Street Crime and Street Culture*

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Abstract

A model of social interactions shows why and when reputation concerns may support an 'underclass' culture of street crime in communities where the incentives for such behavior are otherwise weak. Those who do not gain from street crime directly nevertheless find it optimal to invest in violence and thereby build a reputation that will earn them deference from the rest of the community. It may be that even when the fraction of the population with a direct interest in street crime is small a larger proportion will *necessarily* participate in violence in pursuit of reputation. The model also reveals how the social structure of a community interacts with local returns to crime to determine the value of a street reputation and therefore street crime.
(*JEL* D80, Z10, L14)

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1 Introduction

Why are the rates of street crime so high in many areas of concentrated poverty? Why, in particular, are the young, poor, and able-bodied so often their own victims? If street criminals have a choice among victims, the basic economic incentives would seem to point towards those who have more to steal, and who are less willing or able to resist an assault.

A growing literature argues that direct economic incentives provide incomplete explanations for the extent of crime among the young and poor, and that criminal behavior is marked by social interactions. This literature suggests that social forces generate *cultures* or *norms* of street violence in some communities, and that the same social forces may support other 'underclass' norms with respect to education, fertility, family structure, and preventable disease.[1]

A prominent set of these social theories argues that high rates of crime among the young and poor may be attributed to a 'culture of poverty.' (See, e.g., Wilson and Herrnstein, 1985, and Bennett, et al., 1996.) According to this view, young residents of poor, high-crime neighborhoods often lack the values that would imply violence is undesirable. From the culture of poverty perspective, socialization generates a distribution of preferences among the poor, in particular a tendency towards myopia or impulsiveness, that produces socially sub-optimal behaviors such as widespread street crime.

This paper offers an alternative theory of how a social force, namely *reputation*, may account for 'underclass' behavior with respect to street crime. Founded in ethnographic evidence, the theory explains how reputation concerns may draw those who are patiently forward-looking, and who expect no direct gain from street crime, to adhere to a culture of violence. In the development of this theory, the paper also shows how the social structure of a community interacts with the direct returns to crime to determine the value of a street reputation, and therefore street crime.

Here a reputation for street violence has an instrumental value derived from a concern for self-protection. Reputation has no intrinsic worth; and all but a potentially small segment of the community expects no direct gain from a street crime. Yet even if individuals do not derive utility from a street reputation, or from the behavior necessary to acquire it, they may nevertheless invest in violence to avoid the loss of goods that do have intrinsic value. Reputation is the social force that drives a wedge between the direct economic and the experienced incentives for street crime.

The model draws on a reputation literature motivated largely by questions in industrial organi-

[1] Here a culture or norm refers to a widespread behavior motivated by social rather than direct economic incentives.

zation and extends it to a community-level matching game with two-sided reputation. I consider a community in which there exists a small 'street' element, a fraction of the population for whom a violent crime against a passive victim generates a direct benefit.[2] A street type does not, however, invariably pursue crime; he rationally chooses victims depending both on how likely he thinks they are to resist his assault, and on how likely they are to enhance his street reputation. I assume the remainder of the community has a strict preference for passivity, types are private information, and the community's information about an individual's past behavior is imperfect.

How do reputation concerns lead someone who expects no direct benefit from street crime, a decent type, to nevertheless adhere to a street culture? Consider the problem of a decent who makes regular trips from an apartment to shops and back.[3] He, like the rest of the community, knows there is a street element; but no one knows who is a true street and who merely appears like one. His goal is to make it to and from the shops without incident. The way to avoid an assault is either to be lucky and escape trouble by chance, or to signal the would-be assailant that the costs of an attack on *this* victim are probably too high. The signal is his reputation. His reputation summarizes his past and thus indicates to the rest of the community, both real streets and street poseurs, how likely he is to initiate or resist an assault. By participating in violence himself he may acquire a street reputation; and that reputation will have value if it encourages others to defer to him in the future. If the cost of participating in street crime is small enough, or if the future value of a street reputation is large enough, then even the decent type is violent. At the community level, the result is what appears like a norm of violence in a place where most seem to have nothing directly to gain from assaulting each other: an endogenous street culture.

This paper belongs to the literature on social interactions and their roles in determining economic outcomes.[4] Previous research has provided both theories and evidence of social effects on criminal behavior. Strategic reputation concerns, and the dynamics inherent in reputation building, distinguish this paper from existing theories.[5] Previous studies assume a common and direct payoff to committing crime and concentrate on either the perceived probability of apprehension and

[2]The term street, and its alternative, decent, are taken from sociologist Elijah Anderson's ethnographies of Philadelphia neighborhoods (Anderson, 1990, 1999). These are the labels used by Anderson's low-income subjects to describe the basic typology of their communities.

[3]Alternatively, consider the problem of a high school student maneuvering between classes, lunch room, and home.

[4]On crime see Case and Katz (1991), Sah (1991), Akerlof and Yellen (1994), Glaeser, Sacerdote, and Scheinkman (1996), and Ludwig, Duncan and Hirschfield (2001). Studies of social effects on other economic outcomes include Cole, Mailath and Postlewaite (1992) on savings; Borjas (1995) on human capital investment; Bagwell and Bernheim on conspicuous consumption, and Bertrand, Luttmer and Mullainathan (2000) on welfare program participation.

[5]Empirical research in this area leaves the foundations for social effects unmodeled and focuses instead on the difficult task of identifying their magnitudes.

punishment (Sah, 1991), or on the private incentive to punish, or inform the police of, deviations from lawful activity (Akerlof and Yellen, 1994).[6] In this paper, in contrast, only a potentially small fraction of the population expects to gain directly from a street crime. Taking penalties as given, the focus of this paper is on how reputation concerns may lead those who expect a direct loss from assaulting someone young, poor, and able-bodied to nevertheless adhere to a street culture.

Reputation concerns also explain why propensities for street violence tend to decrease with age (alternatively, tenure in the community). Neither existing theories of crime and social interactions, or culture of poverty arguments indicate why an individual's incentives to participate in crime should decline with age. Also, unlike prior studies, this theory of crime and reputation may explain the tendency for certain types of crime to be committed in public, and in front of witnesses.[7]

Last, this paper differs from most prior economic theories of crime in that it is founded in ethnographic evidence from sociology and anthropology on the social determinants of crime. Sociologists and anthropologists have often described individuals taking part in violence not only to derive material goods, but also to demonstrate to their peers and to the larger community that they are worthy of respect.[8] The sociologist Elijah Anderson's ethnographies (Anderson, 1990, 1999) have, in particular, described how a reputation for brutality has value in some low-income communities of the US. According to Anderson's representations, a reputation for violence is often pursued in these neighborhoods both because violence, reputation, or respect directly produce satisfaction, and because a reputation provides its owner protection from future assault.

Drawing on this evidence, this paper shows formally how the information summarized in reputation has two competing effects on behavior in a matching environment when the reputations of both matched players are payoff-relevant. The first effect reflects the direct influence of information revelation over time, and is in force even when individuals disregard the future. When a person is revealed as member of the street element, he is not mistaken for someone non-violent and may thus avoid some costly encounters in which both participants are violent, even when each would be

[6] Higher crime rates in poor neighborhoods are often attributed to lower levels of private surveillance. Some evidence suggests, however, that private surveillance is not substantially lower among the poor. According to the National Criminal Victimization Survey (NCVS), from 1997-2000 32% of property crimes against households with less than $15,000 were reported to police, while 35% of these crimes against richer households were reported to police.

[7] In the US, 54% of violent crimes occur during daylight hours including 57% of all assaults and 44% of robberies. USDOJ (2000). Qualitative studies of crime such as Katz (1988) and Polk (1999) emphasize the common presence of witnesses and the lack of effort by perpetrators to escape detection.

[8] This finding is common both to studies of low-income communities such as Anderson (1990), (1999), and Newman (1999), and to research focused on criminal behavior such as Butterfield (1996), Daly and Wilson (1988), Katz (1988) and Polk (1999). Anthropologists have often documented the instrumental value of a reputation for brutality in other, traditional communities. See Peristiany (1966) for an early collection of examples.

better off if at least one were passive. The second, competing effect reflects the influence of strategic reputation concerns. An investment in violence today may build an individual's street reputation for the future. The benefit of such a reputation is the deference afforded presumed streets by others who rightly fear violence from someone with such payoffs. Importantly, this second effect of reputation may apply both to street *and* to decent types. Whether the strategic or information effect of reputation dominates will depend on the community's type composition, the tightness of its social structure, and the local returns to street crime.

As noted above, the incentives that reputation generates for violence differ by age: the older derive, on average, less value from violence than the younger. Reputation incentives also differ by type. Given the value of future reputations, if a street would attack an opponent he believes will resist with probability p, then he would attack everyone he thinks is less likely to fight back. For decent types, reputation's incentives work in the opposite direction. For a decent the expected return is lower from fighting someone who appears less likely to fight back. This result hinges on a key feature of two-sided reputation in a community setting: your reputation is not just what you did, but with whom you were seen doing it. As a result, what may be interpreted as *honor* emerges endogenously among decent types; an attack against an apparently weak opponent offers less expected value than the same action against an apparently more dangerous opponent.

In this environment, as in a standard model of crime, in the absence reputation effects the level of violence in the community is determined only by the size of the street element. Following the intuition provided above, it is shown that introducing reputations can induce those with no immediate gain from violence to participate in street crime in order to build their reputations. Characterization of a 'street culture' equilibrium demonstrates that even when the street element is small, it may be that the fraction of the population participating in violence is much larger. This characterization also reveals how the value of a street reputation, and therefore street crime, depends on both the local returns to the crime and on the social structure of the community. Last, we find that under some conditions, this street culture equilibrium will not be just one among many equally plausible but much less violent equilibria. If these conditions hold, and a street culture equilibrium exists, then in every equilibrium decent types will participate in violence.

1.1 Alternative explanations

This paper explains how reputation concerns can support an 'underclass' street culture of violence in communities where the direct incentives for such behavior are weak. Impulsive motivations for some violent crimes such as murder, rape, and assault may also explain part of this phenomenon. Low income may generate greater levels of anger, desperation, or desire for revenge that find expression in local violence against others of the same income class. Alternatively, the poor may be similarly motivated to violent crime but the perceived future costs of violence are increasing in income. Higher rates of violent crime among the poor may not, however, be attributed to non-pecuniary violence alone. From 1997-2001, a member of low income household was twice as likely to be a victim of robbery as a member of a richer household.[9] Thus, to the extent that violent crime is not impulsive, and economic models of crime accurately describe criminal decision-making, proximity is an incomplete explanation of the disproportionate rates of violent crime in areas of concentrated poverty. Other things equal, if the expected yield from a violent assault against a richer victim is higher, and travel costs are not extreme, a criminal should seek richer victims.

Other things may not be equal, however. Lower levels of private surveillance or public law enforcement in poor neighborhoods may also contribute to higher rates of crime in these communities. While difficult to measure systematically, some evidence indicates that levels of private surveillance are, in fact, not substantially different among the poor (see footnote 6). Simple differences in levels of public law enforcement also appear to provide incomplete explanations. While challenging to assess due to the endogeneity of enforcement policy [Levitt, 1997], many have found that differences in measures of police enforcement leave considerable variation in crime rates unexplained.[10] Moreover, simple arguments about variation in levels of law enforcement do not explain why the differences in crime rates among the poor and rich should depend on the type of crime. Over the past five years the violent crime rate among those living in households with less than $15,000 in annual income was on average more than 60 percent higher than that among higher income households [NCVS, 1997-2001]. Yet over the same period households with less than $15,000 in annual income were somewhat *less* likely to be the victim of a property crime.

The preceding two paragraphs are not meant to suggest that the level of law enforcement in low-income communities does not contribute to the higher rates of crime in these areas. I would argue only that existing theories about the sources of violent crime in areas of concentrated poverty are usefully complemented by a model of social interactions that is founded in ethnographic evidence about the social, but instrumental, motivations for street crime.

[9] NCVS 1998-2002. Robbery is a theft directly from a person, of property or cash by force or threat of force.

[10] Glaeser, et. al (1996), for example, can explain less than 30% of the variation in crime rates with observables including police levels. Investigating the response of juvenile crime to criminal penalties, Levitt (1998) explains 60% of the differential growth rates in adult and juvenile crime with differences in their relative punishments.

1.2 Related reputation literature

The setting studied in this paper is similar to those in the literature on reputation in random matching models. (See Rosenthal and Landau 1979, Kandori 1992, Okuno-Fujiwara and Postlewaite 1995.) The primary goal of these prior studies is to understand how reputation could facilitate cooperative outcomes with only weak informational requirements.[11] This paper differs from these prior studies by taking an incomplete-information approach to reputation, and by focussing on how reputation may generate *in*efficient outcomes of community interaction.

By studying reputation's perverse incentives, this paper also relates to a literature initiated by Holmström and Ricart i Costa (1986) who showed how career concerns may lead managers to choose projects that will enhance their reputation at the cost of firm profits. Recently, Morris (2001) has shown how valuable information may lost to the reputation concerns that characterize political correctness. Most previous investigations of incomplete-information based reputation theory, such as Holmström and Ricart i Costa (1986), Diamond (1987), and Morris (2001), have been restricted to settings in which reputation concerns are one-sided. In these studies, there is incomplete information about only one (type of) longer-lived player for whom dynamic reputation considerations are relevant. Studies of two-sided reputation have largely been restricted to two-player games where the one-period-ahead distribution of reputations is deterministic. This paper adds to this incomplete-information based reputation literature by examining some of the consequences of two-sided reputation in a community setting with imperfect public monitoring.

The remainder of the paper is structured as follows. Section 2 describes the model. Section 3 presents benchmark analysis of a static version of the model. Section 4 considers the dynamic setting and isolates the influence of reputation on street types. Section 5 examines reputation's incentives for decent types. Section 6 characterizes a street culture equilibrium in which the participation in street crime by decent types importantly affects the local crime rate. Section 7 presents conclusions.

2 Model

Environment

Consider a community initially composed of a continuum of individuals (players) N of mass one. Time is discrete and indexed by $t = 1, 2, \ldots$. Each player i is one of three types: street, decent, or weak. Denote i's type by $\tau_i \in\ T = \{s, d, w\}$. Types are private information. A player's tenure

[11] These papers do not model types; reputation is not related to differences in preferences or action sets. Instead they assume public information about a player's prior actions is summarized by a state variable interpreted as reputation.

in the community is exponentially distributed with an exogenous probability $\lambda \in (0,1]$ that he will exit after each period. When a player exits, he is simultaneously replaced by a random draw from the underlying population. Let the distribution over types in the underlying population be denoted by the vector $\mathbf{f} = (f_s, f_d, f_w) \in \Delta(T) \equiv \Delta_T$.

Stage Game

At the beginning of every period t, each player i is matched with an opponent $\mu(i,t)$ to play a one-time, simultaneous action stage game. The matching is random and uniform. Upon matching, each player chooses an action a from an action set A. For street and decent types $A = \{V, P\}$. Action V represents violent behavior. Action P represents passivity, or non-violent behavior. Weaks are an action type. They are incapable of violence and therefore have no choice to make.

These actions allow several interpretations. For example, V may be interpreted as a single violent action, "attack," whose outcome depends upon the action of the player's opponent; or V may represent a single, relatively violent, mixed strategy over several actions of different intensities such as shout, shove, punch, bludgeon, knife, shoot. Alternatively, V may be understood as a choice of contingent strategy that conditions such actions on the response of the opponent.[12]

Each player in a match observes both his own action and that of his opponent; the rest of the community, however, receives only a noisy signal of the actions taken in the match.[13] In particular, each match is observed to be either violent or not. Let $x_{i,t} = x_{\mu(i,t),t} \in \{1,0\}$ denote this common signal to the community concerning i's match in period t, where 1 represents violence, and 0 no violence. The probability that a match generates a violent signal depends on the actions taken in the match, with more aggression leading to (weakly) higher probabilities of violent signals. If both players choose violence, then the match generates a violent signal with probability $\rho \in (0,1)$. If, however, *either* player chooses passivity, then the match always generates a non-violent signal.

$$\Pr\left(x_{i,t} = 1 | a_{i,t}, a_{\mu(i,t),t}\right) = \begin{cases} \rho, & \text{if } a_{i,t} = a_{\mu(i,t),t} = V \\ 0, & \text{otherwise.} \end{cases}$$

This information structure is motivated by the following logic. First, when two people have a violent street encounter, the actions taken during the altercation are likely to be unclear to outsiders. The situation is analogous to the scene of an auto accident where it is indisputable that

[12] For this last interpretation, the ability to commit to contigent strategy is important. Otherwise, the model will not be properly described in that strategies will be incorrectly defined, and off-equilibrium path payoffs will not be specified. However, the assumption commitment be accurate for violent encounters because decisions must be made quickly, and moving first may provide a decisive advantage. In violent encounters the lack of commitment to be violent may, in effect, represent a commitment to be passive.

[13] The players in the match also observe the realization of this signal.

two cars have just collided, but often unknown to outsiders what events led up to the collision or what actions taken during the incident would have changed the outcome. Thus actions are private to the match. Second, when two people have a violent interaction, the community is likely to receive imperfect information about the encounter. The average accuracy of information transmission in the community is captured by ρ, and by the fact that unilateral passive behavior always generates a non-violent signal. The information parameter ρ will also be interpreted as a measure of the community's social connectedness. A larger ρ implies a better connected community.

Payoffs. The outcome and payoffs of the match are random variables that depend on the actions taken in the match. I do not model the outcome process but instead focus on the (expected) payoffs from each combination of actions. The payoffs of the stage game differ by type. Let $u_\tau(a, b)$ denote the stage game payoff to a type-τ player choosing action a against an opponent choosing b.

Decents. Decent types have stage game payoffs that satisfy:

A1. A decent strictly prefers that his opponent is passive.

$$u_d(a, P) > u_d(a, V) \text{ for } a \in \{V, P\}$$

A2. A decent strictly prefers to be passive himself.

$$u_d(P, b) > u_d(V, b) \text{ for } b \in \{V, P\}$$

Assumption A1 is natural given that being subject to (more) violence increases the probability of both pain and the loss of possessions. Assumption A2 implies that decent types expect no direct gain from violence.[14] One may interpret this second assumption in several ways. It may be that the human capital of decent types, including their physical and psychological assets, imply that the costs of aggression, including the expected disutility of imprisonment, exceed the returns in terms of goods expropriated. Alternatively, decents may simply find aggression intrinsically distasteful.

Behavior depends on the differences between payoffs, rather than on payoff levels. It is therefore convenient to normalize $u_d(P, P) = 0$, and to denote by C the *cost* to a decent type of violence against a passive opponent $[u_d(P, P) - u_d(V, P)]$. Let a decent's *benefit* from deference (i.e. the benefit of having his opponent play P rather than V) be denoted by $B = [u_d(P, P) - u_d(P, V)]$. To simplify calculations, I assume that a decent's expected cost of violence against a violent opponent is the same as against a passive opponent. Thus $[u_d(P, V) - u_d(V, V)] = C$ and a decent's stage

[14] For decents, violence is strictly dominated in the stage game; and when matched with each other the ex-ante Pareto efficient outcome is achieved when each is passive.

game payoffs are given by (for $B, C > 0$):

		a_j	
		V	P
a_i	V	$-C-B$	$-C$
	P	$-B$	0

expected payoff to decent type playing a_i vs. a_j

<u>Streets</u>. Street types have stage game payoffs that satisfy an analogue of assumption A1 and the following conditions:

A3. $$u_s(V,P) > u_s(P,P)$$

A4. $$u_s(P,V) > u_s(V,V)$$

These assumptions imply a direct gain from violence against a passive victim, but a loss from violence against a violent opponent. Normalize $u_s(P,P) = 0$, and denote the *gain* from attacking a passive victim by $G = [u_s(V,P) - u_s(P,P)]$. To simplify calculations, I assume a symmetric loss from being the passive victim of an attack $[u_s(P,P) - u_s(P,V)] = G$. The additional *loss* from choosing violence against a violent opponent $L = [u_s(P,V) - u_s(V,V)]$; thus a street's stage-game payoffs are (for $G, L > 0$):[15]

		a_j	
		V	P
a_i	V	$-G-L$	G
	P	$-G$	0

expected payoff to street type playing a_i vs. a_j

<u>Weaks</u>. Because weak types do not make decisions, their payoffs play no role. However, in equilibria where decents and streets are pooling, the presence of weaks makes the updating of beliefs non-trivial and generates incentives for both decents and streets to participate in reputation building.[16]

[15] These payoffs imply that if streets met in a static setting with complete information, they would play a 'game of chicken.' The Nash equilibria of that game are the pure strategy equilibria (V,P) and (P,V), and a mixed strategy equilibrium in which streets choose violence with probability $\frac{G}{G+L}$. If a street met a decent type in the same complete information setting, in the unique Nash equilibrium the street would choose violence and the decent passivity.

[16] The role of weaks is clarified by consideration of an equilibrium in which decents mimic streets in the absence of weaks. In this case, regardless of the history of public signals, beliefs remain at the prior, since each type is equally likely to have generated the observed signals. But if this is the case, then a decent has a profitable deviation: choose passivity since there is no reputation cost from generating a non-violent signal. Thus no equilibrium with perfect pooling by streets and decents can exist in the absence of weak types.

Information Structure and Model of Reputation

Following Kreps and Wilson (1982), and Milgrom and Roberts (1982),[17] this paper relies on a distribution of types with different payoff schedules or action sets to give reputation its value in equilibrium. A player's reputation is the community's common belief about his type; his reputation evolves as the community accumulates information about his behavior and rationally updates its beliefs about his type. This type-based approach represents a natural model of the ethnographic evidence about reputation's role in high-crime neighborhoods. Another goal of the modeling strategy is to capture an environment in which each person is the subject of a public evaluation that is relevant both to his choices and to his treatment by others. With this goal in mind, I assume beliefs about a player in period t are based only on the player's reputation in period $t-1$, the reputation of his opponent in period $t-1$, and the signal generated by their match.

Strategies, Beliefs and Equilibrium

Behavior is assumed to be Markov and symmetric by type. The payoff-relevant state for player i is given by his type τ_i, the common belief about his type $\boldsymbol{\phi}_i$, and the common belief about the type of his opponent $\boldsymbol{\phi}_j$. A Markov *strategy* is a mapping:

$$\sigma : \{s, d\} \times \Delta_T^2 \to [0, 1]$$

where $\sigma\left(\tau, \boldsymbol{\phi}_i, \boldsymbol{\phi}_j\right)$ is the probability a type-τ player with reputation $\boldsymbol{\phi}_i$ plays violently when matched with a player with reputation $\boldsymbol{\phi}_j$. Let σ_τ denote the strategy of type-τ players.

The common Markov *beliefs* function is a mapping:

$$\varphi : \Delta_T^2 \times \{0, 1\} \to \Delta_T$$

where $\varphi\left(\boldsymbol{\phi}_i, \boldsymbol{\phi}_j, x\right)$ is the posterior belief about player i's type given the prior about his type $\boldsymbol{\phi}_i$, the prior about his opponent's type $\boldsymbol{\phi}_j$, and the signal from their match x.

A *Markov perfect equilibrium* is a pair (σ, φ) such that: σ maximizes expected discounted[18] future payoffs for all $\tau \in \{s, d\}$, and for all $\left(\boldsymbol{\phi}_i, \boldsymbol{\phi}_j\right) \in \Delta_T^2$, based on beliefs φ that according to Bayes' rule are correct given σ.

Steady State

[17] See Mailath and Samuelson (2001) for a distillation and extension of the literature following these 1982 papers.

[18] Future payoffs are discounted by *effective* discount factor $\beta = \delta(1-\lambda)$, δ represents the standard time discount factor and $(1-\lambda)$ the constant probability of continued tenure.

The analysis considers the community in a steady state. Given an equilibrium strategy σ, a steady state may be defined by two functions, one describing the distribution of types the other the distribution of reputations. The *distribution of types* in the community in period t is a mapping from time into the unit simplex over types:[19]

$$f : Z^{+} \rightarrow \Delta_T \ .$$

Given strategy profile σ, the steady state *distribution of reputations* is described by a probability *measure* on Δ_T:

$$M_\sigma : \mathcal{P}(\Delta_T) \rightarrow [0,1]$$

giving the fraction of the community with a reputation in any subset of the range of beliefs.

3 Benchmark: A Static Setting

To establish a benchmark, consider the case where players spend just one period in the community $(\lambda = 1)$. This static setting is equivalent to a model in which agents are myopic, and there is no public information about a player's prior actions. Analysis of this setting will, when compared with that of a dynamic environment, illuminate two competing effects of reputations on behavior: the calming effect of information revelation, and the agitating effect of strategic reputation concerns.

In this static setting, no information about types is revealed and reputation concerns are absent. The behavior of decents is therefore simple. Violence is strictly dominated in the stage game so decents are never violent. As in a standard model of crime, therefore, the community's street crime rate is determined only by those who expect a direct gain from crime: streets.

Because players spend just one period in the community, the common belief about each player is the prior $\boldsymbol{\phi}^0 = \mathbf{f}$; there is no updating. Proposition 1 characterizes the unique equilibrium of this static setting in terms of the belief that a player is a street, f_s. Streets are always violent if they believe themselves to represent a fraction of the population smaller than a threshold value $\widetilde{\phi}$. The location of this threshold depends the relationship between a street's gain from attacking a passive victim, G, and his loss from violence against a violent opponent L. When priors cross the threshold, street types become increasingly passive, choosing violence with decreasing probability as they believe themselves to represent more and more of the population.

[19]With a continuum of players, in every period there will be an infinite number of exits and replacements, introducing street, decent, and weak types into the community according to their proportions in underlying population. Thus, $f(t+1) = (1-\lambda)f(t) + \lambda\mathbf{f}$, where $\mathbf{f}$ is the distribution of types in the underlying population. In a steady state, the distribution of types in the community is the same as in the underlying population, $f(t+1) = f(t) = \mathbf{f}$.

Proposition 1 *In the unique Markov perfect equilibrium of the static game, decents are never violent, streets choose violence with probability* 1 *if* $f_s \leq \widetilde{\phi} = \frac{G}{L+G}$ *and with probability* $\frac{\widetilde{\phi}}{f_s}$ *otherwise; and beliefs are given by a constant* $\varphi = \mathbf{f}$.

Proof: The hypothesized behavior of decent types trivially represents their unique equilibrium strategy. Let $W_\tau(\boldsymbol{\phi}_i, \boldsymbol{\phi}_j)$ denote the expected payoff to a type-τ player given the strategy σ^*, his reputation $\boldsymbol{\phi}_i$ and that of his match $\boldsymbol{\phi}_j$. If $f_s \leq \widetilde{\phi}$, the hypothesized σ^* implies an expected payoff to a street type of:

$$W_s(\boldsymbol{\phi}^0, \boldsymbol{\phi}^0) = f_s u_s(V,V) + (1 - f_s) u_s(V,P).$$

The expected payoff from a deviation to P is given by

$$W_s(\boldsymbol{\phi}^0, \boldsymbol{\phi}^0; P) = f_s u_s(P,V).$$

If σ^* is optimal then $W_s(\boldsymbol{\phi}^0, \boldsymbol{\phi}^0) \geq W_s(\boldsymbol{\phi}^0, \boldsymbol{\phi}^0; P) \iff f_s \leq \widetilde{\phi}$. The optimality of σ^* when $f_s \leq \widetilde{\phi}$ also implies that there exists no mixed strategy equilibrium in this case, as no such strategy could make streets indifferent between choosing V and P.

Trivially, there exists no symmetric equilibrium with $\sigma_s^* = 0$. Thus there exists no other pure strategy equilibrium when $f_s \leq \widetilde{\phi}$; and if $f_s \in \left(\widetilde{\phi}, 1\right)$ then σ_s^* must be fully mixing and satisfy:

$$\begin{aligned} W_s(\boldsymbol{\phi}^0, \boldsymbol{\phi}^0; V) &= f_s\left[\sigma_s^* u_s(V,V) + (1-\sigma_s^*) u_s(V,P)\right] + (1 - f_s) u_s(V,P) \\ &= W_s(\boldsymbol{\phi}^0, \boldsymbol{\phi}^0; P) = f_s \sigma_s^* u_s(P,V) \end{aligned}$$

$\iff \sigma_s^* = \frac{\widetilde{\phi}}{f_s}$ ■

The equilibrium described by Proposition 1 reflects the basic, short-term trade-off faced by a street type. When a street thinks his own type is rare, he is sufficiently confident his opponent will not fight him, so he chooses violence. When a street believes his type is more common, his behavior becomes increasingly restrained out of fear of participating in an especially violent and costly (V,V) encounter with another street.

At the community level, the fraction of the population participating in violence is simply the proportion of streets f_s. When $f_s \leq \widetilde{\phi}$ the fraction of encounters in which any violence occurs is $2f_s - f_s^2$, and fraction in which each player is violent is f_s^2. Thus the frequency and intensity of violence is increasing in the proportion of streets until they exceed the threshold, beyond which the fraction of encounters in which violence occurs remains constant at $2\widetilde{\phi} - \widetilde{\phi}^2$, and the fraction in which each player is violent is also a constant $\widetilde{\phi}^2$.

These fractions also show that, holding fixed the proportion of streets, this static setting exhibits a discontinuity, or tipping point, in the response of the crime rate to changes in the returns to crime.

Only when the relationship between the gains and losses from crime $\left(\frac{G}{G+L} = \widetilde{\phi}\right)$ falls below the fraction of street types does the crime rate begin to respond to changes in these direct returns. Thus if streets are rare, and the gains from crime G are relatively large, increasing the penalty for assaults (i.e. lowering G) will have no effect on the street crime rate. Only when the gain becomes small enough, would changes in the returns to crime be expected to affect of the crime rate.

It is important that in this static setting the only ones participating in street crime are those with a direct gain from doing so. Street types are more or less violent depending on how certain they are that their opponent will be passive. Like weaks, however, decents are never violent.

4 Reputation for Streets

Now consider a dynamic setting where individuals may remain in the community for an infinite time ($\lambda < 1$). We begin with an analysis that isolates the influence of reputation on the behavior of streets. Study of a community with no decent types ($f_d = 0$) reveals when and why *streets* will pursue violence for reputation's sake alone. Analysis of this case also makes clear the competing effects of reputations on street crime.

In the absence of decent types, beliefs may be summarized by the posterior probability player i is a street. Denote this sufficient statistic for i's reputation by ϕ_{is}, and that of his opponent by ϕ_{js}. Denoting the sufficient statistic for the posterior beliefs function by $\varphi_s\left(\phi_{is}, \phi_{js}, x\right)$, Lemma 1 describes the simple structure of equilibrium beliefs in the absence of decent types. The lemma explains that, regardless of strategies, upon generating his first violent signal a player becomes established as a street; and that once established, a street reputation never fades. Until he becomes established, however, a player's street reputation (weakly) decays.

Lemma 1 *When $f_d = 0$, posterior beliefs satisfy*

$$\begin{aligned} \varphi_s\left(\phi_{is}, \phi_{js}, 1\right) &= 1, \text{ for all } \phi_{is}, \phi_{js} \\ \varphi_s\left(1, \phi_{js}, x\right) &= 1, \text{ for all } \phi_{js}, x \end{aligned}$$

and $\varphi_s\left(\phi_{is}, \phi_{js}, 0\right) \leq \phi_{is}$, for all ϕ_{is}, ϕ_{js}.

Proof: Consider an arbitrary strategy σ, any pair of reputations ϕ_{is}, ϕ_{js}, and an action by player i, that may or may not represent a deviation from his strategy. If player i's match generates a violent signal, then his posterior must equal one, since if he were a weak type the probability of a violent signal is zero. If $x_{i,t} = 0$, then by Bayes' Rule

$$\varphi_s\left(\phi_{is}, \phi_{js}, 0\right) = \frac{\phi_{is}\left(1 - \phi_{js}\sigma_s\left(\phi_{is}, \phi_{js}\right)\sigma_s\left(\phi_{js}, \phi_{is}\right)\rho\right)}{\phi_{is}\left(1 - \phi_{js}\sigma_s\left(\phi_{is}, \phi_{js}\right)\sigma_s\left(\phi_{js}, \phi_{is}\right)\rho\right) + \left(1 - \phi_{is}\right)} \leq \phi_{is}.$$

In particular, when $\phi_{is} = 1, \varphi_s\left(\phi_{is}, \phi_{js}, 0\right) = 1$. ■

4.1 Myopic and Reputation Equilibria

It follows from Lemma 1 that, regardless of his action (on or off equilibrium path), the sufficient statistic for the posterior belief about i's type $\phi_{is} \in [0, f_s] \cup \{1\}$. In what follows, we restrict attention to the case where $f_s < \widetilde{\phi} = \frac{G}{G+L}$. Recall from Proposition 1 that, in the absence of reputations, when $f_s < \widetilde{\phi}$ the behavior of streets is uninfluenced by small changes in the direct returns to street crime. We can imagine, therefore, that efforts to alter the returns to crime by calling for police or for help from a neighbor, will be ineffective. In this case, a street reputation may be a particularly important tool of self-protection.

Given the structure of beliefs, is useful to identify two categories of player: established streets ($\phi_{is} = 1$), and the unestablished ($\phi_{is} \leq f_s$). Restricting the domain of strategies to the feasible space of beliefs, Proposition 2 shows that the behavior of established streets is the same in all equilibria. The established are always violent with the unestablished, and choose violence with probability $\widetilde{\phi} < 1$ against each other.

Proposition 2 *For the set of feasible beliefs described by Lemma 1, if $f_d = 0$ and $f_s < \widetilde{\phi}$ then in every Markov perfect equilibrium the behavior of established streets is given by:*

$$\sigma_s^*\left(1, \phi_{js}\right) = \begin{cases} 1 \text{ if } \phi_{js} < f_s \\ \widetilde{\phi} \text{ if } \phi_{js} = 1. \end{cases}$$

Proof: See Appendix.

With the behavior of the established uniquely determined, we consider the behavior of the unestablished. We restrict attention to strategies that are monotone in the opponent's street reputation. Strategies, that is, are of a form such that for every feasible own reputation, ϕ_{is}, and for every feasible pair of opponents' reputations, ϕ_{js}, ϕ'_{js}, either: (1) $\sigma_s^*\left(\phi_{is}, \phi_{js}\right) \geq \sigma_s^*\left(\phi_{is}, \phi'_{js}\right)$ for all $\phi_{js} \leq \phi'_{js}$ or (2) $\sigma_s^*\left(\phi_{is}, \phi_{js}\right) \leq \sigma_s^*\left(\phi_{is}, \phi'_{js}\right)$ for all $\phi_{js} \leq \phi'_{js}$. Call an equilibrium in monotone strategies a *monotone* equilibrium.[20]

When, in the absence of reputations, streets are insensitive to small changes in the direct returns to crime $\left(f_s < \widetilde{\phi}\right)$, in every monotone equilibrium the unestablished choose violence against each other. As a result there are just two equilibria in which the unestablished also play a pure strategy against the established: a *myopic* equilibrium, and a *reputation* equilibrium. In a myopic

[20] Restricting attention to strategies of this form precludes behavior where a street when confronting opponents with reputations $\phi_{js} > \phi'_{js} > \phi''_{js}$ would be most violent with the opponent posing the greatest potential threat ϕ_{js}, least violent with ϕ'_{js}, and choose an intermediate level of violence against the least threatening, ϕ''_{js}.

equilibrium, when an unestablished street faces an established street, he chooses his myopic best response, passivity. In a reputation equilibrium, when an unestablished street faces an established street he chooses violence. The behavior in these two equilibria may be summarized as follows:

Strategy of Street Player

Myopic Equilibrium

		opponent's reputation: 1	opponent's reputation: $\leq f_s$
player's reputation	1	$\widetilde{\phi}$	1
	$\leq f_s$	0	1

Reputation Equilibrium

		opponent's reputation: 1	opponent's reputation: $\leq f_s$
player's reputation	1	$\widetilde{\phi}$	1
	$\leq f_s$	1	1

When does a reputation equilibrium exist? When does the social force of reputation lead *streets* to forgo their immediate best response and choose violence against someone who will, with certainty, be violent with them? Proposition 3 provides necessary and sufficient conditions for the existence of a reputation equilibrium and for the existence of a myopic equilibrium.

Proposition 3 *For the set of feasible beliefs described by Lemma 1, if $f_d = 0$ and $f_s < \widetilde{\phi}$ then a reputation equilibrium exists if and only if:*

$$\beta\gamma G \geq L \ ;$$

and a myopic equilibrium exits if and only if

$$\beta\eta G \leq L$$

where η and γ are functions of the model's parameters.

Proof: See Appendix.

The intuition for Proposition 3 is straightforward. A reputation equilibrium exists if and only if the discounted expected gain from an established reputation, $\beta\gamma G$, exceeds the cost of acquiring it through violence with an established street, L. A myopic equilibrium exists if and only if the same cost of acquiring an established reputation exceeds the discounted expected gain, now $\beta\eta G$.[21]

In a myopic equilibrium, the incentives to acquire reputation are weaker. Unestablished streets choose their myopic best response and defer to established streets – thus the term myopic. In a reputation equilibrium, concerns for future reputation lead *all* street types to participate in violence with positive probability regardless of their own reputation and that of their opponent.

[21] When the proportion of street types is small enough the myopic and reputation equilibria cannot co-exist. For example, one can show that if $f_s < \frac{3\lambda}{\rho(1-\lambda)}$ then $\gamma < \eta$.

In particular, even when facing an established street whom they know will choose violence against them, unestablished streets invest in violence in expectation of the gains from a street reputation.

4.1.1 The competing effects of reputations

Comparing behavior in a reputation equilibrium with that of static and myopic play demonstrates that reputations have two competing effects on behavior. The information summarized in reputation, *per se,* has a calming effect. The additional information made available through repeated interactions, and summarized by reputation, allows streets to avoid some costly incidents of violence. Even in the relatively violent reputation equilibrium, while the fraction of the population participating in violence with positive probability in any period is the same as it would have been in the absence of information revelation (i.e., under static play), f_s, the fraction of encounters in which both players are violent is smaller:[22]

$$f_s^2 - M_{rep}(1)^2 \left(1 - \widetilde{\phi}^2\right) < f_s^2.$$

This calming effect is due to the meetings of established streets in which the probability that both players are violent $\left(\widetilde{\phi}^2\right)$ is now strictly less than one.

The countervailing influence of strategic reputation concerns is seen when this level of violence is compared with that of myopic play, i.e., when players disregard the future. When players are myopic, information about past behavior is summarized in reputation, but strategic reputation concerns are absent. It is straightforward to show that if $f_s < \widetilde{\phi}$ and $\delta = 0$ there exists a unique equilibrium, and the strategies of that equilibrium take the form of the myopic equilibrium described above. Thus, when players are myopic, the fraction of the population participating in violence with positive probability, $f_s - (f_s - M_{myop}(1))\, M_{myop}(1)$, is strictly less than it would have been in the absence of reputations (static play). This fraction is smaller because as reputations evolve, unestablished streets can identify their established counterparts, and defer to them. For the same reason, when players are myopic, the fraction of encounters in which both players are violent is strictly smaller than that under a reputation equilibrium:

$$f_s^2 - M_{myop}(1)^2 \left(1 - \widetilde{\phi}^2\right) - 2M_{myop}(1)\,(f_s - M_{myop}(1)) < f_s^2 - M_{rep}(1)^2 \left(1 - \widetilde{\phi}^2\right)$$

because $M_{rep}(1)^2 < 2 f_s M_{myop}(1) - M(1)^2_{myop}$.[23] In what follows, we will see how the calming effect of information revelation on crime rates may be dominated when we allow for decent types, and the incentives that reputation concerns generate for their participation in violence.

[22] The fraction of encounters in which anyone is violent is also smaller than under static play.

[23] The fraction of meetings in which *any* violence occurs is strictly larger under myopic play than in a 'reputation' equilibrium because the measure of established streets is smaller under myopic play.

5 Reputation for Decents

When would reputation concerns lead decent types, despite their strict preferences for passivity, to participate in street crime? Consider the case where decents are very few (of zero measure), and thus the equilibrium beliefs and incentives of streets are unchanged from the preceding analysis. The behavior of decents when rare makes clear how reputation incentives for violence differ by type.

A decent type contemplating violence faces a subtle decision. Like a street type, a decent considers whether, given expected future payoffs, the discounted benefit of an established street reputation exceeds the immediate cost of acquiring it. But unlike a street, even when the value of a street reputation is high, a decent must also be assured that his opponent is worthy of a fight; he must be assured that attacking this opponent will generate the desired notoriety.

To illustrate how reputation's incentives for decents depend on the costs to street crime and on the information structure of the community, suppose streets were behaving according to their reputation equilibrium strategies. Now consider a strategy that calls for an unestablished decent to invest in violence against all opponents with sufficiently *large* street reputations. Having established himself as a presumed street by generating a violent signal, a decent will choose passivity until he exits the community.[24] In this environment with very few decents, Proposition 4 provides sufficient conditions for the existence of such a threshold equilibrium. Restricting attention to the space of parameters necessary and sufficient for the existence of a reputation equilibrium, Proposition 4 establishes that whenever the cost of violence C is small enough, there exists an equilibrium with unestablished decent types choosing violence against opponents sufficiently like to fight back.

Proposition 4 *When decent types are of zero measure, $f_s < \widetilde{\phi}$, and $L \leq \beta\gamma G$, then for every feasible reputation ϕ_s there exists a $\overline{C} > 0$, such that for all $C \in \left(0, \overline{C}\right]$ there exists a Markov perfect equilibrium where unestablished decents choose violence against all opponents with street reputations $\phi_{js} \geq \phi_s$*

Proof: See Appendix.

5.1 Honor among decents

The proof of Proposition 4 shows that, given a cost of violence C, the discounted benefit of a street reputation $\beta\Delta EW_d$, and a degree of social connectedness ρ, an unestablished decent chooses

[24] Having established a reputation by generating a violent signal, the decent's reputation will not decay despite his inevitable string of non-violent signals thereafter. This is because the signal x_{it} provides imperfect information about behavior since $\rho < 1$, and the community assigns a prior probability zero to his being a decent.

violence against an opponent with reputation ϕ_{js}, if and only if

$$\phi_{js}\rho\beta\Delta EW_d \geq C.$$

Intuitively, the larger an opponent's potential for violence (the larger ϕ_{js}) the *more* value a decent expects from violence against that opponent. This relationship between a decent's incentives for street crime and his opponent's reputation holds because, unlike a street, a decent gains from violence only if his opponent fights back.

For streets, reputation's net incentives work in the opposite direction. A street stands to gain from violence even when the community learns nothing about it. When his opponent is passive, a street's reputation is not enhanced by violence, but he enjoys the direct gain from the assault, G. As a result, if a street chooses violence against an opponent who will fight back with probability p, he will choose violence against all opponents *less* likely to resist.

These differences in reputation incentives by type highlight an important feature of two-sided reputation in a community setting: how others regard an individual (his reputation) depends not only on what he did but with whom he was seen doing it. As a result, what may be interpreted as honor emerges endogenously among decents: holding constant the value of future reputations, among decents violence against an apparently weak opponent offers less expected value than the same action against an apparently more dangerous opponent.

6 A Street Culture

The preceding analysis of an equilibrium where unestablished decents participate in violence provides insight into why and when those with no direct interest in violent crime would nevertheless engage in violence for reputation's sake. The question remains, however, whether the incentives that reputation concerns generate could importantly influence the crime rate in a community. Could we see economically important differences in the rate of street crime driven largely by the participation of those with no direct interest in violence? Could we, in other words, observe a street culture of violence in a community where relatively few gain directly from street crime?

The model with infinitely-tenured players and a strictly positive measure of all three types is considerably less tractable. For simplicity we consider a modified model in which generations continue to overlap but each member of the community lives for exactly two periods. A principal advantage of this simplified model is that it allows closed forms for the benefits of an established street reputation, and thereby makes clear how the value of a street reputation, and therefore violence, depends on both the local returns to crime and on the social structure of the community.

In this modified environment with finite-tenured players, the state must be expanded to include not just the reputations of each player in the match, but also their ages, as age is now payoff relevant. Maintaining the Markov restriction on behavior, strategies are now a function this expanded state:

$$\sigma\left(\tau_i, age_i, \boldsymbol{\phi}_i, age_j, \boldsymbol{\phi}_j\right) \in [0,1]$$

where $age \in \{y, o\}$ is either young and old. To capture the possibility of a shorter present or youth, and longer future or adulthood, let the weight on payoffs when young equal 1, and the weight on payoffs when old equal $\kappa \geq 0$.

In this setting, old decents are never violent because future payoffs are not a concern and violence is strictly dominated in the stage game. Thus the behavior of old decent and weak types is identical. This feature of equilibrium behavior implies that the relevant beliefs are, about a young player, the prior $\boldsymbol{\phi}^0 = \mathbf{f}$, and, about an old player, the belief he is a street, ϕ_{is}. Of interest is the behavior of young decents and of streets both young and old.

6.1 Street culture equilibrium

Consider a simple but particularly violent equilibrium: a *street culture equilibrium.* In this equilibrium decent types are as violent as they will ever be. When young, streets and decents *always* choose violence. Because decents and streets are behaving identically when young, following a violent signal there is a unique belief about the probability a player is a street. Let ϕ_s^E denote this established reputation resulting from a violent signal that equals the fraction of streets among non-weak types $\left(\frac{f_s}{1-f_w}\right)$. In a street culture equilibrium ϕ_s^E is such that all old streets defer to those with established reputations. More precisely, ϕ_s^E is such that (A) an unestablished old street is passive when facing an established opponent, and (B) an established street chooses violence with probability strictly less than one when facing another established player. The strategies for a player i in a street culture equilibrium are summarized by the following table. They are described in terms of his type, age, and prior signal, and the age (and signal) of his match.

Street Culture Equilibrium
Summary of Strategy for Player i Matched with Opponent j

			Opponent age/signal		
	τ_i	age/signal	young	old $x_{j,t-1}$=1	old $x_{j,t-1}$=0
Player	decent	young	1	1	1
		old	0	0	0
	street	young	1	1	1
		old $x_{i,t-1}$=1	1	$\tilde{\phi}\,/\,\phi_s^E$	1
		old $x_{i,t-1}$=0	1	0	1

The following lemma provides closed-form solutions for the expected gains for young decents and streets from an established reputation in a street culture equilibrium.

Lemma 2 *In a street culture equilibrium the expected gains for decents and streets from an established reputation are given by:*

$$\Delta EW_d = \frac{B}{2}\left[f_s - \widetilde{\phi} M\left(\phi_s^E\right)\right]$$

$$\Delta EW_s = \left\{ \begin{array}{c} M\left(\phi_s^E\right)\left[G\left(\phi_s^E + \frac{\widetilde{\phi}}{\phi_s^E}\left(1-\phi_s^E-\widetilde{\phi}\right)\right) - L\frac{\widetilde{\phi}^2}{\phi_s^E}\right] + \\ (2G+L)\frac{f_s}{2}\left(1-\frac{\rho}{2}\left(1-f_w+f_s\right)\right) \end{array} \right\}$$

where $M\left(\phi_s^E\right) = \frac{\rho}{4}\left(1-f_w\right)\left(1-f_w+f_s\right)$ *and* $\phi_s^E = \frac{f_s}{1-f_w}$.

Proof: See Appendix.

With these closed forms for the expected benefit of an established reputation, Proposition 5 provides necessary and sufficient conditions for the existence of a street culture equilibrium.

Proposition 5 *A street culture equilibrium exists if and only if*

$$\frac{f_s}{1-f_w} > \widetilde{\phi} \geq 1 - f_w \tag{1}$$

$$\kappa\rho\Delta EW_d \geq \frac{C}{\underline{\phi}} \tag{2}$$

$$\kappa\rho\Delta EW_s \geq \frac{f_s L - \left(1-f_s-f_w\right)G}{f_s} \tag{3}$$

where $\underline{\phi}$*, denoting the minimum reputation, equals* $f_s\left(\frac{1-\phi_s^E\rho}{1-f_s\rho}\right)$ *and* $\phi_s^E, \Delta EW_d$*, and* ΔEW_s *are given in Lemma 2.*

Proof: See Appendix

While their closed form expressions are somewhat complex, the interpretation of conditions 1 - 3 is straightforward. Condition 1 reflects that the fraction of streets among non-weak types $\left(\frac{f_s}{1-f_w}\right)$ must be large enough to ensure that the established earn the deference of old streets, and thus give an established reputation its value in equilibrium. In addition, the fraction of weak types f_w must be large enough to ensure that street types of each age have incentive to behave violently against the young, and thereby generate opportunities for young people to establish their reputations. Condition 2 guarantees that the weighted future benefit of an established reputation exceeds the cost of acquiring it for young decent types, no matter how *weak* their opponent appears. Similarly, condition 3 assures that the weighted future benefit of an established reputation exceeds the cost of acquiring it for young street types, regardless of how *strong* their opponent appears.

This street culture equilibrium is distinguished by two basic features. First, despite their preference for avoiding violence, the behavior of young decents is indistinguishable from that of young streets. Thus, as it draws decents into street crime, the social force of reputation may raise the crime rate substantially above the level supported by fundamental economic motives. A second distinction of this equilibrium is the extremity of its behavior. Despite its simplicity, a street culture equilibrium is especially violent. Decents are choosing violence as often as they ever will.

Age, Street Crime, and Reputation

Another important feature of a street culture equilibrium is the relationship between age and violence that it implies. At the individual level, both decents *and* streets are less violent when old than when young. Young decents and streets choose violence against all opponents. Old decents, however, are never violent. Relative to young streets, the behavior of old streets is tempered in two situations. First, the unestablished defer to all established players, streets and decents alike. Second, established streets defer with probability $\left(1 - \frac{\widetilde{\phi}}{\phi_s^E}\right)$ to all other established players.

Reputation's influence on individual propensities for street crime by age naturally generates aggregate differences in the relative rates of violence within age groups. Crime rates are highest among the young. Of the meetings between two young people, only those involving two weaks are lacking in violence. Every other interaction between two youths includes at least one violent participant; and extremely violent (V, V) encounters represent a potentially large fraction of all their interactions $(1 - f_w)^2$. Contrast this level of street crime with that characterizing interactions between the old. In these old-old meetings, street crime is perpetrated only by streets, and even they are not always violent. Only when unestablished streets are paired, and with probability $\left(\frac{\widetilde{\phi}}{\phi_s^E}\right)^2 < 1$ when established streets are paired, is there an extremely violent (V, V) interaction.

Local Returns to Street Crime, Social Structure, and the Value of Violence

The characterization of this simple, but especially violent street culture equilibrium also reveals how the value of a reputation, and thus violence, depends on both the direct returns from crime and deference, and on the social structure of the community. With regard to the direct returns, for decent types the value of an established reputation in this equilibrium (ΔEW_d) is increasing in their own benefit from deference, B. The more a decent type stands to lose by being victimized, the higher the value he assigns to an established street reputation. Changes in the gains from crime for street types, G, however, have the opposite effect on the value of an established reputation for decent types. The *smaller* the expected gains from crime, the *greater* the value of a street reputation for decent types.[25] A street culture cannot be sustained in a community where the stakes for street types are too large. This result derives from the fact that, other things equal, the lower an old street's expected gains from crime, the more likely he is to defer to an established player. The more likely he is to defer, the greater the value of an established reputation.

The social structure of a community also importantly influences the value of an established reputation and violence. This model counters standard theories of social capital that explain how better interpersonal connections facilitate community cooperation and the provision of local public goods such as safety. This model predicts that a community with better social connections, and with higher rates of social interaction, is *more* likely to support a street crime culture.[26] Though this prediction of the model is unambiguous, the ways in which social structures contribute to reputation-based violence are nuanced.

In a direct way, the higher the rate of future social interactions, interpreted as κ, the higher the expected gain from violence for both decents and streets. Conditional on having a future social interaction, an established reputation has a positive expected value; thus the more likely a future interaction the higher the value of violence when young. However, for both decents and streets the value of an established reputation (ΔEW_τ) is *decreasing* in the social connectedness of the community ρ. Holding behavior fixed, the greater the community's ability to communicate about violence, the greater the supply of people with established reputations (including street types). As a result of this increased supply, the expected value of having that reputation is diminished. This does not imply, however, that a better connected community is less likely to sustain a street culture equilibrium. There is a tension: while the value of an established reputation is lower in a better connected community, in a sense, its price is also lower; the probability of acquiring an established reputation when violent also increases. So while $\frac{\partial \Delta EW_\tau}{\partial \rho} < 0$ in an street culture equilibrium $\frac{\partial \rho \Delta EW_\tau}{\partial \rho} > 0$, for both streets and decents.

6.2 The strength of reputation concerns

For the purposes of evaluating the relevance of reputation for street crime rates, an important question is whether the street culture equilibrium is a particularly compelling one. More precisely, can an equilibrium in which decent types never participate in street crime exist along side the street culture equilibrium characterized by Proposition 5? If such a peaceful equilibrium may exist as

[25] Other things equal, the value of an established reputation for street types ΔEW_s is uninfluenced by changes in B. Depending on the values of other parameters, ΔEW_s may be either increasing or decreasing in G.

[26] Glaeser, Sacerdote, and Scheinkman (1996) also predicts more crime in communities with more social interaction.

well as a street culture, one might think that a community that largely prefers to avoid violence could find a way to select the more peaceful equilibrium. In what follows, we see that if a street culture equilibrium exists, and if reputations are established off equilibrium path, then decents are violent in every monotone equilibrium.

Why, if a street culture equilibrium exists, is it difficult to support an equilibrium in which decent types are never violent? Suppose only streets were violent when young. Then if the conditions for the existence of the street culture equilibrium hold, anyone who generates a violent signal when young will earn the most complete form of deference from old streets. But if this is the case, then unless young streets can coordinate and choose violence *more* often against those with established reputations, the benefit of an established reputation will be strictly greater than it was before, and decent types will find it profitable to choose violence. The intuition we developed in previous sections suggests that it will be difficult to get young streets to be gentler with those who they think less likely to fight them back, and indeed this is the case. If a street culture equilibrium exists, then if reputations are established off the equilibrium path, in every monotone equilibrium young decents will participate in street crime.

Proposition 6 *If a street culture equilibrium exists, and if the sufficient statistic for off-equilibrium path beliefs equals one, then there exists no Markov perfect equilibrium in monotone strategies in which* $\sigma\left(d, y, f_s, age_j, \phi_j\right) = 0$ *for all* age_j, ϕ_j.

Proof: See Appendix.

6.3 Numerical illustration

To illustrate concretely the potential for reputation concerns to affect overall crime rates, consider the following numerical example. Let $f_s = 0.25$, $f_w = 0.50$, $\kappa = 1$, and $\rho = 0.75$; and assume the following payoff schedules for decent and street types, respectively:

a_i \ a_j	V	P
V	-101	-1
P	-100	0

expected payoff to decent type playing a_i vs. a_j

a_i \ a_j	V	P
V	-2	1
P	-1	0

expected payoff to street type playing a_i vs. a_j

It is straightforward to show that in the absence of reputation concerns $(\kappa = 0)$, in the unique equilibrium the fraction of the young participating in violence is 0.24. (The characterization in Proposition 1 implies that the fraction young people participating in crime in the absence of reputations would simply be $f_s = 0.25$, thus the calming influence of information revelation, separate from reputation concerns, leads to a small decline in violence among young people.) One can confirm, however, that the parameters in this numerical example satisfy the necessary and sufficient conditions for the existence of a street culture equilibrium. Allowing for strategic reputation concerns, therefore, the rate of participation in crime among young people may more than double to $0.50 = 1 - f_w$, as all young street and decent types invest in violence in order to establish a reputation to be enjoyed when old. As both the costs of violence for decent types C and the relevant population $(1 - f_w)$ decrease, one can construct examples in which reputation effects cause the rate of participation in crime among young people to increase by more than 3, 4 or 10 times.

7 Discussion

This paper develops a model of social interactions to explain how reputation concerns can support an 'underclass' street culture of crime in communities where the direct incentives for such behavior are weak. Here, a reputation for violence has an instrumental value derived from a concern for self-protection. Reputation does not generate utility; and for all but a potentially small street element, there is no direct gain from violence. Nevertheless, even if individuals do not derive utility from a reputation or from the behavior necessary to acquire it, they may adhere to a street culture in order to avoid the future loss of goods that do have intrinsic value.

In a setting of two-sided incomplete information, reputations were shown to have two competing effects on choices about street crime. The first effect reflects the calming influence of information revelation, and is in force even when players disregard the future. The second, competing effect reflects the influence of strategic reputation concerns. An investment in street crime today can add valuably to an individual's street reputation for the future. Importantly, this second effect may apply both to street types *and* to those with a strict preference for passivity, decent types.

When decent types mimic streets and participate in crime for reputation's sake, the effect on overall crime rates can be dramatic. Examples showed that reputation effects could cause the youth street crime rate to more than double from its fundamental level. Moreover, we saw that the problems of incomplete information may make these pooling equilibria compelling. If a street culture, pooling equilibrium exists, and if reputations are established off the equilibrium path, then in every monotone equilibrium decent types will participate in street crime.

Characterization of a street culture equilibrium showed how the dynamics inherent in reputation building, may explain why both the propensity for and the intensity of street crime tends to decrease with age. The analysis also demonstrated the interactions between the direct returns to crime, the social structure of a community, and the value of a street reputation. Lower costs of participating in street crime and greater direct benefits of avoiding victimization naturally contribute to reputation-based violence. Street cultures cannot be sustained, however, where the direct gains for street types are too large. The value of a reputation comes from the deference it generates. If streets' gains are so large that they will not defer, reputations have no value. More subtly, reputation concerns imply that communities with higher levels of social capital, interpreted as higher rates of social interaction and greater degrees of social connection, are *more* likely to support a culture of street crime. We saw that this positive relationship between social capital and socially motivated street crime holds even though the value of an established street reputation is actually lower in a community where information about a violent encounter is more likely to be spread.

This theory of crime and reputation helps explain the tendency for certain types of crime to be committed in public, and in front of witnesses. In addition, by distinguishing between public and private crimes, the model suggests why we may observe differences in the responsiveness of different types of crime to different policies. Consider a community in which reputation concerns draw the decent population into violence. Now introduce policies that disproportionately affect street types. For example, unlike street types, decents presumably have no incentive to commit crime out of public view. Strict enforcement of laws against non-violent, private crime such as petty theft, vandalism, or turnstile jumping could, therefore, effectively identify and remove real streets from the community. If such reductions were substantial and widely publicized, disproportionate decreases in violent crime levels could result as decent types come to find a street reputation less valuable, and a street culture equilibrium falls apart. In this way, the model suggests a foundation for policies like those recently adopted in New York City, where strict enforcement of non-violent misdemeanors is thought to have an indirect impact on violent crime rates (Rashbaum, 2002).

The analysis complements standard theories of crime in that it suggests that law enforcement and human capital levels will, in part, determine where street cultures emerge. Consider two otherwise identical communities, one with weaker law enforcement. That community will have lower costs of violence, and greater benefits from deference, because street crime is less likely to be punished and lost goods are less likely to be returned. Lower costs of violence and greater benefits from deference make a community more likely to sustain a street culture. In a similar vein, where levels of human capital are lower the opportunity costs of violence are smaller as the option value of legitimate work is relatively inelastic to changes in a criminal record. At the same time, the marginal benefit of deference may be especially high among those with low income: losing $50 in groceries may have important consequences for a poor person, and yet be inconsequential for someone with more income. For these reasons the model suggests that street cultures should be easier to sustain in low-income communities with weak law enforcement.

The model analyzed here is highly stylized. Many aspects of community life that may influence street crime rates are omitted. I highlight three missing aspects of particular interest. The first is endogenous meetings. If, in fact, walking the streets exposes a decent type to considerable risk of assault, then it is logical for him to avoid the street as much as possible. If time spent in the street were a choice, the community could make inferences about type based not just on an individual's history of violent signals, but also on the fraction of his time he spends in the street. Importantly, if the street cannot be sufficiently avoided, reputation concerns may make it optimal to spend much more than the minimum amount of time in the street. The implications of this kind of reputation effect may be substantial. If reputations are maintained in part by spending time in the street then, by extension, time spent at school or work may negatively impact street reputations; and thus reputation concerns may influence investment in human capital.

The logic of the preceding paragraph suggests a second missing feature: endogenous types. This paper treats types as though they were permanent and given exogenously. A richer model would allow past actions to influence direct payoffs. If, for example, by committing a street crime an individual went to prison with greater probability, and that prison time influenced his options in the legitimate labor market, then his direct payoffs from future street crimes would change.

Finally, this paper does not consider the dynamic implications of policy changes. If, for example, law-enforcement policies changed and as a result incarcerated those participating in violent crime against passive victims for longer periods, the effective distribution of street types might be effected. This change might, in turn, importantly influence the value of street reputations, and thus street crime rates. These dynamic effects of policy, along with the implications of endogenous meetings and types are left for further research.

A Appendix

Preliminary Notation:

By Lemma 1 the sufficient statistic for posterior beliefs after a violent signal, $\varphi_s\left(\phi_{is}, \phi_{js}, 1\right) = 1$. To simplify notation let $\varphi_s\left(\phi_{is}, \phi_{js}, 0\right) \equiv \varphi_s^0\left(\phi_{is}, \phi_{js}\right)$ denote the sufficient statistic for posterior beliefs following a non-violent signal. The expected continuation payoff resulting from a violent signal is denoted by $EW_s\left(1, \widehat{\phi}_{js}\right)$, where the expectation is with respect to the reputation of the match next period $\widehat{\phi}_{js} = E\left(\phi_{js}\right)$. The expected continuation payoff from a non-violent signal is denoted by $EW_s\left(\varphi_s^0\left(\phi_{is}, \phi_{js}\right), \widehat{\phi}_{js}\right)$. Let the difference between these two values be denoted by $\Delta EW_s\left(\phi_{is}, \phi_{js}\right)$. Finally, with abuse of notation, the steady state measure of players with reputation $\boldsymbol{\phi}$, $M\left(\{(s, d, w)\}\right)$ is denoted by $M\left(s\right)$.

Proof of Proposition 2.

Consider the possibility of mixed strategies for established streets. If $f_s < \widetilde{\phi} = \frac{G}{G+L}$, then only other established streets could play strategies to make the established indifferent between V and P. To see this, note that such a strategy $\sigma_s\left(\phi_{js}, 1\right)$ must satisfy:

$$\begin{aligned} W_s\left(1, \phi_{js}; V\right) &= \left\{ \begin{array}{c} \phi_{js}\left[\sigma_s\left(\phi_{js}, 1\right) u_s\left(V, V\right) + \left(1 - \sigma_s\left(\phi_{js}, 1\right)\right) u_s\left(V, P\right)\right] + \\ \left(1 - \phi_{js}\right) u_s\left(V, P\right) + \beta EW_s\left(1, \widehat{\phi_{js}}\right) \end{array} \right\} \\ &= W_s\left(1, \phi_{js}; P\right) = \phi_{js}\sigma_s\left(\phi_{js}, 1\right) u_s\left(P, V\right) + \beta EW_s\left(1, \widehat{\phi_{js}}\right) \end{aligned}$$

or $\sigma_s\left(\phi_{js}, 1\right) = \frac{G}{(G+L)\phi_{js}}$. Since $\sigma_s\left(\phi_{js}, 1\right) \leq 1$, the indifference condition can be satisfied only if $\frac{G}{G+L} \leq \phi_{js}$. A mixed strategy $\sigma_s^*\left(1, 1\right) = \frac{G}{G+L}$ is thus optimal for established streets when matched with each other; and there exists no equilibrium with established streets playing a mixed strategy against the unestablished. Trivially, there exists no symmetric equilibrium in pure strategies for established streets when facing each other. Thus any symmetric MPE has $\sigma_s^*\left(1, 1\right) = \frac{G}{G+L}$.

We have determined that when facing an unestablished player the established street plays a pure strategy. He chooses violence against the unestablished iff $W_s\left(1, \phi_{js}; V\right) \geq W_s\left(1, \phi_{js}; P\right)$ from above. This condition is satisfied if $\frac{G}{G+L} \geq \phi_{js}\sigma_s\left(\phi_{js}, 1\right)$, which always holds if $f_s < \widetilde{\phi}$. Thus any symmetric MPE has $\sigma_s^*\left(1, \phi_{js}\right) = 1$, for $\phi_{js} < \widetilde{\phi}$.■

Proof of Proposition 3.

Given the behavior of established streets described by Proposition 2, consider the optimal behavior for unestablished streets. If the opponent is also unestablished, $\left(\phi_{is}, \phi_{js} < \frac{G}{G+L}\right)$, then by the one-shot deviation principal only $\sigma\left(\phi_{is}, \phi_{js}\right) = 1$ is optimal if

$$\begin{aligned} W_s\left(\phi_{is}, \phi_{js}\right) &= \left\{ \begin{array}{c} \phi_{js}\left[\sigma\left(\phi_{js}, \phi_{is}\right) u_s\left(V, V\right) + \left(1 - \sigma\left(\phi_{js}, \phi_{is}\right)\right) u_s\left(V, P\right)\right] + \\ \left(1 - \phi_{js}\right) u_s\left(V, P\right) + \\ \beta\left[\begin{array}{c} \phi_{js}\sigma\left(\phi_{js}, \phi_{is}\right)\rho EW_s\left(1, \widehat{\phi}_{js}\right) + \\ \left(1 - \phi_{js}\sigma\left(\phi_{js}, \phi_{is}\right)\rho\right) EW_s\left(\varphi_s^0\left(\phi_{is}, \phi_{js}\right), \widehat{\phi}_{js}\right) \end{array} \right] \end{array} \right\} \\ &> W_s\left(\phi_{is}, \phi_{js}; P\right) = \phi_{js}\sigma\left(\phi_{js}, \phi_{is}\right) u_s\left(P, V\right) + \beta EW_s\left(\varphi_s^0\left(\phi_{is}, \phi_{js}\right), \widehat{\phi}_{js}\right) \end{aligned}$$

$\Longleftrightarrow G + \sigma\left(\phi_{js}, \phi_{is}\right)\phi_{js}\beta\rho\Delta EW_s\left(\phi_{is}, \phi_{js}\right) > \sigma\left(\phi_{js}, \phi_{is}\right)\phi_{js}\left(G + L\right)$; which, because $\phi_{js} < \frac{G}{G+L}$, will always hold if $\Delta EW_s\left(\phi_{is}, \phi_{js}\right) \geq 0$. Thus, in any equilibrium, unestablished streets choose V against each other if $\Delta EW_s\left(\phi_{is}, \phi_{js}\right) \geq 0$. Note that $\Delta EW_s\left(\phi_{is}, \phi_{js}\right) < 0$ only if unestablished streets, in expectation, choose violence with a higher probability when facing established streets than they do when facing unestablished streets who generated non-violent signals after meeting established streets. One can show, however, that such behavior cannot be sustained by monotonic strategies. (See the last section of the proof of Proposition 6 for the basic argument.)

When facing an established street, because his opponent is choosing violence, by the one-shot deviation principle $\sigma_s^*(\phi_{is}, 1) = 1$ only if:

$$\begin{aligned} W_s(\phi_{is}, 1; V) &= u_s(V, V) + \beta\left[\rho EW_s\left(1, \widehat{\phi}_{js}\right) + (1-\rho) EW_s\left(\varphi_s^0(\phi_{is}, 1), \widehat{\phi}_{js}\right)\right] \geq \\ W_s(\phi_{is}, 1; P) &= u_s(P, V) + \beta EW_s\left(\varphi_s^0(\phi_{is}, 1), \widehat{\phi}_{js}\right) \end{aligned}$$

$\iff L \leq \beta\rho\Delta EW_s(\phi_{is}, 1)$. Thus a myopic equilibrium exists if and only if $L \geq \beta\rho\Delta EW_s(\phi_{is}, 1)$, and a reputation equilibrium exists if and only if $L \leq \beta\rho\Delta EW_s(\phi_{is}, 1)$. Observe that $\Delta EW_s(\phi_{is}, 1)$ need not be the same across these equilibria. We confirm that the condition $\Delta EW_s(\phi_{is}, \phi_{js}) \geq 0$ follows from the fact that in either equilibrium (myopic or reputation) the expected stage game payoff when $\phi_{is} = 1$ is greater than that when $\phi_{is} < 1$.

The characterization of these two equilibria is completed by solving for the closed forms of $\Delta EW_s(\phi_{is}, \phi_{js})$. In a myopic equilibrium

$$EW_s\left(1, \widehat{\phi}_{js}\right) = M_m(1)\,\widetilde{\phi}^2 u_s(V, V) + (1 - M(1))\, u_s(V, P) + \beta EW_s\left(1, \widehat{\phi}_{js}\right)$$

$$EW_s\left(\varphi_s^0(\phi_{is}, \phi_{js}), \widehat{\phi}_{js}\right) = \left\{ \begin{array}{c} M_m(1)\, u_s(P, V) + (f_s - M_m(1))\, u_s(V, V) + (1 - f_s)\, u_s(V, P) + \\ \beta \left[\begin{array}{c} (f_s - M_m(1))\, \rho EW_s\left(1, \widehat{\phi}_{js}\right) + \\ (1 - (f_s - M_m(1))\,\rho)\, EW_s\left(\varphi_s^0(\phi_{is}, \phi_{js}), \widehat{\phi}_{js}\right) \end{array} \right] \end{array} \right\}$$

Note in this second equality that while beliefs would be updated (downward) following a non-violent signal, the continuation value is unchanged because behavior is unchanged for downward adjustments of beliefs. Some algebra reveals that

$$\Delta EW_s(\phi_{is}, \phi_{js}) = \frac{G\left(2f_s - M_m(1)\left(1 + \widetilde{\phi}^2\right)\right) + L\left(f_s - M_m(1)\left(1 + \widetilde{\phi}^2\right)\right)}{1 - \beta(1 - (f_s - M_m(1))\,\rho)}$$

Thus a myopic equilibrium exits if and only if $\beta\eta G \leq L$, where $\eta = \frac{\rho 2 f_s - \rho M_m(1)\left(1+\widetilde{\phi}^2\right)}{1 - \beta + \beta\rho M_m(1)\widetilde{\phi}^2}$.

In a reputation equilibrium the expected value of an established reputation is:

$$EW_s\left(1, \widehat{\phi}_{js}\right) = \left\{ \begin{array}{c} M_{rep}(1)\left[\widetilde{\phi}\left(\widetilde{\phi} u_s(V, V) + \left(1 - \widetilde{\phi}\right) u_s(V, P)\right) + \left(1 - \widetilde{\phi}\right)\widetilde{\phi} u_s(P, V)\right] + \\ (f_s - M_{rep}(1))\, u_s(V, V) + (1 - f_s)\, u_s(V, P) + \beta EW_s\left(1, \widehat{\phi}_{js}\right) \end{array} \right\}$$

and the expected continuation value of a reputation $\phi_{is} < 1$ is:

$$EW_s\left(\varphi_s^0(\phi_{is}, \phi_{js}), \widehat{\phi}_{js}\right) = \left\{ \begin{array}{c} M(1)\, u_s(V, V) + (f_s - M(1))\, u_s(V, V) + (1 - f_s)\, u_s(V, P) + \\ \beta\left[f_s \rho EW_s\left(1, \widehat{\phi}_{js}\right) + (1 - f_s\rho)\, EW_s\left(\varphi_s^0(\phi_{is}, \phi_{js}), \widehat{\phi}_{js}\right)\right] \end{array} \right\}$$

Thus $EW_s\left(1,\widehat{\phi}_{js}\right)-EW_s\left(\varphi_s^0\left(\phi_{is},\phi_{js}\right),\widehat{\phi}_{js}\right)=\Delta EW_s\left(\phi_{is},\phi_{js}\right)=\frac{M_{rep}(1)(L+G)\left(1-\widetilde{\phi}^2\right)}{1-\beta(1-f_s\rho)}$; and some algebra reveals that a reputation equilibrium exists if and only if $\beta\gamma G\geq L$, where $\gamma=\frac{\rho(2M_{rep}(1)-f_s)-(1-\beta)}{\beta\rho(f_s-M_{rep}(1))+(1-\beta)}$.■

Closed forms for the necessary and sufficient conditions for the existence of these two equilibria may be derived by solving for the steady state measures of established streets in each equilibrium. Lemma 3 provides those measures.

Lemma 3 *If $f_d=0$ and $f_s<\widetilde{\phi}$, in a myopic equilibrium the steady state reputation distribution M_σ is such that $M_m(1)=f_s\left(1-\frac{\sqrt{1+4f_s\rho\left(\frac{1-\lambda}{\lambda}\right)}-1}{2f_s\rho\left(\frac{1-\lambda}{\lambda}\right)}\right)$ and in a reputation equilibrium M_σ is such that $M_{rep}(1)=f_s\left(\frac{f_s}{f_s+\frac{\lambda}{\rho(1-\lambda)}}\right)$.*

Proof of Lemma 3.

For the myopic equilibrium, in general: $M_m^{(t+1)}(1)=(1-\lambda)\left[M_m^{(t)}(1)+\left(f_s-M_m^{(t)}(1)\right)^2\rho\right]$ as the fraction of the population consisting of established streets in period $t+1$ consists of established streets surviving from last period and unestablished streets who met other unestablished streets, generated a violent signals and survived from the last period. The steady state equation is therefore: $M_m(1)=(1-\lambda)\left[M_m(1)+(f_s-M_m(1))^2\rho\right]$, which has two solutions, only one of which $\left(\frac{2f_s(1-\lambda)\rho+\lambda-\sqrt{\lambda^2+4f_s(1-\lambda)\rho\lambda}}{2(1-\lambda)\rho}\right)$ is feasible in that $M_m(1)\leq f_s$. Some algebra gives the result.

In a reputation equilibrium, in general: $M_{rep}^{(t+t)}(1)=(1-\lambda)\left[M_{rep}^{(t)}(1)+\left(f_s-M_{rep}^{(t)}(1)\right)f_s\rho\right]$; as the fraction of the population consisting of established streets in period $t+1$, is made up of established streets surviving from last period and unestablished streets who met any other street, generated a violent signal and survived from the last period. The steady state equation is therefore: $M_{rep}(1)=(1-\lambda)\left[M_{rep}(1)+(f_s-M_{rep}(1))f_s\rho\right]\Leftrightarrow M_{rep}(1)=f_s\left(\frac{\rho(1-\lambda)f_s}{\rho(1-\lambda)f_s+\lambda}\right)$.■

Proof of Proposition 4.

Consider an equilibrium $\left(\sigma^{\underline{\phi}},\varphi^{\underline{\phi}}\right)$ in which streets play the reputation equilibrium strategy of Proposition 3 and decents choose P when established and a threshold strategy, V iff $\phi_{js}\geq\underline{\phi}\in(0,1]$, when unestablished. The decent is playing a myopic best response when $\phi_{is}=1$. Since beliefs will not change, there is no profitable deviation from $\sigma^{\underline{\phi}}$ when $\phi_{is}=1$. The alternative case has $\phi_{is}<1$. Because the one-shot deviation principle applies, the strategy $\sigma_d^{\underline{\phi}}\left(\phi_{is},\phi_{js}\right)$ is optimal if and only if

$$\begin{aligned}
W_d\left(\phi_{is},\phi_{js};V\right) &= \left\{\begin{array}{c}\phi_{js}u_d(V,V)+\left(1-\phi_{js}\right)u_d(V,P)+\\ \beta\left[\rho\phi_{js}EW_d\left(1,\widehat{\phi}_{js}\right)+\left(1-\rho\phi_{js}\right)EW_d\left(\varphi_s^0\left(\phi_i,\phi_{js}\right),\widehat{\phi}_{js}\right)\right]\end{array}\right\}\geq \\
W_d\left(\phi_{is},\phi_{js};P\right) &= \phi_{js}u_d(P,V)+\beta EW_d\left(\varphi_s^0\left(\phi_{is},\phi_{js}\right),\widehat{\phi}_{js}\right)\Longleftrightarrow
\end{aligned}$$

$$\phi_{js}\beta\rho\Delta EW_d \geq C \tag{4}$$

Let $\Delta EW_d^{\underline{\phi}}$ denote the gain from an established reputation in the equilibrium $\left(\sigma^{\underline{\phi}}, \varphi^{\underline{\phi}}\right)$. For all $\underline{\phi} \in (0,1]$, $\Delta EW_d^{\underline{\phi}} > 0$ because in all feasible meetings the equilibrium stage game payoffs for established decents are at least as large as those for the unestablished, and strictly higher in some of those meetings. Thus for any threshold $\underline{\phi}$ there exits a $\overline{C} > 0$ such that $\overline{C} = \underline{\phi}\beta\rho\Delta EW_d^{\underline{\phi}}$. Given the threshold $\underline{\phi}$ and the cost $\overline{C} = \underline{\phi}\beta\rho\Delta EW_d^{\underline{\phi}}$, by condition (4) violence is optimal for unestablished decents facing opponents with street reputations greater than $\underline{\phi}$. It follows that for every threshold $\underline{\phi}$ there exits a cost of violence $\overline{C}$ such that the strategy $\sigma^{\underline{\phi}}$ along with consistent beliefs $\varphi^{\underline{\phi}}$ is a Markov perfect equilibrium. The expected behavior of opponents is invariant to changes in $\underline{\phi}$. Thus, as $\underline{\phi}$ decreases the expected continuation payoff for decents from an established reputation is unchanged. However, as $\underline{\phi}$ decreases the expected continuation payoff from an unestablished reputation decreases because the fraction of opponents against which the unestablished decent chooses violence increases. Thus $\Delta EW_d^{\underline{\phi}}$ is decreasing in $\underline{\phi}$. It follows that for every $C \leq \overline{C}$ there exists an equilibrium with threshold $\underline{\phi}' \leq \underline{\phi}$ such that decents choose violence against opponents with street reputations greater than the original threshold $\underline{\phi}$.■

Proof of Lemma 2.

To solve for ΔEW_d and ΔEW_s in the 'street culture equilibrium,' first we calculate the measure of the community who is old and who generated a violent signal when young

$$M\left(\phi_s^E\right) = \frac{1}{2}\left(1-f_w\right)\left[\frac{1}{2}\left(1-f_w\right)+\frac{1}{2}f_s\right]\rho$$

This measure represents all the young street and decents who met either another young street or decent, or an old street, and generated a violent signal. It follows that the expected continuation value to decents from generating a violent signal, and a non violent signal is given by, respectively:

$$EW_d\left(1, \widehat{\phi}_{js}\right) = \frac{1}{2}\left(1-f_w\right)u_d\left(P,V\right) + M\left(\phi_s^E\right)\widetilde{\phi}u_d\left(P,V\right)$$

$$EW_d\left(\varphi_s^0\left(\phi_y,\phi_j\right), \widehat{\phi}_{js}\right) = \frac{1}{2}\left(1-f_w\right)u_d\left(P,V\right) + \frac{1}{2}f_s u_d\left(P,V\right)$$

The important difference is therefore given by $\Delta EW_d = B\left[\frac{f_s}{2} - \widetilde{\phi}M\left(\phi_s^E\right)\right]$. For street types:

$$\begin{aligned}
EW_s\left(1, \widehat{\phi}_{js}\right) &= \frac{1}{2}\left[f_w u_s\left(V,P\right) + \left(1-f_w\right)u_s\left(V,V\right)\right] \\
&+ M\left(\phi_s^E\right)\left[\begin{array}{c} \widetilde{\phi}\left(\frac{\widetilde{\phi}}{\phi_s^E}u_s\left(V,V\right) + \left(1-\frac{\widetilde{\phi}}{\phi_s^E}\right)u_s\left(V,P\right)\right) + \\ \frac{\widetilde{\phi}}{\phi_s^E}\left(1-\phi_s^E\right)u_s\left(V,P\right) + \left(1-\frac{\widetilde{\phi}}{\phi_s^E}\right)\widetilde{\phi}u_s\left(P,V\right) \end{array}\right] \\
&+ \left(\frac{1}{2} - M\left(\phi_s^E\right)\right)u_s\left(V,P\right)
\end{aligned}$$

$$EW_s\left(\varphi_s^0\left(\phi_y,\phi_j\right),\widehat{\phi}_{js}\right) = \frac{1}{2}\left[f_w u_s\left(V,P\right)+\left(1-f_w\right)u_s\left(V,V\right)\right]+M\left(\phi_s^E\right)\phi_s^E u_s\left(P,V\right) + \left(\frac{1}{2}-M\left(\phi_s^E\right)\right)\left[\left(1-\phi\left(0\right)\right)u_s\left(V,P\right)+\phi\left(0\right)\left(V,V\right)\right]$$

where $\phi(0)$, denoting the proportion of streets among the old with non-violent signals, equals:

$$\frac{\frac{1}{2}f_s\left(1-\frac{1}{2}\rho\left(1-f_w+f_s\right)\right)}{\frac{1}{2}-M\left(\phi_s^E\right)}.$$

The important difference is therefore given by:

$$\Delta EW_s = M\left(\phi_s^E\right)\left[G\left(\phi_s^E-\widetilde{\phi}+\frac{\widetilde{\phi}}{\phi_s^E}-\frac{\widetilde{\phi}^2}{\phi_s^E}\right)-\frac{\widetilde{\phi}^2}{\phi_s^E}L\right]+\left(\frac{1}{2}-M\left(\phi_s^E\right)\right)\phi\left(0\right)\left(2G+L\right)\ .$$

Proof of Proposition 5.

The proposed strategies for weak types, and old decent types are trivially optimal. The following proof describes the conditions under which the strategies of a street culture equilibrium are optimal (given consistent beliefs) for every other feasible match, case by case. Consider first the behavior of street types when old:

$Case\ (1)$: If $\sigma^*\left(s,o,\phi_s^E,y,f_s\right)=1$ is optimal then

$$f_w u_s\left(V,P\right)+\left(1-f_w\right)u_s\left(V,V\right)\geq\left(1-f_w\right)u_s\left(P,V\right)\Longleftrightarrow\widetilde{\phi}\geq 1-f_w\ .$$

$Case\ (2)$: $\sigma^*\left(s,o,\phi_s^E,o,\phi_j\right)=1$ is optimal for $\phi_j<\phi_s^E$ because V is a dominant strategy for streets when facing an opponent playing P.

$Case\ (3)$: A fully mixing strategy $\sigma^*\left(s,o,\phi_s^E,o,\phi_s^E\right)=\sigma^*$ is optimal if σ^* satisfies:

$$\phi_s^E\left[\sigma^* u_s\left(V,V\right)+\left(1-\sigma^*\right)u_s\left(V,P\right)\right]+\left(1-\phi_s^E\right)u_s\left(V,P\right) = \phi_s^E\sigma^* u_s\left(P,V\right)\Longleftrightarrow\sigma^*=\frac{\widetilde{\phi}}{\phi_s^E}.$$

Thus, for $\sigma^*\left(s,o,\phi_s^E,o,\phi_s^E\right)=\sigma^*$ to be feasible it must be that $\widetilde{\phi}<\phi_s^E$.

$Case\ (4)$: If $\sigma^*\left(s,o,\phi_i,y,f_s\right)=1$ is optimal, then, as in $Case\ (1)$, it must be that $\widetilde{\phi}\geq 1-f_w$.

$Case\ (5)$:If $\sigma^*\left(s,o,\phi_i,o,\phi_j\right)=1$ is optimal then

$$\phi_j u_s\left(V,V\right)+\left(1-\phi_j\right)u_s\left(V,P\right)\geq\phi_j u_s\left(P,V\right)\Longleftrightarrow\widetilde{\phi}\geq\phi_j$$

which is implied by the condition for optimality in $Case\ (1)$ since by Bayes' Rule $\phi_j<f_s$ and by assumption $f_s<1-f_w$.

$Case\ (6)$: If $\sigma^*\left(s,o,\phi_j,o,\phi_s^E\right)=0$ is optimal then

$$\phi_s^E u_s\left(P,V\right)\geq\phi_s^E u_s\left(V,V\right)+\left(1-\phi_s^E\right)u_s\left(V,P\right)\Longleftrightarrow\phi_s^E\geq\widetilde{\phi}$$

which is guaranteed by the condition to satisfy optimality in $Case\ (3)$.

Consider next the possible scenarios for young streets:

$Case\ (7)$:If $\sigma^*\left(s, y, f_s, o, \phi_s^E\right) = 1$ is optimal then

$$\begin{aligned} & \phi_s^E u_s(V,V) + \left(1-\phi_s^E\right) u_s(V,P) + \kappa\left[\phi_s^E \rho EW_s\left(1, \widehat{\phi}_{js}\right) + \left(1-\phi_s^E\right) EW_s\left(\varphi_s^0\left(\phi_i,\phi_j\right), \widehat{\phi}_{js}\right)\right] \\ \geq\ & \phi_s^E u_s(P,V) + \kappa EW_s\left(\varphi_s^0\left(\phi_i,\phi_j\right), \widehat{\phi}_{js}\right) \Longleftrightarrow \Delta EW_s \geq \frac{\phi_s^E L - \left(1-\phi_s^E\right) G}{\kappa\rho\phi_s^E}. \end{aligned}$$

Similarly if $\sigma^*\left(s, y, f_s, o, \phi_j\right) = 1$ is optimal then

$$\Delta EW_s \geq \frac{\phi_j L - \left(1-\phi_j\right) G}{\kappa\rho\phi_j} \text{ for all feasible } \phi_j,$$

and if $\sigma^*\left(s, y, \phi_y, y, \phi_y\right) = 1$ is optimal then

$$\Delta EW_s \geq \frac{(1-f_w) L - f_w G}{\kappa\rho(1-f_w)}.$$

To determine which of these is the binding inequality constraint note that since $\phi_j < \phi_s^E$ for all feasible ϕ_j, $\frac{\phi_s^E L-\left(1-\phi_s^E\right)G}{\kappa\rho\phi_s^E} > \frac{\phi_j L-\left(1-\phi_j\right)G}{\kappa\rho\phi_j}$ for all feasible ϕ_j. Similarly $\frac{\phi_s^E L-\left(1-\phi_s^E\right)G}{\kappa\rho\phi_s^E} \geq \frac{(1-f_w)L-f_w G}{\kappa\rho(1-f_w)}$ by conditions satisfying optimality for $Cases$ (1) and (3) which imply $(1-f_w) \leq \widetilde{\phi} < \phi_s^E$.

Last we consider the possible scenarios for young decent types.

$Case\ (8)$: If $\sigma^*\left(d, y, \phi_y, o, \phi_s^E\right) = 1$ is optimal then

$$\begin{aligned} & \phi_s^E u_d(V,V) + \left(1-\phi_s^E\right) u_d(V,P) + \kappa\left[\phi_s^E \rho EW_d\left(1, \widehat{\phi}_{js}\right) + \left(1-\phi_s^E\right) EW_d\left(\varphi_s^0\left(\phi_i,\phi_j\right), \widehat{\phi}_{js}\right)\right] \\ \geq\ & \phi_s^E u_d(P,V) + \kappa EW_d\left(\varphi_s^0\left(\phi_i,\phi_j\right), \widehat{\phi}_{js}\right) \Longleftrightarrow \Delta EW_d \geq \frac{C}{\kappa\rho\phi_s^E} \end{aligned}$$

Similarly if $\sigma^*\left(d, y, \phi_y, o, \phi_j\right) = 1$ is optimal then $\Delta EW_d \geq \frac{C}{\kappa\rho\phi_j}$ for all $\phi_j$and if $\sigma^*\left(d, y, \phi_y, y, \phi_y\right) = 1$ is optimal then $\Delta EW_d \geq \frac{C}{\kappa\rho(1-f_w)}$.

From the conditions for optimality in $Cases$ (1) and (3) we have $(1-f_w) \leq \widetilde{\phi} < \phi_s^E$, and the condition for optimality in $Case$ (5) implies $\phi_j \leq \widetilde{\phi}$. In order to identify the binding inequality, we first prove the following Lemma that bounds reputations when old.

Lemma 4 *The maximum feasible belief in a street culture equilibrium is the posterior belief following a violent signal, denoted by* $\phi_s^E = \varphi_s\left(y, \phi_y, \cdot, \cdot, 1\right) = \frac{f_s}{1-f_w}$; *and the minimum feasible belief, denoted by* $\underline{\phi}$, *equals* $\frac{f_s\left(1-\phi_s^E\rho\right)}{1-f_s\rho}$.

Proof: Since young streets and decents are pooling when young, after a violent signal the posterior belief is simply the fraction of streets among the non weak types, $\frac{f_s}{1-f_w}$. *It is a direct consequence of the two-period lives of agents that this is the maximum belief. The minimum belief after a* *non-violent signal when matched with old player is given by* $\varphi_s\left(y, \phi_y, o, \phi_s^E, 0\right) = \frac{f_s\left(1-\phi_s^E\rho\right)}{1-(1-f_w)\phi_s^E\rho} = \frac{f_s\left(1-\phi_s^E\rho\right)}{1-f_s\rho}$*. (It is minimal because* $\varphi_s\left(y, \phi_y, o, \phi_j, 0\right)$ *is strictly decreasing in* ϕ_j*.) The belief after a non-violent signal when matched with another young player is given by* $\varphi_s\left(y, \phi_y, y, \phi_y, 0\right) = \frac{f_s(1-(1-f_w)\rho)}{1-(1-f_w)(1-f_w)\rho} > \frac{f_s\left(1-\phi_s^E\rho\right)}{1-f_s\rho}$ *because* $\phi_s^E > (1-f_w)$*.*

It follows that the binding constraint is $\Delta EW_d \geq \frac{C}{\kappa\rho\underline{\phi}}$.■

Proof of Proposition 6.

First, three observations about the structure of equilibria when the conditions for the existence of a street culture equilibrium (SCE) hold:

1. The strategies of players when old are the same across all equilibria since condition 1 of the SCE is met, and when old the game is static.

2. If decents never participate in violence, and $\varphi_s(y, \cdot, \cdot, \cdot, 1) = 1$ off equilibrium path, then all equilibria must have young streets generating violent signals and earning reputations $\phi_i = 1$ either on or off equilibrium path. If not, it would be profitable for a young street to deviate and play V against other youths because this action could make him no worse off with respect to future meetings and only better off in expectation against this opponent.

3. If an equilibrium in which decents are never violent exists then young streets must play V against established streets with a probability strictly greater than that against those players who did not generate violent signals when young. This condition must hold because, given the assumption on off-equilibrium path beliefs, by generating a violent signal a player is established as a street, $\phi_s^E = 1$. Thus, by generating a violent signal, a young player would earn even greater deference from older players than he would in the SCE. Thus, unless young streets are less violent with those with $\phi_{is} < 1$, ΔEW_τ must be at least as large as under the SCE. But if ΔEW_τ is as large in this separating equilibrium, then by the arguments for case (8) in the proof of Proposition 5 young decents would choose to deviate and play V against established streets, a contradiction.

It remains to show that if strategies are monotonic then the necessary condition (described in observation 3) for such a strictly separating equilibrium cannot be met. If young streets are willing to fight established streets with positive probability then:

$$EW_s\left(1, \widehat{\phi}_{js}\right) - EW_s\left(\varphi_s^0\left(\phi^0, 1\right), \widehat{\phi}_{js}\right) \geq \frac{L}{\kappa\rho}. \tag{5}$$

Because the behavior of old streets is static, Condition 5 implies:

$$\sigma_s(y, \boldsymbol{\phi}^0, o, \varphi_s^0\left(\phi^0, 1\right))\frac{f_s}{2}\left(2G+L\right) \geq \frac{L}{\kappa\rho} + \left[\begin{array}{c} \sigma_s(y, \boldsymbol{\phi}^0, o, 1)\frac{f_s}{2}\left(2G+L\right) - \frac{f_s}{2}\left(2G+L\right) \\ +M\left(1\right)\left(1+\widetilde{\phi}^2\right)\left(L+G\right) \end{array}\right].$$

If, in addition, the probability of playing violently against an old player with reputation $\varphi_s^0\left(\phi^0, 1\right)$ must be less than that against an established street then it must also be that:

$$\sigma_s(y, \boldsymbol{\phi}^0, o, \varphi_s^{0,0})\frac{f_s}{2}\left(2G+L\right) \leq \frac{\varphi_s^0 L - \left(1-\varphi_s^0\right)G}{\varphi_s^0\kappa\rho} + \left[\begin{array}{c} \sigma_s(y, \boldsymbol{\phi}^0, o, 1)\frac{f_s}{2}\left(2G+L\right) - \frac{f_s}{2}\left(2G+L\right) \\ +M\left(1\right)\left(1+\widetilde{\phi}^2\right)\left(L+G\right) \end{array}\right]$$

where for ease of notation we have let φ_s^0 denote $\varphi_s^0\left(\phi^0, 1\right)$, and $\varphi_s^{0,0}$ denote $\varphi_s^0\left(\phi^0, \varphi_s^0\left(\phi^0, 1\right)\right)$. An application of Bayes' Rule shows that $\varphi_s^0 < \varphi_s^{0,0} < 1$. Given $\widetilde{\phi} \geq 1 - f_w$, it follows that $\frac{\varphi_s^0 L - \left(1-\varphi_s^0\right)G}{\varphi_s^0\kappa\rho} < 0$. If $\frac{\varphi_s^0 L - \left(1-\varphi_s^0\right)G}{\varphi_s^0\kappa\rho} < 0$ then

$$\sigma_s(y, \boldsymbol{\phi}^0, o, \varphi_s^{0,0}) < \sigma_s(y, \boldsymbol{\phi}^0, o, \varphi_s^0)$$

and by hypothesis

$$\sigma_s(y, \boldsymbol{\phi}^0, o, \varphi_s^0) < \sigma_s(y, \boldsymbol{\phi}^0, o, 1)$$

which contradicts the assumption that strategies are monotonic in the opponent's street reputation.■

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