Police Department Design, Political Pressure, and Racial Inequality in Arrests

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Abstract

This paper theorizes a source of bias in discretionary arrests: strategic limits on police officer learning. Within policing organizations led by chiefs with special expertise in crime control, the chief's assignments are a source of information about the most effective practices. However, if street-level officers are uncertain whether their chief is independent of political pressures, the chief's assignments will be less persuasive when they align with what political advocates want. In general, this mechanism represents a constraint on the effectiveness of professional police departments, where chiefs have limited means to force officer compliance with directives. In the post-civil rights era, this institutional inefficiency would have constrained the set of circumstances in which police officers could learn that they should reduce the intensity of arrests on Black residents.

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In many US jurisdictions, people racialized as Black make up a disproportionately large share of those arrested for minor offenses such as disorderly conduct or public intoxication. Police officers exercise discretion with limited oversight in such cases, and routinely choose not to arrest people for such conduct, leading scholars to refer to these as 'discretionary arrests' (National Research Council 2004, 63–64). While some of this disparity is due to different rates of offending, studies have identified jurisdictions where the probability of being arrested, conditional on engaging in criminal behavior, is higher for people racialized as Black than for those racialized as white (Beckett et al. 2005; Gelman, Fagan, and Kiss 2007; Knox and Mummolo 2020). This over-punishment has negative social, economic, and political consequences for Black residents in the United States (Burch 2013; Lerman and Weaver 2014; White 2019).

A growing body of research examines why the US carceral state is so racially disproportionate in its punishment. Some point to political strategies amplifying the influence of racial conservatives who saw police and prisons as tools of racial domination (Weaver 2007; Murakawa 2014; Hinton 2016; Eckhouse 2019); some point to ideological or institutional choices that preserved older practices with clear racial consequences (Miller 2008, 2010; Murakawa 2014; Taylor 2018; McCall 2019; Miller 2010); while others identify segregation and concentrated poverty among urban Black populations (Fortner 2015; Forman Jr 2017; Lacey and Soskice 2015). From these accounts, observed disparity in punishment has either persisted, emerged as the result of racial animus, or emerged in response to concentrated offending and criminal victimization.

I argue the design of police departments can be a source of racial bias under political conditions that regularly occur in US cities. If police chiefs were politically independent experts committed to crime control, their assignments for patrol officers would reflect their insights into what arrest practices best control crime. However, if police chiefs give assignments to satisfy political demands, officers cannot learn the most effective strategy from them. When

officers are uncertain whether assignments originate from their chief's expertise or a pressure group's goals, they can develop inaccurate beliefs that cause a form of racial discrimination in their arrest decisions. Two department features are necessary to produce this result. First, strong job protections for rank and file officers, which leave chiefs reliant on persuasion to change officer behavior. Second, limited job protections for expert chiefs, which provides a way for groups to pressure them into enacting particular policies.

I make this argument with a game of imperfect information between a police chief and patrol officers, in which the chief has private information about the arrest intensity that would best reduce crime among people in a social category. The chief cares either about controlling crime or satisfying political demands, and gives the officers an assignment before they choose an arrest intensity. The possibility that the chief is responding to political pressure makes their assignment less convincing when it matches what an influential group wants. Under parameters that correspond to many US cities since the civil rights movement, the model predicts that chiefs would only be able to convince officers that they should raise arrests intensity in Black neighborhoods, not lower it. Because officer learning is limited by features of the political and institutional context, I call this 'context constrained learning'.

The bureaucratic environment represented by the model is not unique to policing or racial equality in public services. Within policing, this mechanism could interfere with a department efficiently allocating punishment to any group whose exposure to punishment is contested, such as the homeless, juveniles, or people officers identify as LGBTQIA+. Similar dynamics could also arise in other street-level bureaucracies where the chief executive is both better informed about policy effects and vulnerable to political pressure, such as in public health agencies or financial regulators.

This paper's primary contribution is to identify a source of racial disparity in police stops and minor arrests that does not rely on officers or chiefs wanting to discriminate or failing to reason perfectly. It examines police departments as sites of racial learning for the officers

who enforce the law, and shows how features of their design can combine with political competition to systematically bias what those officers believe constitutes effective policing.

The model also shows how the incomplete transformation of American police departments from enforcers for political machines to expert-led and independent crime-control bureaucracies could produce new sources of disadvantage for residents. Reformers throughout the twentieth century articulated a vision of police chiefs as technocrats with sufficient neutrality and expertise that they should be isolated from political efforts to influence their methods. Some advocates saw these changes as a path to greater racial equity in policing. Despite widespread adoption of some reforms, independence from elected officials eluded most departments heads (Fogelson 1977, Ch 9). The model below shows that this incomplete transformation ensured that the benefits promised by police reformers would not be enjoyed by all.

The next section situates context constrained learning within research on strategic information transmission and racism. Section 2 presents and analyzes the model, identifying the conditions under which officers can learn from the chief. Section 3 summarizes key developments in the design of police departments that led to the communication inefficiency studied here, and section 4 discusses the implications of the model for the trajectory of racial inequality in arrests during the civil rights movement.

1 Sources of Inequality in Bureaucratic Decisions

This theory builds on models of statistical discrimination in policing, which posit that racial disparity may be driven by officers responding rationally to differences in rates of offense (Arrow 1971; Phelps 1972; Knowles, Persico, and Todd 2001). I depart from this research by not assuming that officers are correct about the optimal rates of arrest by race, instead modeling one source of information they have about it. In this way the model can identify

settings that generate what Bohren et al. call 'inaccurate statistical discrimination'. The model also builds on studies of strategic information transmission that have shown policy makers will be more responsive to advice from experts they agree with (Crawford and Sobel 1982; Calvert 1985; Gailmard and Patty 2012, Ch 5). In effect, disagreement about ideal outcomes garbles information transmission (Blackwell 1953). I emphasize an under-explored aspect of this general phenomenon, showing how it can generate asymmetric policy stickiness from *internal features* of 'street-level bureaucracies'.

According to Lipsky's definition, 'street-level bureaucracies' are characterized by limited oversight and variation in the particular decisions employees must make while dealing with the public (Lipsky 2010, 3). This affords individual bureaucrats tremendous discretion to decide according to whatever they think will work best. In this context when a bureaucrat cannot learn that a particular approach is best, they will not use it when told to, reducing the benefits of having experts direct policy for the organization.

> **Definition**: a bureaucrat's learning from a source is *constrained* if there is one or more possible practices that they cannot learn they should adopt, even when that would be their best option.[1] Their learning is *context constrained* if the constraint is the result of some feature of the learning context.

An unconstrained learning source is one from which the bureaucrat can learn that any of the possible "best" practices, is in fact the best (when this is the case). This paper studies the case of police officers learning from their chief about the effectiveness of different arrest

[1] This definition is agnostic with respect to how a bureaucrat's "best" option is defined. For the intuition from the model to apply, the only requirements on the objective is that it correlate with the department head's goals (see online appendix).

intensities. Officers' learning is constrained if, for example, they cannot learn that making fewer arrests would be best even when it is.

When applied to the case of policing and racial equality in arrests, constrained learning produces a form of discrimination under certain conditions. Unlike implicit bias or stereotyping this discrimination does not occur because officers use common mental shortcuts or reason incorrectly (Eberhardt et al. 2004; Glaser 2014; see Hübert and Little 2020 for a behavioral model with this feature). They are fully rational to do so, because features of their department design undercut the reliability of messages that tell them not to.

The notion that learned beliefs cause individuals to discriminate on the basis of race is central to definitions of prejudice (Allport, Clark, and Pettigrew 1954, ch1; Kinder and Sears 1981; Kinder, Sanders, and Sanders 1996; Bobo 1999). However, prejudice is conceptualized as an irrational or a-rational blend of preferences and beliefs without factual basis. The distinctive feature of what I propose, relative to prejudice, is to identify institutional features that bias how street-level bureaucrats learn to use race in their decision making. These features make reproducing racial inequality the rational course of action from the perspective of police officers, and so are an example of what Omi and Winant call a racial project that is racist (2014, 56).

Scholars of racial domination have theorized a role for institutions and reasoning in perpetuating discrimination, but relied on unexamined habits of thought and action. Eduardo Bonilla-Silva identifies frames, or "set paths for interpreting information" as central to the maintenance of 'color-blind racism' since the the civil rights movement (Bonilla-Silva 2013, 4–8, 73–78). These frames are mental habits for explaining phenomena that would, if considered differently, force revision of a person's racial beliefs. I show that police officer uncertainty about the motivations of their police chief can play an analogous role in preserving the belief that high arrest rates in Black neighborhoods is the most effective way to control crime. Rather than a mental habit, I show this can emerge from the governance structure

of municipal police departments.

Ian Haney López theorizes institutional racism as racial status enforcement that relies on racial meanings that are so widely shared as to not be examined (López 2000). López's theory assumes most behavior is guided by sets of familiar practices that people follow without conscious reflection. These 'scripts' are taught to new members of an organization, and so can cause an organization to coordinate around practices that rely on widely held racial meanings to reinforce racial hierarchies. This is a mechanism through which racial discrimination by individuals is perpetuated as a result of organizational features: the scripts given to new members. Context constrained learning differs from López's institutional racism because it relies on explicit reasoning, and so influences what police officers believe in addition to their actions.

2 Model of Officer Learning from Assignments

I represent arrest policy change as a game of incomplete information between a police chief (C) and n patrol officers under their command ($P_1 ... P_n$). In the game C assigns the Ps to raise, lower, or maintain the current arrest intensity ($a \in \Omega$, where $\Omega = \{\omega_R, \omega_M, \omega_L\}$). The Ps observe the assignment and then choose what arrest intensity to employ (x). I assume C knows which practice would be most effective, representing an environment where the Ps could potentially learn the most effective way to do their jobs from C. However, I complicate the scenario with the possibility that C is responding to political demands rather than choosing the most effective crime control strategy, and some subset of the Ps who just follow instructions. It is a modified special case of the costless signaling game introduced by Crawford and Sobel 1982.

The Ps' choices, $x_i \in \Omega$, together with a random variable, $\omega \in \Omega$, determine the department's performance reducing crime in a particular area or among a sub-population:

$y = -\sum_{i=1}^{n}(x_i - \omega)^2$. The ω represents conditions in the area or population that determine whether the department would be most effective if they raised (ω_R), lowered (ω_L), or maintained the status quo arrest intensity (ω_M).[2] For convenient, I assume that the increase or decrease is symmetric: $\omega_M - \omega_L = \omega_R - \omega_M = \Delta$. The *ex ante* probability that arrest intensities should lower, remain the same, or raise are $\pi_{\omega L}, \pi_{\omega M}, \pi_{\omega R} \in (0, 1)$. In order to highlight the effects of information transmission possibilities on behavior, I examine only those parameters where the Ps are confident enough in the status quo that they will change practices only if they learn some new information ($|\pi_{\omega R} - \pi_{\omega L}| < \frac{1}{2}$).

I represent the Ps as one of two types: either they care about their individual effect on crime or about following the assignment. Formally, $u_{p,i} = -\theta_{p,i}(x_i - \omega)^2 - (1 - \theta_{p,i})(x_i - a)^2$, where $\theta_p \in \{0, 1\}$ is P_i's type, the first term is their contribution to department performance, and a is the assignment. I refer to the Ps that care about department performance as 'crime-motivated' ($\theta_{p,i} = 1$) and the others as 'conflict-averse' ($\theta_{p,i} = 0$), because they decide in a way that minimizes conflict with their superior. The proportion of Ps that are crime-motivated is a parameter: $\lambda \in (0, 1)$. Higher values of λ represent departments with weaker disciplinary systems, more public service motivated officers, or a more powerful union.[3]

[2] I use ω to represent the most effective arrest intensity within a specific area or population, not relative to some other area or population. The model assumes a single most effective arrest intensity within the context of the other policy decisions the Chief makes. This does not imply that an entirely different approach to public safety would have the same optimal arrest intensity.

[3] Note, the costs of higher arrest intensities are not borne by the officer so assignments will not be disobeyed because they increase workloads.

C also has two types. The parameter π_c is the probability C is 'independent' ($\theta_c = 1$) and cares about reducing crime. Otherwise C is 'responsive' ($\theta_c = 0$) and wants the arrest intensity to satisfy one of two pressure groups. Their utility is: $u_c = \theta_c y - (1 - \theta_c) \sum_{i=1}^{n} (x_i - \gamma)^2$. I model the direction of the pressure as the realization of a random variable ($\gamma \in \{\omega_L, \omega_R\}$) in order to represent the Ps not being certain which political coalition is influencing C: one trying to lower arrest rates or raise them. Lower values of π_γ represent circumstances where pressure on the chief is more likely to come from anti-racists. C's types could represent fixed characteristics of an individual when a new chief is appointed, or could represent how a single person makes decisions over time as political conditions change.

Both C types know everything about the game. They observe the optimal arrest intensity (ω), their own type (θ_c), and the direction of political pressure (γ) before choosing an assignment (a). They also know the proportion of Ps that are crime-motivated (λ). The Ps observe C's assignment, but only know the *ex ante* probabilities that each arrest practice would be most effective ($\pi_{\omega L}, \pi_{\omega M}, \pi_{\omega R}$), C is independent (π_c), and the pressure group wants to raise arrest intensity (π_γ).

To summarize, the game proceeds as follows:

0. Nature chooses C's type, the direction of political pressure, and the most effective arrest intensity.

1. C observes their type, the direction of political pressure, and the most effective arrest intensity and then gives an assignment.

2. The Ps observe the assignment and simultaneously choose arrest intensities.

Representation of Police Objectives and Information

This model represents police officers and their chief as motivated to reduce crime, and treats the relationship between arrest intensity and crime reduction as the realization of a random variable unobserved by patrol officers. This partial equilibrium approach differs

from models of statistical discrimination in policing, which assume officer utility derives from arresting law breakers (e.g. Knowles, Persico, and Todd 2001). Arrest maximization can be interpreted as maximizing crime control only with additional assumptions about the relationship between arrests, searches, and crime reduction (Stashko 2020). Anwar and Fang note that career advancement in the department they study is in part determined by officer arrest records (Anwar and Fang 2006, 134), but I incorporate career concerns by assuming that some fraction of officers pay a cost from choosing an arrest intensity that differs from their assignment.

The information asymmetry studied here is not present in models of statistical discrimination and much scholarship in agency theory. To solve statistical discrimination models of policing, analysts assume officers are correct about the marginal effect of increased arrest intensity by race as part of the Perfect Bayes solution concept. Agency models tend to assume that agents will have better information than their principal about the specific conditions that determine a policy's effect (Bendor, Glazer, and Hammond 2001). I reverse this because police officers do not observe their effect on crime; at best they can see whether a person they arrested went on to re-offend, but they never observe *what would have happened if they had done something else*. Better resourced police departments have maintained units that analyze crime and arrest data to inform policy choices since before World War II (Fogelson 1977, 224; See National Research Council 2004, Ch 6). While this did not solve the fundamental problem of causal inference, it put chiefs in a better position than patrol officers to estimate the effect of arrests on crime rates.

What Assignments Could Produce 'Racial Learning'?

Although racial profiling by police continues to be identified in the twenty-first century, its use is subject to careful scrutiny by US courts, so police chiefs in most departments would not give explicit instructions to increase punishment on Black people (American Civil Liberties Union 2009). However, overtly racial assignments are not required for officers to

learn to use racial cues in a way that would change the racial distribution of arrests.

Assignments dealing with racially homogeneous groups could lead to learning with racial consequences. Residential segregation provides many racially homogeneous neighborhoods, where instructions about arrest practices meet this criteria. Assignments relating to racially exclusive organizations, such as street gangs in some cities, do as well. Officer assignments dealing with these groups could induce learning that does not apply to every member of a racial group, but applies to a racially defined subset of the population.[4]

Officers might also learn about the appropriate racial distribution of arrests when public discussion focuses on that feature of a police program. When advocates call for policy change because the status quo involves too many arrests of people from a particular racial or ethnic group, and department leadership defends the effectiveness of those programs while acknowledging the racial disparity it involves, officers would be correct to conclude that their leaders are saying that disparity is integral to good law enforcement. Public debates in the early 2010s about 'stop and frisk' policies in New York had this structure (See Baker 2010).

2.1 Analysis: Officer Beliefs and Arrest Behavior

I examine the information transmission properties of this institutional setting using the perfect Bayesian equilibrium solution concept because it is a sequential game with private information. In this analysis, I focus on pure strategy PBE in which the independent chief assigns the arrest intensity that is most effective. For the remainder of this analysis, I refer to these as Semi-Truthful Equilibria (STE), because they are semi-separating equilibria where one of the chief's types truthfully reports the most effective arrest intensity. I restrict my

[4] See Crenshaw 1989 for a critique of defining discriminatory practices as 'racial' only when they disadvantage all members of a racialized group.

attention to STE because these are in the set of equilibria in which the Ps can learn the most, exist for all parameters I consider, and within them C's assignments can serve as an unconstrained learning source, where possible.[5]

The Ps move after receiving an assignment and so can condition their choice on a. Since the conflict-averse Ps' utility depends only on matching a, their unique sequentially rational action is to follow the assignment. In contrast the crime-motivated Ps' utility depends on what action would be most effective, so they will only raise or lower their arrest intensity if they are sufficiently confident that the change would be more effective. Thus, C's assignment can only change their behavior by changing their beliefs.

Lemma 1. *In equilibrium the crime-motivated Ps will raise or lower their arrest intensity only if they are sufficiently convinced by their assignment that doing so will improve department performance, while the conflict-averse Ps will follow their assignment.*

Formally, the Ps' sequentially rational choices are:

$$x(a, \theta_{p,i}) = \begin{cases} \omega_j & \text{if } \theta_{p,i} = 1 \text{ and } Pr(\omega_j|a) \geq \frac{1}{2} + Pr(\omega_k|a) \text{ for } j,k \in \{L,R\} \\ \omega_M & \text{if } \theta_{p,i} = 1 \text{ and } |Pr(\omega_j|a) - Pr(\omega_k|a)| \leq \frac{1}{2} \text{ for } j,k \in \{L,R\} \\ a & \text{if } \theta_{p,i} = 0 \end{cases}$$

[5] I demonstrate equilibrium existence in appendix A. In the online appendix I show that, within the parameters I consider, the Ps cannot learn more in any other PBE than in the STE.

Proof. $EU_{p,i}(x_j|a, \theta_{p,i} = 1) = \begin{cases} -\Delta^2(Pr(\omega_M|a) + 4Pr(\omega_R|a)), & \text{when } x_j = \omega_L \\ -\Delta^2(Pr(\omega_L|a) + Pr(\omega_R|a)), & \text{when } x_j = \omega_M \\ -\Delta^2(Pr(\omega_M|a) + 4Pr(\omega_L|a)), & \text{when } x_j = \omega_R \end{cases}$. Substituting for $Pr(\omega_M|a)$, it is sequentially rational for P_i to choose ω_j when $\theta_{p,i} = 1$ iff:

$$Pr(\omega_j|a) \geq \frac{1}{2} + Pr(\omega_k|a) \qquad \text{for } j, k \in \{L, R\} \tag{1}$$

If the conditions for ω_L and ω_R are not met, P_i's sequentially rational choice is ω_M.

$EU_{p,i}(x_i = \omega_j|a = \omega_j) = 0$ and $EU_{p,i}(x_i = \omega_k|a = \omega_j) < 0$ for any $j, k \in \{L, M, R\}$ so the unique sequentially rational choice when $\theta_{p,i} = 0$ is $x_i = a$. □

Since the Ps do not know which pressure group might be influencing C, they remain uncertain about the most effective policy when told to change. After observing $a \in \{\omega_L, \omega_R\}$ they could be facing an independent C who chose what they know is best, or a responsive C who ignored their private information. In contrast they know that the status quo is most effective when told to maintain it because both pressure groups want to change policy in one direction or the other.

Lemma 2. *In an STE the Ps will be certain that the status quo is most effective if they are assigned it. However, C's assignment to lower (raise) arrests is less convincing as: 1) the chances increase that the pressure group that wants to lower (raise) arrests is most influential; 2) the chances decrease that C is independent; and 3) the chances decrease that lowering (raising) arrests is most effective.*

Proof. I show that the Ps' beliefs consistent with C's STE strategy are:

$$Pr(\omega_j|a) = \begin{cases} \pi_{\omega j}\left(\frac{\pi_c + Pr(\gamma=\omega_j)(1-\pi_c)}{\pi_{\omega j}\pi_c + Pr(\gamma=\omega_j)(1-\pi_c)}\right), & \text{if } j \in \{L,R\} \text{ and } a = \omega_j \\ \pi_{\omega j}\left(\frac{Pr(\gamma=\omega_k)(1-\pi_c)}{\pi_{\omega k}\pi_c + Pr(\gamma=\omega_k)(1-\pi_c)}\right), & \text{if } j \in \{L,R\} \text{ and } a = \omega_k \text{ for } k \in \{L,M,R\} \\ 1, & \text{if } j = M \text{ and } a = \omega_M \\ 0, & \text{if } j \neq M \text{ and } a = \omega_M \end{cases} \tag{2}$$

The Ps' beliefs that the assignment $a = \omega_j$ is the most effective are:

$$Pr(\omega_j|a) = Pr(\omega_j|a, \theta_c = 1)Pr(\theta_c = 1|a) + Pr(\omega_j|a, \theta_c = 0)Pr(\theta_c = 0|a) \tag{3}$$

When C uses the STE strategy, $Pr(\omega_j|a = \omega_j, \theta_c = 1) = 1$, $Pr(\omega_k|a = \omega_j, \theta_c = 1) = 0$, $Pr(\omega_j|a = \omega_j, \theta_c = 0) = \pi_{\omega j}$ and $Pr(\omega_k|a = \omega_j, \theta_c = 0) = \pi_{\omega k}$ for all $j, k \in \{L, M, R\}$.

In an STE $Pr(\theta_c = 1|a = \omega_j) = \frac{Pr(a=\omega_j|\theta_c=1)Pr(\theta_c=1)}{Pr(a=\omega_j|\theta_c=1)Pr(\theta_c=1)+Pr(a=\omega_j|\theta_c=0)(1-Pr(\theta_c=1))}$. After $a \in \{\omega_L, \omega_R\}$, $Pr(a = \omega_j|\theta_c = 1) = \pi_{\omega j}$ and $Pr(a = \omega_j|\theta_c = 0) = Pr(\gamma = \omega_j)$. Therefore $Pr(\theta_c = 1|a = \omega_L) = \frac{\pi_{\omega L}\pi_c}{\pi_{\omega L}\pi_c + (1-\pi_\gamma)(1-\pi_c)}$ and $Pr(\theta_c = 1|a = \omega_R) = \frac{\pi_{\omega R}\pi_c}{\pi_{\omega R}\pi_c + \pi_\gamma(1-\pi_c)}$. Making the substitutions into equation (3), the beliefs consistent with $a \in \{\omega_L, \omega_R\}$ in an STE are in equation (2). After $a = \omega_M$, $Pr(\theta_c = 0|a = \omega_M) = 0$, so $P(\omega_j|a = \omega_M) = Pr(\omega_j|a = \omega_M, \theta_c = 1)$. Therefore the beliefs consistent with $a = \omega_M$ in an STE are in equation (2).

Note from equation (2), $\frac{\partial}{\partial \pi_c} Pr(\omega_j|a = \omega_j) > 0$ and $\frac{\partial}{\partial \pi_{\omega j}} Pr(\omega_j|a = \omega_j) > 0$ for $j \in \{L, R\}$, so $Pr(\omega_j|a = \omega_j)$ is increasing in π_c and π_{ω_j}. Also, $\frac{\partial}{\partial \pi_\gamma} Pr(\omega_R|a = \omega_R) < 0$ and $\frac{\partial}{\partial \pi_\gamma} Pr(\omega_L|a = \omega_L) > 0$, so $Pr(\omega_R|a = \omega_R)$ is decreasing in π_γ and $Pr(\omega_L|a = \omega_L)$ is increasing in π_γ. □

The Ps' certainty that an assignment is correct depends on the institutional environment and their expectations of what will be most effective. When they are confident in the chief's independence ($\pi_c \to 1$) any assignment is likely the most effective. As their confidence in C's independence declines, they will be less convinced by assignments that contradict their

expectations. Similarly, changes that the pressure groups are likely to have influenced also become less convincing. When both pressure groups are as likely to have influenced C, learning is impacted equally for both possible changes. However, if one pressure group is more likely to be influential, assignments in that direction become uniquely less convincing. For example, if the most influential pressure group is likely to be the one that wants to reduce arrest intensity ($\pi_\gamma \to 0$), those assignments become less convincing than assignments to raise arrest intensity.

The fact that C's assignment can convey different amounts of information to the Ps creates the possibility that the crime-motivated Ps will not obey all assignments in equilibrium. If their confidence in C's independence falls below certain levels, which I call **learning thresholds** (π_c^{*L}, π_c^{*R}), the assignment is not convincing enough for the crime-motivated Ps to follow it and they will choose to maintain the status quo instead.

Proposition 1. *No PBE exist in which the crime-motivated Ps will lower (raise) arrest intensity if C is independent with probability less than the learning threshold π_c^{*L} (π_c^{*R}). The learning threshold for either direction of change decreases as the officers become more confident that change in practices is the most effective, and increases with the chance that the more influential pressure group wants it.*

Formally, there are no PBE where $x_i^*(\omega_j|\theta_{p,i} = 1, \pi_c < \pi_c^{*j}) = \omega_j$ for $j \in \{L, R\}$, and $\frac{\partial \pi_c^{*j}}{\partial Pr(\gamma=\omega_j)} > 0$ and $\frac{\partial \pi_c^{*j}}{\partial \pi_{\omega j}} < 0$ for $j \in \{L, R\}$.

Proof. I derive π_c^{*L}, π_c^{*R} and show by contradiction.

I show in the proof for Lemma (1) that $x_i^*(\omega_j|\theta_{p,i} = 1) = \omega_j$ for $j \in \{L, R\}$ requires inequality (1). Substituting the Ps' consistent beliefs from equation (2), this gives the

learning thresholds:

$$\pi_c^{*R} = \frac{\pi_\gamma(1 + 2\pi_{\omega L} - 2\pi_{\omega R})}{\pi_\gamma(1 + 2\pi_{\omega L} - 2\pi_{\omega R}) + \pi_{\omega R}} \qquad \pi_c^{*L} = \frac{(1 - \pi_\gamma)(1 + 2\pi_{\omega R} - 2\pi_{\omega L})}{(1 - \pi_\gamma)(1 + 2\pi_{\omega R} - 2\pi_{\omega L}) + \pi_{\omega L}}$$

Note, $\frac{\partial \pi_c^{*L}}{\partial \pi_\gamma} < 0$ and $\frac{\partial \pi_c^{*R}}{\partial \pi_\gamma} > 0$ when $|\pi_{\omega R} - \pi_{\omega L}| < \frac{1}{2}$, and $\frac{\partial \pi_c^{*L}}{\partial \pi_{\omega L}}, \frac{\partial \pi_c^{*R}}{\partial \pi_{\omega R}} < 0$ for all parameters.

Suppose toward a contradiction, there were a PBE where $x_i^*(\omega_j|\theta_{p,i} = 1, \pi_c < \pi_c^{*j}) = \omega_j$ for $j \in \{L, R\}$. Let $z = \gamma$ for $\theta_c = 0$ or $z = \omega$ for $\theta_c = 1$. Using the unique sequentially rational choices for P when $\theta_{p,i} = 0$ from Lemma 1,

$$EU_c(a|z) = \begin{cases} -n\lambda(\omega_j - z)^2 - n(1-\lambda)(\omega_j - z)^2, & \text{if } a = \omega_j \\ -n\lambda(x_i^*(\omega_M|\theta_{p,i} = 1) - z)^2 - n(1-\lambda)(\omega_M - z)^2, & \text{if } a = \omega_M \\ -n\lambda(x_i^*(\omega_k|\theta_{p,i} = 1) - z)^2 - n(1-\lambda)(\omega_k - z)^2, & \text{if } a = \omega_k \end{cases}$$

When $z = \omega_j$, C strictly prefers $a = \omega_j$ over $a \in \{\omega_M, \omega_k\}$ if $\lambda < 1$. Since λ $(0, 1)$ any PBE includes $a^*(z = \omega_j, \pi_c) = \omega_j$, so the Ps consistent beliefs include $Pr(a = \omega_j|\theta_c = 0, \gamma = \omega_j) = 1$,$Pr(a = \omega_j|\theta_c = 1, \omega_j) = 1$, and $Pr(a = \omega_k|\theta_c = 1, \omega_j) = 0$. In addition, when $z \neq \omega_j$, C strictly prefers some $a \in \{\omega_M, \omega_k\}$ over $a = \omega_j$ if $\lambda < 1$. Thus any PBE includes $a^*(z \neq \omega_j, \pi_c) \neq \omega_j$, so the Ps consistent beliefs include $Pr(a = \omega_j|\theta_c = 0, \gamma \neq \omega_j) = 0$ and $Pr(a = \omega_j|\theta_c = 1, \omega \neq \omega_j) = 0$. Therefore $Pr(a = \omega_j|\theta_c = 0) = Pr(\gamma = \omega_j)$, $Pr(a = \omega_j|\theta_c = 1) = Pr(\omega_j) = \pi_{\omega j}$, $Pr(\omega_j|a = \omega_j, \theta_c = 0) = \pi_{\omega j}$, and $Pr(\omega_j|\theta_c = 1) = 1$. Also $Pr(\omega_k|a = \omega_j, \theta_c = 1) = 0$ and $Pr(\omega_k|a = \omega_j, \theta_c = 0) = \pi_{\omega k}$.

Substituting these quantities into equation (3) for $j, k \in \{L, R\}$ gives the consistent beliefs $Pr(\omega_j|a = \omega_j)$ and $Pr(\omega_k|a = \omega_j)$ from equation (2). I showed that satisfying inequality (1) with the beliefs in equation (2) requires $\pi_c \geq \pi_c^{*j}$, so by lemma 1 $x(\omega_j|\theta_{p,i} = 1, \pi_c < \pi_c^{*j}) = \omega_j$ is not sequentially rational, so no PBE exists that includes it. □

Proposition 1 expresses the core argument of this paper: when the crime motivated Ps are unsure enough of C's independence, they cannot be convinced to change their arrest practices. When C faces more pressure to change in one direction, convincing the Ps to

follow that assignment requires an even higher chance of being independent. While my analysis has focused on a particular kind of equilibrium, Proposition 1 also shows that limits on when the Ps can be convinced to change practices hold for all PBE of the model.[6]

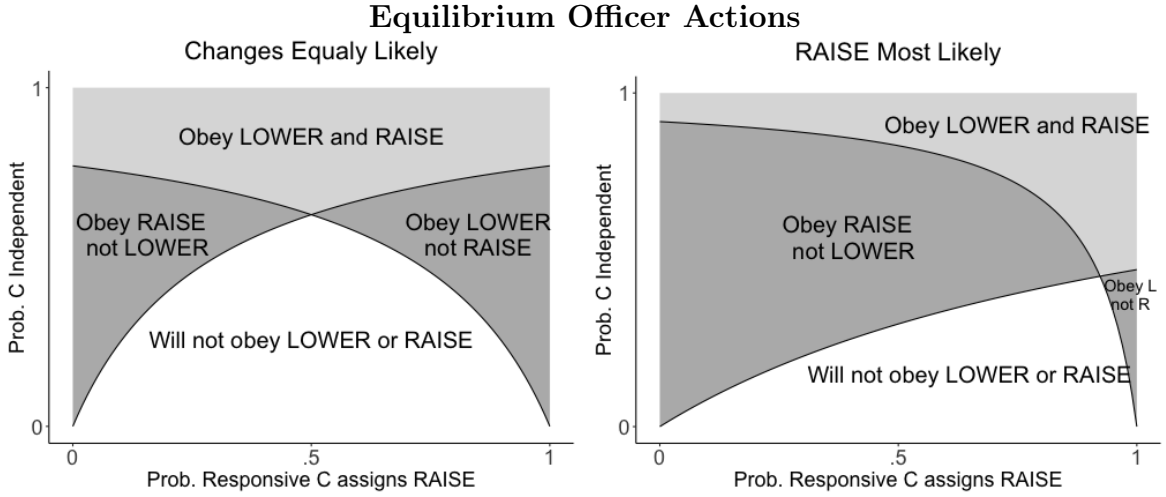

Figure 1: solid lines are learning thresholds. Constrained learning below solid lines; constraint asymmetric in dark gray regions. Left: $\pi_{\omega L} = \pi_{\omega R} = .3$; Right: $\pi_{\omega L} = .15$, $\pi_{\omega R} = .45$

Figure 1 shows the boundaries of where the crime motivated Ps will obey assignments to change arrest practices. The solid lines in both panels are the learning thresholds, and so delimit where equilibria exist in which the Ps will obey all assignments (light gray), neither raise nor lower (white), or only raise OR lower (dark gray). The left panel assumes both changes are equally likely to be most effective ex ante, and illustrates that as pressure becomes stronger in either direction, a region emerges within which C can convince officers to change in one direction but not the other (in dark gray). When officer priors are symmetric, this region is identical for both directions of possible influence.

The right panel of figure 1 is a case where raising arrests is more likely to be the most effective. It shows that this asymmetry in the Ps ex ante beliefs creates a larger region where they will obey an assignment to raise arrests but not lower them. Further, with this asymmetry the pressure on C no longer has to be stronger in favor lowering arrests in order

[6] I show in the online appendix that the learning limits hold for all PBE.

for the Ps to obey assignments to raise arrests but not lower them. This illustrates that a pressure group advocating for a change that the Ps are skeptical of can have less influence over C before their intervention constraints learning. The right side of the figure represents parameters where the C would be under heavier pressure to raise arrests on Black residents than lower them, but there is still a range of possible chief independence within which the Ps will obey assignments to raise arrest intensity but not lower it.

In the dark gray regions *rational officers cannot be convinced that one change to policy is the most effective crime control strategy.* However, they can learn that a change in the opposite direction is most effective. Thus, C's assignments are a context constrained learning source when C's chances of being independent fall between the two learning thresholds.

2.2 The Cost of Pressuring the Police

The analysis thus far suggests that an expert-led police department where officers have significant discretion can manifest an information-based resistance to political intervention. This raises the question: why would groups attempt to publicly intervene in the operation of a police department if it can prevent some officers from learning that their preferred strategy is best? An account of what determines the political strategy of groups or movements attempting to influence police behavior is beyond the scope of this paper, but the model offers one insight on the topic: groups whose preferred policy is unlikely to be enacted lose less from constraining officer learning. I show this by considering the welfare of a pressure group with utility identical to the responsive C: $u_G = -\sum_{i=1}^{n}(x_i - \omega_L)^2$ or $u_G = -\sum_{i=1}^{n}(x_i - \omega_R)^2$.

Lemma 3. *The pressure group always pays a cost if officer learning is constrained from their preferred policy. This cost is increasing in the chance that their preferred policy is most effective, and the proportion of officers that are crime-motivated.*

Proof. After the realizations of π_c and λ, a pressure group's expected utility from a STE is:

$$\begin{aligned} EU_G(STE) =& Pr(\omega_j, \theta_c = 1) EU_G(x^*|a = \omega_j) + Pr(\omega_M, \theta_c = 1) EU_G(x^*|a = \omega_M) \\ &+ Pr(\omega_k, \theta_c = 1) EU_G(x^*|a = \omega_k) + Pr(\theta_c = 0, \gamma = \omega_j) EU_G(x^*|a = \omega_j) \\ &+ Pr(\theta_c = 0, \gamma = \omega_k) EU_G(x^*|a = \omega_k) \end{aligned}$$

For $j, k \in \{L, R\}$. The difference for a pressure group that prefers ω_j is $D = n\Delta^2\lambda(\pi_c\pi_{\omega j} + (1 - \pi_c)Pr(\gamma = \omega_j))$, so $D > 0$ when $\pi_c, \pi_\gamma, \lambda \in (0, 1)$. Note, $\frac{\partial D}{\partial \pi_{\omega j}} = n\lambda\pi_c\Delta^2 > 0$ and $\frac{\partial D}{\partial \lambda} = n\Delta^2(\pi_c\pi_{\omega j} + (1 - \pi_c)Pr(\gamma = \omega_j)) > 0$, so since $\lambda, \pi_c \in (0, 1)$ and $\Delta > 0$, D is strictly increasing in $\pi_{\omega j}$ and λ. □

Lemma 3 gives one indication of which pressure groups would be more likely to try to influence the chief despite their intervention constraining the Ps' learning. Groups whose preferred policy is less likely to be arrived at without political pressure lose less when officer learning is constrained. In addition, the immediate material consequences of the constraint are reduced as $\lambda \to 0$. Thus in departments where the chief has greater control over the disciplinary process, the immediate behavioral consequences of learning constraints can be mitigated. However, these still result in police officers and future police chiefs developing inaccurate beliefs about the contribution of arrests to crime reduction.

2.3 Outside Pressure vs. Expert Advice

The model analyzed above makes the simplifying assumption that a department has a single objective, and that outside pressure groups want the same change no matter its impact on department performance (as the Ps value it). This ensures that pressure can provide no information about the most effective arrest practices. From a substantive standpoint, this assumes an especially difficult position for the pressure group: one where their interests

are unrelated to the goals of the street-level bureaucrats whose behavior they are trying to change.

In an online appendix I analyze an extension to this model in which a single pressure group's demand is not static, but responds to the effectiveness of police practices at controlling a different definition of crime.[7] In this extension the relationship between following the pressure group's wishes and controlling crime (as defined by the officers) is determined by how similar their goals are. When the goals are very similar, the pressure group is effectively an outside expert, while if their goals are very different, the pressure group's demand tells the officer nothing about how to best achieve their goals.

I show that the officers' learning threshold changes as a result of how similar the pressure group's goals are to the crime-motivated officers. When a group's goals are very different, the learning threshold is higher. However, when goals are similar enough, the officer's can have very little faith in the chief's independence and still be convinced to change. This shows that officer beliefs about a pressure group's goals are central to whether their campaigns induce context constrained learning within a police department. If officers see the pressure group as trying to change policy in line with their expertise, so long as their goals are similar enough, the group can be more influential before officer learning is constrained. In contrast

[7] James Q. Wilson noted that although the stated purpose of police departments is to control crime, implementing this objective requires deciding between contradictory defensible interpretations (J. Q. Wilson 1968, 61–2). For example, crime minimization and the equalization of crime risk throughout a jurisdiction are not, in general, compatible goals. When considering the occurrence of a single crime, there might be political disagreement about which objective the police should pursue. In a world where a plethora of behaviors are criminalized, the set of defensible definitions is practically limitless (Carbado 2016).

if the officers construct a group as trying to change policy without regard for its impacts on department performance, the group can have less influence before officers no longer learn that their preferred policy is the most effective.

3 The Political Development of Police Independence

The model above shows that bureaucracies led by an expert who is vulnerable to political pressure, while their less-informed subordinates are not, will be resistant to certain kinds of policy change. But why would any bureaucracy have these features? In short, US police agencies were built through what Eric Schickler calls "disjointed pluralism" (Schickler 2001, 12–18). Local political coalitions made changes at different times, for different reasons, often with a mix of contradictory objectives united within the coalition necessary to enact reform. This established the preconditions for expert police chiefs and racial justice advocates to find themselves at odds over how increasing Black political power should be wielded to change municipal policing from the civil rights movement to the present.

Political machines, political parties, and ideological campaigns have all used control of police departments to advance their goals. Political machines used them as sources of patronage jobs and selectively deployed their enforcement powers to benefit residents loyal to the machine (Fogelson 1977, Ch 1; Pinderhughes 1987, Ch 6; Balto 2019, Ch 2). When this influence caused scandals in the late nineteenth century, several state legislatures took control of urban police departments from city administrations from the opposing party (Fogelson 1977, 14–15). Marie Gottshalk recounts how the anti-domestic violence and anti-rape movements pressured police departments to address their concerns (Gottschalk 2006, 118–128). Their methods and objectives differed, but all of these actors saw controlling the police as a means to their ends.

Starting in the early twentieth century, police chiefs joined anti-machine reformers in

lobbying for three kinds of changes to give expert chiefs greater influence on policy. Some aimed to increase the departments ability to plan and assess the effect of officer activities, including systems for distributing orders, more expansive record keeping, and data analysis units (Fogelson 1977, Ch 9). These gave chiefs unprecedented expertise, represented in the model by C knowing the most effective policy, and gradually took root in all major cities. Chiefs also aimed to reduce their own vulnerability to outside political pressure, through fixed terms or enumerating the acceptable grounds for their dismissal (e.g. IACP Police Chief Executive Committee 1976, 132–39). Elected officials were loathe to tie their hands so protections were fleeting in the few cities that established them, corresponding to lower probabilities of independent chiefs in the model (Smith Sr and Smith Jr 1960, 198–200). Finally, chiefs and their allies attempted to centralize control over police activity in the chief's office, such as by giving chiefs exclusive control over personnel decisions and establishing units to investigate officer behavior (e.g. O. W. Wilson 1963, 120–24). As police unions gained strength, they successfully won the opposite changes in many cities: procedural protections for officers the chief wanted to discipline and organized labor action to retaliate when they felt the chief was treating one of their number unfairly (Fogelson 1977, 229). This corresponds to higher proportions of 'crime-motivated' officers in the model. This combination of reforms created the information and accountability structure that I study.

The selective resistance to policy change identified by this model was the result of neither police chiefs nor racial justice advocates being powerful enough to redesign the institution without having to compromise. If police chiefs advocating professionalization had their way, they would have given themselves total independence and unrestricted disciplinary control ($\lambda = 0$ and $\pi_c = 1$). Learning is not constrained without uncertainty about the chief's motivations, but it would create a department without incentive to respond to local political preferences. On the other hand if community control advocates had achieved total victory, the chief would be responsive for certain and officers would have been subject to

strict discipline ($\pi_c = 0$ and $\lambda = 0$). In this case officer discretion would be minimal so political victory would come with policy control, but department policy would only respond to expertise that elected officials could be convinced to follow.

With increasing Black political power in the 1950s and '60s, the political projects of racial equality and police independence came into conflict for the first time. To reduce abuse of Black residents, some civil rights groups called for external accountability through civilian review boards. Police chief associations decried these boards as political intervention that would make departments less effective at controlling crime (e.g. Tamm 1964), and united with police unions to eliminate them in several major cities (Richardson 1974, 183–85). These conflicts established the political battle lines through American cities that were entrenched over the next half century.

4 Implications

The model shows that vulnerability to political pressure reduces the persuasiveness of a chief's assignment, and when that pressure is asymmetric it creates the possibility that officers can only be convinced to change arrest intensity in one direction. Further, as the officer's prior credence in a particular change decreases, they require even greater belief in the chief's independence to follow that assignment.

These results show common features of department design change the value of political resources in contests over what the goals of policing should be, favoring groups ideologically aligned with rank and file officers. Rather than eliminating political influence on police, this structure generates resistance to groups influencing policing through mass protest or electoral victories. Groups with the resources to pressure the chief without officers knowing, who can develop what officers recognize as expertise, or whose goals align with the rank and file officers can influence the department without being constrained by this mechanism.

Crucially, the design reduces the value of a political resource central to the repertoire of racial and economic justice advocates.

The racial implications of this department design differ in two recent phases of US racial politics, which King and Smith call the 'Jim Crow' and 'color-blind' racial orders (King and Smith 2011). The Jim Crow order was defined by the explicit political objective of preserving white racial domination, leaving racial liberals to call for an end to racial considerations in public life. Politics in the color-blind racial order are characterized by nominal consensus around racial equality, and involve racial liberals advocating race-conscious policies to address discrimination and its aftereffects while conservatives advocate race-neutral policies. The transition from the Jim Crow order to a color-blind order occurred at different times in different places, as did reforms aimed at professionalizing police departments, so the immediate impact of reforms should have depended on local political and racial contexts (Weir 2005).

Where some measure of professional independence was achieved under a Jim Crow racial order (when $\pi_\gamma \to 1$ in the model), such as Atlanta in the 1950s, the communication inefficiency identified in this model would have impaired the ability of white supremacists in the governing coalition to increase punishment of Black residents. In particular, crime motivated officers would need to be relatively certain of the chief's independence in order to learn from their assignments that increasing arrests on Black residents was the most effective strategy. The notion that more professionalized police would be resistant to white supremacist pressure was central to the possibility of coalition between racial liberals and conservatives around 'race-neutral' carceral state building in the 1960s (Murakawa 2014, Ch 3).

Under a color-blind racial order (when $\pi_\gamma \to 0$ in the model), the communication inefficiency would hamper efforts to reduce punishment on those groups. Direct political pressure for a reduction in rates of punishment for Black citizens would reduce the persuasiveness of a chief's assignment to reduce arrest rates of Black people. Consider the example of Detroit.

Jerome Cavanagh won the 1961 Detroit mayoral election with heavy support from Detroit's growing Black population. During the campaign he promised Black supporters that he would improve how police treated them, and upon taking office he appointed George C. Edwards as police commissioner. Edwards had a history of advocating for racial equality in housing and policing, and his appointment garnered widespread approval from Detroit's Black political elite (Stolberg 2002, 17–28, 130–31). The Detroit Free Press reported that many rank and file officers saw Edwards' appointment as evidence that "the day of enforcing the law in Detroit was over and that the days of semi-independence from political control were at an end" (128).[8] This scenario corresponds to parameters in the model where officers think the chief is likely responsive, and place high probability on the outside pressure group advocating for lower arrest intensity among Black residents. With these parameters the model implies that a chief's assignment to reduce arrest intensity would be unlikely to convince crime-motivated officers to obey.

Available data from the Detroit Police Department suggests that Edwards was unsuccessful at reducing Black-white disparity in discretionary arrests. Figure 2 shows arrests for various less serious offenses for the years 1958 though 1965. The filled circles are the number of arrests coded as non-white (the vast majority of which were Black), the open triangles are white arrests, and the line is the difference between them.[9] Edwards was Commissioner for most of 1962 and '63, and the figure shows that the difference between the numbers of non-white and white arrests was higher when he resigned than when he started.

[8] Although Edwards required "reassurance that he would have a free hand to run the police department without political interference" before he agreed to accept the position (Ibid., 36).

[9] I plot two racial categories because the arrest figures are only aggregated by white/non-white in the reports for 1963-65. I exclude assault because the reports do not distinguish between felony and misdemeanor assault in 1964-65.

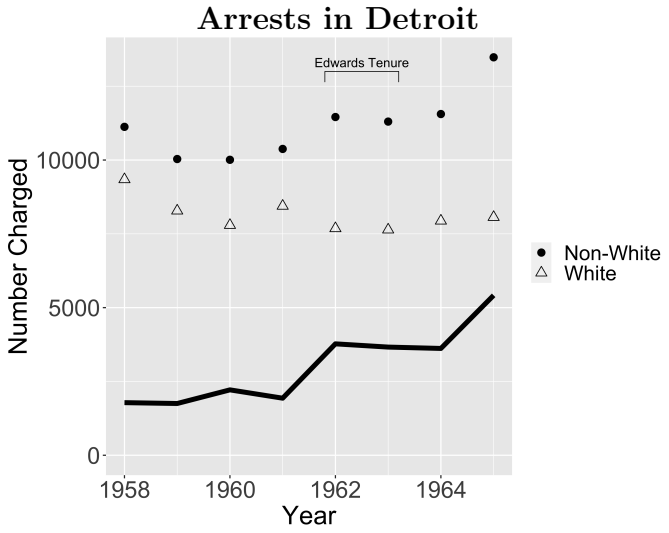

Figure 2: arrests by racial classification for UCR Part 2 offenses in Detroit (excluding assault, traffic, and other motor vehicle offenses). Solid line: difference between non-white and white totals. Edwards led the department Jan. 3rd, 1962 to Dec. 19th, 1963. Source: Record Bureau 1959-66.

It is certainly the case that Edwards faced opposition to his policies by police officers who wanted to enforce racial segregation and enjoyed punishing Black people. However, the overt racism of some Detroit officers does not demonstrate that, but for the racism of his subordinates, Edwards would have been successful at reducing racial disparity in punishment. The results presented above suggest that regardless of their attitude toward racial hierarchy, Edwards may not have been able to convince officers that reducing arrests of Black Detroiters was the most effective crime-control strategy.

The implications of this model are not only historical. Building a police force capable of enforcing the law without racial bias requires either finding people without preferences and beliefs that would cause biased decisions, or counteracting beliefs and preferences that could generate biased decisions. The dominant strategy taken by police departments since the civil rights movement has been to try to eliminate beliefs that cause biased policing through training. This was on full display in the summer of 2020, as public figures called for more police training in response to protests against police violence against Black civilians

(Demirijian 2020). The results of this analysis suggest that the potential impact of these training changes might be limited in places where officers view them as imposed by inexpert political groups without regard for the department's effectiveness. More generally, it echoes a caution articulated by Lipsky 2010 and Brown 1981 in the decades immediately following the civil rights movement: interventions into the functioning of a bureaucracy must take seriously *how those interventions will be viewed by the bureaucrats whose behavior they seek to change*. In the case of police training to reduce racial disparity in stops and arrests, this model offers the additional caution that the success of the training should not presuppose that officers are unaware of the political forces that led to their receiving it.

5 Conclusion

Since the civil rights movement, many US police departments have been led by a chief nominally appointed to make policy according to their expertise, but whose independence from political factions was questionable. This paper presents a model representing the resulting bureaucratic structure, showing how campaigns to influence the chief's choices can constrain what officers are able to learn from their assignments. When the chief's independence is uncertain, assignments that match what powerful advocates want will be less persuasive than those that contradict political pressure. As a result, the model predicts the increasing influence of anti-racist groups would have increased bureaucratic resistance to their preferred reforms. This effect should be the same regardless of officer race, and so could also help explain anti-Black bias among Black officers.

The model shows racial inequality in arrests can be sustained by, or emerge as a result of, the information and accountability structure of professional police departments and political struggles over the racial distribution of punishment. The existence of such a mechanism does not detract from the relevance of individual racism in determining the quality of policing

that Black people receive in the US. Bias among officers is real, so efforts to eliminate racial inequality that do not address it will fail. However, if such efforts ignore constraints on officer learning, the normal operation of police departments and city politics may well revive another variation on the same old racist theme.

A Appendix

Proposition 2. *A PBE where C follows the STE strategy, P_i choose $x_i^*(a|\theta_{p,i}=0)=a$, and all P_i's have beliefs in (2) exists for all parameters $(\pi_\gamma, \pi_{\omega R}, \pi_{\omega L}, \pi_c, \lambda)$ where $|\pi_{\omega R}-\pi_{\omega L}|<\frac{1}{2}$. For P_j s.t. $\theta_{p,j}=1$, PBE requires:*

$$x_j^*(a|\theta_{p,j}=1,\pi_c)=\begin{cases} a, & \forall a \text{ when } \pi_c > \pi_c^{*L}, \pi_c^{*R} \\ \omega_M, & \text{if } a \in \{\omega_M, \omega_L\} \text{ when } \pi_c^{*L} > \pi_c > \pi_c^{*R} \\ & \text{or if } a \in \{\omega_M, \omega_R\} \text{ when } \pi_c^{*R} > \pi_c > \pi_c^{*L} \\ \omega_L, & \text{if } a=\omega_L \text{ when } \pi_c^{*R} > \pi_c > \pi_c^{*L} \\ \omega_R, & \text{if } a=\omega_R \text{ when } \pi_c^{*L} > \pi_c > \pi_c^{*R} \\ \omega_M, & \forall a \text{ when } \pi_c^{*L}, \pi_c^{*R} > \pi_c \end{cases}$$

Proof. Lemma 1 shows P_i's sequentially rational strategies, and equation (2) is the beliefs consistent with C using the STE strategy. I showed in the proof for Proposition 1 that $x_i^*(a)=a$ is only sequentially rational for all Ps when $\pi_c \geq \pi_c^{*L}, \pi_c^{*R}$. If $\theta_{p,i}=1$ and $\pi_c < \pi_c^{*j}$, P_i's sequentially rational choice following $a=\omega_j$ is $x_i=\omega_M$ for $j \in \{L,R\}$ when $|\pi_{\omega R}-\pi_{\omega L}|<\frac{1}{2}$. Therefore the following strategy is sequentially rational for P_i when C uses the STE strategy and $|\pi_{\omega R}-\pi_{\omega L}|<\frac{1}{2}$:

$$x_i^*(a|\theta_{p,i},\pi_c) = \begin{cases} a, & \text{if } \theta_{p,i}=0 \\ \omega_j, & \text{if } \theta_{p,i}=1,\ a=\omega_j \text{ and } \pi_c \geq \pi_c^{*j} \text{ for } j \in \{L,R\} \\ \omega_M, & \text{otherwise} \end{cases}.$$

I show the STE strategy is sequentially rational for C for all parameters π_c, λ.

If $\pi_c \geq \pi_c^{*L}, \pi_c^{*R}$, $EU_c(a=\omega|\theta_c=1)=0$ while $EU_c(a\neq\omega|\theta_c=1)<0$, and $EU_c(a=\gamma|\theta_c=0)=0$ while $EU_c(a\neq\gamma|\theta_c=0)<0$, so the STE strategy is sequentially rational for C when $\pi_c \geq \pi_c^{*L}, \pi_c^{*R}$.

If $\pi_c^{*j} > \pi_c \geq \pi_c^{*k}$ for $j,k \in \{L,R\}$, $EU_c(a=\omega|\theta_c=1)=0$ and $EU_c(a\neq\omega|\theta_c=1)<0$ for $\omega \in \{\omega_M, \omega_j\}$. Similarly, $EU_c(a=\gamma|\theta_c=0)=0$ and $EU_c(a\neq\gamma|\theta_c=0)<0$ for $\gamma=\omega_j$. If $\theta_c=1$ and $\omega=\omega_k$ or $\theta_c=0$ and $\gamma=\omega_k$, $EU_c(a|\theta_c) = \begin{cases} -n\lambda\Delta^2, & \text{if } a=\omega_k \\ -n\Delta^2, & \text{if } a=\omega_M \\ -4n\Delta^2, & \text{if } a=\omega_j \end{cases}$, so $EU_c(a=\omega_k|\theta_c) > EU_c(a\neq\omega_k|\theta_c)\ \forall\lambda$. Therefore the STE strategy is sequentially rational for C when $\pi_c^{*j} > \pi_c \geq \pi_c^{*k}\ \forall\lambda$.

Finally, if $\pi_c^{*L}, \pi_c^{*R} > \pi_c$, $EU_c(a=\omega_M|\theta_c=1)=0$ and $EU_c(a\neq\omega_M|\theta_c=1)<0$ when $\omega=\omega_M$. If $\theta_c=1$ and $\omega=\omega_j \in \{\omega_L,\omega_R\}$ or $\theta_c=0$ and $\gamma=\omega_j \in \{\omega_L,\omega_R\}$, $EU_c(a|\theta_c) = \begin{cases} -n\lambda\Delta^2, & \text{if } a=\omega_j \\ -n\Delta^2, & \text{if } a=\omega_M, \text{ so } EU_c(a=\omega|\theta_c=1) > EU_c(a\neq\omega|\theta_c=1) \text{ and} \\ -n\lambda\Delta^2 - 4(1-\lambda)n\Delta^2, & \text{if } a=\omega_k \end{cases}$ $EU_c(a=\gamma|\theta_c=0) > EU_c(a\neq\gamma|\theta_c=0)\ \forall\lambda$. Therefore the STE strategy is sequentially rational for C when $\pi_c < \pi_c^{*k}, \pi_c^{*j}$.

□

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