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Backing up Words with Deeds:
Information and punishment in organized crime

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In his study of the origins of the Italian Mafia, Gambetta (1993) emphasizes its role as a private provider of protection. Demand for the protection services of gangs can emerge when the public supply of these goods is low, for instance, in regions remote from the centers of power, as in montainous regions of Albania, Montenegro, the Caucasus, Sicily, or Corsica, in transitional historical periods following war, as in Italy after World War II, or revolution, as in some Eastern European countries.[1] In the last case, excessive bureaucratic power, strict regulation and the elimination of legal markets for many goods had created a need for black markets before the transition. When the systems collapsed, the agents who previously organized these black markets created organizations which assumed the role of providers of private protection. Indeed the provision of protection services can be thought of as the defining characteristic of gangs and mafias.[2]

Protection can yield clear benefits to the 'protected' agents. However, gangs that monopolize enforcement power are likely to abuse this power in order to extract rents. Hence, it is hard to tell whether a gang is using its monopoly power as a means of providing the benefits of enforcement of property rights or to extort a reward from the

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1. See Skaperdas (1996a) for a discussion. For an analysis of the competing roles of government and the mafia as providers of protection see Grossman (1995).
2. A majority of researchers in the field recognize that enforcement is a central aspect of organized crime and perhaps its constitutional element. For instance, Schelling (1971/84) defined organized crime as an organization that has monopoly power over illegal activities. Celentani, Marrelli and Martina (1995:254) refer to a more general definition of organized crime, "...describing it as a set of agents (criminal firms) that have market power and recognize the mutual influence of their activities and are therefore possibly in a position to exploit some sort of cooperation." Gambetta and Reuter (1995) report a large number of cases in which the 'mafia' had offered or even had been asked to offer its services as a device for creating credible commitment and for generating monopoly power in markets for legal goods. They even report data about the reward that has been paid for these services.

agents in its territory. In the extreme case, the Mafia may ask for tribute and offer in return 'protection' from the Mafia itself – the case of pure extortion. Oppenheimer (1928), who studied the evolution of primitive states, observed a related phenomenon. In ancient times groups of farmers were often held up by nomadic tribes. In the beginning this was pure extortion, but it often developed into an (unequal) exchange in which the nomads, taking over the role of the ruling class, also enforced legal rules and protected the farmers from other predators.

Today, extortion/protection is a widespread phenomenon, not only in the countries which are popularly known for their organized crime sector, like the U.S. or southern Italy. For example, extortion and the payment of protection money plays a major role throughout all business sectors in countries that formerly belonged to the Soviet Union. As mentioned in *The Economist* (1994:57): "in a report prepared for President Yeltsin, the Analytical Centre for Social and Economic Policies claims that three quarters of private enterprises are forced to pay 10-20 percent of their earnings to criminal gangs: 150 such gangs, it says, control some 40,000 private and state run companies, including most of the country's 1,800 commercial banks."

In what follows we examine the extortion aspect of the extortion/protection business in organized crime. For additional discussion of the origin of gangs, their internal organization and their market structure, we refer to Skaperdas (1996a), Skaperdas and Syropoulos (1995) and the bibliographical notes given there.

The extortion game

We consider the following extortion game with two players: a gang and its victim.

Stage 1: The gang has to decide whether to start up its business. This could typically involve the expenditure of resources on hiring staff, equipping them, bribing judges and the police, and other related activities. We denote the gang's total investment in such activities by e. The gang also approaches a potential victim and asks for an amount x of protection money. It has to decide how much money to ask for.

Stage 2: The victim decides whether to pay or to refuse to pay.

Stage 3: If the victim pays, typically the gang will not punish him further in this period and the game ends. If he refuses to pay, the gang may or may not punish him. If he were to be punished, he would incur damage y. The probability that he is punished is q which, in general, depends on the gang's investment, e.

The idea of a credible punishment probability $q(e)$ could easily be given a precise microeconomic underpinning. Here we only provide an intuitive explanation. If a victim refuses to pay, a gang has to decide whether to punish him. The gang may have some gains of punishing that are not considered explicitly here. For instance, it may gain reputation vis a vis other victims, it may benefit from plundering the shop it destroys, or the thugs hired may enjoy having an opportunity to smash windows or beat people. In addition, the gang incurs costs. Actual physical costs may be very low - a bullet does not cost much. More substantial costs may be involved in the possibility of being arrested, prosecuted, and sentenced. Whether a gang punishes a shopkeeper depends on a comparison between these benefits and costs. The gang can reduce the expected cost of arrest by bribing policemen, prosecutors, or judges. Furthermore, spending resources on the internal cohesion of the gang's organization may make it more difficult for the police to infiltrate the gang. Overall, the gang's investment in stage 1 affects the expected cost of its members of being arrested and punished.

Under full information and full commitment this extortion game is straightforward. The gang invests resources to create the optimal punishment threat, then asks the victim for an amount of money that makes him just indifferent between paying and refusing to pay, taking into account the probability of punishment, and the victim pays.

In reality this game is loaded with information problems. First, a gang that approaches a victim does not precisely know the victim's ability and reluctance to pay. Schelling (1971/84) has argued that it is easier to extort from some businesses than from others.[3] He points out that observability of profits is an important aspect in the gang's choice of victims. But even archetypical victims such as bookmakers and Italian restaurant owners may get away with some business on the side and have superior information as regards their true profits. This information problem leads to extortion equilibria in which refusal to pay and violence are equilibrium phenomena. Because of this information problem, the gang's optimal choice of the amount of protection money and its willingness to punish victims who refuse to pay also depends on the time horizon of the gang. If a gang expects to control a territory for a long time horizon it may be more or less aggressive than a gang with a short time horizon. We will explore several effects in a dynamic setting in a later section. The victim's resistance to pay also depends on his expectations about the persistence of the gang. His decision to pay reveals information about his true income. This revelation of information is important if the gang persists for several periods.

Second, a victim who is asked for protection money may not know whether the gang's punishment threat is credible. The gang punishes in stage 3 only if its benefits (including possible reputation effects) exceed its cost. Cost depends on the gang's investment. The victim who is asked for protection money may be unable to observe this investment.

We have studied some of these information and credibility problems in two previous papers (Konrad and Skaperdas 1994, 1997) and this paper partially relies on some of these earlier results. We will also extend several aspects of the analysis. In particular, we will consider the dynamic effects if gangs expect to control a territory for several periods, and also the impact of competition between rival gangs.

Unobservable ability to pay

When a gang extorts from a victim, sometimes a victim may refuse to pay because he cannot pay: the gang has asked for too much money. This puts the gang in a difficult situation. It would prefer not to punish a victim who cannot pay. However, if it can be expected that a gang will never punish a victim who claims he cannot pay, all agents asked for protection money will claim that

3. Schelling's (1971/84:186n.) criteria are: (i) victims should be poor at protecting themselves. (ii) Victims should be unable to hide from the extortionist, at least, not without giving up their business. (iii) Extortionists should be able to monitor victims' activities and earnings. (iv) It helps if the victim's business is a regular business that he cannot carry away in an attempt to escape extortion. (v) Victims should know that they are treated similarly to other victims. For instance, if all victims are competitors and all pay a surcharge to the extortionist, much of this burden can be shifted to their customers in the equilibrium

they cannot pay. Hence, the gang must punish an agent who refuses to pay, at least with some probability, or it will never successfully extort any money. As will become clearer later, the informational asymmetry with regard to victims' ability to pay creates an outcome in which violence is an equilibrium phenomenon. Violence and the destruction of property in the equilibrium with incomplete information implies a reduction in aggregate wealth – a clear cut welfare loss. The explicit and more general solution of the static game, which considers counter measures like police effort as well, is in Konrad and Skaperdas (1994).

Gangs emerge and over time may disintegrate or be defeated by rival gangs. Where organized crime cannot be totally eliminated, a major policy question is whether short or long lived gangs generate the larger welfare losses.[4] To consider this question we analyse a two-period framework in which the gang that controls a territory in period 1 may lose its territory in period 2. Whether short or long lived gangs generate the larger welfare losses depends, among other things, on the intertemporal correlation of the victims' profits.

Consider the following dynamic game with two periods $t = 1,2$. In period 1 extortion proceeds in three stages. In stage 1 the gang chooses some amount (e_1) of effort to maintain an organized crime network and asks the victim for tribute (x_1). The victim's period profit (y_1) is a random variable. The victim learns the true value of his profit in this stage. The gang only knows the cumulative distribution function of the victim's profit. For simplicity we assume that the victim's period-1 profit is uniformly distributed on the interval $[0,y_{max}]$. In *stage 2* in period 1 the victim knows the gang's effort and the amount of tribute the gang asks for, and decides whether to pay or to refuse. In *stage 3* in period 1 the gang punishes the victim or not. If the victim paid in stage 2, no punishment occurs. If he refused to pay, his business is destroyed (and he also loses his future profits) with a probability that depends on the effort the gang has chosen in stage 1. The probability that a victim who refused payment is punished is a strictly increasing and concave function $q_1=q(e_1)$ of the gang's period-1 effort.

We assume that a victim whose business has been destroyed in period 1 closes down in period 2. This may exaggerate the consequences of punishment. Most types of punishment (breaking bones, smashing shop-windows) may only reduce the earning capacity of the owner of a business. The victim who has seriously been harmed, however, may decide to give up and close down his business. Similarly, aggressive gang behavior in terms of observed violence discourages new business or makes business move out of the gang-controlled area. We sum up and approximate these effects by the assumption that the victims punished in period 1 are those that have disappeared in period 2. The more general assumption that the number of victims in period 2 is a monotonically decreasing function of observed violence in period 1 would lead to results similar to the ones obtained here.

Territorial competition between gangs will be endogenized in a subsequent section. We will assume that rival gangs may try to

4. A different but related problem has been analysed by Celentani, Marrelli and Martina (1995). They view organized crime as a group of firms which collude and earn monopoly profits. The government can influence their behavior if it can threaten to close down individual firms in this group if they do not follow a behavioral pattern prescribed by the government.

conquer the gang's territory. Gangs and families of the Mafia are known for fierce – and sometimes bloody– territorial wars. The outcome of such contests depends, among other things, on the effort each gang uses in such fights. For the time being, however, we assume that the gang may face competition in period 1 and survives and controls the territory in period 2 with an exogenous tenure probability denoted as p_a.

The game continues as follows in period 2. If the victim has been punished and has disappeared, he cannot be extorted from further and the game ends. If the victim paid, or if he refused to pay but was not punished, the game as in period 1 is repeated. In *stage 1* in period 2 the gang that controls the territory with this victim's business is either the same gang as in period 1 or it has been replaced by a new gang. Whether the old gang is replaced by a new gang or not does not matter for gang behavior in period 2, given that profits are intertemporally independent. The gang that controls the territory in period 2 chooses some effort (e_2) and asks the victim for tribute x_2. At the same time the victim finds out about the profit of his business in period 2. Again, his profit is a random variable that is uniformly distributed on the interval $[0,y_{max}]$.

As we assume that period profits are stochastically independent, period-2 profit is again the victim's private information. The gang only knows the distribution, analogously to period 1. This is an important assumption and we will discuss the effects of intertemporal correlation of period profits later. In *stage 2* in period 2 the victim knows the gang's effort and decides whether to pay tribute or to refuse to pay. In *stage 3* the gang punishes the victim or not, according to the same rules as in stage 3 in the previous period.

This game can be solved by backward induction. Consider first the subgames in period 2. The victim and the gang maximize their own expected payoffs. Whether the gang that controls the territory in period 2 is the same as in period 1 or not is irrelevant for the subgame. All gangs have the same period-2 payoffs, extortion technology and strategy space. If the victim closed down after period 1 (because his business was destroyed), the subgame is trivial. The victim and the gang receive a payoff equal to zero.

Suppose the victim did not close down. The victim earns profit minus tribute if he pays. If he does not pay he earns the full amount of profit if he is not punished, and zero otherwise. Hence, his expected profit equals full period-2 profit times the probability that he is not punished, given that he refused to pay tribute. For given amounts of profit, tribute asked for, and punishment probability, the victim chooses the alternative for which his expected payoff is higher. He pays if the tribute he is asked for is not higher than the expected loss from the punishment threat. This condition determines a critical level of income such that, for given tribute and punishment threat, a victim pays if and only if the tribute is not higher than the expected damage from refusal to pay. Hence, this critical level of profit is implicitly determined by $x_2=\bar{y}_2 q(e_2)$.

The gang's payoff depends on the victim's payment decision. The gang spends effort e_2 in any case. The gang receives x_2 only if the victim pays. Using the victim's decision criterion about payment, we can write the gang's expected payoff as

$$E\pi_2(e_2, x_2)=\frac{y_{max}-[x_2/q(e_2)]}{y_{max}}\,x_2-e_2. \qquad (1)$$

The first factor in the first term is the probability that the victim pays. Maximization of this expected payoff by the gang's choice of tribute and effort yields

$$(2) \qquad \bar{y}_2^* = y_{max} / 2 \text{ and } \frac{1}{2} \frac{y_{max}}{2} q'(e_2^*) = 1.$$

These equations show that refusal to pay and violence become equilibrium phenomena. An existing victim in period 2 refuses to pay if his profit is smaller than $y_{max}/2$, given that profit is uniformly distributed. Hence refusal to pay occurs with probability 1/2. A victim who refuses to pay is punished with probability $q(e_2^*)$.

The choices in (2) can be used to determine the victim's and the gang's expected payoffs in period 2 if the victim has not been punished in period 1. A few considerations show that these payoffs are

$$(3) \qquad EV_2^* = \frac{y_{max}}{2}[1-3q(e_2^*) / 4]$$

for the victim, and

$$(4) \qquad E\pi_2^* = - e_2^* + y_{max} q(e_2^*) / 4$$

for the gang.

Now we consider the game in period 1. A discount factor equal to 1 is assumed throughout. In period 1 the victim's payment decision again depends on his period profit, given the amount of tribute and the punishment threat. However, if the victim refuses to pay and is punished, he loses the period-1 profit and, in addition, his expected payoff from period-2 business. Again, a critical profit level y_1 exists such that a victim pays if and only if his period-1 profit is not smaller than this level. This level is implicitly determined by

$$(5) \qquad q(e_1)[\bar{y}_1 + EV_2^*] = x_1$$

Using condition (5) the gang's expected payoff from extortion in the two periods can be written as

$$(6) \qquad E\Pi = -e_1 + x_1 - \frac{(x_1)^2}{q(e_1)\, y_{max}} + \frac{EV_2^* x_1}{y_{max}}$$
$$+ p_a^* [1 - \frac{x_1}{y_{max}} + \frac{EV_2^*}{y_{max}} q(e_1)] E\pi_2^*.$$

The first term is effort in period 1. Terms 2 to 4 constitute the expected payments of tribute in period 1. Term 5 is the expected payoff in period 2. It is equal to $E\pi^*_2$ times the probability that the gang will control the territory with this victim in period 2 times the probability that the victim is still there, that is, he has not been punished in period 1. A straightforward comparative static analysis using the first-order conditions for a maximum of (6) shows that the gang's effort and the tribute demanded is higher if the tenure probability of the gang is lower, if the gang's expected period-2 payoff as in (4) is higher, or if the victim's expected period-2 payoff as in (3) is lower.

These results are intuitively plausible. Consider, for instance, effort and the gang's tenure probability. If the gang is less likely to control the territory in period 2, it is less costly for the gang to punish a victim who does not pay. The period-2 profit that can be extorted from him if he is not punished in period 1 is less likely to be earned by this incumbent gang in any case. Hence, a decrease in the tenure probability increases the optimal effort in period 1.[5]

Incomplete information is essential for this

5. The results are in line with earlier literature on expropriation threats. For instance, Long (1975) has shown that a multinational that extracts a resource in a host country tends to overextract if it is threatened by the possibility of nationalization or expropriation by the host country's government. Similarly, in other natural resource contexts it has been pointed out that common access leads to overextraction.

rent. Under full information no violence occurs in the extortion equilibrium. The gang chooses just the right extortion amount to make all victims pay and victims do not earn an information rent in any period. When the earnings of the victim are private information, the victims earn an information rent in each period. The fact that they earn an information rent also in period 2 has two consequences. First, victims lose this rent if they do not pay in period 1 and are punished. Therefore, they are more interested in avoiding punishment. Their willingness to pay given the same punishment threat is higher. Second, the gang also loses some expected income if it destroys a victim's business or makes a victim move. With some probability, the incumbent gang will continue to control the territory in period 2. In this case it can extort from the victim only if the victim still has a business in the gang's territory. The gang has an additional opportunity cost of destroying the business of the victim if the probability that the gang stays in business is higher.

Now we discuss intertemporal correlation of a victim's profits. For simplicity we concentrate on the extreme case in which the victim's profit in period 1 is equal to his profit in period 2 – provided that he continues his business in period 2. With extortion it is unlikely that a gang can credibly commit itself to its future extortionary activities. Freixas et al. (1985), for instance, pointed out that if principals cannot commit themselves to long-term principal-agent contracts, agents have an incentive to hide information in early periods. Suppose the gang (the principal) wants to extract extortion money from a victim in a one-period game. The victim has private information about his true income. In the simple model we consider, the victim chooses one of two contracts:[6] payment and no punishment, or refusal to pay and a positive punishment probability. Since the contract with possible punishment is less attractive for a victim with higher profit, his choice reveals information about his true income but, since there is no future period, the gang cannot use this information later on. Now suppose there is a period 2, and the same gang makes the victim an extortion offer in that period as well. Suppose further this second period comes completely as a surprise to the victim. Then the gang will use efficiently all information about period-2 profit that is revealed by the victim's period-1 choice. The revealed information is: period-2 profit is uniformly distributed on $[\bar{y}_1, y_{max}]$ if the victim paid in period 1, and it is uniformly distributed on $[0, \bar{y}_1]$ if the victim did not pay in period 1. The information is valuable for the gang and can be used to extract more rent from the victim in period 2. Of course the victim is not naive and anticipates that there will be a second period. He knows that his payment decision in period 1 may have an influence on the information rent he can earn in period 2. His behavior will be different from that in the one-shot game. It may pay him to behave like a low-earning victim (refuse to pay and take a risk of being punished) in period 1 to take advantage of the possibility of obtaining an even higher information rent in period 2.

The full comparative statics of this

6. Gangs may devise a more sophisticated incentive scheme. If a gang can commit itself to choosing a different punishment probability or a different punishment for shopkeepers who make different amounts of payments, it can increase its expected payoff. If the gang can use a more sophisticated mechanism it can reduce the optimal information rent that is left to the shopkeeper. However, the optimal mechanism will typically leave some expected information rent to the shopkeeper. So we can expect that our results hold qualitatively in these cases.

problem are cumbersome. However we can obtain two results [please see the Appendix for details].

(i) For any given choice of gang effort and tribute in period 1, there is a unique critical level of profit such that a victim pays or refuses to pay, depending on whether his true income is higher or lower than this critical level.

(ii) A victim is more reluctant to pay in period 1 (and thereby reveal information about high period-2 income) if the gang uses the information in period 2. More precisely, for a given choice of gang effort and tribute in period 1, let a victim have some profit so that he is just indifferent between paying tribute or refusing to pay, given that he knows that the gang that extorts him in period 1 will also extort from him in period 2. For the same choice of gang effort and tribute in period 1, this victim prefers to pay in period 1, if he knows that the gang that extorts from him in period 1 will be defeated and replaced by a different gang in period 2.

As a result, in the initial periods when a gang starts controlling a territory and begins to extort from victims, we may observe victims being more obstinate if they can believe that the new gang will control the territory for a long time. Whether there is more or less violence in period 1 in the two cases depends on the gang's choice of the punishment threat (effort). For instance, if gang effort is exogenously fixed and the same in both cases, we expect to observe more violence in period 1 where the gang is expected to continue to control the territory in future periods. In later periods the gang has gained considerable experience about its victims. The level of violence will be low and the protection business will run smoothly. If the aim of public policy is to keep violence low it may want to stabilize (and maybe regulate) the incumbent gang rather than stimulate territorial wars with other gangs. If it tries to eliminate extortion, gang wars and a replacement of the incumbent by a rival gang may be helpful because informational asymmetries in the initial periods of control by a new gang will lead to more resistance by potential victims.

Gang contests

In the previous section the gang's tenure probability (p_a) is exogenous. In this section we will endogenize this probability. Suppose gang *a* controls a territory and earns all protection money from this territory in period 1. Gang *b* considers invading and contesting *a*'s territory.

Consider first the case in which the victim's profits are intertemporally uncorrelated. Success in the contests between gangs is typically determined by the gangs' contest activities and some random elements. Let c_a and c_b denote the monetary cost of the gangs' chosen contest activities. Suppose that the gangs choose their contest efforts in the same stage when the incumbent gang chooses its other instruments, e_1 and x_1. The probability that gang *a* will win the contest – and extort the territory in period 2 also – is a function $p_a = p_a(c_a, c_b)$.[7] Accordingly, $p_b = 1 - p_a(c_a, c_b)$ is gang *b*'s success probability. If *b* succeeds, it controls the territory in period 2. It earns the period-2 payoff as in (4) if there is a victim to be extorted from in period 2.

An equilibrium is characterized by a vector $(e^*_1, x^*_1, c^*_a, c^*_b, \bar{y}^*_1)$ in period 1 and choices (e^*_2, x^*_2) by the winning gang in the period 2 subgame that determine $E\pi^*_2$ (if there is a

7. For an axiomatization of contest success functions see Skaperdas (1996b).

victim in period 2 who can be extorted from). Here, e_1^* and x_1^* solve the incumbent gang's problem of maximizing (6) with $p_a = p_a(c_a^*, c_b^*)$, $\bar{y}_1^*$ is the critical profit level in period 1 such that the victim pays if and only if his profit is at least $\bar{y}_1^*$, and (assuming that the contest problem is well behaved) the equilibrium contest effort is determined by the first-order conditions

$$(7) \quad \frac{\partial}{\partial c_a} p_a(c_a^*, c_b^*) \cdot [1 - q(e_1^*) \frac{\bar{y}_1^*}{y_{\max}}] E\pi_2^* = 1$$
$$\text{and} \quad \frac{\partial}{\partial c_b} p_b(c_a^*, c_b^*) \cdot [1 - q(e_1^*) \frac{\bar{y}_1^*}{y_{\max}}] E\pi_2^* = 1.$$

This problem is symmetric; to carry out the extortion business in period 1 in the contested territory does not in itself generate an incumbency advantage here.

Things are different if the victim's profits in two consecutive periods are correlated. In this case the incumbent gang has an information advantage if the rival gang cannot observe first-period payments. The incumbent is better informed about the true incomes of the victim in period 2. The expected gang payoff in extorting from the victim in period 2 is higher if the incumbent gang in period 1 continues to extort from the victim, compared to the payoff a newly entering gang could achieve. From rent seeking theory it is known (see, e.g., Nitzan 1994) that asymmetric valuation of prizes typically reduces rent dissipation and favors the contestant who values the prize more highly. As a result an incumbent gang has a higher incentive to use contest effort than a rival gang. It spends more effort in the equilibrium than the rival gang. This makes it more likely that the incumbent wins.

Further, if the rival gang can observe the incumbent gang's extortion behavior in period 1 before contest efforts are chosen, the incumbent can choose its extortion policy in period 1 as a strategic variable. The gang can choose an extortion policy that increases its information about the victim's period-2 profits. Such a choice affects the incumbent gang's valuation and the rival gang's valuation of period-2-extortion income differently and increases the difference between the extortion amount that the incumbent gang could obtain in period 2 if it wins the contest and the amount the rival gang could obtain. This asymmetry in valuation reduces rent dissipation in contests and makes winning more likely for the contestant with high valuation of the prize.

Summarizing, the gang's tenure probability can be endogenized straightforwardly. If the incomes of victims are not correlated over time (or if mobility among victims is high), incomplete information does not create strategic links between gang-contests and the extortion business. If the incomes of victims are correlated over time, an incumbency advantage is created because the incumbent gang gains superior information about its victims' ability to pay from extorting from them in early periods.

Gangs' credibility problems

Gambetta and Reuter (1995) showed that the Mafia is sometimes hired as an enforcement mechanism for collusion and restricting competition. This enforcement mechanism works only if the threat to punish anyone who defects is credible. Usually the Mafia is hired because its threats are considered credible. However, one may more generally ask where the Mafia's credibility comes from. Gambetta (1993:34) reports the following story about an extorted victim in Italy: "[A] firm was approached by a man making the vague sorts of threats for which mafiosi are renowned. So sure had they been that someone at some point demand protection money in precisely this way that they took it for granted *this* was the person. They paid for about two years before realizing that they had been conned; their 'mafioso' was a phony." This credibility problem is discussed in Konrad and Skaperdas (1997) and we summarize central results in what follows.

Consider a situation with one gang and one victim. Extortion proceeds along a slightly changed game structure. *Stage 1*: the gang decides whether to build up the infrastructure that enables it to punish victims. For simplicity we assume here this is a discrete decision. The gang's set of pure strategies is $\{0,e\}$. If the gang does not invest, it cannot punish. If it invests it can punish without further cost.[8] The gang may choose any mixed strategy with ρ denoting the probability of investing in infrastructure. A central problem we disregarded in the previous sections is that victims often cannot observe whether the gang actually has invested or not.[9] The gang also asks the victim to pay an amount x in this stage and threatens to punish the victim if he does not pay. *Stage 2*: The victim decides whether to pay or to refuse to pay, i.e., to 'challenge' the gang. The victim can randomize between these two strategies. Let θ be the probability by which he challenges the gang. *Stage 3*: The gang may punish the victim or not. That is, the gang may impose damage on him (destruction of property, loss of income, violence). This damage is $y > x$. Its size is known to the victim and the gang. The gang cannot punish the victim if it has not invested in stage 1.

This game has a simple and unique equilibrium: the gang never invests ($\rho = 0$) and the victim never pays ($\theta = 0$). There is no extortion in the equilibrium. This is evident from considering the payoff matrix in pure strategies:

	Refuse to pay	Pay
Invest	$(-e,-y)$	$(-e+x, -x)$
Not invest	$(0,0)$	$(x,-x)$

It is a dominant strategy for the gang not to invest. This is anticipated by the victim. Hence, he refuses to pay.

The outcome changes if the gang can ask many victims for tribute, one after the other. The no-extortion outcome vanishes as a subgame perfect equilibrium, and subgame perfect equilibria emerge in which the gang invests with a strictly positive probability. Intuitively, the reason is as follows. Suppose the no-extortion-no-investment equilibrium continued to exist. The gang does not invest and no victim pays. If this gang asks the first victim for protection money it is challenged by this victim. It will reveal that it has no means of carrying out a punishment. All further victims will refuse payment and the gang will never earn any extortion income. The gang's payoff in this case is zero. A gang that is challenged by the first victim can do better. If it invests with probability 1 it is able to punish the first victim. All further victims will observe this and prefer to pay tribute. The payoff of the gang is $(N-1)x - e$, with

8. A different problem emerges if it is costly for the gang to carry out punishment. Suppose this cost is certain and positive. In this case Selten's (1978) chain store paradox applies. However, we know from Kreps and Wilson (1982) how Selten's paradox can be overcome if gangs have private information about their cost (or pleasure) of carrying out threats.

9. Suppose the gang may bribe judges and the police. This needs to be done secretly. If the gang has bribed a judge or the police, it may tell this to the victim in a confidential talk, and the victim may believe it or not. But it is difficult to give evidence without providing the victim with a way of incriminating the judge or the police that can be used to eliminate the strategic advantage in the future.

N the number of victims. For sufficiently large N, this payoff is strictly positive. Investment that occurs with probability one does not characterize the equilibrium outcome here, but the argument shows that the no-extortion equilibrium ceases to exist. The subgame perfect equilibrium necessarily is in mixed strategies. The gang invests with positive probability and is challenged also with some probability.

It can be argued (see Konrad and Skaperdas, 1997, for details) that the most plausible outcome among the subgame perfect equilibria is as follows. The gang invests with some uniquely determined positive probability: $\rho = x/y$. The first victim who is asked for tribute is just indifferent about whether to pay or to refuse to pay, and he challenges the gang with positive probability θ_1. If he pays, all subsequent victims also pay. If he challenges the gang, the further outcome depends on whether the gang has invested. If it has, it punishes this first victim. All future victims observe this and prefer to pay tribute. If the gang has not invested, it is unable to punish the first victim. This is observed and all future victims will refuse to pay.

This equilibrium has several properties that can explain some stylized facts. First, it explains why successful extortion needs many victims. One of the properties of the mixed-strategies equilibrium we described is that the expected payoff of the gang in the equilibrium increases more than proportionately with the number of victims. More precisely, if the gang extorts $N+1$ instead of N victims, its expected payoff increases by more than the maximum payment x of the additional victim. Therefore extortion is an increasing returns to scale business. This may contribute to an explanation why rival gangs compete more fiercely than competitors in other industries. Further, the equilibrium we singled out has the property that it is decided at the very beginning whether organized crime is established or not. Once it is established, the gang is never challenged again for the rest of the time horizon. This fits well with the observation that extortion crime has been established in some regions but not in others, and once it has been established it is a persistent phenomenon.

Summary

In this paper we have considered effects of information asymmetries between gangs and potential victims.

We showed that information asymmetries as regards victims' abilities to pay explain refusal to pay, violence and the destruction of business as equilibrium phenomena. We showed that gang competition may make incumbent gangs more aggressive towards victims. A gang that is unlikely to control a given territory next period does not have to ponder the effects on future extortion profits if it behaves more aggressively towards victims in the current period. Hence, a gang that expects to control a territory for many future periods may treat its victims more carefully. But a long term relationship between a gang and its victim may also lead to higher welfare losses in initial periods if the gang can learn from the victim's behavior in current periods about his ability to pay in future periods.

We also considered a gang's credibility problem if it has to make some unobservable up-front investment to be able to carry out punishment threats. For small numbers of victims only a no-extortion equilibrium exists. However, as the number of potential victims becomes large, this equilibrium disappears. Mixed-strategy equilibria emerge in which refusal to pay and punishment again become equilibrium phenomena. Further, these equilibria are characterized by increasing returns to scale. This may explain why gangs fight fierce territorial wars.

Appendix

First we calculate period-2 outcomes if the gang has learned in period 1 that the victim's profit is higher or lower than some level $\bar{y}_1$.

If $y > \bar{y}_1$, the gang's expected profit is

$$E\pi_2 = -e_2 + \frac{y_{max} - \bar{y}_2}{y_{max} - \bar{y}_1} q(e_2)\bar{y}_2 \text{ where } \bar{y}_2 = x_2/q(e_2)$$

Maximization yields $\bar{y}_2^H = max\ (\bar{y}_1, y_{max}/2)$ and e_2^H is implicitly determined by the first order condition

$$\text{(A.1)} \quad \frac{dE\pi_2}{de_2} = -1 + \frac{y_{max} - \bar{y}_2^H}{y_{max} - \bar{y}_1} q'(e_2^H)\bar{y}_2^H = 0,$$

where superscript H indicates optimal period-2 values if the gang knows the victim has profit larger than $\bar{y}_1$. The actual expected payoff of a victim with income $y_1 = y_2 = y$ in period 2 therefore is

$$\text{(A.2)} \quad EV_2(y) = \begin{cases} (1 - q(e_2^H))y & \text{if } y \in [\bar{y}_1 \bar{y}_2^H) \\ y - q(e_2^H)\bar{y}_2^H & \text{if } y \in [\bar{y}_2^H, y_{max}] \end{cases}$$

If $y \leq \bar{y}_1$ and the victim's business has not been destroyed in period 1, then $\bar{y}_1$ has the role of y_{max} in a one-period game. Hence, the critical profit can be calculated analogously to (2) as

$$\text{(A.3)} \quad \bar{y}_2^L = \bar{y}_1 / 2.$$

Effort e_2^L is implicitly determined by the first-order condition

$$\text{(A.4)} \quad (\bar{y}_1 / 4)\ q'(e_2^L) = 1.$$

Superscripts L indicate the gang's optimal choices if period-1 behavior of the victim revealed that his income is $y < \bar{y}_1$. The expected profit of a victim with income $y_1 = y_2 = y$ in period 2 if his business was not destroyed in period 1 therefore is

$$\text{(A.5)} \quad EV_2(y) = \begin{cases} (1 - q(e_2^L))y & \text{if } y \in [0, \bar{y}_1/2) \\ y - q(e_2^L)(\bar{y}_2^H/2) & \text{if } y \in [\bar{y}_1/2, \bar{y}_1] \end{cases}$$

Claim (i) states that for any given choice (e_1, x_1) there is a critical income level $\bar{y}_1(e_1, x_1)$ such that a victim with income $y > \bar{y}_1(e_1, x_1)$ pays and a victim with $y < \bar{y}_1(e_1, x_1)$ refuses to pay. We first calculate the indifference income $\bar{y}_1(e_1, x_1)$. It is determined by

$$\text{(A.6)} \quad \bar{y}_1 - x_1 + (1 - q(e_2^H))\bar{y}_1 = (1 - q(e_1))\bar{y}_1 + (1 - q(e_1))(1 - \frac{q(e_2^L)}{2})\bar{y}_1.$$

The left-hand side is the victim's expected payoff if he pays in period 1. This makes use of $\bar{y}_1 \leq \bar{y}_2^H$. The right-hand side is the victim's expected payoff if he refuses to pay in period 1. It makes use of (A.3). Equation (A.6) has a unique solution, implying that extortion in the first period indeed separates high-earning victims and low-earning victims.

Claim (ii): Consider a victim who earns $y = \bar{y}_1$ such that (A.6) holds with equality. This victim is just indifferent between paying and refusing payment in period 1. We show that he would strictly prefer to pay in period 1 if the information that his income is $y_1 \in [\bar{y}_1, y_{max}]$ is not used by the gang in period 2. If the gang does not use the information in period 2, his expected payoff in period 2 *if* his business is not destroyed in period 1 is independent of his choice in period 1. Let this payoff be $EV_2(\bar{y}_1)$. Hence, this victim compares

(A.7) $\bar{y}_1 - x_1 + EV_2(\bar{y}_1) \left\{ \begin{matrix} > \\ = \\ < \end{matrix} \right\} (1 - q(e_1))\bar{y}_1 + (1 - q(e_1)) EV_2(\bar{y}_1)$.

For a victim with income $y = \bar{y}_1$ such that (A.6) is fulfilled with equality, (A.7) holds with ">", if

(A.8) $EV_2(\bar{y}_1) - (1 - q(e_2^H))\bar{y}_1 > (1 - q(e_1)) EV_2(\bar{y}_1) - (1 - \frac{q(e_2^L)}{2}\bar{y}_1]$.

We have to distinguish two cases as regards $EV_2(\bar{y}_1)$ if the information is not used.

Suppose $EV_2(\bar{y}_1) = \bar{y}_1 - x_2$ with some optimally chosen x_2. Then (A.8) can be written equivalently as $\bar{y}_1 - x_2 - \bar{y}_1 + q(e_2^H)\bar{y}_1 > (1 - q(e_1))[\bar{y}_1 - x_2 - \bar{y}_1 + q(e_2^L)\bar{y}_1/2]$, or,

(A.9) $q(e_2^H)\bar{y}_1 - x_2 > (1 - q(e_1))[q(e_2^L)\bar{y}_1/2 - x_2]$.

Suppose $EV_2(\bar{y}_1) = (1 - q(e_2))\bar{y}_1$ for some optimally chosen e_2. Then (B.8) can be written equivalently as

(A.10) $[q(e_2^H) - q(e_2)]\bar{y}_1 > (1 - q(e_1))[q(e_2^L)/2 - q(e_2)]\bar{y}_1$.

Inequalities (A.9) and (A.10) hold if $q(e_2^H) > q(e_2^L)$. The conditions determining e_2^H and e_2^L are $q'(e_2^H) = \frac{y_{max} - \bar{y}_1}{y_{max} - \bar{y}_1^H}\frac{1}{\bar{y}_1}$ and $q'(e_2^L) = 4/\bar{y}_1$ by (A.1) and (A.3). Using $\bar{y}_2^H = \max\{\bar{y}_1, y_{max}/2\}$, we obtain $\frac{y_{max} - \bar{y}_1}{y_{max} - \bar{y}_2^H} < 4$. Together with $q'' < 0$ this implies $q(e_2^H) > q(e_2^L)$.

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