media exemplifies this tension. Social media has become both a key tool for governments' surveillance (e.g., Qin et al. (2017)), and for citizens' collective action coordination (e.g., Fergusson and Molina (2019); Qin et al. (2022)).

Our model rests on two premises. i) There is a potential threat, and information about it is distributed across the population. ii) While the preferences of citizens and the government are mis-aligned, there is no conflict between citizens. There is a continuum of citizens, for whom socialization is valuable. When people socialize with each other, they learn information about each other. The government exploits those social ties to collect information, interrogating citizens about their acquaintances. It can then arrest individuals perceived as a threat based on the information collected. We consider two main dimensions of civil liberties, as limits on the coercive behavior of the government: an endogenous limit on how many people can be questioned (e.g., a "limit on searches and seizures"), and an exogenous restriction on how strong the evidence against a citizen must be for an arrest to be possible (e.g., a "standard of proof").[2] Civil liberties, as a buffer between the government and civil society, are often seen as an attempt to compromise between the conflicting objectives of prosecuting potential threats and protecting citizens from state intrusion. The Bill of Rights of the U.S. Constitution, for example, imposes restrictions on the government's ability to undertake searches and seizures and on the use of cruel punishments, and imposes minimal requirements for prosecution in the form of probable cause, Miranda rights, or varying degrees of evidentiary standards of proof. Indeed, our model can capture a variety of threats: terrorism threats, an epidemic, subversive threats, or imaginary threats such as a witch hunt. Faced with the prospect of being perceived as a threat, citizens make socialization choices. Finally, we model society's ability to resist coercion with a contagion technology that depends on the strength of citizens' underlying 'civic values', which we take as exogenous, and more importantly, on features of the endogenous social structure.

A key trade-off shapes citizens' socialization efforts: while social ties are intrinsically valuable, the government collects better information about citizens with more ties. Weak

[2]Experiences abound where coercion and intrusion are used for information aggregation purposes. The medieval witch hunts in Europe (Briggs (1996); Johnson and Koyama (2014); Roper (2004)), the Salem witch hunt of 1692 (Godbeer (2011)), the Spanish Inquisition (Hassner (2020); Langbein (1977)) or Stalin's, Mao's, and Pinochet's purges are all well documented. Another example is Senator McCarthy's persecution of alleged communism sympathizers in the 1950s (Klingaman (1996); Oshinsky (1983)). In the US, intelligence agencies were allowed to use water boarding for terrorism suspect interrogations following 9/11. Also, advanced information-verification technologies involving massive databases are now deployed to track unlawfully present immigrants in the US (Ciancio and García-Jimeno (2022)).

civil liberties exacerbate this trade-off by increasing the cost of becoming a subject of interest to the government. To prevent the government from learning about them, citizens reduce the intensity of their socialization. The citizens' response brings about a commitment problem for the government: at the interim stage after citizens have socialized, more intensive interrogation allows more information collection. Ex-ante, citizens' expectations of aggressive interrogation weaken their socialization incentives. Such erosion of social ties weakens the information aggregation ability of the government. Strong civil liberties both protect citizens, and are a valuable commitment device for the government. Weak civil liberties make friendships scarce and the government unable to aggregate information effectively.

In general equilibrium, prevailing civil liberties and social structure are jointly determined. We model the constraint on the government's information collection capacity as pinned down by societal resistance to excessive intrusion. Resistance is mediated by the ease with which collective action against the government spreads in the population, which in turn depends both on the underlying strength of society's 'civic values', and on the density of social ties across citizens. While expectations of low levels of intrusion benefit the government by giving citizens incentives for socialization, facilitating information collection, the resulting cohesive social structure makes collective action more effective, making it harder for the government to interrogate widely without triggering a collective action response from citizens. The government's strategic problem involves optimally mediating this trade-off.

The focus of our analysis is a setting where citizens vary along a payoff-irrelevant but observable dimension (e.g., a group trait). The likelihood of threat membership is orthogonal to the trait, and citizens' payoff from befriending others does not depend on the trait either. We allow for asymmetric strategies, however, under which the government can condition its interrogation choices, and citizens can condition their socialization efforts, on this trait. This allows the government weaken social cohesion by altering the socialization incentives of citizens, who may prefer to segregate (i.e., choose different in-group and cross-group socialization efforts). We refer to an equilibrium under which the government interrogates citizens with different traits at different rates as one exhibiting *unequal treatment*.

We show that in the absence of in-group biases in citizens' socialization preferences, and in the absence of ex-ante government favoritism towards any group, multiple equilibria with unequal treatment (different standards of government intrusion across groups) and segregation (different rates of socialization across groups) exist.[3] Socialization decisions by citizens

[3]In Mukand and Rodrik (2020), when a minority facing the threat of coercion happens to be pivotal within the political bargain between the elite and the majority, civil liberties protections arise as part of the social bargain. From a different angle, Lagunoff (2001) proposes a theory of civil liberties where a majority refrains from imposing restrictive legal standards towards behaviors preferred by a minority when there can be errors in the interpretation of the symbolic content of behavior that could lead to punishment of members

are responsive to the governments' asymmetric treatment of them. This is because forming friendships with citizens who are targets of government interrogation is costly. As a result, unequal treatment equilibria exhibit social segregation.[4] These equilibria are sustained by self-fulfilling beliefs. An expectation of unequal treatment is necessary for citizens to segregate, and a segregated social structure is necessary for the government to find unequal treatment profitable.[5]

Unequal treatment equilibria represent coordination failures from the citizens' perspective. Coordination failure results from two externalities: first, a citizen who socializes more intensely increases the mass of friends of other citizens, making it more likely that the government receives information about them. Second, a citizen who socializes more intensely facilitates contagion of social resistance, tightening the collective action constraint faced by the government. Unequal treatment equilibria coexist with an equal treatment equilibrium where all players ignore the trait. The equilibria with unequal treatment, however, are robust: whenever they exist, they are the unique strict equilibria. All citizens are hurt by unequal treatment, including those experiencing better treatment. The government, in contrast, can be strictly better off under unequal treatment, but only when equal treatment would entail high levels of social cohesiveness.[6]

The model yields qualitative predictions about the resulting social structures, the extent of unequal treatment, and the distribution of traits required to sustain unequal treatment. When the minority (the group with the least prevalent trait) is relatively large and incentives for socialization are relatively weak, society segregates completely. In this case, cohesiveness (as measured by citizens' average degree) and segregation covary positively. When the minority is relatively small and incentives for socialization are relatively strong, there is partial

of the majority. In these and papers, political conflict between minorities and majorities is at the heart of the emergence (or not) of civil liberties. We take a different approach, suggesting that civil liberties mediate the conflict between citizens and governments with mis-aligned preferences over information aggregation, and show that endogenous social cleavages can emerge.

[4] Thus, our study also relates to the literature on socialization and segregation (e.g., Akerlof (1976); Alesina and LaFerrara (2000); Bisin and Verdier (2011); Lang (1986); Schelling (1969)). Most of this literature explores the relationship between patterns of socialization and culture or individual preferences. Instead, we focus on how these relate to political institutions and the behavior of the state. Related literature exploring the relationship between socialization and social capital includes Letki (2008); Putnam (2007).

[5] The unequal treatment here is reminiscent of the literature on labor market discrimination. Lang and Khan-Lang (2020) argue that while most of it has focused on either taste-based or statistical discrimination, "[The] idea of discrimination as a system is not easy for economists to address. Developing truly general equilibrium models is difficult, especially when the endogenous variables go beyond prices and quantities" (p. 85). Our model is one attempt to take on this challenge.

[6] In Weingast (1997), coordination failures can also impede the emergence of the 'rule of law'. The nature of this coordination failure, however, is different to the one here. There, the government can make an agreement with one group whose support it needs, allowing it to mis-treat the other group. There is coordination failure because both groups could be better of if they agreed on ousting the ruler.

segregation, and cohesiveness and segregation covary negatively. We also find that there is more unequal treatment (in the sense that the difference in interrogation rates across groups is larger) in partially segregated societies than in fully segregated ones. This is because preventing contagion of social resistance is harder in a society where there is some cross-group socialization, forcing the government to reduce the interrogation rate on the more favorably treated group. In the equilibria with unequal treatment the extent of segregation is pinned down by the socialization efforts of the more favorably treated group. Finally, we find that in equilibria leading to both fully or partially segregated societies, the government will prefer to target the largest group for unfavorable treatment unless the majority is so large that targeting it would be sufficient to make the social resistance constraint bind.

We explore a few extensions. First, we present a more general version of the model where the prior likelihood of threat membership is different for citizens with different traits. While the benchmark version of our model allows us to show the possibility of unequal treatment and segregation despite the payoff-irrelevance of the trait, the government has strong incentives to unfavorably treat the larger group. The more general model, in contrast, can rationalize equilibria with isolated and unfavorably treated minorities. Second, we explore an alternative micro-foundation for the government's ability to extract information, where the nature of social ties may matter for its ability to interrogate effectively. For example, social norms such as Banfield (1958)'s *amoral familism* among Southern Italians, or the well-known codes of silence of the mafia (see Servadio (1976)), would suggest that a government will be ineffective at extracting accurate information from people who can sustain social norms of this kind. In this extension community enforcement of a norm not to disclose information to the government can be sustained through common friendships between citizens.

Our results highlight that civil liberties can sustain social cohesion. We are not the first suggesting a relationship between coercion and the erosion of trust (see Badescu and Uslaner (2003); Traps (2009) in the context of Eastern European countries under communist regimes, or Nunn and Wantchekon (2011) in the context of the slave trade in tropical Africa). Our model suggests, however, a novel nexus between social structure and unequal treatment by the government. It also that highlights how features of the informational environment are key mediators between citizens' willingness to socialize and the state's ability to exercise coercion over them. We discuss how different dimensions relevant to the informational environment shape equilibria. The increasing use of real-time monitoring technologies by governments (video-cameras, social media tracking, large databases, etc.) makes these comparative static results particularly relevant. Moreover, our model highlights the endogenous and dual role of the social structure, both as a component of the government's information aggregation technology and as a determinant of society's ability to resist coercion.

2 Environment

We consider a static economy with a mass 1 of citizens who make socialization efforts leading to friendships. Friendships are valuable, but also allow citizens to (imperfectly) learn information about each other. After citizens form friendships, they may exogenously become members of a threat. The government tries to learn which citizens are members of this threat by interrogating them about their friends. Civil liberties and civil resistance limit the government's ability to interrogate citizens and to subsequently arrest those who are deemed likely members of the threat.

In subsection 2.1 we provide a broad description of the environment. The formal model is presented more concisely in subsection 2.2.

2.1 Preliminaries

2.1.1 Preferences and Socialization Efforts

Citizen $i \in S = [0, 1]$ chooses private socialization strategy $p_{ij} \in [\underline{\rho}, 1]$ towards all other citizens j, where $\underline{\rho} > 0$. For each pair of citizens i and j, a friendship is formed between them with probability $p_{ij}p_{ji}$. Ties are drawn independently across pairs of citizens.[7] We write $e_{ij} = 1$ if a friendship is formed, and $e_{ij} = 0$ otherwise. As a result, the realized *degree* of citizen i will be:[8]

$$d_i = \int_{j \in S} e_{ij} \mathtt{d}j = \int_{j \in S} p_{ij} p_{ji} \mathtt{d}j. \tag{1}$$

After friendships are realized, each citizen independently becomes member of a threat with probability χ.[9] We denote by T the set of citizens who belong to the threat, so that

[7] Golub and Livne (2010) model socialization choices in a similar vein in a network formation model where not only direct links but also higher order connections are valuable.

[8] We restrict the action set to $(p_{ij})_{j \in S/i}$ such that $f_i(j) \equiv p_{ij}$ is a measurable function. $f_{ii}(j) \equiv p_{ij}p_{ji}$ does not need to be integrable as a function of j, however. Throughout the paper we focus on symmetric strategy equilibria (across subsets of citizens), so all integrals that follow are well defined. To encompass the general case without restriction to any subset of equilibria, all integrals can be changed to lower integrals. In general each citizen i can choose a mixed strategy in $\Delta([\underline{\rho}, 1]^{S/i})$. The only payoff relevant aspect of i's strategy is the realized degree d_i. As it will be clear later, i's best reply, in equilibrium, must always entail a deterministic d_i even under alternative socialization rates over his peers. Thus, we simplify the exposition focusing on pure strategies. This is without loss of generality for the resulting network structure and payoffs.

[9] Assuming the threat is realized only after socialization decisions are made implies socialization strategies will not depend on membership status. This is inconsequential when the government cannot observe citizens' realized degree: citizens don't value links based on threat membership directly, and the government is unable to target citizens based on their degree. If the government could observe citizens' degree, in the resulting asymmetric information game threat members would need to play a pooling socialization strategy; otherwise, their differential degree would reveal their type.

$$\lambda(T) = \chi \tag{2}$$

is the measure of the threat set.[10] We also suppose that each citizen, regardless of threat-membership status, receives information about each of his friends, as we will describe below. Citizens value friendships and incur a cost if arrested according to the payoff function

$$U_i = \sqrt{d_i} - \kappa \mathbb{1}_{i \in A}, \tag{3}$$

where A denotes the set of arrested citizens.[11] Although in (3) κ is a utility parameter, it may also be interpreted as partly reflecting the civil liberties standards of this economy. The Eight Amendment to the US Constitution, for example, directly bans excessive bail and fines, and forbids cruel and unusual punishments.

The government, on the other hand, cares about prosecuting the potential threat. Here we assume its payoff function is simply

$$V = \lambda(A). \tag{4}$$

Under (4), the government cares only about the mass of citizens arrested. It does not face a cost from arresting non-threat members. This payoff function can be interpreted as a reduced-form of a micro-founded objective where the government cares about regime survival, for example, if regime survival depends positively on the mass of arrests of threat members. The government can undertake two actions: first, it selects a subset of citizens for interrogation. We denote by N the set of citizens brought forth for interrogation. Second, once interrogations have happened, it selects a subset of citizens to arrest. Neither set needs to be a subset of the other. We interpret the interrogating and arresting limits faced by the government as reflecting the extent of civil liberties in place.

2.1.2 Institutions and Technologies

To prosecute a threat the government needs to aggregate information distributed across the citizenry. Technologies, institutions, and the underlying social structure all shape the information aggregation process. Exploiting the social network of friendships, the government

[10]Throughout, $\lambda(X)$ denotes the measure of set X.

[11]For simplicity we do not allow for a cost of being interrogated, but this is without loss of generality. Citizens could also directly value the prosecution of the threat (e.g., if it is a terrorist threat or an epidemic). Because each citizen is infinitesimal, their individual actions do not affect any aggregates, and any such additional component of their payoff will not affect their optimal behavior.

interrogates some citizens to collect information about other citizens[12] and uses the gathered information to subsequently target citizens for arrest.[13] The scope of arrests, in turn, can also be limited by rules. We first describe the information aggregation technology for a given set of interrogated citizens, and then describe the limits on arrests and interrogations.

Information aggregation The government has access to an information aggregation technology it employs over interrogated citizens. For simplicity, we suppose it operates as follows: each citizen j in the interrogation set $N \subseteq S$ generates a clue about each of his friends. As a result, the government receives a measure s_i of clues about citizen i:

$$s_i = \int_{j \in N} e_{ij} \mathtt{d} j. \tag{5}$$

The government then receives a binary signal θ_i about i's membership in the threat with precision proportional to s_i. We suppose that

$$\begin{aligned} \sigma_0(s_i) &\equiv \mathbb{P}(\theta_i = 1 | i \notin T, s_i) = a - b s_i \\ \sigma_1(s_i) &\equiv \mathbb{P}(\theta_i = 1 | i \in T, s_i) = a + b s_i, \end{aligned} \tag{6}$$

where $a, b > 0$, $b < a < 1$, and $a + b < 1$. Larger values for b imply more efficient information aggregation.[14] This information structure satisfies the monotone likelihood ratio property. The government will learn more accurately the type of a citizen who had a larger fraction of his friends interrogated. Under this technology, governments facing more cohesive social structures–as measured by citizens' average degree–, can aggregate information more effectively. Moreover, interrogated citizens cannot provide, on average, misleading information to the government. This may capture the idea that most governments rely on specialized bureaucracies that can corroborate information obtained from citizens using a variety of

[12]For simplicity we will assume that a citizen does not provide evidence about himself, only about his friends. This could, for example, follow from an existing right not to testify against oneself. In the context of an epidemic, what we call interrogations can take the form of, for example, 'contact tracing'.

[13]In the Spanish Inquisition context, for example, (Hassner, 2020, p. 2) discusses "... how information provided under torture by one detainee led to the arrest, interrogation, or torture of others in their network".

[14]The nature of the threat (e.g., terrorism, an epidemic, a subversive opposition, etc.) can shape some features of the information aggregation technology (σ_0, σ_1). For example, during medieval witch trials, a simple rumor might suffice to convince a prosecutor or community, of the guilt of an alleged witch. In a terrorism context, a weak civil liberties environment that allows the use of torture during interrogations may lead to inefficient information aggregation: confessions extracted through physical coercion are often unreliable. Baliga and Ely (2016), for example, show that prosecutors allowed to use torture face commitment problems so that ex-post it is hard for them not to rely on it even if ex-ante relinquishing its use is more likely to lead to valuable information collection.

surveillance technologies, for example.[15] It does rule out other mechanisms through which citizens may resist the government's use of the social network to aggregate information.

After observing the realized signals for each citizen, the government updates its beliefs using Bayes' rule. χ_i denotes the posterior belief that $i \in T$, after observing $\theta_i = 1$:

$$\chi_i \equiv \mathbb{P}(i \in T | \theta_i = 1, s_i) = \left(1 + \frac{1-\chi}{\chi} \frac{\sigma_0(s_i)}{\sigma_1(s_i)}\right)^{-1}. \tag{7}$$

We incorporate civil liberties into our model as (possibly endogenous) restrictions on the government's ability to interrogate and arrest citizens.

Limits on Arrests We suppose that the government faces a lower bound $\underline{\chi}$ 'standard of proof', so that only citizens with posterior above $\underline{\chi}$ can be arrested. This civil liberty restriction is drawn from a uniform distribution

$$\underline{\chi} \sim U\left[\chi, \overline{\chi}\right], \tag{8}$$

with $0 < \chi < \overline{\chi} < 1$ so that the 'standard of proof' is subject to some ex-ante uncertainty.[16] It captures the idea that societies may require minimum levels of evidence to allow an arrest or a conviction, for example through probable cause or varying degrees of standards of proof. Its uncertainty can reflect the margin of leeway that judges or courts often have in interpreting a given legal standard. The lower bound on the uniform distribution being the prior simply rules out 'blind arrests': the government cannot arrest citizens based on the prior alone. Moreover, Bayesian updating implies that citizens for whom a signal $\theta_i = 0$ is realized cannot be arrested either, as the posterior over them will fall below the prior. Higher values of $\overline{\chi}$ imply stronger expected civil liberties' protections, while $\overline{\chi} < 1$ ensures there will always be some posterior evidence convincing enough to warrant an arrest. We will maintain the following assumption:

Assumption 1.

$$\overline{\chi} > \left(1 + \frac{1-\chi}{\chi} \frac{a-b}{a+b}\right)^{-1}.$$

This inequality implies that all feasible posteriors following a signal $\theta_i = 1$ are in the support of $\underline{\chi}$. Upon updating its beliefs about every citizen, the government makes arrests.

[15] Facing this technology, a government that could observe citizens' degree would have incentives to target highly connected individuals for interrogation. Here we rule out this possibility by assuming that the government does not observe citizens' degree at the time of deciding whom to interrogate.

[16] The randomness in $\underline{\chi}$ simply allows us to smooth out a discontinuity in the citizens' payoff function arising when citizens can perfectly predict a threshold level of civil liberties. The discontinuity gives rise to an uninteresting equilibrium where citizens chose a level of socialization just below the discontinuity.

Limits on interrogations We now describe interrogations. Governments face limits on their ability to interrogate citizens or collect evidence through, for example, search and seizure restrictions. We argue that social structure shapes society's ability to limit governmental intrusion. Thus, we propose a network-based micro-foundation for the emergence of an endogenous constraint on it.[17] After socialization choices are realized, the government can interrogate as many citizens as it wants. Excessive interrogation, however, generates a response from civil society in the form of a protest or riot, based on a simple form of contagion across citizens. This form of backlash will set a limit on the government's willingness to interrogate indiscriminately. This echoes the idea that effective coordination, in the form of collective action, allows citizens to pose credible threats to the survival of governments that violate expected limits on its behavior (Weingast (1997)).[18] Crucially, the density of friendships across citizens mediates the contagiousness of collective action.[19]

Citizens become 'reactive' over rounds of contagion, and we suppose the interrogated citizens are the seed of the contagion process (e.g., Erol et al. (2020); Morris (2000)).[20] A citizen who observes more than share ψ of his friends be reactive, becomes reactive himself into the next round.[21] Denoting R_t as the set of reactive citizens in step t, with $R_0 = N$, the contagion dynamics are given by

$$R_t = R_{t-1} \cup \left\{ i \in [0,1] : \int_{j \in R_{t-1}} p_{ij} p_{ji} \mathtt{d}j > \psi d_i \right\}.$$

Because lower values of ψ require fewer reactive friends for contagion to spread across social

[17] We choose to make endogenous the limit on interrogations rather than the standard of proof as this leads to a more tractable model. This choice, however, provides us with an exogenous model parameter, namely χ, that allows us to ask comparative statics questions related to other characteristics of government coerciveness that one may still want to consider exogenous to the model.

[18] The literature on collective action, for example, points out that group features such as its size, ethnic or demographic homogeneity, social connectedness, etc., are key determinants of participation in community activities, political engagement, and public goods provision (see Alesina and LaFerrara (2000); Banerjee et al. (2008); Chay and Munshi (2015); Dippel (2014)).

[19] Scholars of the Soviet Union have illustrated how social cohesiveness was a key constraint on state coercion: facing the threat of a strong civil society, the regime focused its efforts on co-opting all forms of social organization: "Autonomous social organization was ... replaced by state-administered apparatuses that coordinated the behavior of ... trade unions, professional associations, youth groups, the mass media, the education system, and even, at the high point of totalitarian aspirations, leisure-time clubs" (Bernhard and Karakoc, 2007, p. 545-6).

[20] Recent empirical studies provide evidence of the importance of social network ties in fostering the spread of collective action (e.g., García-Jimeno et al. (2022)).

[21] In our model civic engagement as captured by ψ, is exogenous. Naturally, in practice it is likely to respond to the government's exercise of coercion and to society's cohesiveness. For example, Bautista (2016) documents how Chilean citizens who suffered human rights abuses as young adults under the Pinochet dictatorship report low political engagement thirty years later. In the Soviet context, Jowitt (1993) similarly argued that "The population at large viewed the political realm as something... to avoid" (p. 288).

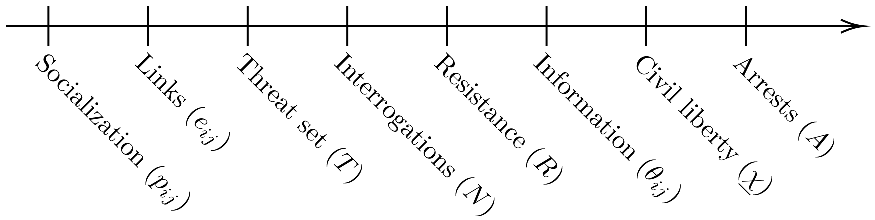


Figure 1: Timeline of Events. The figure illustrates the timing of events in the baseline game.

ties, ψ can be interpreted as an (inverse) measure of the strength of civic values. Societies with smaller values of ψ are ones where citizens are more easily persuaded to engage in collective action. The set of citizens who eventually become reactive is[22]

$$R_* = \cup_{t \geq 0} R_t$$

If fraction ν of society eventually becomes reactive, citizens engage in a form of collective action (riot) that, for simplicity, we suppose prevents the government from undertaking any arrests. Thus, the *no-riot constraint* (NRC) is

$$\lambda(R_*) \leq \nu. \tag{NRC}$$

ν allows us to parametrize the strength of the government vis-a-vis the citizens. When ν is large, even large numbers of reactive citizens are insufficient to prevent the government from engaging in intrusive behavior.

Throughout we assume $\nu \in [\psi, 1)$. If $\nu = 1$, (NRC) would never be violated. We also rule out $\nu < \psi$ because in that range there would either be no contagion, or any measure of interrogations would directly induce the riot even without contagion. If the riot takes place, the government cannot make any arrests and its payoff is zero. Because the government can always satisfy (NRC), in any equilibrium this constraint will be satisfied. Thus, without loss of generality we will treat the (NRC) as a constraint on the government's choice set.

2.2 Model

Given the information aggregation technology (a, b), the prior threat perception χ, standard of proof $\overline{\chi}$, citizen's disutility of arrest κ, civic values ψ, and relative government strength ν, the timeline of events, shown in Figure 1, is as follows:

[22] Under the restriction to symmetric strategies (within subsets of citizens) that we will make explicit below, R_t is measurable for all t. The countable union of measurable sets is also measurable, so R_* is measurable as well.

1. Each citizen $i \in S$ chooses socialization efforts $(p_{ij})_{j\in S}$, and friendships e_{ij} are formed as described in (1).
2. Nature chooses the threat set T uniformly at random according to (2).
3. The government chooses the set of citizens to interrogate, $N \subseteq S$, satisfying (NRC).
4. The government observes signals θ_i according to (5) and (6), the standard of proof $\underline{\chi}$ is realized according to (8), and the government arrests the set A of citizens whose posterior in (7) exceeds $\underline{\chi}$.

We are now ready to define an equilibrium of this economy.

Definition 1. An equilibrium is a collection $\left(((p_{ij})_{j\in S})_{i\in S}, N\right)$ such that

1. $(p_{ij})_{j\in S}$ maximizes citizen i's expected payoff (3) given $((p_{jj'})_{j'\in S})_{j\in S/i}$ and N.
2. N maximizes the government's payoff (4) given $((p_{ij})_{j\in S})_{i\in S}$.

3 Unequal Treatment and Social Segregation: Equilibria under Group-symmetric Strategies

In many societies *unequal treatment* is pervasive: equally situated citizens are treated differently by the government or the law. Our main analysis proposes a novel relationship between social segregation and unequal treatment, in the context of the environment we posited above. As we will show here, they sustain each other in equilibrium. We do this focusing on group-symmetric strategies, where groups are defined by a payoff-irrelevant trait.[23]

The density of social ties across the citizenry mediate in two ways the government's ability to aggregate information. First, a cohesive society allows the government to aggregate information more effectively because each interrogated citizen can provide information about more citizens. Second, in cohesive societies collective action may more easily galvanize in response to intrusion by the government. This creates a tension between the government's ex-ante and the ex-post incentives. Whereas for a given social structure the government benefits from weak civil liberties that allow widespread information collection, before citizens have made their socialization decisions expectations of strong civil liberties lead to more intense socialization that results in more efficient information aggregation.

Because societal resistance spreads through contagion via social ties, and citizens' socialization choices respond to beliefs about interrogation intensity over peers, an asymmetric

[23] Equal treatment under the law can itself be considered a type of civil liberty. Indeed, it was arguably the prime concern of the Civil Rights movement in the US, and is also addressed in the US Constitution.

strategy that treats subsets of citizens differently can allow the government to relax the (NRC) and ease this trade-off. The expectation that the government will target a subset of the population with a high interrogation rate, for example, should decrease the willingness of citizens to socialize with that group, as it becomes costly to be friends with citizens likely to reveal information about you. The erosion of social ties can in turn undermine the effectiveness of contagion, relaxing the (NRC), allowing the government to fulfill the expectation. The government trades off the erosion of social ties implied by such interrogating behavior, against the increased interrogation rate it can afford under the consequently relaxed (NRC). We formalize this intuition showing that group-symmetric equilibria with unequal treatment exist. We also discuss their properties and implications over social structure.

Definition 2. Given an partition of S into two sets $\mathcal{G} = \{\mathcal{A}, \mathcal{B}\}$, where $\lambda_G \equiv \lambda(G)$ denotes the measure of group $G \in \mathcal{G}$, a strategy profile is called $\mathcal{G}$-group symmetric if for some $(p_{AA}, p_{AB}, p_{BA}, p_{BB})$, for any $i \in G \in \mathcal{G}$ and any $j \in H \in \mathcal{G}$, $p_{ij} = p_{GH}$. An equilibrium is called $\mathcal{G}$-group symmetric if:

- The strategy profile of citizens is $\mathcal{G}$-group symmetric.
- The government interrogates uniformly at random within each group: any citizen in $G \in \mathcal{G}$ is interrogated independently with probability t_G.

A partition $\mathcal{G}$, for example, could be induced by an observed and immutable characteristic that is payoff irrelevant (it is independent of threat membership, and for all citizens, the utility from forming friendships with members of either group is the same).

3.1 The Government's Problem

We first characterize the optimal arresting behavior, which takes place after the standard of proof has been drawn, and the optimal interrogation behavior, which takes place after citizens have made their socialization decisions and the threat set has been drawn. The government wants to maximize the number of arrests. Accordingly, it will want to arrest any citizen whose signal is $\theta_i = 1$, regardless of the signal's precision. This in turn implies that conditional on $\theta_i = 1$, the government's arresting strategy is easily characterized: an arrest happens if and only if $\chi_i > \underline{\chi}$.

Taking a step back, the government chooses possibly different interrogation rates $t_{\mathcal{A}}$ and $t_{\mathcal{B}}$ for each group. Because the government gets a payoff of zero if contagion across all of society happens, it will avoid choosing interrogation rates that lead to full contagion.

Proposition 1. *For* $\{G, H\} = \{\mathcal{A}, \mathcal{B}\}$*, define*

$$\tilde{t}_G \equiv min\left\{1 - \frac{1-\nu}{\lambda_G}, \psi - (1-\psi)\frac{p_{GH}p_{HG}}{p_{GG}^2}\frac{\lambda_H}{\lambda_G}\right\}.$$

Under any group-symmetric strategy profile played by citizens, the government's optimal action is one of the three possibilities below:

1. Unequal treatment towards A*: interrogate all members of* A *and interrogate as many members of* B *as possible without violating (NRC). This is,* $t_A = 1$*,* $t_B = \tilde{t}_B$*.*

2. Unequal treatment towards B*: interrogate all members of* B *and interrogate as many members of* A *as possible without violating (NRC). This is,* $t_B = 1$*,* $t_A = \tilde{t}_A$*.*

3. Equal treatment: interrogate citizens uniformly regardless of group $t_A = t_B = \psi$*.*

Proposition 1 describes necessary features of the government's optimal behavior given the realized pattern of socialization of citizens. To understand it, consider the government's interim expected payoff after citizens have socialized at rates $\mathbf{p} = (p_{\mathcal{AA}}, p_{\mathcal{AB}}, p_{\mathcal{BA}}, p_{\mathcal{BB}})$. It's expected payoff $\mathbb{E}_{\underline{\chi}}[V]$ is proportional to

$$\widetilde{V} = \left(\lambda_{\mathcal{A}}^2 p_{\mathcal{AA}}^2 + \lambda_{\mathcal{A}}\lambda_{\mathcal{B}}p_{\mathcal{AB}}p_{\mathcal{BA}}\right) t_{\mathcal{A}} + \left(\lambda_{\mathcal{B}}^2 p_{\mathcal{BB}}^2 + \lambda_{\mathcal{A}}\lambda_{\mathcal{B}}p_{\mathcal{AB}}p_{\mathcal{BA}}\right) t_{\mathcal{B}},$$

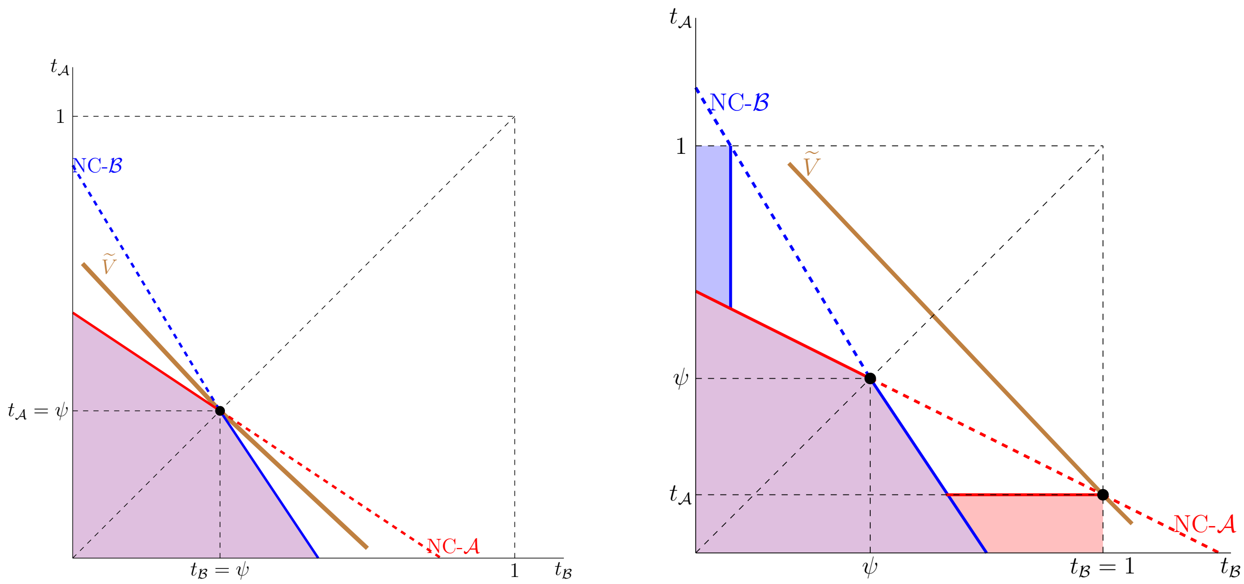
which is linear in both interrogation rates, with slopes that depend on the average degree of citizens of the corresponding group. The degree of $\mathcal{A}$ citizens, for example is $\lambda_{\mathcal{A}} p_{\mathcal{AA}}^2 + \lambda_{\mathcal{B}} p_{\mathcal{AB}} p_{\mathcal{BA}}$. The indifference contours are straight lines.

In a setting with two groups and symmetric strategies *within* group, the contagion dynamics are simple: either there is no contagion so only the interrogated group is reactive, there is contagion among all citizens of only one group, or there is contagion of all citizens. Thus, to characterize the government's problem it is useful to consider the constraints that determine whether there is contagion within in each of the groups. We define Γ_g recursively as the fraction of reactive citizens in group g, when the group experiences interrogation rate t_g. This is equal to the mass of interrogated citizens from that group, t_g, if the no-contagion constraint holds for the group, and it is 1 otherwise:

$$\Gamma_g \equiv \begin{cases} t_g & \text{if NC-g holds} \\ 1 & \text{otherwise} \end{cases}$$

The no-contagion constraint for group $G \in \{A, B\}$ takes the form

$$\lambda_G p_{GG}^2 t_G + \lambda_H p_{GH} p_{HG} \Gamma_H \leq \psi\left(\lambda_G p_{GG}^2 + \lambda_H p_{GH} p_{HG}\right). \qquad \text{(NC-}G\text{)}$$



(a) Interior (equal treatment) **(b) Corner (unequal treatment)**

Figure 2: Government's Best Response: The figure illustrates the optimal choice of interrogation rates by the government for fixed socialization rates. Panel (a) represents the case in which the optimum entails no contagion on either group, and equal treatment. Panel (b) represents the case in which one group experiences contagion and there is unequal treatment. The brown lines labeled $\widetilde{V}$ represent the highest indifference curves that satisfy the constraint set. The red and blue curves represent the no-contagion constraints for groups $\mathcal{A}$ and $\mathcal{B}$.

The left-hand side represents the mass of reactive citizens with whom a citizen from group G has a social tie. This includes all his interrogated friends from group G, $\lambda_G p_{GG}^2 t_G$, and all his reactive friends from group H, $\lambda_H p_{GH} p_{HG} \Gamma_H$. This citizen will not become reactive himself if this is not larger than fraction ψ of all his friends.

The government must ensure the total mass of reactive citizens does not exceed ν, and thus, that at least one of the no-contagion constraints holds. Otherwise, contagion across all citizens would occur. Thus, the government's best reply to a given $\mathbf{p} = (p_{\mathcal{AA}}, p_{\mathcal{AB}}, p_{\mathcal{BA}}, p_{\mathcal{BB}})$ is the solution to:

$$\mathbf{t}(\mathbf{p}|\psi, \nu, \lambda_{\mathcal{A}}) = \underset{(t_{\mathcal{A}}, t_{\mathcal{B}}) \in [0,1]^2}{\operatorname{argmax}} \widetilde{V}$$

subject to

$$\Gamma_{\mathcal{A}} \lambda_{\mathcal{A}} + \Gamma_{\mathcal{B}} \lambda_{\mathcal{B}} \leq \nu. \tag{NRC$'$}$$

This is a linear programming problem: the objective is linear in $(t_{\mathcal{A}}, t_{\mathcal{B}})$, and the constraint set is piece-wise linear as well. The slope of the indifference curves is a weighted average of the slopes of the no-contagion constraints when neither group experiences contagion.

Figure 2 illustrates the government's optimization problem. In panel (a), citizens' socialization rates are such that neither of the no-contagion constraints can be violated without triggering contagion on the other group. In this case, the constraint set is convex with a kink at (ψ, ψ), making *equal treatment* the unique best response (case 3 of Proposition 1). Note that (ψ, ψ) is always a feasible choice that avoids contagion in both groups. In the case represented in panel (b), in contrast, citizens' socialization rates make it possible to violate only one of the no-contagion constraints. When the government chooses a high enough interrogation rate for group $\mathcal{B}$ citizens such that this group experiences contagion, for example, (NC-B) becomes a horizontal line, and the constraint set is non-convex. Symmetry within a group implies that if contagion happens within the group, the whole group becomes reactive. In such case it must be optimal for the government to interrogate all citizens of the group. It follows that the unique optimum entails a corner solution with *unequal treatment*, where $t_{\mathcal{B}} = 1$. In this case (NC-A) and (NRC$'$) coincide. Accordingly, $t_{\mathcal{A}} = t^*_A$ is sufficiently low that (NC-A) exactly binds and a second round of contagion is prevented (cases 1 and 2 of Proposition 1).[24] The expression for $\tilde{t}_G$ in the proposition reflects the non-negativity of the interrogation rates, and a binding (NC-G).

The extent of unequal treatment depends on the intensity of cross-group socialization relative to within-group socialization of the more favorably treated group. Lower socialization efforts across groups make it easier for the government to satisfy (NC-G), allowing it to impose a larger interrogation rate on the more favorably treated group. Thus, a more segregated society enhances the government's ability to implement worse civil liberties. Relative group sizes are also a key determinant of the feasibility and extent of unequal treatment. Holding socialization rates constant, when the unequally treated group is smaller, the government can afford a higher interrogation rate for the favorably treated group. Finally, a stronger civil society (lower ψ) forces the government to chose a more favorable interrogation rate toward the favorably treated group. Note this *increases* the extent of inequality in treatment across groups.

3.2 Citizens' Socialization Decision

We now describe the citizens' socialization choices. Under group-symmetric strategies, citizens can choose different in-group and out-group socialization efforts, that depend on beliefs about the subsequent government interrogating behavior $(\tau_{\mathcal{A}}, \tau_{\mathcal{B}})$, and on other citizens' socialization efforts. Optimal effort choices, which maximize the expected utility in (A.1), are shaped by the trade-off between a higher degree (more friendships) and a higher risk that the government will learn more information about the citizen through his increased

[24] In the non-generic case in which contagion on only one group is feasible and the slope of the indifference curves $\widetilde{V}$ is such that an indifference curve passes through both the intersection of (NC-A) with $t_{\mathcal{B}} = 1$, and of (NC-B) with $t_{\mathcal{A}} = 1$, the government's best reply is not unique (it has two elements).

connections.[25] The trade-off is mediated by

$$\omega \equiv \frac{\overline{\chi} - \chi}{2b(\chi(1-\overline{\chi}) + \overline{\chi}(1-\chi))\kappa} > 0, \tag{9}$$

a reduced-form parameter that depends on the underlying information aggregation technology and the dis-utility of being arrested. Larger values of ω increase the marginal benefit of socialization. An increased informative of signals, b, for example, reduces ω. A higher upper bound for the standard of proof, $\overline{\chi}$, which reduces the likelihood that a positive signal can turn into an arrest, increases ω.

Straightforward first order conditions from (A.1) with respect to the socialization efforts yield citizens' best responses to each other. Further imposing symmetry within groups, for citizens from group $\mathcal{A}$ we have:

Proposition 2. *When citizens believe the government will interrogate citizens of groups $\mathcal{A}$ and $\mathcal{B}$ at rates $\tau_{\mathcal{A}}$ and $\tau_{\mathcal{B}}$, their best replies satisfy*

$$p_{\mathcal{AA}} = \left[\!\left[\frac{(\omega/\tau_{\mathcal{A}})^2 - \lambda_{\mathcal{B}} p_{\mathcal{AB}} p_{\mathcal{BA}}}{\lambda_{\mathcal{A}} p_{\mathcal{AA}}}\right]\!\right], \qquad p_{\mathcal{AB}} = \left[\!\left[\frac{(\omega/\tau_{\mathcal{B}})^2 - \lambda_{\mathcal{A}} p_{\mathcal{AA}}^2}{\lambda_{\mathcal{B}} p_{\mathcal{BA}}}\right]\!\right], \tag{10}$$

and for citizens from group $\mathcal{B}$,

$$p_{\mathcal{BA}} = \left[\!\left[\frac{(\omega/\tau_{\mathcal{A}})^2 - \lambda_{\mathcal{B}} p_{\mathcal{BB}}^2}{\lambda_{\mathcal{A}} p_{\mathcal{AB}}}\right]\!\right], \qquad p_{\mathcal{BB}} = \left[\!\left[\frac{(\omega/\tau_{\mathcal{B}})^2 - \lambda_{\mathcal{A}} p_{\mathcal{AB}} p_{\mathcal{BA}}}{\lambda_{\mathcal{B}} p_{\mathcal{BB}}}\right]\!\right], \tag{11}$$

where $[\![x]\!] = max\{\underline{\rho}, min\{1, x\}\}$.[26]

This is a system of four non-linear equations in the four socialization rates, which we write more compactly as $\mathbf{p} = \Psi(\mathbf{p}|\boldsymbol{\tau}, \omega, \lambda_{\mathcal{A}})$. Fixed points of Ψ on $[\underline{\rho}, 1]^4$ are mutually consistent in-group and out-group socialization strategies for a given vector of interrogation rates $\boldsymbol{\tau}$.

Proposition 2 illustrates the forces shaping citizens' socialization decisions. First, expectations about the government's behavior. Within-group and cross-group socialization decisions depend on the interrogation rates expected on both groups. When citizens expect unequal treatment ($\tau_{\mathcal{A}} \neq \tau_{\mathcal{B}}$), Ψ has a unique fixed point where some of the socialization rates are interior. Consider, for example, the best replies for group $\mathcal{A}$ in (10). These two equations cannot hold simultaneously at interior values for $(p_{\mathcal{AA}}, p_{\mathcal{AB}})$ when $\tau_{\mathcal{A}} \neq \tau_{\mathcal{B}}$. In this

[25] In our benchmark model the government cannot target citizens based on their network characteristics. Although we do not explore the alternative possibility, if the government could target people with many friends, this would be an additional reason to reduce socialization efforts.

[26] Throughout the paper we focus on small $\underline{\rho} > 0$, and take the limit as $\underline{\rho} \to 0$. This allows us to rule out the trivial equilibrium in which no citizen socializes because no other citizen is socializing.

case, one of the socialization rates must be at a corner ($\underline{\rho}$ or $= 1$). As we will see below, relative group sizes will pin down when the different corner solution socialization rates arise. When citizens expect equal treatment ($\tau_{\mathcal{A}} = \tau_{\mathcal{B}}$), in contrast, each pair of best replies in (10) and (11) reduces to the same equation, so we have two equations in four unknowns. This explains why homogeneous socialization rates are consistent with equal treatment and why in this case Ψ has a continuum of fixed points.

3.3 Equilibria

We now discuss the equilibria of this game. Because $\mathbf{t}(\mathbf{p}|\psi, \lambda_{\mathcal{A}})$ describes the government's best reply to all citizens' strategies, and the fixed points of $\Psi(\mathbf{p}|\boldsymbol{\tau}, \omega, \lambda_{\mathcal{A}})$ describe consistent citizens' play against each other for given beliefs about the government's interrogation response, the equilibria of this game are the $(\mathbf{p}^*, \mathbf{t}^*)$ such that: (i) $\mathbf{p}^*$ is a fixed point of $\Psi\left(\mathbf{p}|\mathbf{t}(\mathbf{p}|\psi, \nu, \lambda_{\mathcal{A}}), \omega, \lambda_{\mathcal{A}}\right)$, and (ii), $\mathbf{t}^* = \mathbf{t}(\mathbf{p}^*|\psi, \nu, \lambda_{\mathcal{A}})$. Proposition 3 presents our main result. Throughout, we define partial segregation as an equilibrium pattern of socialization under which in-group degree is different from cross-group degree, and full segregation as one under which cross-group degree is zero. Recall that ω measures the incentives for socialization, and define

$$\Omega_H \equiv \frac{\omega}{t_H},$$

which measures the benefit for a citizen from befriending a citizen from group H.

Proposition 3. *Assume $\omega < \psi$.*[27] *Equilibria exist and every equilibrium satisfies one of the following:*

Unequal treatment with full segregation (UTF). *For one $G \in \{A, B\}$, the interrogation rates are such that members of G are treated unfavorably:*

$$(t_H^*, t_G^*) = \left(\min\left\{\psi, \frac{\nu - \lambda_G}{\lambda_H}\right\}, 1\right). \tag{12}$$

The (unique) profile of socialization rates imply a fully segregated society:

$$(p_{HH}^*, p_{HG}^*, p_{GH}^*, p_{GG}^*) = \left(\min\left\{1, \frac{\Omega_H}{\sqrt{\lambda_H}}\right\}, 0, 1, \min\left\{1, \frac{\Omega_G}{\sqrt{\lambda_G}}\right\}\right). \tag{13}$$

The region of the parameter space where UTF exist is a subset of $\nu \geq \lambda_G$ and $\lambda_H \geq \omega^2$. In this region, UTF is the unique strict equilibrium. The complete description of this region

[27] When $\psi \leq \omega$, citizens from one of the groups will always choose maximal socialization regardless of other citizens' strategies. The parameter restriction, thus, rules out equilibria in which strategic dependence in citizens' socialization decisions is absent.

can be found in Lemma A.7 in the Appendix.

Unequal treatment with partial segregation (UTP). *For one $G \in \{A, B\}$, the interrogation rates are such that members of G are treated unfavorably:*

$$(t_H^*, t_G^*) = \left(\min\left\{ 1 - \frac{1-\psi}{\lambda_H}\omega^2 \, , \, \frac{\nu - \lambda_G}{\lambda_H} \right\}, 1 \right). \tag{14}$$

The (unique) profile of socialization rates imply a partially segregated society:

$$(p_{HH}^*, p_{HG}^*, p_{GH}^*, p_{GG}^*) = \left(1, \frac{\Omega_G^2 - \lambda_H}{\lambda_G}, 1, \min\left\{ 1, \frac{1}{\lambda_G}\sqrt{\Omega_G^2(\lambda_G - \lambda_H) + \lambda_H^2} \right\} \right). \tag{15}$$

The region of the parameter space where UTP exist is a subset of $\nu \geq \lambda_G$ and $\lambda_H < \omega^2$. In this region, UTP is the unique strict equilibrium. The complete description of this region can be found in Lemma A.7 in the Appendix.

Equal treatment (ET): *The interrogation rates are such that members of both groups are treated equally:*

$$(t_A^*, t_B^*) = (\psi, \psi). \tag{16}$$

Any equilibrium profile of socialization rates $(p_{AA}^*, p_{AB}^*, p_{BA}^*, p_{BB}^*)$ leads to the same degree for each citizen:

$$\begin{aligned} \lambda_A {p_{AA}^*}^2 + \lambda_B p_{AB}^* p_{BA}^* &= \Omega_A^2 \\ \lambda_B {p_{BB}^*}^2 + \lambda_A p_{BA}^* p_{AB}^* &= \Omega_B^2, \end{aligned} \tag{17}$$

ET exist everywhere in the parameter space.

3.4 Civil liberties and social structure under group symmetric strategies

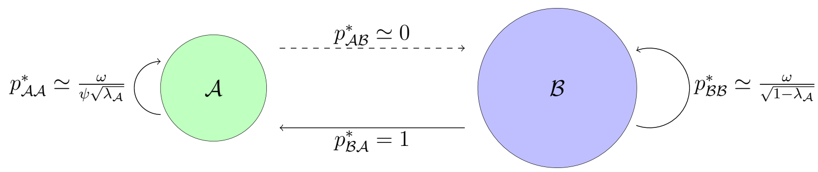
Our result from Proposition 3 stands in contrast to the previous literature on inter-group socialization. Bisin and Verdier (2011) point out that to rationalize segregation, all models of socialization starting at least with Schelling (1969), rely on *imperfect empathy* –assumed differences in payoffs, even if small, from interacting with individuals of different types–. Our model assumes no such differences. Society may still experience segregation even when citizens have no inherent bias for interacting with their own type. Here self-fulfilling beliefs about differences in the government's treatment of people from different groups induce the heterogeneity in willingness to socialize differentially across groups.

Equilibria with unequal treatment correspond to corner solutions to the government's best reply, as illustrated in panel (b) of Figure 2. They exist only if $\min\{\lambda_{\mathcal{A}}, \lambda_{\mathcal{B}}\} \leq \nu$, this is, as long as group sizes are such that contagion over all society can be prevented while fully interrogating one group. Indeed, in an equilibrium with unequal treatment, the government interrogates all members of the disadvantaged group. The favorably treated group, in contrast, is subject to an interrogation rate weakly lower than ψ. The extent of inequality in treatment is thus pinned down by how favorably the more advantaged group is treated. Economies with a civil society that can galvanize collective action effectively (small ν), or with a relatively large minority, are less likely to sustain unequal treatment.

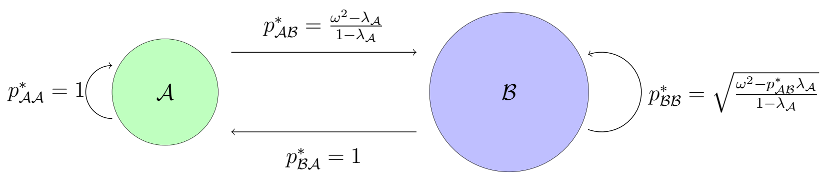
The belief that the government will target one group with a high interrogation rate gives citizens of both groups incentives to reduce their socialization towards members of that group. This segregated and less cohesive social structure weakens the effectiveness of social contagion of civic unrest. Weakened contagion relaxes the no-contagion constraints, allowing the government to impose a high interrogation rate on the disadvantaged group, thus fulfilling the citizens' belief of unequal treatment. In the parameter regions where UT equilibria exist, multiplicity is sustained by different self-fulfilling beliefs about civil liberties and patterns of socialization. Unequal treatment and uneven socialization across groups sustain each other: the government will only chose to exercise unequal treatment when society exhibits some segregation, and individuals socialize asymmetrically across groups because the government treats them differently.

Equal treatment, where the government ignores group membership and citizens chose any socialization rates that yield their optimal mass of friends, is an equilibrium for any economy. This is no surprise, as the group labels in our model are economically irrelevant. In an equal treatment equilibrium, the belief that the government will use the same interrogation rate on both groups eliminates any preference for preferential socialization towards one group or another. A society with homogeneous degree, in turn, implies that there is no value for the government from interrogating people from different groups at different rates. Heterogeneous socialization rates across groups are a necessary condition for unequal treatment to be of any value to the government.[28]

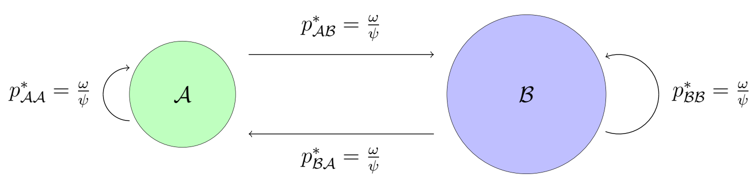
[28] When $p_{\mathcal{AA}} = p_{\mathcal{AB}} = p_{\mathcal{BA}} = p_{\mathcal{BB}}$, the no contagion constraints for both groups coincide, and thus each group's constraint binds if the constraint for the other group binds. The government cannot improve upon equal treatment without triggering a riot. Moreover, in this case the slope of the government's indifference curves coincides with the slope of the no-contagion constraints, which is the reason why the ET equilibrium from Proposition 3 is not strict.



(a) Equilibrium Social Structure under UTF. Members of the group subject to a high interrogation rate –the majority– have a lower degree than members of the group subject to a low interrogation rate –the minority–. Members of the group subject to a low interrogation rate do not socialize with members of the group subject to a high interrogation rate, leading to complete segregation.



(b) Equilibrium Social Structure under UTP. Members of the group subject to a high interrogation rate –the majority– have a lower degree than members of the group subject to a low interrogation rate –the minority–. Members of the group subject to a low interrogation rate socialize at a low rate with members of the group subject to a high interrogation rate, leading to partial segregation.



(c) Equilibrium Social Structure under Equal Treatment. All players ignore the arbitrary group labels, leading to a homogeneous society where all citizens have the same degree, and where segregation is low.

Figure 3: Equilibrium Social Structures from Proposition 3. In these examples $\lambda_{\mathcal{B}} > \lambda_{\mathcal{A}}$.

3.4.1 Social Structure

The proposition also yields sharp predictions about social structure. Equilibria with unequal treatment always entail segregation. Full segregation, where there are no friendships across groups, requires λ_H, the size of the favorably treated group, to be larger than ω^2. This is because in a full segregation equilibrium, it is the favorably treated group the one unwilling to socialize with the disadvantaged group ($p_{HG} \simeq 0$). If the size of the advantaged group were smaller, it would be a profitable deviation for its members to socialize with members of the disfavored group. Thus, full segregation requires a sufficiently large group size. Figure 3a illustrates the social structure under an unequal treatment equilibrium with full segregation, in an example where $\lambda_{\mathcal{A}} < \lambda_{\mathcal{B}}$, and $\mathcal{B}$ is the unfavorably treated group.

Partial segregation can be sustained when the size of the favorably treated group, λ_H is less than ω^2. The favored group is small enough that the marginal benefit of connecting to a fraction of the disfavored group compensates the increased risk of governmental information acquisition. Within-group socialization, however, is higher than cross-group socialization, and pinned down by the government's constrain on interrogations that just avoids a riot. In this equilibrium the favorably treated group is fully connected within. In Figure 3b we illustrate the social structure in an equilibrium with unequal treatment and partial segregation. Unequal treatment equilibria with either full or partial segregation produce societies with a heterogeneous degree distribution.

Equal treatment equilibria under group-symmetric strategies exist everywhere. Under them, the government treats citizens of both groups equally. As a result, citizens are indifferent about the group identities of whom they connect with, and any socialization rates that satisfy (17) constitute an equilibrium.

Corollary 1. *In any strategy profile that constitutes an ET equilibrium, the degree of every citizen is the same, and equal to* $(\omega/\psi)^2$*. All ET are payoff equivalent.*

Equal treatment equilibria produce a homogeneous (in degree) society. A focal equilibrium in this case is the one where $p_{\mathcal{AA}} = p_{\mathcal{AB}} = p_{\mathcal{BA}} = p_{\mathcal{BB}}$, so the group labels are ignored. Figure 3c illustrates this situation. Equal treatment equilibria are not strict equilibria because they are all payoff equivalent.

3.4.2 Group sizes and unequal treatment

Our model has implications about the relationship between group sizes an unequal treatment.

Proposition 4. *In any equilibrium that exhibits unequal treatment and full or partial segregation, the minority group will be the disfavored one only if disfavoring the majority group would violate* (NRC)*.*

In particular, if $\nu > max\{\lambda_{\mathcal{A}}, \lambda_{\mathcal{B}}\}$ *(strong government), the unequal treatment equilibria disfavor the majority. If* $max\{\lambda_{\mathcal{A}}, \lambda_{\mathcal{B}}\} > \nu > min\{\lambda_{\mathcal{A}}, \lambda_{\mathcal{B}}\} + \psi max\{\lambda_{\mathcal{A}}, \lambda_{\mathcal{B}}\}$ *(weak government), the unequal treatment equilibria disfavor the minority.*

Because the government does not have an inherent preference over group identities, inequality in treatment across groups is driven by how social structure shapes the government's incentives to aggregate information. As long as the government can satisfy (NRC) while unfavorably treating the larger group, unequal treatment equilibria will disfavor the majority.

This preference is based on the value of information aggregation.[29]

Only when social structure makes targeting the majority infeasible should we observe a higher interrogation rate on the minority. Proposition 4 points out that unequal treatment against minorities may be observed when unequally treating majorities is infeasible given their strength in numbers relative to the government, or when social ties across groups are such that contagion of collective action can spread from the majority to the minority.

Historical experiences of majorities being the subjects of unequal treatment are not uncommon. Just to mention a few examples, between the 17th and the 19th centuries the population of the British Caribbean was at least three fifths black, the vast majority of whom were enslaved (Engerman and Higman (2003)). In Apartheid South Africa, by the 1950s native blacks constituted around three quarters of the population (Chimere-dan (1992)). In Syria prior to the deposition of the Assad regime in 2024, the advantaged Alawite Shia minority constituted around 15 percent of the population with the disadvantaged Sunni majority making up around three quarters of the population (CIA (2023)).

3.4.3 Comparative statics

While Proposition 4 indicates that the largest group is likely to be unfavorably treated, we now ask how the unequal treatment equilibria that lead to this outcome are affected by changes in relative group sizes.

Corollary 2. *Under any unequal treatment equilibrium, a marginal increase in the size of the unfavorably treated group λ_G has the following effects:*

- $t^*_G = 1$ *is unchanged, while* t^*_H *weakly decreases.*
- p^*_{HH} *and* p^*_{HG} *weakly increase.*
- $p^*_{GH} = 1$ *is unchanged, while* p^*_{GG} *decreases.*

When the unfavorably treated group becomes larger, the set of reactive citizens is larger. To make sure the (NRC) still holds, the government must treat the favorably treated group even more favorably, increasing the extent of unequal treatment between groups. And while socialization incentives for the favorably treated group go up, they go down for the unfavorably treated group.

[29]The reason why the minority is the favored group in such cases is different from Olson (1971)'s well-known argument about the success of minorities being driven by their comparative ability to avoid free-rider problems. It is also in contrast with the more traditional view of civil liberties as societal protections for minorities from majorities.

In Appendix B we show that Proposition 3 also implies that through ω and across all equilibria, socialization rates (and the average degree of citizens) are weakly increasing in the standard of proof, and weakly decreasing in the threat likelihood and the precision of signals. They are also inversely related to ψ, as small values of this parameter tighten the (NRC). This echoes Besley and Persson (2019), for example, who argue that society's ability to organize depends on its social capital and democratic values. Thus, our model predicts that social cohesiveness and the strength of civil liberties should covary positively with the strength of civic engagement.

3.4.4 Equilibrium payoffs, lack of commitment, and coordination failure

Our results also illustrate the role of civil liberties as a source of commitment for the government. Consider, for example, equilibria with equal treatment where group labels are ignored. The mass of arrests the government can undertake in equilibrium is strictly larger than in the absence of a constraint on interrogations.[30] Strong civic values, leading to stronger equilibrium civil liberties, are a source of commitment for the government. In the absence of a no-riot constraint, the government would choose $\lambda(N) = 1$, and its equilibrium payoff would be ω^2, the minimum possible. Thus, civil liberties in our model both protect citizens from the government, and protect the government from itself.[31] The reason is that a fragmented social structure hurts the government's ability to aggregate information effectively. The erosion of social cohesion induced by citizens' expectations of the government's behavior undermines the effectiveness of the information aggregation technology more than one to one with the interrogation rate. This is not an artifact of the linearity in the information aggregation technology. Rather, it is driven by the strategic substitutability of citizens' socialization efforts: an increase in the interrogation rate has a direct effect that reduces incentives to build social connections. It has an additional indirect effect, because the marginal benefits of socialization effort fall as other citizens socialize less intensely.

This discussion motivates the following question: does the government aggregate more information under an unequal treatment equilibrium than under equal treatment?

Lemma 1. *Whenever unequal treatment is an equilibrium, the expected number of arrests is strictly lower than under the equal treatment equilibria.*

In the equilibria with unequal treatment the government interrogates the unfavorably treated group at a maximal rate. Ex-post, however, the equilibrium number of arrests it can

[30] Because the measure A_τ of arrests under civil liberties τ corresponds to the ex-ante probability faced by a citizen of being arrested, $\mathbb{E}_{\underline{\chi}}\left[\mathbb{1}\{\chi_i > \chi\}\mathbb{P}(\theta_i = 1)\right]$, it is easily verified from the proof of Lemma A.1 that A_τ is decreasing in τ so that $A_1 < A_\psi$.

[31] For $\omega < 1$, the government would like to commit to $\lambda(N) \leq \omega$, in which case its payoff would be ω.

undertake is lower than under the corresponding ET equilibrium. Lemma 1 highlights the underlying commitment problem faced by the government. Although ex ante this government would benefit from committing to equal treatment, ex post, once citizens have segregated, the government chooses unequal interrogation rates that yield less expected arrests. The reduction in information aggregation stemming from the erosion of the social fabric induced by expectations of unequal treatment outweighs the increased information collection possible under the higher interrogation rate on the unfavorably treated group, leading to less equilibrium arrests than if the government could commit to equal treatment.

Looking at the citizens' payoffs, we have the following result:

Lemma 2. *Whenever unequal treatment is an equilibrium, the payoff for citizens of both groups is lower under than under the equal treatment equilibria.*

Citizens are worse off under unequal treatment, *including* the members of the more favorably treated group. Thus, unequal treatment equilibria (and segregation), represent coordination failures by citizens of both groups. This is a novel result. It arises from the network effects embedded in our model, through which depressed socialization rates hurt all citizens. Equilibrium segregation in our model is of a different nature than in Lang (1986), for example, where a (transaction) cost of interaction between the two groups (in the form of a language barrier) is a primitive of the model. Here the differential cost from interacting across groups is endogenous. It is also in contrast to other models of socialization such as Alesina and LaFerrara (2000)'s model of participation in collective activities, where segregation can make one group better off at the expense of the other.[32]

Social segregation in the presence of coordination failure is reminiscent of models where social norms arise to sustain non-myopic behavior as in the caste model of Akerlof (1976) or the class systems model of Cole et al. (1998). In Akerlof's model, for example, a segregated caste system is sustained by a norm that excludes from the caste anyone who interacts with members of another caste. In our model, in contrast, members of the more favorably treated group reduce their socialization with members of the unfavorably treated group because the high interrogation rate imposed by the government on this group makes it costly to interact with them. Neither members of the favorably treated group nor the government face inter-temporal repercussions from deviating from equilibrium behavior. In our setting, social norms are not necessary to sustain segregation. In fact, in Appendix B we show that

[32]In classic labor market discrimination models (e.g., Coate and Loury (1993); Foster and Vohra (1992)), coordination failure happens only within the discriminated group: the advantaged group is unaffected. In subsequent labor market discrimination models (e.g., Mailath et al. (2000); Moro and Norman (2004)), the advantaged group benefits from discrimination on the disadvantaged group. In our model, both groups are hurt by unequal treatment, and the coordination failure involves citizens from both groups.

a caste system along the lines of Akerlof (1976) can only arise in the context of our model if group sizes are such that equilibrium *does not* entail unequal treatment.

3.5 Discussion

Several historical experiences are reminiscent of the feedback between civil liberties and social cohesiveness highlighted by our results. Contemporary Scandinavian societies, for example, are recognized to be highly cohesive and trustful, and also highly politically engaged. In turn their governments show a remarkable capacity to collect information about their citizens. In former Soviet republics, in contrast, citizens were suspicious of each other (Havel (1985)). Civic engagement was also low, as effective collective action is limited by the inability of citizens to publicly express their preferences (Kuran (1995)). In turn, these governments had to invest heavily in intelligence agencies and secret police services, possibly to compensate for their ineffectiveness at information aggregation. Discussing witch trials in 16th Century France, Johnson and Koyama (2014) similarly argue that in regions where local courts could exercise more discretion by ignoring standard rules of evidence, more trials took place because the trials themselves triggered fears of witchcraft among the population, leading to increased demand for further trials.

The East German experience between the 1950s and 1980s similarly suggests a two-way relationship between governmental intrusion and societal cohesiveness along the lines suggested by our model. In this period, the Stasi developed a widespread system of surveillance. At its height, around 15 percent of East Germans were Stasi informants, while the majority of citizens were the subjects of it. Historians have documented the deep distrust and erosion of social ties between East German citizens this produced (Fullbrook (2005); Gieseke (2014)). Recent work further documents the persistence of reduced interpersonal trust among post-reunification East Germans well into the present (Lichter et al. (2021)).

4 Extensions

4.1 Heterogeneous likelihood of threat membership

The model above assumes a homogeneous likelihood of threat membership. That special case allowed us to show that even in the absence of payoff-relevant heterogeneity, equilibria with unequal treatment exist. In some settings, the likelihood of threat membership may be correlated with group membership, which by itself could motivate differences in behavior by the government towards the different groups. Here we consider a more general setup where the common prior about the threat likelihood differs across groups: $\chi^A \neq \chi^B$. To maintain the assumption that in the absence of information the arrest threshold would not be met, we generalize our earlier restriction on χ: $\chi \geq \max\{\chi^A, \chi^B\}$. In this case, the posterior belief about $i \in G \in \{\mathcal{A}, \mathcal{B}\}$ after a signal $\theta_i = 1$ is

$$\chi_i = \left(1 + \frac{1-\chi^G}{\chi^G}\frac{\sigma_0(s_i)}{\sigma_1(s_i)}\right)^{-1}.$$

We maintain Assumption 1, and generalize the definitions from section 3 accordingly:

$$\omega^G = \frac{\overline{\chi} - \chi}{2b[\chi^G(1-\chi) + \chi(1-\chi^G)]\kappa}, \qquad \Omega_{GH} = \frac{\omega^G}{t_H}.$$

Ω_{GH} measures the benefit for a citizen from G from befriending a citizen from group H. While this benefit still depends on the interrogation risk faced by H citizens, it now also depends on the group-specific threat likelihood faced by a citizen from G.

Proposition 5. *Assume $\omega_{\mathcal{A}}, \omega_{\mathcal{B}} < \psi$. The results in Proposition 3 generalize as follows: Throughout, replace ω for ω_H.*

In (13), replace Ω_H for Ω_{HH}, and Ω_G for Ω_{GG}, and

In (15), replace Ω_G for Ω_{HG} in the expression for p^*_{HG}, and replace Ω_G for Ω_{GG} in the expression for p^*_{GG}.

In (17), replace $\Omega_{\mathcal{A}}$ for $\Omega_{\mathcal{AA}}$, and $\Omega_{\mathcal{B}}$ for $\Omega_{\mathcal{BB}}$.

Proposition 5 shows that the nature of the equilibria from section 3 is robust to this more general informational environment. However, Proposition 4 does not hold anymore. The government's best reply now depends not only on group sizes but also on how likely it is that citizens of either group belong to the threat. Consider, for example, a society where $\lambda_{\mathcal{A}} < \lambda_{\mathcal{B}}$, and $\chi_{\mathcal{A}} > \chi_{\mathcal{B}}$ so that $\omega_{\mathcal{A}} < \omega_{\mathcal{B}}$. It follows from Lemma A.7 that for large enough $\chi_{\mathcal{A}}$, both full and partial segregation equilibria exist where the government unequally treats the minority even when unequally treating the majority makes (NRC) slack. Under these equilibria, the minority group is now the one with a lower degree, so these are societies with a fragmented and isolated minority that is also unfavorably treated[33].

4.2 Information Aggregation under Community Enforcement

We have considered an environment where citizens provide information to the government whenever they are interrogated. This hurts the citizens about whom information is revealed. While in section 3 we endogenized the limit on interrogations through a collective action

[33]We thank an anonymous referee for suggesting this possibility.

mechanism, here we provide an alternative considering the existence of endogenous social norms limiting the ability of the government to interrogate effectively. Social norms such as Banfield (1958)'s *amoral familism* among Southern Italians, or the codes of silence of the mafia (e.g., Servadio (1976)), for example, suggest that community enforcement of social norms against collaboration with the government may emerge and limit its ability to exploit the social structure to aggregate information.

Consider an extension of our model (in the absence of group labels) where interrogated citizens can choose to resist sharing information about their friends. The government provides incentives in the form of punishments for resisting. We suppose that talking is publicly observed, so friends of a talking citizen may punish him for talking (ostracism, severing of economic relations, etc.). When the punishment for talking scales with the number of friends about whom an interrogated citizen talked, more cohesive social networks will be more effective at enforcing a code of silence. Citizens who resist are punishers.

Formally, we introduce two new sub-games: i) after a citizen is taken for interrogation, he decides whether to talk or resist. If he resists, the government imposes on him a cost $r_i \sim U[0, \tilde{r}]$, which is iid and realized at the time it is imposed. ii) This decision is observed by his $\tilde{d}_i$ punisher friends, who then impose a punishment $\tilde{r}\sqrt{\tilde{d}_i}$ if he talked, where $\tilde{r}$ is a constant. The extent of social punishment for talkers is determined by the mass of punishers and talkers. These masses, in turn, are determined by the cost of social punishment.

In symmetric equilibrium, all citizens choose a socialization rate p, so every citizen's degree is $d = p^2$. Denote by $r \in [0, \tilde{r}]$ the marginal resistance cost: if $r_i < r$, interrogated citizen i is willing to bear this cost, does not talk, and joins the group of punishers. If $r_i \geq r$, the punishment is too high and citizen i talks. Thus, $r/\tilde{r}$ is the fraction of punishers, and $1-(r/\tilde{r})$ is the fraction of talkers. Accordingly, the mass of punisher friends is $\tilde{d} = (r/\tilde{r})d$, and the cost of talking is $\sqrt{dr\tilde{r}}$. The marginal talker is thus pinned down by $r = \min\left\{\tilde{r}, \sqrt{dr\tilde{r}}\right\}$.

This talking sub-game has two equilibria. The first is $r = 0$. Here all citizens are talkers, and none punish, so no citizen has an incentive to resist. We call it the all-talk equilibrium. Because the continuation game is governed by the all-talk equilibrium, equilibrium socialization is simply $p^* = \omega$.

The second equilibrium of the talking sub-game is $r = d\tilde{r}$, which implies $d = r/\tilde{r}$. Fraction d of citizens are punishers and fraction $1 - d$ are talkers. We call it the community enforcement equilibrum. We now characterize the equilibrium socialization rate for this case. Consider a citizen i deciding on p_i given all other citizens choose p. His degree will be $d_i = p_i p$. During his interrogation, he can resist and suffer cost r_i. Alternatively, he can talk and suffer the social punishment $\tilde{r}\sqrt{d_i d}$ since, in equilibrium, fraction d of his friends will be punishers. The ex-ante expected interrogation cost for citizen i is thus,

$$\mathbb{E}_{r_i}\left[\min\left\{r_i, \tilde{r}\sqrt{d_i d}\right\}\right] = \tilde{r}\left(\sqrt{d_i d} - \frac{1}{2}d_i d\right).$$

Citizen i also must consider the expected cost of being arrested. There will be $d_i(1-d)$ talkers among his friends, so the government will receive $s_i = d_i(1-d)$ clues about him. The expected arrest cost is thus $\frac{d_i(1-d)}{2\omega}$, and his ex-ante expected utility is proportional to

$$\sqrt{d_i} - \tilde{r}\left(2\sqrt{d_i d} - \frac{1}{2}d_i d\right) - \frac{d_i(1-d)}{2\omega}.$$

Taking the first order condition and imposing symmetry ($d_i = d$), we find

$$\frac{1}{\sqrt{d}} - \left(\tilde{r} + \frac{1}{\omega}\right)(1-d) = 0 \quad \Longleftrightarrow \quad p(p-1)(p+1) + a = 0$$

since in equilibrium $p = \sqrt{d}$, and $a \equiv ((1/\omega) + \tilde{r})^{-1}$. This cubic equation has a solution iff $a \leq \frac{2}{3\sqrt{3}}$, in which case it has two positive roots in $[0,1]$. The first solution is increasing in a, ranging from $p = 0$ to $p = 1/3$ as a increases from 0 to $\frac{2}{3\sqrt{3}}$. The second solution is decreasing in a, ranging from $p = 1$ to $p = 1/3$ as a increases from 0 to $\frac{2}{3\sqrt{3}}$.[34]

5 Conclusion

Civil liberties in the form of restrictions on the use of coercion by government agents are a key buffer between citizens and the state. While governments use such coercion to aggregate information that is distributed in society, the social structure, in turn, mediates both the government's ability to collect information efficiently and the citizens' ability to resist intrusion. In this paper we have offered a first look at how the governments' ability to collect information and citizens' socialization decisions are jointly determined.

We argue that when civil liberties are weak, governments attempting to exploit their coercive advantages will be ineffective at aggregating information because such efforts will erode

[34] This simple extension rationalizes the decision to reveal information to the government. It does not however, provide a rationale for why punishers would want to punish. We can justify equilibrium punishment with the following argument: suppose that part of the social norm prescribes that punishers who refuse to punish talkers are treated as talkers and punished accordingly. As long as punishers have a large enough number of friends, punishing will be incentive compatible. This is true in the symmetric equilibrium we described above. What if a positive-mass coalition of punishers wanted to jointly deviate and not punish? It is easy to verify that in this model, no coalition within the set of punishers can benefit from jointly deviating: for any positive-mass coalition, the reduction in expected punishment (from there being less punishers) is strictly lower than the margin by which any citizen prefers to resist talking over talking.

the social network of citizens. Iron Curtain governments were characterized by their unconstrained ability to exercise coercion over their citizens, and concomitantly by mistrustful societies with eroded social fabrics. The massive investments in intelligence agencies, secret police services, and prison camps of these governments may well have been a symptom of their ineffectiveness at aggregating information about their citizens. Thus, civil liberties that can be sustained in equilibrium not only protect citizens from the state, they also protect the government from itself.

Cohesive societies facilitate information aggregation, but they also strengthen the ability of civil society to resist it. We show this opens the door to the possibility of unequal treatment, where the government treats ex-ante identical citizens differently. By making some citizens the targets of more interrogation, the government makes them unattractive partners for socialization. The government can thus provide incentives that fracture the social structure, weakening civil society's resistance, and leading to segregation. We show that segregation is necessary for unequal treatment to be justified, and unequal treatment rationalizes segregated socialization choices. These equilibria are robust when they exist, providing a novel rationale for segregation. They are reminiscent of the high levels of segregation along ethnic lines inside US prisons, for example. An intriguing avenue for future research could explore whether ideas along the lines of our model can help explain inmates' socialization decisions and the corresponding behavior of guards and prison administrators.

Our model can be extended in several directions. It could be specialized, for example, to a setting where the underlying threat is an epidemic, so that socialization choices involve contagion externalities. Naturally, it also has many limitations. Throughout we took society's ability to engage in collective action as exogenous. In practice, civil liberties and the social structure likely shape some aspects of civic engagement. We also abstained from exploring the political economy shaping the government's information aggregation objective.

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A Proofs and Auxiliary Results

Below, we write down all our proofs in the context of the general model from subsection 4.1 with heterogeneous priors between groups. Accordingly, we work with the group-specific parameters as defined in that section. Throughout the appendix, we also denote

$$e_{GH} \equiv p_{GH} p_{HG} \lambda_G \lambda_H$$

as the measure of friends of citizens in group G from citizens in group H, and

$$e_G \equiv e_{GG} + e_{GH}$$

as the measure of friends of citizens in G.

Lemma A.1. ***(Auxiliary)***
The government's payoff function is proportional to

$$V \propto \sum_G \sum_H \frac{e_{GH}}{\Omega_{GH}}$$

Proof of Lemma A.1.
Given the citizens' group-symmetric socialization strategies and interrogation rates (t_A, t_B), the interim (before signals and standard of proof are realized) expected payoff of the government can be expressed as:

$$\begin{aligned}
\mathbb{E}_{\underline{\chi}}[V] &\propto \mathbb{E}_{\underline{\chi}}\left[\sum_G \lambda_G \mathbb{I}[\underline{\chi} < \chi_G]\left(\chi\sigma_1(s_G) + (1-\chi)\sigma_0(s_G)\right)\right] \\
&= \sum_G \lambda_G \frac{\chi^G - \underline{\chi}_1^G}{\underline{\chi}_2^G - \underline{\chi}_1^G}\left(\chi^G\sigma_1(s_G) + (1-\chi^G)\sigma_0(s_G)\right) \\
&= \sum_G \lambda_G \frac{\chi^G(1-\underline{\chi}_1^G)b_1 + \underline{\chi}_1^G(1-\chi^G)b_0}{\underline{\chi}_2^G - \underline{\chi}_1^G} s_G \\
&\propto \sum_G \lambda_G \frac{1}{\omega^G} s_G = \sum_G \lambda_G \frac{1}{\omega^G} \sum_H p_{GH} p_{HG} \lambda_H t_H = \sum_G \sum_H \frac{e_{GH}}{\Omega_{GH}}
\end{aligned}$$

Proof of Proposition 1.
This follows from the result in Lemma A.1 and the explanation after the statement of the proposition in subsection 3.1.

Proof of Proposition 2.
Given all other citizens play group-symmetric strategies, the expected payoff of $i \in G$ is proportional to

$$\mathbb{E}_{\rho_{iA},,\rho_{iB},,\underline{\chi}}[u_i] \propto \mathbb{E}_{\rho_{iA},,\rho_{iB},}\left[\sqrt{\sum_H \rho_{iH} p_{HG} \lambda_H} - \frac{1}{2\omega^G}\left(\sum_H \rho_{iH} p_{HG} \lambda_H t_H\right)\right] \tag{A.1}$$

Taking first order conditions with respect to i's strategy (ρ_{iA}, ρ_{iB}), the best responses in (10) and (11) follow.

In what follows, for convenience we will use $x \simeq y$ to denote $x - y = O(\underline{\rho})$ as $\underline{\rho} \to 0$, and $x \succeq y$ to denote $x - y \geq O(\underline{\rho})$ as $\underline{\rho} \to 0$.

Lemma A.2. ***(Auxiliary)*** *In equilibrium, if $t_A = 1$, then for any $G \in \{A, B\}$, either $p_{GB} = 1$ or $p_{GA} = \epsilon \neq p_{GB} \neq 1$.*

Proof of Lemma A.2.

Suppose that $t_A = 1$. Then, $\Omega_{GA} = \omega_G < \frac{\omega_G}{\psi} \leq \frac{\omega_G}{\tau_B} = \Omega_{GB}$.

Using Proposition 2 we can show the following:

Step 1: $\{p_{GB}, p_{GA}\} \cap \{\epsilon, 1\} \neq \emptyset$.

Proof: If p_{AA} and p_{AB} in (10) are both interior (i.e. $p_{AB}, p_{AA} \in (\epsilon, 1)$), then $\Omega^2_{AA} = p_{AB}p_{BA}\lambda_B + p^2_{AA}\lambda_A = \Omega^2_{AB}$ which does not hold. Similarly, p_{BA} and p_{BB} from (11) cannot be interior at the same time. □

Step 2: $p_{GA} = 1$ implies $p_{GB} = 1$.

Proof: If $p_{BA} = 1$, then by p_{BA} from (11), $\frac{\Omega^2_{BA} - p^2_{BB}\lambda_B}{p_{AB}\lambda_A} \geq 1$. This implies $p_{AB}\lambda_A + p^2_{BB}\lambda_B \leq \Omega^2_{BA} < \Omega^2_{BB}$. Then, by p_{BB} from (11), $p_{BB} = 1$. Similarly, $p_{AA} = 1$ implies $p_{AB} = 1$. □

Step 3: $p_{GB} \neq \epsilon$.

Proof: If $p_{BB} = \epsilon$, then by p_{BB} from (11), $\frac{\Omega^2_{BB} - p_{BA}p_{AB}\lambda_A}{p_{BB}\lambda_B} \leq 0$. This implies $p_{BA}p_{AB}\lambda_A \geq \Omega^2_{BB} > \Omega^2_{BA}$. In turn, by p_{PA} from (11),

$$p_{BA} = \max\left\{\epsilon, \min\left\{1, \frac{p_{BA}p_{AB}\lambda_A - \epsilon^2\lambda_B}{p_{AB}\lambda_A}\right\}\right\} < p_{BA}$$

which is a contradiction. So $p_{BB} \neq \epsilon$.

If $p_{AB} = \epsilon$, then by (10),

$$p_{AA} = \min\left\{1, \frac{\Omega^2_{AA}}{p_{AA}\lambda_A}\right\} \leq \frac{\Omega^2_{AA}}{p_{AA}\lambda_A} < \frac{\Omega^2_{AB}}{p_{AA}\lambda_A} < p_{AA}$$

which is a contradiction. So $p_{AB} \neq \epsilon$. □

Step 4: Suppose $p_{GB} \neq 1$. Then by Step 2 $p_{GA} \neq 1$. If $p_{GA} \neq \epsilon$ then by Step 1 $p_{GB} = \epsilon$, which contradicts Step 3: $p_{GB} \neq \epsilon$. So $p_{GA} = \epsilon$. Combining all steps, we get the result. □

Lemma A.3. ***(Auxiliary)*** *Recall that Equal Treatment is always feasible (the NRC is not violated). Suppose that Unequal Treatment against A is feasible too. If Unequal Treatment against A is preferred to Equal Treatment, then* $e_{AA}e_{BB} \geq e_{AB}e_{BA}$.

Proof of Lemma A.3.

Unequal Treatment against A is preferred over Equal Treatment if

$$\begin{aligned}
&\frac{e_{AA}}{\omega_A} + \frac{e_{AB}}{\omega_A}\tau_B + \frac{e_{BB}}{\omega_B}\tau_B + \frac{e_{BA}}{\omega_B} \geq \frac{e_{AA}}{\omega_A}\psi + \frac{e_{AB}}{\omega_A}\psi + \frac{e_{BB}}{\omega_B}\psi + \frac{e_{BA}}{\omega_B}\psi \\
\iff &\left(\frac{e_{AA}}{\omega_A} + \frac{e_{BA}}{\omega_B}\right)(1-\psi) \geq \left(\frac{e_{AB}}{\omega_A} + \frac{e_{BB}}{\omega_B}\right)(\psi - \tau_B) \\
\implies &e_{AA}e_{BB} \geq e_{AB}e_{BA}
\end{aligned}$$

Lemma A.4. ***(Auxiliary)*** *Any equilibrium in which* $p_{BA} = \epsilon$ *and* $t_A = 1$ *satisfies*

$$\begin{aligned}
&t_A = 1,\, t_B \approx \min\left\{\psi, \frac{\nu - \lambda_A}{\lambda_B}\right\} \\
&p^2_{AA} \approx \min\left\{1, \frac{\Omega^2_{AA}}{\lambda_A}\right\} \\
&p^2_{BB} \approx \min\left\{1, \frac{\Omega^2_{BB}}{\lambda_B}\right\} \\
&p_{AB} = 1,\, p_{BA} \approx 0
\end{aligned}$$

Suppose $\nu \geq \lambda_A$. This strategy profile satisfies citizens' incentives in Proposition 2 if and only if $\omega_B^2 < \lambda_B$. Furthermore, notice this implies

$$d_{BB} \simeq \min\left\{\lambda_B, \Omega_{BB}^2\right\}, \;\; e_{AB} \simeq 0, \;\; d_{AA} \simeq \min\left\{\lambda_A, \Omega_{AA}^2\right\}$$

$$e_{BB} \simeq \min\left\{\lambda_B^2, \lambda_B \Omega_{BB}^2\right\}, \;\; e_{AB} \simeq 0, \;\; e_{AA} \simeq \min\left\{\lambda_A^2, \lambda_A \Omega_{AA}^2\right\}.$$

Proof of Lemma A.4.

First notice that $\nu \geq \lambda_B$ must hold. Otherwise, $\tau_B < 0$ and so $t_A = 1$ is not feasible.

We have $p_{BA} = \epsilon$. Then by p_{AA} in Proposition 2, $p_{AA} \neq \epsilon$. Then by Lemma A.2, $p_{AB} = 1$. Then in Proposition 2, p_{AB} holds, p_{BA} becomes $\Omega_{BA}^2 < \lambda_B$, and p_{AA} and p_{BB} become

$$p_{AA}^2 = \min\left\{1, \frac{\Omega_{AA}^2 - \epsilon\lambda_B}{\lambda_A}\right\}, \;\; p_{BB}^2 = \min\left\{1, \frac{\Omega_{BB}^2 - \epsilon\lambda_A}{\lambda_B}\right\}.$$

By $t_A = 1$, $\Omega_{BA}^2 < \lambda_B$ is equivalent to $\omega_B^2 < \lambda_B$. In this case, $\tau_B = \min\left\{\psi - (1-\psi)\frac{p_{AB}p_{BA}}{p_{BB}^2}\frac{\lambda_A}{\lambda_B}, \frac{\nu - \lambda_A}{\lambda_B}\right\} \simeq \min\left\{\psi, \frac{\nu-\lambda_A}{\lambda_B}\right\}$.

Lemma A.5. ***(Auxiliary)*** *Any equilibria in which $p_{BA} \neq \epsilon$ and $t_A = 1$ satisfies (a) or (b):*

(a)

$$t_A = 1, \;\; t_B = \min\left\{1 - \frac{1-\psi}{\lambda_B}\omega_B^2, \frac{\nu - \lambda_A}{\lambda_B}\right\}$$
$$p_{BA} = \frac{\Omega_{BA}^2 - \lambda_B}{\lambda_A} = \frac{\omega_B^2 - \lambda_B}{\lambda_A},$$
$$p_{AA}^2 = \min\left\{1, \frac{\Omega_{AA}^2 - p_{BA}\lambda_B}{\lambda_A}\right\},$$
$$p_{AB} = p_{BB} = 1.$$

Note that this implies

$$d_{BB} = \lambda_B, \;\; d_{BA} = \Omega_{BA}^2 - \lambda_B, \;\; d_{AA} = \Omega_{AA}^2 - d_{AB}$$

$$e_{BB} = \lambda_B^2, \;\; e_{BA} = e_{AB} = \Omega_{BA}^2\lambda_B - \lambda_B^2, \;\; e_{AA} = \min\left\{\lambda_A^2, \Omega_{AA}^2\lambda_A - e_{AB}.\right\}$$

(b)

$$t_A = 1, \;\; t_B = \min\left\{1 - \frac{1-\psi}{\lambda_B}, \frac{\nu - \lambda_A}{\lambda_B}\right\}$$
$$p_{GH} = 1.$$

Suppose $\nu \geq \lambda_A$. Case (a) satisfies citizens' incentives in Proposition 2 if and only if $1 > \omega_B^2 > \lambda_B$. Case (b) satisfies citizens' incentives in Proposition 2 if and only if $\omega_A, \omega_B \geq 1$.

Proof of Lemma A.5.

Note, $\nu \geq \lambda_B$ must hold. Otherwise, $\tau_B < 0$ and so $t_A = 1$ is not feasible.

By $p_{BA} \neq \epsilon$ and Lemma A.2, $p_{BB} = 1$.

By Lemma A.2, $p_{AB} \neq \epsilon$. From Lemma A.3 we have that $p_{AA}p_{BB} \geq p_{AB}p_{BA}$, so that $p_{AA} \neq \epsilon$. Then by Lemma A.2, $p_{AB} = 1$.

Thus, $p_{AB} = p_{BB} = 1$ and $p_{BA}, p_{AA} \neq \epsilon$. Then by the expression for p_{AA} from (10) and for p_{BA} from (11), it follows that $p_{BA} = \min\left\{1, \frac{\omega_B^2 - \lambda_B}{\lambda_A}\right\}$ and $p_{AA}^2 = \min\left\{1, \frac{\omega_A^2 - p_{BA}\lambda_B}{\lambda_A}\right\}$. Note that this makes $t_A = 1$ and $t_B = \min\left\{1 - \frac{1-\psi}{\lambda_B}\min\left\{1, \omega_B^2\right\}, \frac{\nu-\lambda_A}{\lambda_B}\right\}$.

Under the values above, (10) holds for p_{AB} and (11) and holds for p_{BB}. Moreover, the expression for p_{BA} in (11) holds if and only if $\omega_B^2 > \lambda_B$. Finally, the expression for p_{AA} in (10) is implied by p_{BA} in (11) and Lemma A.3.

Finally observe that for part (b), $p_{BA} = 1$ if and only if $\omega_B \geq 1$. Also, $p_{AA}p_{BB} \geq p_{AB}p_{BA}$ if and only if $p_{AA} = 1$, which requires $\omega_A \geq 1$.

Lemma A.6. *(**Auxiliary**) Any equilibrium in which $t_A = t_B = \psi$ satisfies either of the following two cases:*

- *$\omega_G > \psi$ and $p_{GG} = p_{GH} = 1$.*
- *$\omega_G < \psi$ and $\frac{1}{\psi^2}\omega_G^2 = p_{GG}^2\lambda_G + p_{GH}p_{HG}\lambda_H$.*

If either of these cases holds, then citizens' incentives from Proposition 2 hold.

Proof of Lemma A.6.

Straightforward.

Proof of Proposition 5.

Corollary to Lemma A.4, Lemma A.5, and Lemma A.6.

Proof of Proposition 3.

Corollary to Proposition 5, when $\omega_A = \omega_B = \omega$.

Lemma A.7. *Denote $O_A = \frac{e_{AA}}{\omega_A} + \frac{e_{BA}}{\omega_B}$, $O_B = \frac{e_{AB}}{\omega_A} + \frac{e_{BB}}{\omega_B}$.*

Unequal treatment against A is a best reply if and only if (i) and (ii) hold:

(i) $\tau_B \geq \max\left\{0, \psi - (1-\psi)\frac{O_A}{O_B}\right\}$.

(ii) $\tau_A < 0$ or $\tau_A \leq 1 - (1-\tau_B)\frac{O_B}{O_A}$.

Equivalently,

(i) $\max\left\{\frac{e_B}{e_{BB}}(1-\psi), \frac{1}{\lambda_B}(1-\nu)\right\} \leq \min\left\{1, (1-\psi)\left(1+\frac{O_A}{O_B}\right)\right\}$.

(ii) $\max\left\{\frac{e_A}{e_{AA}}(1-\psi), \frac{1}{\lambda_A}(1-\nu)\right\} \geq \max\left\{\frac{e_B}{e_{BB}}(1-\psi), \frac{1}{\lambda_B}(1-\nu)\right\}\frac{O_B}{O_A}$ or $\max\left\{\frac{e_A}{e_{AA}}(1-\psi), \frac{1}{\lambda_A}(1-\nu)\right\} > 1$.

Proof of Lemma A.7

By Lemma A.1, if feasible, Unequal Treatment against A yields a payoff of $O_A + \tau_B O_B$ to the government. Unequal Treatment against B yields a payoff of $\tau_A O_A + O_B$ to the government. Equal Treatment yields a payoff of $\psi O_A + \psi O_B$ to the government. Then Proposition 1 and simple algebra deliver the result.

Proof of Proposition 4.

Maintain the parameter assumptions from Proposition 3.

Unequal Treatment against A yields a payoff of $O_A + \tau_B O_B$ to the government, whereas Unequal Treatment against B yields a payoff of $\tau_A O_A + O_B$. Suppose that Unequal Treatment against A and Unequal Treatment against B are both feasible, and that the government's payoff under Unequal Treatment against A is higher than under Unequal Treatment against B. Then we have $(1-\tau_A)O_A \geq (1-\tau_B)O_B$. Then, because $1-\tau_G = \max\left\{\frac{e_G}{e_{GG}}(1-\psi), \frac{1}{\lambda_G}(1-\nu)\right\}$, $(1-\tau_A)O_A \geq (1-\tau_B)O_B$ implies that either (i) $\frac{e_A}{e_{AA}}O_A \geq \frac{e_B}{e_{BB}}O_B$ or (ii) $\frac{O_A}{\lambda_A} \geq \frac{O_B}{\lambda_B}$ hold. Next consider (i) and (ii) under both UTF and UTP equilibria.

Consider UTF. (i) is equivalent to $\min\left\{\lambda_A^2, \lambda_A\omega^2\right\} \geq \min\left\{\lambda_B^2, \lambda_B\omega^2\frac{1}{t_B^2}\right\}$ which implies $\lambda_A \geq \lambda_B$. (ii) is equivalent to $\min\left\{\lambda_A, \omega^2\right\} \geq \min\left\{\lambda_B, \omega^2\frac{1}{t_B^2}\right\}$ which also implies $\lambda_A \geq \lambda_B$. So $\lambda_A \geq \lambda_B$ under UTF.

Consider UTP. Note that $p_{AA}^2 = 1 + \min\left\{0, (\lambda_B - \lambda_A)\frac{1-\omega^2}{\lambda_A^2}\right\}$. Suppose (i) holds, and suppose also that $\lambda_B \geq \lambda_A$. Then $p_{AA} = 1$, then $d_A = \lambda_A + \lambda_B\frac{\omega_B^2 - \lambda_B}{\lambda_A}$ and $d_{AA} = \lambda_A$, then $\frac{\left(\lambda_A + \lambda_B\frac{\omega_B^2-\lambda_B}{\lambda_A}\right)\lambda_A}{\lambda_A^2}\left(\lambda_A + \lambda_B\frac{\omega_B^2-\lambda_B}{\lambda_A}\right)\lambda_A >$

$\frac{\omega^2}{\lambda_B}\omega^2\lambda_B$, then $\lambda_A^2 + \lambda_B\left(\omega^2 - \lambda_B\right) > \omega^2\lambda_A$, then $\lambda_A > \lambda_B$, which contradicts $\lambda_B \geq \lambda_A$. So (i) implies $\lambda_A > \lambda_B$. Now suppose (ii) holds. It is equivalent to $d_A \geq d_B$, which is equivalent to $\min\left\{\lambda_A + \frac{\omega^2\lambda_B - \lambda_B^2}{\lambda_A}, \omega^2\right\} \geq \omega^2$. So $\lambda_A + \frac{\omega^2\lambda_B - \lambda_B^2}{\lambda_A} \leq \omega^2$, which yields $\lambda_A \geq \lambda_B$.

Proof of Corollary 1.

Follows trivially by evaluating (1) at any Equal Treatment equilibrium strategy profile.

B Appendix

B.1 Changes in the Economic Environment

Here we turn to a description of the comparative statics with respect to several parameters of interest. Conveniently, these affect equilibrium quantities exclusively through ω, the reduced-form parameter capturing how the information technology shapes socialization incentives. Here we discuss only the UT equilibria. In all unequal treatment equilibria, comparative statics over socialization rates and over interrogation rates are monotone in the key parameters of the model (within an equilibrium). We rely on the following Corollary to Proposition 3:

Corollary B.1. *Comparative statics with respect to ω:*

1. *UTF:*
$$\frac{\partial p^*_{HH}}{\partial \omega} > 0, \quad \frac{\partial p^*_{HG}}{\partial \omega} = \frac{\partial p^*_{GH}}{\partial \omega} = 0, \quad \frac{\partial p^*_{GG}}{\partial \omega} > 0,$$
$$\frac{\partial t^*_H}{\partial \omega} = \frac{\partial t^*_G}{\partial \omega} = 0.$$

2. *UTP:*
$$\frac{\partial p^*_{HH}}{\partial \omega} = 0, \quad \frac{\partial p^*_{HG}}{\partial \omega} > 0, \quad \frac{\partial p^*_{GH}}{\partial \omega} = 0, \quad \frac{\partial p^*_{GG}}{\partial \omega} > 0,$$
$$\frac{\partial t^*_H}{\partial \omega} < 0, \quad \frac{\partial t^*_G}{\partial \omega} = 0.$$

Increases in the likelihood of a threat χ:

$$\frac{\partial \omega}{\partial \chi} < 0. \tag{B.1}$$

When a threat that is perceived to be more likely (e.g., the US following the 9/11 terrorist attacks, or Turkey after the failed coup attempt of 2016) incentives for socialization fall. Thus, from Corollary B.1, a more likely threat leads to lower within and cross-group socialization, and a smaller gap between the interrogation rates of the favorably and unfavorably treated groups (a smaller gap between $t^*_{\mathcal{H}}$ and $t^*_{\mathcal{G}}$).

Improvements in the information technology b:

$$\frac{\partial \omega}{\partial b} < 0.$$

Improvements in the efficiency of the government's information aggregation technology (e.g., better internet surveillance protocols, diffusion of videocamera use by law enforcement) reduce incentives for socialization. Recall that a signal $\theta_i = 1$ is necessary for citizen i to be arrested. Conditional on such a signal, the posterior probability of threat membership will be higher the better the technology at correctly detecting threat members, and at avoiding wrong threat membership signals (the larger b). Because citizens unambiguously benefit from a lower probability of a signal $\theta_i = 1$, information technologies that make less of both type I and type II errors will reduce ex-ante socialization incentives. Corollary B.1 implies that more efficient information aggregation technologies lead to lower within and cross-group socialization, and a smaller gap between the interrogation rates of the favorably and unfavorably treated groups

Improvements in the 'standard of proof' $[\chi, \overline{\chi}]$:

$$\frac{\partial \omega}{\partial \overline{\chi}} > 0. \tag{B.2}$$

As (B.2) indicates, a higher upper bound for the standard of proof requirement, which makes it harder for the government to undertake arrests ex-post, increase socialization incentives. Corollary B.1 implies that a more stringent standard of proof leads to more within and cross-group socialization, and a larger gap between the interrogation rates of the favorably and unfavorably treated groups under partial segregation.

B.2 Unequal Treatment in the Akerlof (1976) Model

Suppose a group with label $\mathcal{B}$ and endogenous size $\lambda_{\mathcal{B}}$ is the outcast group. A social norm exists according to which any citizen who forms a link with an outcast is also an outcast (naturally, here we must allow for $\underline{\rho} = 0$). Group identities and socialization choices are determined simultaneously. Each citizen chooses $(\rho_{i,\mathcal{A}}, \rho_{i,\mathcal{B}})$, and $\mathcal{B}$ is determined as $\mathcal{B} = \{i \in \mathcal{B} \text{ iff } \rho_{iB} > 0\}$. As in our benchmark model, interrogation rates $(\tau_{\mathcal{A}}, \tau_{\mathcal{B}})$ are determined after socialization decisions have taken place. Notice that by construction, $\mathcal{A}$ and $\mathcal{B}$ are two disjoint groups. Consider symmetric equilibria where members of $\mathcal{A}$ play $(\rho_{\mathcal{A}\mathcal{A}}, 0)$, and members of $\mathcal{B}$ play $(0, \rho_{\mathcal{B}\mathcal{B}})$. Assuming no agent is born an outcast, $\mathcal{A} = \varnothing$ and $\mathcal{B} = \varnothing$ are both equilibrium group compositions. Are there (symmetric) equilibria where $\lambda_{\mathcal{B}} \neq 0$? Given $p_{\mathcal{A}\mathcal{A}}, p_{\mathcal{B}\mathcal{B}}$ and the expectations $t_{\mathcal{A}}, t_{\mathcal{B}}$, citizens' best replies can be characterized as follows: citizen i playing $(p_{i\mathcal{A}}, p_{i\mathcal{B}})$ has payoff

$$\begin{cases} \sqrt{p_{i\mathcal{A}} p_{\mathcal{A}\mathcal{A}} \lambda_{\mathcal{A}}} - \frac{1}{2\omega} p_{i\mathcal{A}} p_{\mathcal{A}\mathcal{A}} \lambda_{\mathcal{A}} t_{\mathcal{A}} \text{ if } p_{i\mathcal{B}} = 0 \\ \sqrt{p_{i\mathcal{B}} p_{\mathcal{B}\mathcal{B}} \lambda_{\mathcal{B}}} - \frac{1}{2\omega} p_{i\mathcal{B}} p_{\mathcal{B}\mathcal{B}} \lambda_{\mathcal{B}} t_{\mathcal{B}} \text{ if } p_{i\mathcal{B}} > 0 \end{cases}$$

Thus, in equilibrium,

$$\max_{p_{i\mathcal{A}}} \sqrt{p_{i\mathcal{A}} p_{\mathcal{A}\mathcal{A}} \lambda_{\mathcal{A}}} - \frac{1}{2\omega} p_{i\mathcal{A}} p_{\mathcal{A}\mathcal{A}} \lambda_{\mathcal{A}} t_{\mathcal{A}} = \max_{p_{i\mathcal{B}}} \sqrt{p_{i\mathcal{B}} p_{\mathcal{B}\mathcal{B}} \lambda_{\mathcal{B}}} - \frac{1}{2\omega} p_{i\mathcal{B}} p_{\mathcal{B}\mathcal{B}} \lambda_{\mathcal{B}} t_{\mathcal{B}},$$

which implies

$$\frac{\omega}{2t_{\mathcal{A}}} = \frac{\omega}{2t_{\mathcal{B}}} \Longrightarrow t_{\mathcal{A}} = t_{\mathcal{B}}.$$