

**Payment, Protection and Punishment: The Role of Information and
Reputation in the Mafia**

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Abstract

A game theoretic model is used to examine the relationship between the Mafia and entrepreneurs. Because they fear the Mafia's ability to punish, entrepreneurs will pay protection money to the Mafia. However, the entrepreneurs' willingness to pay encourages opportunistic criminals to use the Mafia's reputation to demand money as well. We examine the dynamics governing the relationship between the Mafia and entrepreneurs. We characterise the conditions under which violence occurs. Shocks to this relationship, such as changes in policing practices, succession disputes or inflation, often lead to violence until beliefs are reestablished.

Keywords: Mafia, Russia, Protection, Fakers, Violence.

INTRODUCTION¹

From afar, the world of the Mafia seems a simple one.² A group controls a territory, everybody knows who the members of the group are and shopkeepers regularly pay the gang. In this simplified vision of a Mafia world, paying protection money amounts to paying a tax to a well-defined authority. Matters are not always so simple. Often, there is a great deal of confusion over who is a real Mafioso and who is not. Ladyzhensii, a correspondent for the Russian journal *Kriminal'naya Khronika*, gave the following account of the situation at the time of the transition to the market in Russia:

Perestroika was marked by the appearance of an embryonic form of free enterprise and ruthless and unregulated criminal racketeering. Everyone was involved in this racketeering: low-level gangs, students, sportsmen, former as well as current militiamen. As a result, it was necessary to have protection against such 'arbitrariness'. The state could not provide it, moreover it did not want to ... Only serious criminal structures could supply real help to businessmen. To pay them was expensive, but businessmen saw it as the lesser of two evils. (Ladyzhensii 1994, pp. 4).

How does one distinguish "ruthless and unregulated criminal racketeering" from "serious criminal structures"?

In a world where there is an expectation of Mafia presence, impostors have an incentive to pass as real Mafiosi, exploit the benefits of the Mafia reputation for violence, take the money and run. Joseph Serio, a security consultant who works in Moscow, has drawn attention to "teenage wannabes" (*khoodigani*). They "... are 17-20 year-olds who pass themselves as young toughs trying to take advantage of foreigners' well-known fear of 'Mafia' ... " Serio offers an example: "An American firm was approached by three wannabes in search of easy money. They presented themselves

¹We are grateful to Diego Gambetta for his comments on an earlier version of this paper.

²By 'Mafia' we refer to "an industry which produces, promotes, and sells private protection." (Gambetta 1993, p. 1). A 'mafia group' is a firm that operates in this peculiar industry. A Mafioso (plural Mafiosi) is a member of a mafia group.

as members of the Chechen criminal community (*obshchina*), knowing that the Chechens have a reputation for being particularly fierce” (Serio 1997, p. 97). The Moscow representative of the firm did not pay and the would-be Mafiosi failed to show up again. (Another instance of fly-by-night protectors is narrated in Serio 1997, p. 97.)

This phenomenon does not occur only at times when Mafia groups are emerging for the first time.³ Gambetta, a student of the Sicilian Mafia, was the first author to draw attention to the phenomenon of fakers: “A local [Palermo] entrepreneur told me the (to him hilarious) story of a northern firm doing business in Sicily on a large contract. The firm was approached by a man making the sort of vague threats for which Mafiosi are renowned. So sure had they been that someone would at some point demand protection money in precisely this way that they took it for granted *this* was the person. They paid up for about two years before realizing they had been conned ...” (Gambetta 1993, p. 34). Another instance is recalled by Antonio Calderone, a prominent Catania Mafioso turned state witness. An employee of a northern firm operating in Catania started to make extortion calls to the manager, posing as a real Mafioso. It turned out that the same firm employed Calderone himself, precisely in order to be protected. The employee was duly killed (Testimony of A. Calderone, 1987-1998, quoted in Gambetta 1993, p. 34.) Mafia impostors have also been reported in Hong Kong. A senior officer of the Triad Society Bureau recalls:

Toward the end of 1973, a total of 57 people in good occupations were telephoned by a man who demanded money from them in the name of a triad society ... all paid except one and as a result of this report to the police, an arrest was made and police learned about the other offences. The person concerned had made a very large sum of money and was never a member of a triad society at all. (*South China Morning Post*, 30/06/1975, quoted in Chu 1996, p. 98).

These instances highlight a number of key questions that relate to the Mafia and to countries where mafia groups flourish. First of all, it is clear that reputation is a crucial asset for a mafia group. Chechens have a reputation in Russia for being very cruel and so do Triads in Hong Kong and

³For an argument explaining why the Mafia has emerged in Russia at the time of transition to the market economy, see Varese (1994).

the Sicilian Mafia in Palermo. The reputation for being tough enables them to save on the direct use of violence as a resource when they interact with their victims (Gambetta 1994, p. 44). Few people would dare to challenge somebody who claims to be a Mafioso, enabling the latter to save time and effort in convincing their victims to pay.

As pointed out by Gambetta, the costs of probing whether the man asking for protection money is a real Mafioso are significant, hence signals that ‘honestly’ reveal ones type are of value. If one could be sure that a dark skin in Russia (or dark glasses in Palermo) were signalling Mafia membership, an entrepreneur could make a reliable inference and know whether to pay or not. However, too many people have dark skin in Russia and anybody can wear dark glasses in Palermo. Gambetta (1994) presents a simple game of incomplete information that tries to capture this situation. In this game “... if the victim does not know to which type the Mafioso belongs, only one equilibrium is possible, namely always complying ...” (Gambetta 1994, p. 356). Gambetta then suggests that real Mafiosi have an incentive to protect the signals associated with Mafia membership, so they cannot be ‘stolen’. He also shows how imaginative mafia groups can be in this regard. The limit imposed on this practice is that the Mafia must, at the same time, preserve the secrecy of the organisation. There is a limit to the efforts that the Mafia can take to devise credible signals, such as reliable Mafia I.D. If they issued Mafia I.D., the police would easily identify them.⁴ A fuller picture of this dynamic process needs to incorporate violence. We take the ability to use violence effectively against both non-payment of protection money and against fakers as a credible signal of being a Mafioso. Punishment, however, is inevitably constrained by some other variables, such as level of policing in a given area. This is a variable absent from the original model by Gambetta.

⁴In a recent interview, Vyacheslav Kirillovich Ivan’kov, nicknamed Yaponchik (The Japanese), reputedly the most prominent Russian Mafioso in the US, has denied the existence of any form of Russian organised crime (*Sovershenno Sekretno*, number 5, May, 1997). The FBI arrested him for conspiring with Colombian and Italian organised crime syndicates (see *Komsomol’skaya Pravda*, 05/10/1994).

1 Goals of the Paper

In this paper we look at how relevant actors - entrepreneurs who have to pay protection money, impostors and real Mafiosi - solve the dilemmas outlined above. When is it more likely that both impostors and Mafiosi request money? And what would the entrepreneur do when faced with such a request? Entrepreneurs are likely to be punished for non-payment to the real Mafia, while they would be better off not paying impostors. Impostors are either unable to inflict punishment, for the lack of violence resources, or, if they punish non-payers, they signal their presence to the Mafia. Real Mafiosi are then likely to punish impostors, as in the instance narrated by Calderone. The model we present allows us to characterise the conditions under which violence occurs. A further element that we take into consideration is the expected level of policing, which affects the decisions of Mafiosi, impostors and Mafia victims. Shocks to the Mafia/entrepreneur relationship, such as changes in policing, succession disputes or inflation often lead to violence until consistent beliefs are re-established.

1.1 The Game

We analyse the interaction between thugs and entrepreneurs. We consider the following scenario: a thug enters a business and demands protection money from its owner. Entrepreneurs must decide whether or not to pay protection money. If they do then the thug leaves happy. However, if the entrepreneur refuses to pay the thug may then opt to damage the business or harm the entrepreneur.

We examine the following questions: When do thugs demand money? Under what conditions do entrepreneurs pay protection money and what influences whether the thug punishes non-payers?

In the first stage of the model, the thug decides whether to demand money from the entrepreneur. How much should the thug demand? Empirically, focal points appear to be essential in determining the size of payments. In 1988, there were more than 6,000 reported cases of racketeering in the Soviet Union. Of these, in almost half the cases (2,800) the demand was for 500 rubles. In 535, it was for 1,000 rubles and in 928 instances, criminals tried to charge more than 1,000 rubles (*Trud*, 19/05/1990). Racketeers tried to extort 1,000 rubles in protection money from a food co-operative in Moscow in 1990 (*Novoe russkoe slovo*, 15/01/1990). Kiosk owners in a

district of the Russian city of Perm are asked to pay a fixed sum at regular intervals, usually monthly. The sum paid is 10,000 rubles per day (Varese 1996, p. 183).⁵ Although in principle thugs could ask for 9,999 or 10,001 rubles, this does not appear to happen. This evidence also suggests that thugs do not demand a percentage of the firm's profits. The reason might be that businessmen try to conceal their real income from both the tax inspectors *and* the Mafia. It would be costly for the Mafia to carry out extensive inquiries into the accounts of every business. Given the above evidence, we assume that the size of the demand is fixed at m . We discuss the consequences of allowing payments to vary in the appendix. Yet, since this generalisation creates no substantive differences in outcomes, we do not discuss it in the main text.

For the purposes of this model it does not matter what the nature of the business is. The question under consideration is, when a thug demands money, does the entrepreneur pay? We assume that entrepreneurs want to avoid punishment. However, they also wish to avoid paying protection money. Avoiding punishment provides a powerful incentive for entrepreneurs to pay. If punishment is severe and certain then the entrepreneur is certain to pay. At the same time, this creates an incentive for other opportunistic thugs (non-Mafiosi). If entrepreneurs always pay, then anyone demanding money gets paid. Thus, non-Mafiosi join the protection racket, demanding money and pretending to be Mafiosi.

The entrepreneur is unsure about whether or not the thug is a Mafioso. The thug could be a legitimate member of the local mafia group. Alternatively, the thug could have no associations with the Mafia and simply be trying to cash in on the desire to pay off the Mafia and avoid punishment. For convenience, we describe these two types as Mafioso and faker. Where appropriate we represent them by the letters M and F respectively.

When the thug first enters the entrepreneur's business, the entrepreneur does not know whether or not the thug is a Mafioso or a faker. Both Mafioso and faker look identical – like thugs. (As we shall see, as more

⁵Furthermore, the size of the payment is low enough to prevent the enterprise from going out of business. Don Vito Cascio Ferro, the man credited with inventing the extortion racket in Sicily in the years following the First World War, would give the following advice to trainee racketeers: "Don't throw people into bankruptcy with ridiculous demands for money. Offer them your protection instead, help them to make their business prosperous, and not only will they be happy to pay but they'll kiss your hands out of gratitude" (quoted in Servadio 1976, p. 59).

thugs attempt to imitate Mafiosi, entrepreneurs become more reluctant to pay protection. This makes it harder for the Mafia to maintain its income.) Gambetta stresses that the Mafia has an incentive to develop reliable signals of Mafia membership. For instance, Yakuza members "... are identifiable by all-over tattoos and severed fingers (lopped off to punish themselves for their professional mistakes) ..." (Kaplan and Dubro 1986, p. 26 and p. 146, quoted in Gambetta 1994, p. 363). However, there is a limit to the manipulation of the signals by Mafiosi. Apparent fakers could in principle be members of a competing Mafia group, trying to poach in a different territory. In this case, they are faking not Mafia membership in general, but just membership of a particular group. They would already have their bodies tattooed and fingers chopped off.⁶

Given the above evidence, it should appear that it is not an easy matter to distinguish fakers from Mafiosi at first sight. Therefore, we assume that an entrepreneur cannot distinguish between Mafiosi and fakers with certainty, but will have certain beliefs based on a 'reading' of the available signals. We let θ represent the entrepreneur's beliefs about the type of thug they are facing. Thus θ , a number between 0 and 1, is the probability that the thug is in the Mafia. If $\theta = 1$ then the entrepreneur is certain that the thug is a member of the Mafia. If the entrepreneur was certain that the thug had no Mafia connections then that beliefs would be represented by $\theta = 0$.

As we shall show, the entrepreneur's beliefs are critical in the decision about whether to pay. Why does the entrepreneur want to pay Mafiosi but not fakers? The reason entrepreneurs pay is not the identity of the thug, but rather the propensity of the different types to punish. Mafiosi are more likely to use violence against non-payers than fakers are. This is so because Mafiosi and fakers face different incentives. Both Mafiosi and fakers fear official punishment, by which we mean the police and the judiciary. The Hong Kong impostor was indeed arrested by the police,

⁶In most countries, tattoos are a feature of prison life (or, indeed, of any closed male communities, such as the navy and the army) and do not distinguish Mafiosi from fakers. According to conservative estimates, 28 to 30 million of Russian prison inmates were tattooed (data refer to the 35 million people who went through the prison system between the mid 1960s and the 1980s - Bronnikov 1993, p. 50.) Bronnikov also reports that "... as convictions increase and the terms of incarceration become more severe, the tattoos multiply ..." In the Russian criminal world, tattoos signal the inmate's standing in the prison hierarchy, rather than his membership of a mafia group operating outside.

after having extorted money from at least 57 people. However, fakers face an additional risk, that of being discovered by the Mafia. We start by considering the risk that Mafiosi face when using violence.

While one might think of the Mafia as above the law, in reality Mafiosi risk imprisonment if they are caught. Although their Mafia status might provide some insulation against the police, Mafiosi are not immune from prosecution. We assume that under some situations the police are watching Mafia activities closely. On such occasions, punishing non-payers is risky since the risk of arrest, prosecution and conviction is high. On other occasions, Mafiosi benefit from punishing non-payers. When senior members of the Mafia watch the activities of a junior Mafioso, it is important for him to appear strong. We assume that the Mafia as a profession attracts those with a propensity towards violence in the first place. An individual entering the profession of Mafioso must be prepared to use violence, since it is the resource most needed by a credible seller of private protection. They must be stronger than all the parties they aspire to protect combined. Furthermore, toughness is not a continuous but rather a dichotomous variable: either one is tough or one is not. Often Mafiosi show an unnecessary amount of violence precisely to make the point that they are tough, so that all of the world will know about it. This is an important reason why Mafiosi have strong incentives to show off their skills in violence. On these occasions, the opportunity to punish allows the Mafioso to demonstrate this toughness. Under these circumstances, the Mafioso might benefit from punishing.

There are a variety of factors that affects a Mafioso's costs and benefits for punishing non-payers. We model these in the following way. We assume that the level of police presence varies across time. If the police presence is high then Mafiosi face serious risks from damaging businesses and hence punishment is costly. If, on the other hand, the police presence is low then there is little risk associated with violence and the Mafiosi benefit from using violence within the mafia group in terms of reputation. While this is a simplification, we use this device to represent differing costs and benefits for using violence.

In addition to the risk of prosecution, fakers face additional risks from the real Mafia. The Mafia wants to minimise competition. Therefore, if the Mafia discovers a faker's activities, then the faker's life is in jeopardy. This risk of discovery depends upon the faker's actions. If fakers do nothing, then they have little to fear from the Mafia. However, their risk of discovery goes up if they demand money. It is even more dangerous for fakers to use

violence since the destruction of property is readily observable.

Having outlined the motivation for the model, we now describe its components in detail.

2 The Model

Figure 1 shows a pictorial representation of the game. At the first node, nature decides the type of the thug. With probability θ the thug is a member of the Mafia and with probability $(1 - \theta)$ the thug is a faker. At node 2, the thug, whether Mafioso or faker, decides whether or not to demand money from the entrepreneur. If fakers demand money then they risk discovery by the Mafia. We represent this risk by its expected cost r . Thus, if fakers ever demands money, they pay a cost r . If the thug makes no demands then the game ends and both players, the thug and the entrepreneur, receive a payoff of zero.

If the thug makes a demand then the entrepreneur decides whether or not to pay. When making this decision, entrepreneurs are not certain if they are dealing with a Mafioso or a faker. In figure 1, this situation is represented by a dashed line. Although uncertain, entrepreneurs have beliefs about the types they are dealing with. These beliefs are determined by their prior beliefs (θ) and the choices made by the different types. If the entrepreneur pays then the game ends with a transfer of m from the entrepreneur to the thug. Thus, the thug's payoff is m if they are a Mafiosi and $m - r$ if they are a faker. The entrepreneur's payoff is $-m$.

If the entrepreneur refuses to pay then the thug can use violence to punish him. As discussed above the costs associated with violence differ between Mafiosi and fakers. If fakers use violence then they face an additional risk of discovery. Thus, if fakers use violence then their final payoffs are $-R$. However, if fakers do not punish, they can avoid this additional risk. In this case their final payoffs are $-r$ (where $R \gg r$). The Mafioso's costs depend upon the level of police presence. If the level of policing is high then using violence is costly. However, using violence benefits the Mafioso providing that the level of policing is low. We model this as follows. Immediately before Mafiosi contemplate violence they observe the level of policing, which is low with probability p and high with probability $(1 - p)$. Mafiosi then decide whether or not to use force. If they use force and the level of policing is low then the payoff is $+1$. Alternatively, if the

level of policing is high, then the payoff for violence is -1 .⁷ The payoff for non-violence is 0.

If the thug uses violence to punish the entrepreneur, the cost of the damage is D . Thus if violence is used, the entrepreneur's payoff is $-D$. If no violence occurs then the payoff is 0. We place some restrictions on these payoffs to keep the game plausible. Specifically, we assume that $D > m$ (otherwise the entrepreneur would prefer violence to payment and hence would never pay under any circumstance) and $m > 1$ (the Mafioso prefers payment to using violence).⁸

We assume that only Mafiosi are able to observe the level of policing, an apparently odd requirement of the model which needs to be justified. The Mafia is not the only recipient of information on the level of policing in a certain area, but at the margin they are slightly better informed about the local chances of being caught. This assumption is consistent with widespread evidence of Mafia informants in the police. We could also let F see the information that M sees, but since F's costs are always higher than M's, this would not be of any real consequence to the theory. One might prefer to assume that E also knows something about policing levels. Indeed, if entrepreneurs know the exact incentives that Mafiosi face, they

⁷Since fakers face the risk of being discovered by both the police and the Mafia we should think of the risk to the faker as always being much greater than that of the Mafioso. Hence we set $R \geq 2$.

⁸The level of damage done to a business is partly at the discretion of the thug. However, certain bounds are likely to exist. Firstly, the amount demanded should be less than the value of the damage, otherwise the entrepreneur would prefer to suffer the violence rather than pay. Secondly, if the amount of damage is too large, the entrepreneur goes out of business and cannot pay in the future. Within these limits we consider the comparative statics of varying the amount of damage. There is evidence that confirms the above reasoning. In Sicily, "... [t]hose who refused to pay protection money against thefts, or to come to some agreement with the mafia chief, found their property suffering from fires, robberies, and acts of vandalism. Should the injured party persist in standing out against the racket, then his personal safety would be threatened, and he would be the target of increasingly serious attacks, until in the end his life would be at risk" (Arlacchi 1986, p. 26). Instances of damage inflicted on fixed establishments in Russia appear to follow a similar pattern. The owner of an Italian restaurant in Moscow told *La Repubblica* (30/07/1994): "After I rented these premises, restoration works started. One day, a young lad comes in, looks around and says: 'You will need protection'. I hesitate and shortly afterwards my car is burned." At the next encounter, the entrepreneur complies. *The Independent* (15/02/1994) narrates of a gang of Russians and local criminals targeting a hotel in Vilnius, Lithuania. The damage started off in the form of excessive noise and it proved sufficient to convince the hotel owner to pay.

are better able to predict whether non-payment will be punished. However, the entrepreneur cannot reasonably hope to know all the complex factors that combine to structure the incentives facing Mafiosi at any particular moment. As a simplification we have collapsed these complex incentives into a single variable: policing levels. While E s has knowledge of many of these factors, they cannot be expected to observe them all. For example, they are unlikely to know confidential information about police strategies and factors internal to the Mafia, such as the level of monitoring within the Mafia hierarchy or the supply of “muscle” within the Mafia. As a simplification we assume that E knows nothing about the Mafia incentives to punish.

Table 1: Summary of Variables

Variable	Interpretation
θ	Probability that the thug is a Mafioso
m	Level of protection money demanded
D	Damage inflicted if the thug uses violence
r	Faker’s risk when demanding money
R	Faker’s risk when using violence
p	Probability of low police presence

3 Results

Formally, we solve this game by characterising the sequential equilibria (Kreps and Wilson 1982). The appendix contains all the details of these equilibria. In the main text we explain the intuition behind these equilibria and discuss the results. Those readers interested in technical aspects of the model should refer to the appendix.

We use backward induction to explain the decisions of each actor in this game. In order to predict whether the thug demands money we need to understand the likely consequences of this choice. In particular, thugs are more likely to demand money if they expect to get paid. Yet, the entrepreneur’s decision depends upon the likelihood of punishment. Before we can understand the demand and payment decisions we need to predict whether punishment will occur. The backward induction algorithm starts with the last decision and works back up the tree, predicting each decision

in light of what is expected to follow. In order to answer questions about demands and payments, we start by analysing the decision to punish.

Punishment. Suppose a faker demands money and the entrepreneur refuses. If fakers use violence then their payoffs are $-R$, the risk associated with using violence. Without violence, the faker's payoff is $-r$. Therefore, fakers never punish non-payers. Mafiosi sometimes do. If there is a high police presence then Mafiosi do not punish (the payoff from punishment, -1 , is worse than the payoff from not punishing, 0). Yet, a low police presence leads to violent punishment (the payoff from punishment, $+1$, is better than the payoff from not punishing, 0).

Payment. Fakers never punish and Mafiosi only punish when it is cheap to do so. Suppose the entrepreneur believes that the probability that the thug is a Mafioso is μ . As we shall show in a moment, the earlier behaviour of the thug influences the entrepreneur's beliefs. Thus, μ need not necessarily be equal to E's initial belief, θ . If entrepreneurs refuse to pay then they are punished only when the thug is a Mafioso and the police presence is low. (When punished, the entrepreneur's payoff is $-D$.) Thus, the probability of punishment is μp . Therefore, E's average payoff from refusing to pay is $-D\mu p$. This compares with a payoff of $-m$ if the entrepreneur complies with the thug's demands. Let σ_E represent the probability that the entrepreneur pays. If $\mu > \frac{m}{Dp}$ then E should pay, $\sigma_E = 1$. If $\mu < \frac{m}{Dp}$ then E should refuse to pay, $\sigma_E = 0$ and if $\mu = \frac{m}{Dp}$ then E is indifferent between paying and refusing and could do either. σ_E is a number between 0 and 1.

The Decision to Demand. Thugs should make demands only if they expect to gain from doing so. Mafiosi always expect to gain from demands; whether fakers also gain depends upon the reaction of the entrepreneur. Even when the entrepreneur refuses to pay, the Mafioso gets to use violence when the police presence is low. Formally, M's payoff is $U_M = m\sigma_E + p(1 - \sigma_E) + (1 - p)(1 - \sigma_E)0 = m\sigma_E + p(1 - \sigma_E) > 0$. Thus, Mafiosi always expect to do better by making demands and the probability that a Mafioso make demands is $\sigma_M = 1$.

Fakers risk discovery by both the police and the Mafia when they make demands. Therefore, they will only risk making demands when they expect

to get paid. If Fs make a demand then with probability σ_E they get paid, which is worth $m - r$. Yet, with probability $(1 - \sigma_E)$ E refuses to pay. As we have already discussed above, Fs will not use violence, so their payoffs are $-r$. On average F's expected payoff is $U_F = \sigma_E(m - r) - r(1 - \sigma_E) = -r + \sigma_E m$. When this is positive, F demands money. If it is negative then F makes no demand and when $-r + \sigma_E m = 0$ then F is indifferent.

Let σ_F represent the probability that fakers demand money. Note that F's demand decision depends upon expectations about E's response. In turn, E's response depends upon beliefs about the thug. In order to proceed we need to examine how E's beliefs change.

Initially, E's beliefs are θ . This means that the probability that the thug is a Mafioso is θ . Suppose that fakers decide not to demand money, σ_F . Since fakers do not demand money, if the thug makes demands then the thug must be a Mafioso, $\mu = 1$. Alternatively, consider the case where both Mafiosi and fakers always demand money, $\sigma_F = 1$. Upon being threatened, the entrepreneur's beliefs remain the same, $\mu = \theta$. In general, if a demand is made then $\mu = \frac{\theta\sigma_M}{\theta\sigma_M + (1-\theta)\sigma_F}$. Since $\sigma_M = 1$, this reduces to $\mu = \frac{\theta}{\theta + (1-\theta)\sigma_F}$. This form of updating is known as Bayes' rule.

3.1 Predictions

Whether thugs demand money and whether entrepreneurs pay depends upon the entrepreneur's beliefs and the expected level of policing. The results are summarised in Figure 2. There are three patterns of behaviour, which are denoted regions 1, 2 and 3 in the figure. In region 1, only Mafiosi demand money and the entrepreneur always refuses to pay. The Mafioso uses violence only when the police presence is low. In region 2, both Mafioso and fakers demand money and the entrepreneur always pays. In region 3, the Mafioso always demands money, but the fakers only demand money sometimes. In response to demands, the entrepreneur sometimes (but not always) pays.

In this section, we describe each of these patterns of behaviour and the conditions under which they occur in more detail. While we explain the intuition behind each case, the formal analysis is in the appendix. We start by examining region 1. Substantively, this region is the least interesting. Yet examining it helps to provide insight into the thug/entrepreneur relationship.

Region 1. The behaviour in this region could be described as vandalism. This type of behaviour occurs when the police presence is usually high. Entrepreneurs never pay the thug even if they are certain that the thug is member of the Mafia. Since they never expected to get paid, only Mafiosi demand money. Yet despite being certain that the thug is a Mafioso, the entrepreneur prefers to risk being punished than pay protection money.

The reason for this behaviour is as follows: The Mafioso only uses violence when the police presence is low. In region 1, the police presence tends to be high. Specifically, the probability of a low policing levels is less than $\frac{m}{D}$. Even when the thug is certainly a Mafioso, the probability of violence is still only p . Since $p < \frac{m}{D}$, the expected cost from refusing to pay, pD , is less than the protection money, m . Therefore, **E** never pays. Fakers have no incentive to demand money since it is never paid. In game theoretic terms, this pattern of behaviour is called separating: different types behave differently.

Substantively, this region is uninteresting. Given the high average level of policing, entrepreneurs refuse to pay protection. It is impossible for organised crime to occur under these circumstances. It is interesting to note that as the level of policing increases (p goes down), the Mafia need to augment punishments (increase D) and reduce demands (decrease m) in order to stay out of region 1 and keep organised crime viable.

Having examined behaviour when organised crime does not exist, we consider those situations where entrepreneurs pay if they are certain that they are dealing with a true Mafioso.

Region 2. In region 2, the entrepreneur believes ththat the thug is likely to be legitimate member of the Mafia, $\theta > \frac{m}{Dp}$. Believing that the thug is likely to be a Mafioso, the entrepreneur pays when threatened. Since the entrepreneur always pays, fakers, as well as Mafiosi, demand money.

Entrepreneurs know that non-payment will be punished by a true Mafioso only when the police presence is low. Yet, given these prior beliefs, $\theta > \frac{m}{Dp}$, the size of damages, D and the probability of punishment, θp , outweigh the cost of paying protection, m . Since both M and F demand money, entrepreneurs cannot distinguish between them. Since they cannot update their beliefs about the thug's type and their priors suggest that they should pay, entrepreneurs pay whenever threatened. This pattern of behaviour is commonly referred to as pooling.

The pattern of behaviour in region 2 occurs only when E is fairly certain that the thug is a Mafioso, damages are large and demands are small: $\theta > \frac{m}{Dp}$. Under these conditions, there is never any violence. If the Mafia establishes a reputation and can prevent fakers from entering the market for protection then they never actually have to carry out threats since entrepreneurs comply with their demands. In the dynamic setting, we might want to consider the credibility of behaviour in region 2. Under these conditions, entrepreneurs always pay and it is extremely tempting for fakers to make demands. Hence, once established, the Mafia must work hard to exclude fakers from the protection market. The role of focal points in the size of demands is also important. Without such focal points, the Mafia would be tempted to bid the size of m up towards θDp . In effect, this moves the line ($\theta = \frac{m}{Dp}$) between regions 2 and 3 upwards.

At this point, it is worth considering what happens on the line between regions 2 and 3 since it will be important when we return to the dynamic analysis later. On the line $\theta = \frac{m}{Dp}$, E is indifferent about whether to pay the money demanded: the expected punishment exactly equals the amount to pay in protection. Therefore, anything is a best response for entrepreneurs. They could pay, refuse to pay, or randomise whether to pay or not. As discussed, whatever the entrepreneur does, the Mafioso always demands money. Fakers demand money only if the expected payoff from doing so is positive: $U_F = \sigma_E(m - r) - r(1 - \sigma_E) = -r + \sigma_E m$. Thus, if the entrepreneur often pays, $\sigma_E > \frac{r}{m}$, then fakers demand money ($\sigma_F = 1$). If the entrepreneur rarely pays, $\sigma_E < \frac{r}{m}$, then fakers do not demand money ($\sigma_F = 0$). If the entrepreneur pays with probability $\frac{r}{m}$, then fakers are indifferent about whether to demand money. Therefore, providing that $\sigma_E \geq \frac{r}{m}$ we can support the pooling behaviour characteristic of region 2 on the line $\theta = \frac{m}{Dp}$.

Region 3. In region 3, fakers sometimes demand money and entrepreneurs sometimes pay. This behaviour occurs when the entrepreneur thinks the probability of the thug being a Mafia member is low, $\theta < \frac{m}{Dp}$. In this region violence occurs because entrepreneurs sometime refuse to pay Mafiosi.

To explain the logic behind this behaviour, it is useful to consider why neither of the previous patterns can exist. Given the entrepreneur's *ex ante* beliefs, they should refuse to pay the thug. Since $\theta < \frac{m}{Dp}$, on average, it

is cheaper to risk punishment than to pay. Suppose that the entrepreneur refuses to pay. In this situation only the true Mafiosi demand money. This is the separating behaviour observed in region 1. However, under the conditions in region 3 this cannot be equilibrium behaviour. In region 3, since $p > \frac{m}{D}$ entrepreneurs would pay if they were certain they were dealing with a Mafioso. Yet, this is not the situation that obtains. Since only Mafiosi demand money, upon seeing a demand, E must infer that thug is a legitimate Mafia member. Knowing this, E should pay. However, if E pays whenever a demand is made then the fakers should also demand money.

Thus neither the separating behaviour of region 1, nor the pooling behaviour of region 2 are possible in region 3. If the thugs separate, as in region 1, then E should pay. Then fakers would also prefer to demand money. If the thugs pool, as in region 2, then E should refuse demands. But since E never pays, fakers do not want to make costly threats. In region 3, fakers sometimes demand money and entrepreneurs sometimes pay. We detail this behaviour, often referred to as semi-pooling or semi-separating, below.

Fakers demand money only sometimes. Since fakers sometimes do not make demands, upon being threatened, entrepreneurs are more likely to believe they are dealing with a Mafioso than they did previously. The intuition here is that initially there is a pool of thugs. Some of the fakers in this pool drop out (by failing to threaten). Since some fakers leave, the pool is richer in Mafiosi than before. In particular, if $\sigma_F = \frac{\theta(pD-m)}{m(1-\theta)}$ then the entrepreneur is indifferent about whether to pay. In this situation, E randomizes whether or not to pay. Specifically, $\sigma_E = \frac{r}{m}$. Since E pays only with probability $\frac{r}{m}$, in expectation, F's gets the same payoff whether or not they demand money. Hence randomising his decision is optimal. Given this pattern of behaviour, no player could do better by playing differently.

Having outlined the intuition behind the semi-pooling equilibria, it is worthwhile to examine it more closely. As the entrepreneur's beliefs change so does the probability that the thug demands money. When the thug is likely to be a faker (low θ) then they are unlikely to make demands. However, as the likelihood of Mafia membership increases, fakers demand money more often. As these beliefs approach $\theta = \frac{m}{Dp}$ then all fakers demand money (the pooling equilibrium of region 2).

3.2 Comparative Statics

The behaviour of thugs and entrepreneurs depends upon their circumstances. When the expected level of policing is high, entrepreneurs never pay even if they are certain that they are dealing with a Mafioso. Under these conditions violence occurs, but sufficiently infrequently that entrepreneurs are not coerced into paying protection. As such, high levels of policing prevent organised crime from becoming established. There is a further counter-intuitive conclusion that we can draw from the analysis of region 1, namely that the presence of a certain amount of violence is not an indication of the significant presence of organised crime *per se*. Let us now consider a transition from a low level of policing to a higher level. As policing increases, the Mafia must lower their demands (small m) and increase the damage they inflict (large D) if they ever expect to get paid. The level of violence observed by citizens actually increases precisely at the moment when the State is supplying better policing to the community. At the same time, the Mafia seems more reasonable in its demands.

When policing is sufficiently poor ($p > \frac{m}{D}$) and entrepreneurs think the thug is likely to be a Mafioso ($\theta > \frac{m}{Dp}$) then thugs always demand money and the entrepreneur always pays rather than risk punishment. Under these circumstances, violence never occurs. This is the exact obverse of the situation described above as far as the observed level of violence goes. The absence of violence actually means that the Mafia is fully in charge and nobody dares to challenge its monopoly over protection. When all is quiet, everything may be going wrong.

When entrepreneurs are less certain of the thug's type, $\theta < \frac{m}{Dp}$, they sometimes refuse to pay. This can lead to violence. In this region (region 3), fakers are more likely to make demands as E becomes more likely to believe they are Mafiosi (increasing θ), as policing levels fall (increasing p), as punishments augment (increasing D) and as demands shrink (decreasing m). The rate at which E pays increases as demands get smaller and as the risk to fakers increases. Thus, from the Mafia's point of view, the more they can identify and punish fakers the easier it is to receive payment from entrepreneurs. It should not come as a surprise, therefore, that Mafiosi are very keen to punish fakers. The presence of fakers, in turn, increases the level of turbulence.

In region 3, the probability that violence occurs is $\theta p(1 - \frac{r}{m})$. There is no violence in region 2. As E s become more certain that they are dealing

with Mafiosi (increasing θ) or the level of policing falls (increasing p), the level of violence initially increases and then drops to 0 once $\theta > \frac{m}{Dp}$. Thus, the occurrence of violence is non-linear: initially increasing and then falling to zero.

The fact that the size of demands tends to be fixed by focal points has an interesting dynamic effect. Since inflation erodes the real value of m , we expect the following pattern to occur in a setting which experiences both high inflation and Mafia presence - such as Russia in the late 1980s and early 1990s. Fixing all the other parameters, as m becomes smaller over time then fewer fakers make demands and **E** becomes more likely to pay when threatened. As the value of m falls we enter region 2, where **E** always pays. The declining value of m also reduces the amount of violence. Although, inflation increases compliance, it also erodes the value of supplying protection rapidly. The stickiness of focal points means that the size of m cannot be index linked. Thus, the nominal level of demands will jump periodically. Associated with each jump is an increase in non-payment and violence. In order to avoid this outcome, Mafia groups may prefer to be paid in hard currency or in kind. The available evidence (see e.g. Varese 1994 and 1996; Serio 1997, pp. 97-101) seems to point to the fact that until the mid 1990s, criminals demanded payments either in US dollars or in kind. Before 1990 and after 1995, they resorted to using both rubles and US dollars. (It is no coincidence that since mid 1995, the exchange rate between the ruble and the US dollar has floated within a ‘corridor’ that has periodically been revised to allow the gradual depreciation of the ruble.) The recent decision by the government and the Russian Central Bank to support an average exchange rate of 6.1 rubles to the dollar during 1998 (and an average rate of 6.2 rubles to the dollar from 1998-2000) should further stabilise the currency (*RFE/RL*, 10/11/1997) and make the ruble a currency again used to pay the Mafia.

4 Repeated Interactions

Using the simple model above we have been able to tell several dynamic stories about how change affects the Mafia/entrepreneur relationship. However, we have not yet considered the most important dynamic effect: reputation (see Alt *et al.* 1988). If entrepreneurs believe that the thug is a Mafioso then they will always pay (Region 2: $\theta > \frac{m}{Dp}$). This provides thugs

with an incentive to build a reputation. If they take actions that convince entrepreneurs that they are Mafiosi then in the future they are always paid. Thus, thugs might undertake myopically sub-optimal actions today, because the reputation this creates helps them to collect tomorrow. The importance of reputation can hardly be exaggerated for the Mafia. Reputation is important on two accounts. As with any other business, protection agencies thrive if they have a good name. More customers are attracted to the 'family' and competitors do not dare to enter the market. Furthermore, a Mafioso's reputation enables him to save directly on 'production costs' (Gambetta 1993, p. 44). A reputation as a credible protector enables the Mafioso to save on the use of violence to convince reluctant victims to pay and competitors not to enter the territory of the mafia group.

The value of a good Mafia reputation can be appreciated indirectly by the fact that it may persist even if unfounded. Many Mafia families in the United States have lived off their reputation for a considerable number of years after the Prohibition wars. If seriously challenged, they would not have been able to collect protection money and scare the competition off (Reuter 1986, chapter 6). Entrepreneurs who pay protection money therefore have an incentive to find out whether thugs are as strong as they claim to be. Ultimately, the test of being a genuine Mafioso is the ability to punish non-payment. Rather than continually paying protection in the long run, the entrepreneur might find it worthwhile to risk being punished initially in order to weed out fakers demanding money. The Italian restaurant owner in Moscow waited for his car to be burned before he starting paying protection money. In the same way, the representative of the American firm approached by supposed Chechen Mafiosi refused to pay, but in this case no punishment ensued. These are both instances of the same strategy: victims of the Mafia are testing out whether the source of the request is genuine or bogus.

How does the prospect of repeated interactions affects behaviour? Under what conditions do thugs attempt to build a reputation and when are they successful? Given that entrepreneurs face repeated protection payments, when do they test the credibility of thugs? In order to address these questions, we analyse the protection game in the repeated setting. Rather than playing the game only once, we examine what happens when the Mafia has repeated opportunities to demand money. The game is played twice. Unlike the single-period game where players wanted to maximise their immediate payoffs, in the repeated setting players must worry about

how their actions affect future behaviours. Although we repeat the game only twice, the model captures the tensions created by repeated play. As we have already observed, behaviour and hence payoffs in the second period depend upon the beliefs of entrepreneurs. In the first period, players are not only concerned with immediate rewards but with the information that is revealed and how this will affect future interactions.

The mathematical analysis of the repeated game is considerably more complex than that for the single-period game. For this reason, all the mathematics has been consigned to the appendix. In the main text, we concentrate on the intuition behind the results and use a series of pictures (figures 3-5), rather than mathematics, to explain the logic.

For completeness sake, we start by analysing behaviour in region 1. When $p \leq \frac{m}{D}$ entrepreneurs never pay a thug even if they are convinced that the thug is a Mafioso. When the level of policing is high, the thug has too few opportunities to punish the entrepreneur. Repeating the game does not alter this situation. In the future, the entrepreneur will never pay, so the thug has no incentive to behave sub-optimally today to build a reputation. The possibility of organised crime under these conditions is remote. Yet, as the level of policing falls, the threat of punishment encourages the entrepreneur to pay. We consider regions 2 and 3 next.

If $p > \frac{m}{D}$ then, myopically, the entrepreneur would sooner pay than risk punishment. In the short term, if thugs can convince entrepreneurs that they are Mafiosi, then in the long run they can expect to be paid. Thus, the thug has incentives to act tough today to ensure payment tomorrow. Yet, we should be wary of assuming that thugs can easily build a reputation. If all types have an incentive to act tough, then such toughness does not tell the entrepreneur anything about the thug's type. The entrepreneur also has an incentive to act tough in the short term. If fakers are unwilling to risk punishing entrepreneurs then they can use this to determine the type of thug they are facing and avoid paying fakers in the future.

There are six equilibria: Ia, Ib, IIa, IIb, IIIa and IIIb. We illustrate the conditions under which equilibrium occurs in figures 3-5. When the faker's risk for using violence is large then equilibria Ia, Ib, IIa and IIb occur. When the contrary is true, $m \geq R$, then we observe equilibria IIIa and IIIb. In general, when E's initial beliefs are high, that is the thug is likely to be a Mafioso, then both fakers and Mafiosi demand money. We denote these equilibria with an **a**. In the equilibria denoted **b**, the Mafiosi always demand money and fakers sometimes demand money. In these semi-

pooling equilibria the entrepreneur sometimes refuses to pay. However, in the pooling equilibria (**a**), **E** always pays. In the situation where $R \geq m$, there are two patterns of behaviour. When the expected police presence is low ($p \geq \frac{m}{r-m}(r+1-m)$), equilibria Ia and Ib, punishment occurs only when Mafiosi observe a low police presence. In contrast, when the police presence is higher, $p \leq m-1$, Mafiosi punish regardless of police presence but fakers do not punish.⁹ In equilibrium IIIa, all types punish non-payment. In equilibrium IIIb, fakers sometimes punish non-payment, but Mafiosi always do. Equilibria IIIa and IIIb only occur when payments are large relative to the risks that fakers face, that is $m \geq R$.

In the single-period game, the demand decision acts as a signal of type. In the repeated game, the thug has two additional opportunities to signal type: the first demand decision and the decision to punish. We discuss these in reverse order. Myopically, thugs punish non-payment only when they are Mafiosi and the police presence is low. Since only Mafiosi should punish, using violence is a signal of Mafia status. Yet, it is a costly signal to use. Mafiosi risk imprisonment when using violence if the police presence is high. Fakers face the additional risk of Mafia detection. In the equilibria labelled Ia and Ib, thugs do not exploit this option and non-payment is punished only by true Mafiosi when the police presence is low. For fakers the risk of detection by the real Mafia is too high. When the police presence is high, the Mafioso also regards it as too risky to punish.¹⁰ In the equilibria denoted II, M punishes whether or not the police are watching, but fakers never punish. In equilibria IIIa and IIIb all types punish (at least sometimes). The incentive to appear tough means that thugs punish when myopically they should not.

Thugs' incentive to punish often means that their willingness to use force goes unobserved. For example, in equilibrium IIIa non-payment is always punished for a large range of conditions. Therefore, as we might expect, entrepreneurs always pay up. It is important not to misunderstand the role of reputation in this result. In the pooling equilibria, Ia, IIa and IIIa (in which all types make first round demands), no reputation is created.

⁹There are values of p for which both constraints hold. Thus, if $m-1 \geq p \geq \frac{m}{r-m}(r+1-m)$ then there are two equilibrium predictions.

¹⁰Paradoxically, it is when the police presence is likely to be low that M does not punish. The reason is as follows: Since p is high (relative to m) then tomorrow M expects to enjoy punishing E at low cost. Although, M could convince E to pay tomorrow by using force, the risk does not justify the benefit.

All types take the same action so the beliefs of entrepreneurs remain unchanged. However, it is the prospect that thugs want to build and maintain reputations that leads E to fear punishment and hence to pay. When E's prior is above $\frac{m}{pD}$ (region 2) it is perhaps not unexpected that E pays. Given these priors, the probability of the thug being a Mafioso leads the entrepreneur to want to pay. The entrepreneur is willing to pay demands in region 2 even in the single-period game. Yet, E will sometimes pay even outside this range. Figure 4 shows that equilibrium IIa occurs in part of region 3. In this equilibrium the entrepreneur pays all demands. Myopically, E should not pay in this region. Yet, the incentives to build reputation mean that M punishes even if the police are watching. This bias towards violence compels E to pay. In summary, the desire to form a reputation means that thugs are more likely to punish than is the case in the single-period game. This propensity to use violence can induce E to pay even when it would not normally do so in single-period play (Figure 4: equilibrium IIa in region 3). Although thugs try to build a reputation, in the pooling equilibria E's beliefs are unchanged since the sincerity of demands is never tested.

In conclusion, thugs want to build a reputation. To do so they prefer to use force when myopically they should not. This propensity to use force deters E from testing the thug's resolve. Hence entrepreneurs pay even though myopically they should not. This behaviour occurs in those regions of equilibria IIa and IIIa that lie in region 3. For real Mafiosi, the prospect of few opportunities to punish in the future cause them to risk using force to establish a reputation ($p \leq m - 1$). As payments increase both M and F become more likely to punish non-payment since the reputation this generates is worth more.

The long-run interests of reputation building make thugs overly aggressive. Long run benefits also cause entrepreneurs to act against their short-term interests. As we saw in the single-period play, myopically E should pay if his beliefs are $\theta \geq \frac{m}{Dp}$ (region 2). Given these beliefs, the risk of punishment is larger than the protection money demanded. Yet the entrepreneur may refuse to pay the thug under these conditions. While it is better to pay once to avoid the risk of punishment, the risk does not justify paying twice. In a repeated setting, entrepreneurs use the early interactions to gauge whether or not they should be paying the thug.

We introduced the idea of filtering out the fakers in the semi-pooling equilibria of region 3 for the case of the single-period game. In these equilibria, the entrepreneur sometimes refuses to pay and this sometimes results

in the E being punished. Yet, the advantage of refusing to pay is that some of the fakers drop out, either by making no demands or by refusing to punish. These actions help E identify the fakers and so avoid paying them in the future.

In single-period play we saw that if $\theta \geq \frac{m}{Dp}$ (region 2) then E prefers to pay rather than risk punishment. In repeated play, entrepreneurs have an incentive to refuse payment when myopically they should pay. To illustrate, consider the region of equilibrium IIb that lies in region 2: $\theta < \frac{2m}{m+D}$, $R \geq m$ and $p \geq \frac{m+D}{2D}$ (Figure 4). Suppose that in this zone all types make demands (as in single-period play). If Es pay in the first period then they learn nothing about the thug they face. Hence, given their prior beliefs, they also pay in the second round. Instead of paying in both rounds, E can risk taking a lottery. Given the large risks of being identified ($R \geq m$), fakers will not punish; but Mafiosi punish regardless of the police presence. If entrepreneurs refuse to pay then they will be punished by Mafiosi but not by fakers. This enables Es to identify fakers and refuse to pay them in the second round. Thus, with probability θ , E's payoff is $-D - m$, but with probability $(1 - \theta)$ E identifies the faker and avoids having to pay protection. Thus, if $\theta < \frac{2m}{m+D}$ then E prefers to risk punishment in order to filter out the fakers and avoid paying them in the long run.

While it risks punishment, refusing to pay in the first round enables the entrepreneur to identify fakers and avoid repeatedly paying them. This prevents fakers from always demanding money in the first place. Thus, even when on the basis of their priors Es should pay, fakers will not always demand money. When E's beliefs are low, that is the thug is likely to be a faker, all the equilibria are semi-pooling: fakers sometimes demand money and the entrepreneur sometimes risks punishment to filter fakers out.

The desire of the E to filter out the fakers can also be seen in figure 3. In equilibria Ia and Ib M only punishes when the police presence is low. For $\frac{2m}{p(2D+m-Dp)} > \theta > \frac{m}{pD}$, E sometimes refuses to pay. Again the filtering works by two mechanisms. First it discourages fakers from demanding money in the first place and second E partially identifies fakers by their refusal to punish.

In the semi-pooling equilibria (Ib, IIb and IIIb) Es learn about the thug. Thugs that make no demands are identified as fakers. If demands are made then the updated beliefs of entrepreneurs make them indifferent about paying. Although reputation and information drive equilibrium be-

haviour, they do not do so in a direct manner. Specifically, in the pooling equilibria the desire of thugs to further their reputation prevents the entrepreneur from testing the thug's resolve. This can be seen in the section of equilibria IIa and IIIa that occur in region 3. In these equilibria, Es pay protection money even though they think the thug is likely to be a faker. They do so because of the thug's propensity to punish in order to build a reputation. At the same time, precisely because Es pay, they fails to learn about the thug. Although in the first period Es pay because of the incentive to build reputation, in the second period Es do not always pay because no learning occurs. Learning and reputation building occur in the semi-pooling equilibria. The entrepreneur occasionally risks punishment to filter out fakers and avoid long-term payments.

Although we repeated the game only twice, we can gain insight into repeated interaction between thugs and entrepreneurs. The desire to build and maintain a reputation encourages thugs to punish when myopically they should not. Once the entrepreneur's beliefs are suitably high, the probability that thugs will punish to maintain their reputation deters the entrepreneur from refusing demands. The result is no violence and no additional learning. Dynamically the game becomes frozen with beliefs remaining unchanged. As the game is repeated either the thug is identified as a faker or entrepreneurs beliefs increase until they believes that the thug is most likely to be a Mafioso. At this point, E always pays and no additional information is revealed.

Es filter out fakers by sometimes refusing to pay. Each time they do this some fakers drop out of the pool and Es become more convinced that they are dealing with a real Mafioso. Once they are suitably convinced they always pay in the future. The length of the filtering process depends upon E's beliefs and other conditions. For example, in equilibrium Ib filtering typically only takes a single period. Either the faker drops out and is identified by E or E's beliefs increase ($\mu(\text{pay}) > \frac{m}{pD}$) such that E pays in the future. Yet if the thug refuses to punish in the first period then E filters again in the second period. Under other circumstances the filtering process typically takes two periods. For example, in equilibrium IIb, if $p < \frac{m+D}{2D}$, then filtering takes two periods because after the first round E's beliefs still lie in region 3.¹¹

¹¹The regions of equilibria IIa and IIIa that lie below the line $\theta = \frac{m}{pD}$ suggest that filtering is delayed. In these equilibria, pooling occurs in the first period and filter occurs

When the entrepreneur's initial beliefs are low then fakers are more reluctant to demand money since the entrepreneur sometimes refuses to pay in order partially to filter out the fakers. Yet, after the initial filtering E's beliefs tend to become fixed. It is during the initial period that E filters. This remains true even if the number of interactions is increased. To see why, consider the motivation for filtering. By refusing to pay the demand, E tests whether the thug is really a Mafioso and also discourages fakers from demanding money in the first place. Once fakers are identified, the entrepreneur never has to pay them again. However, it is costly to filter because sometimes E refuses to pay the legitimate Mafia and is punished as a consequence. If the game were 10 periods long, there would be no point trying to identify fakers in the penultimate period. Suppose the thug was a faker. The entrepreneur has already paid them uselessly for eight periods and borne the same risk of punishment. Entrepreneurs partially filter in their initial interaction. In subsequent periods E's beliefs remain fixed and violence does not occur.

Despite the perpetual threat of violence, after the initial interactions, beliefs become fixed and dynamically the game is frozen. Once the Mafia has established itself, the amount of violence is minimal. However, exogenous shocks to the system may provoke a return to violence. Changes in the size of demands, the level of policing or confusion over succession may lead to a new period of violence as entrepreneurs partially filter and re-establish their beliefs that they should pay in the long run. Since we have already discussed the effect of inflation on demands, we first examine changes in policing and then confusion over succession. To avoid having to discuss pre-emption, we only consider unanticipated changes.

We illustrate possible effects of policing changing in figure 6 which is an example of equilibria Ia and Ib. Following the initial interaction, E's beliefs become frozen on the line $\theta = \frac{2m}{p(2D+m-Dp)}$. Once these beliefs are held, little violence occurs because E realises that it is in his interest to pay. To start with, consider a shock that reduces the level of policing. Following the change, E strictly wants to pay when threatened and observationally

in the semi-pooling equilibrium in the second period. However, this late filter is only an artefact of the two-period structure. In these equilibria the thug's desire to create a reputation means that he punishes even when myopically he should not. This deters E from refusing to pay. This incentive to create a reputation disappears in the last period. However, as long as the game continues then thugs want to create a reputation and E continues to pay.

there is no increase in violence. The beliefs that E held prior to the shock were on the line $\theta = \frac{2m}{p(2D+m-Dp)}$. Yet, following the shock, E's beliefs are in the interior of region 3. At this point, it is never worth testing the thug's resolve and the entrepreneur pays in all future interactions. Paradoxically, one can reduce Mafia violence by taking police off the streets. Yet, the absence of violence is a sign Mafia entrenchment and policy failure.

Policies producing an increase in policing levels also lead to a short-term increase in violence. Consider an increase in the expected level of policing from p to p' . E's beliefs now lie below the line $\theta = \frac{2m}{p(2D+m-Dp)}$. Given these beliefs, the entrepreneur attempts to partially filter out fakers. Thus, immediately following an increase in policing, entrepreneurs sometimes refuse to continue paying. This inevitably leads to an increase in violence, since E's refusal to pay is punished by real Mafiosi. The analysis suggests that although increasing the level of policing will reduce the overall number of thugs that engage in organised crime, the initial impact of the policy is to increase the amount of violence. The increase in violence is only a short-term phenomenon while entrepreneurs attempt to filter out fakers. Violence is an unavoidable consequence of combating organised crime.

Similarly, confusion over succession in a Mafia family may cause uncertainty over whom to pay. When a boss goes to prison, is deposed or becomes unavailable for some other reason, new arrangements emerge. For instance, when Joe Bonanno, a prominent Sicilian Mafioso, left the US in 1957, he was "... careful to make preparations to avoid confusion and to ensure continuity in his absence ..." (Bonanno 1983, p. 195, quoted in Gambetta, 1993, p. 62). In a world where information flows perfectly, customers would be informed immediately and would have no doubts over whom to pay in the next stage of the interaction with the mafia group. The Mafia however is not this ideal world. For instance, confusion among the Mafia's customers ensued when Mariano Marsala, the boss of the small Sicilian town of Vicari, was deposed as a consequence of the Mafia war of the late 1970s and 1980s. Some of his old customers continued to ask Don Mariano for protection, even though he was no longer in a position to supply it. As far as our model is concerned, he *had become* a faker. Don Mariano kept supplying protection behind the back of the new boss until 1983, when he was exposed and killed (Vicenzo Marsala's testimony 1985, quoted in Gambetta 1993, p. 63).¹² The issue of succession can be

¹²In situations where the Mafia is more stable, succession is announced almost publicly.

addressed within the framework of this model. Our game models behaviour with respect to beliefs. Hence if news of a succession is completely confined to the Mafia, an E's beliefs would not be altered and they would continue to pay the previous Mafioso, as in the case of Mariano Marsala's customers. If information flows perfectly, entrepreneurs would update their beliefs and switch to paying the new Mafioso. If information flows imperfectly, Es will be unsure about whether or not they are dealing with a real Mafioso. Depending on the level of uncertainty, they will act accordingly. This model can account for the effect of differing levels of information dissemination on the entrepreneur's decision to pay.

Once entrepreneurs are convinced that they are dealing with the Mafia, they pay. Outwardly there is no sign of Mafia involvement. Mafia activity becomes visible only when their position is challenged. Increased policing, succession disputes and outside rivals all lead to increased violence as entrepreneurs test credibility and filter out the fakers. The Mafia punishes to restore its position as the only supplier of private protection.

5 Conclusions

From the analysis of the one-shot game, we obtain three different regions. In Region 1, entrepreneurs know that those making demands are Mafiosi, but the damage they can inflict is not high enough for the entrepreneur to comply. This may lead to sporadic violence. Paradoxically, this is a sign of a well-policed territory. It might be more fruitful to think of region 1 as a context that has recently moved to a situation of high policing, rather than one which has been Mafia-free for a lengthy period of time. Over time, it is likely that the Mafia would disappear as a viable profession, individuals prone to violence emigrating or finding a different form of employment. Once a Mafia-free equilibrium has been established for a long time, skills,

After the death of Carmelo Colletti, boss in the town of Ribera (Agrigento, Sicily) in 1983, a meeting was held to appoint a successor. At the end of the meeting the participants paraded to the town's main bar, in full public view. According to investigators, this parade served to inform the public of the identity of the new boss, Gennaro Sortino, who marched at the head of the procession (Gambetta 1993, p. 60). In the Japanese Yakuza, which enjoys greater official tolerance than the Sicilian Mafia, "... succession is announced with some formality in the relevant social segments of the underworld" (Iwai 1986, p. 217). In one case, a leaflet was produced with the name of the new boss and his supporters (Iwai 1986, p. 217).

know-how and social acquiescence for the Mafia would disappear. It would take more than a decrease in the level of policing for a Mafia to re-emerge.

The analysis of the one-shot game shows that a transition from low to higher levels of policing lead Mafiosi to use harsher punishment (big D) and make smaller demands (small m) in order to continue organised crime. More violence is in fact an indicator of an increased effort by the State to stamp out the Mafia.

The absence of violence does not indicate that the Mafia is not operating in a certain area. Our model shows that no violence occurs when entrepreneurs always pay the Mafia. When all is quiet, everything might be going wrong. A dynamic pattern emerges from this setting in which the Mafia are in charge and the entrepreneurs always pay. We have shown that in this region, fakers have an incentive to enter the market. This causes the entrepreneurs' beliefs to change. As more fakers enter the protection market, the system moves to region 3, where the entrepreneur is not so sure of the identity of the thug and hence sometimes refuses to pay. When a context moves to this equilibrium (region 3), we expect an increase in violence: the Mafia punishes those fakers it can identify and it also punishes those entrepreneurs who make the mistake of not paying a real Mafiosi. Because entrepreneurs are not certain about whom they are dealing with, they sometimes try to filter out fakers by refusing to pay. The fact that payment is not certain causes fakers to drop out of the protection business. As fakers drop out and entrepreneurs start to believe that there are only real Mafiosi, they again start invariable payment. When the transition back to region 2 is completed, violence again drops to zero.

We have identified a (potential) external source of shock in settings where there is both high Mafia presence and high inflation. If protection money is paid in the local currency, we should expect that over time entrepreneurs will be more inclined to pay, since the value of the payment is eroded by inflation. We should also expect sudden jumps in the size of demands, accompanied by violence. Precisely to avoid this scenario, Mafia groups prefer to be paid in hard currency or in kind.

Although the one-shot game yielded a number of insights, it could not account for a fundamental aspect of this social situation, namely reputation building. When Mafiosi expect to interact a second time with entrepreneurs, they have an incentive to build up their reputations, in order to save on the production of violence. For this reason, we might observe an "excessive" use of violence in the first interaction. Thugs are more likely to

punish to preserve or enhance their reputation. Of course, this can make entrepreneurs compliant with demands since they know that thugs are more likely to use violence to punish non-payment.

However, thugs are not the only ones who can behave (apparently) sub-optimally in the short term. When entrepreneurs anticipate multiple interactions, they have an incentive to establish the identity of the thug during the initial interaction. Under some conditions, entrepreneurs refuse to pay because it helps them to determine whether or not they should be paying the thug over the long term. Although risky, because of the possibility of punishment in the short run, it helps prevent unnecessary repeated payment in the long run.

The repeated interactions are driven by these two phenomena. Firstly, thugs are overly aggressive to establish their reputations, which in turn often makes entrepreneurs compliant. Secondly, entrepreneurs use the initial interactions to filter out fakers. We characterise the conditions under which each pattern of behaviour occurs. The initial interactions serve to determine the entrepreneur's beliefs about the legitimacy of the thug's demands and hence to determine the course of future interactions. As entrepreneurs filter, either thugs are identified as fakers by their refusal to punish or failure to make demands, or the beliefs of E s increase until they are convinced with enough certainty that the thugs are Mafiosi. At this point, in the later case, the entrepreneur pays demands in all future interactions. Once the entrepreneur's beliefs are established, there is no violence because entrepreneurs pay so no more information is revealed. Dynamically the game is frozen.

Once this equilibrium is reached, fakers have an incentive to emerge. This or an exogenous shock to the system can lead to violence until beliefs about the legitimacy of the thug are re-established. We analysed two potential external shocks, changes in the level of policing and changes in the Mafia leadership. If there is a shock that reduces the level of policing, E strictly wants to pay when threatened and we observe no increase in violence. Policies that lead to an increase in policing also lead to a short-term increase in violence.

Changes in Mafia leadership may also cause entrepreneurs to question whom they should be paying. If entrepreneurs sense that there have been changes in Mafia leadership but they are not quite sure about their nature, they will be inclined to test whether they are paying the right person. Following a succession dispute, real Mafiosi (who may or may not be the same

individuals as before) use violence against non-payers until their legitimacy is re-established. The Mafia has an incentive to communicate changes in leadership to its customers and it does so where it is more established. Our model identifies the mechanism that is at the base of the increase in turbulence associated with Mafia succession.

6 Appendix

In the main text we have characterised the best responses for all players. We know that $\sigma_M = 1$. Rather than repeat the exact analysis in the text more formally, we cut straight to characterising the equilibria. Since $\sigma_M = 1$, there are three possible cases: separating ($\sigma_F = 0$), pooling ($\sigma_F = 1$) and semi-pooling ($\sigma_F \in (0, 1)$). These correspond to regions 1, 2 and 3 in figure 2, respectively.

Separating Equilibria. We start by characterising the conditions under which separating equilibria can occur: $\sigma_M = 1$ and $\sigma_F = 0$. Examining the best response function for the fakers we see that F does not make demands when $\sigma_E m - r \leq 0$. Therefore, if a separating equilibrium exists then $\sigma_E \leq \frac{r}{m}$. Since E does not always pay, $U_E(\text{pay}) = -m \leq -\mu pD = U_E(\text{not pay})$. If M and F play separating strategies, then by Bayes' rule $\mu = 1$. This implies that $m \geq pD$.

Therefore, $m > pD$ then $\sigma_M = 1$ and $\sigma_F = 0$ and $\sigma_E = 0$ is a sequential equilibrium in which E's beliefs upon being threatened are $\mu = 1$.¹³ This is the behaviour in region 1 of figure 2.

Pooling Equilibria. Suppose $\sigma_M = 1$ and $\sigma_F = 1$. In order that $\sigma_F = 1$, $U_F(\text{demand}) = \sigma_E m - r \geq 0 = U_F(\text{no demand})$. Therefore, $\sigma_E \geq \frac{r}{m}$. This implies that $U_E(\text{pay}) = -m \geq -\mu pD = U_E(\text{not pay})$. Since, both types pool on the same message, $\mu = \theta$. Therefore, pooling equilibria exist only if $\theta \geq \frac{m}{pD}$. We can now state the equilibria formally.

If $\theta > \frac{m}{pD}$ then $\sigma_M = 1$, $\sigma_F = 1$ and $\sigma_E = 1$ and the entrepreneur's beliefs are $\mu = \theta$. This is the equilibrium that occurs in region 2 of figure 2.

¹³Note that if $m = pD$ then $\sigma_M = 1$ and $\sigma_F = 0$ and thus $\sigma_E \leq \frac{r}{m}$ is also a sequential equilibrium. This is a special knife-edge case that occurs on the line separating regions 1 and 3.

When $\theta = \frac{m}{pD}$ there are a range of equilibria in which $\sigma_M = 1$, $\sigma_F = 1$ and $\sigma_E \geq \frac{r}{m}$ and the entrepreneur's beliefs are $\mu = \theta$. These equilibria occur on the line separating regions 2 and 3 in figure 2.

Semi-Pooling Equilibria. Suppose $\sigma_M = 1$ and $\sigma_F \in (0, 1)$. In order that fakers randomise their demand decision, F must be indifferent about whether or not to make demands: $U_F(\text{demand}) = \sigma_E m - r = 0 = U_F(\text{no demand})$. This implies that $\sigma_E = \frac{r}{m}$. In any equilibrium in which F randomises it must be the case that $\sigma_E = \frac{r}{m}$. However, since this also requires that the entrepreneur is randomising, E must be indifferent between paying and not: $U_E(\text{pay}) = -m = -\mu p D = U_E(\text{not pay})$. Therefore, $\mu = \frac{m}{Dp}$. By Bayes' rule, $\mu = \frac{\theta}{\theta + (1-\theta)\sigma_F}$. Therefore, if E is indifferent, then $\sigma_F = \frac{\theta(Dp-m)}{m(1-\theta)}$. We can now formally state the equilibrium.

If $\theta \in (0, \frac{m}{Dp})$ and $m < Dp$ then $\sigma_M = 1$, $\sigma_F = \frac{\theta(Dp-m)}{m(1-\theta)}$, $\sigma_E = \frac{r}{m}$ and E's beliefs are $\mu = \frac{m}{Dp}$. This is region 3 in figure 2.

Since we have exclusively searched all the possible strategy profiles for thugs, these equilibria represent all possible cases.

6.0.1 Size of Demands

So far we have assumed that the size of m is fixed. What, if any, are the consequences of allowing the thugs to choose m endogenously? The first thing to note is that (in equilibrium) M and F must demand the same amount. (We do not regard $m = 0$ as equivalent to making no demand.) If M and F were to send different signals then the entrepreneur could instantly recognise the fakers and refuse to pay them. Thus, F would prefer either to demand the same as M or to make no demand.

So M and F must demand the same amount. However, can this amount vary? Game theoretically, there are equilibria where only demands of a single size are made. Suppose in equilibrium, when they make demands, both M and F ask for m . In equilibrium, demands of other sizes are not made. If, for example, a thug demanded $m' \neq m$ then what should the entrepreneur believe about the thug's type? Bayes' rule tells us nothing about this situation, as it is a zero probability event (the denominator in the Bayes' formula is zero and hence our beliefs are $\frac{0}{0}$, which is undefined.) Therefore, consistent with sequential equilibrium, we are free to fix any beliefs. If these beliefs are that fakers are the type that demand m' then no

type would ever want to ask for m' . Hence in equilibrium all types ask for m . If we relax the assumption that m is exogenously fixed then observationally equivalent equilibria exist. As we discussed informally above, the Mafia may have preferences over the set of possible equilibria. In terms of equilibrium selection, we should probably concentrate on the most preferred equilibria from the Mafioso point of view. Since, in practice, focal points seem central to the size of demands, we treat m as fixed.

6.1 Twice-Repeated Game

In order to examine the effect of reputation, we examine the twice-repeated game. Additional notation is required to analyse this game. We index the notation by the time period in which the decision takes place: $t = 1, 2$. In addition, the strategies of players may also depend upon the previous outcomes. Let h represent the history of play; that is the previous decisions of the players. For convenience, we represent the histories in as concise a form as possible where this leads to no ambiguity. For example, suppose the thug demands money in the first round, E refuses and the thug punishes. We would represent E's beliefs as $\mu(\textit{violence})$ since the violent outcome can only be reached via a demand and consequent refusal to pay. In the single-period game, we did not introduce any notation for the thug's decision to punish. Let $s_F^{t=1}$ be the probability that the faker punishes in the first period. Similarly, $s_M^{t=1}(\textit{high})$ and $s_M^{t=1}(\textit{low})$ represent the probabilities that a Mafioso punishes in the first round given high and low police presence respectively.

The solution concept, sequential equilibrium, requires that strategies be sequentially rational. This means that when making choices, players must optimise at every point and they cannot commit to take sub-optimal actions in the future. Therefore, the behaviour in the second period of the game is given in the earlier analysis. Given this, for any set of beliefs held by E we can predict behaviour in the second round. Hence, for any given belief, we know the expected payoff for each player in the second period.¹⁴ The question then becomes: how do players act in the first round to affect subsequent beliefs given that we know how beliefs affect payoffs in the second round? Before proceeding, it is worthwhile to summarise the second-

¹⁴The only exception is if $\theta = \frac{m}{pD}$ in which case there are multiple equilibria, each with different payoffs for the thug.

round expected payoff for each player for any given set of beliefs. First consider region 2: $p \geq \frac{m}{D}$ and $\mu(h) \geq \frac{m}{pD}$. Suppose that given the first-round history of play h , that $\mu(h) > \frac{m}{pD}$. In the second period, all types of thug demand money and E always pays. Hence E's second round payoff, $U_E^{t=2}(h)$, is $-m$. Similarly, $U_F^{t=2}(h) = m - r$ and $U_M^{t=2}(h) = m$. If the history of play is such that $\theta(h) = \frac{m}{pD}$, then $U_E^{t=2}(h) = -m$, $U_F^{t=2}(h) = \sigma_E^{t=2}(h)m - r$ and $U_M^{t=2}(h) = \sigma_E^{t=2}(h)m + (1 - \sigma_E^{t=2}(h))p$, where $\sigma_E^{t=2}(h)$ is the probability that E pays in the second round. If the beliefs generated in the first round are in region 3, then in the second round we observe semi-pooling equilibrium behaviour. Hence if $\mu(h) < \frac{m}{pD}$, then $U_E^{t=2}(h) = -\mu(h)Dp > -m$, $U_F^{t=2}(h) = 0$ and $U_M^{t=2}(h) = \sigma_E^{t=2}(h)m + (1 - \sigma_E^{t=2}(h))p = r + p - \frac{pr}{m} > 0$.

With these preliminaries over, we analyse the equilibria. Details, such as out-of-equilibrium belief refinements, are introduced as required.

6.1.1 Region 1: $p \leq \frac{m}{D}$

In region 1, whatever the beliefs of entrepreneurs, they refuse to pay. In single-period play, this means that only Mafiosi demand money and that (despite being convinced of the thug's Mafia status) Es refuse to pay. The Mafiosi punish only when the police presence is low. In this case the extension to repeated play is trivial since E's beliefs do not affect behaviour. Players have no incentive to manipulate their play in early rounds to affect E's beliefs because E's play is independent of such information. In every period, play is identical to that in the single-period game.

6.1.2 Regions 2 and 3: $p \geq \frac{m}{D}$

In the main text we informally discussed the equilibria. In this section, our intention is to formally characterise the equilibria and to provide some intuition as to why other patterns of behaviour cannot be equilibria. During these characterisations we make several assumptions about out-of-equilibrium beliefs. To illustrate, suppose that in equilibrium all types demand money in the first round. Since all types threaten, what should E believe if the thug makes no first-round threat? The solution concept provides no constraints in this situation since Bayes' rule is undefined. There are numerous equilibrium refinement (see Banks 1991 for discussion). The spirit of these refinements is to find the type that would gain most from sending the out-of-equilibrium message. The refinements assume that it is this type that

sends the out-of-equilibrium message. Therefore, in this situation, if no demand is the out-of-equilibrium message, then E should infer that the thug is a faker, $\mu = 0$. Similarly, an out-of-equilibrium failure to punish implies that the thug is a faker. Alternatively, an out-of-equilibrium threat or use of violence as punishment should lead E to believe that the thug is a Mafioso, $\mu = 1$.

Before characterising the equilibria we demonstrate why other forms of behaviour cannot be equilibria. In the first period, M and F never separate on making demands. To demonstrate why, suppose they do separate: $\sigma_M^{t=1} = 1$ and $\sigma_F^{t=1} = 0$. E's beliefs are $\mu(\text{demand}) = 1$ and $\mu(\text{no demand}) = 0$. Since they are completely identified, there is no subsequent benefit from punishing unless it is cheap: $s_F^{t=1} = 0$, $s_M^{t=1}(\text{low}) = 1$ and $s_M^{t=1}(\text{high}) = 0$. Given this, E's best response to a threat is to pay, since Es knows they are dealing with Ms who will punish with probability p : $\sigma_E^{t=1} = 1$. However, if E always pays then F also demands money. This contradicts the original premise that the types separate. Hence, there are no separating equilibria. Thus, we need consider only strategy profiles in which types pool or semi-pool in their decision to demand money.

The two-period game offers the thug an alternative opportunity to signal his type. If E refuses to pay then the thug decides whether or not to punish. Given our out-of-equilibrium belief refinements, M always punishes when it is cheap. We can place an additional restriction on thugs' decisions to punish. Specifically, $s_F^{t=1} = 1$ and $s_M^{t=1}(\text{high}) < 1$ can never be part of an equilibrium profile. Suppose it were, $\mu(\text{no violence}) = 1$. In the second period E would always pay: $\sigma_E^{t=2}(\text{no violence}) = 1$. But then in the first period $U_F(\text{not punish}) = -r + m - r$. If F punishes then $U_F(\text{punish}) = -R + \zeta$, where the maximum value for ζ is $m - r$. But this contradicts the original premise that F punishes.

In order to prove that the strategy profiles are indeed equilibria, we analyse each profile separately and find the conditions under which it is a sequential equilibrium. Since equilibrium behaviour in the second period is completely described by the original analysis, we do not repeat these results unless ambiguity might arise.

6.2 Equilibrium Ia.

If $p \geq \left(\frac{m}{r-m}\right)(r+1-m)$, $R \geq m$ and $\theta \geq 2\frac{m}{p(2D+m-Dp)}$ then the strategy profile $\sigma_F^{t=1} = 1$, $\sigma_M^{t=1} = 1$, $\sigma_E^{t=1} = 1$, $s_F^{t=1} = 0$, $s_M^{t=1}(\text{high}) = 0$, $s_M^{t=1}(\text{low}) = 1$ is a sequential equilibrium with beliefs $\mu(\text{demand}) = \theta$, $\mu(\text{no demand}) = 0$, $\mu(\text{violence}) = 1$ and $\mu(\text{no violence}) = \frac{\theta(1-p)}{\theta(1-p)+(1-\theta)} < \theta$.

Proof: Note that the beliefs are all consistent with Bayes' rule. Therefore, we simply need to check that every player is utility maximising given their type, their beliefs and the strategy of the other players.

Consider E's decision to pay in the first period. $U_E(\text{pay}) = -2m$ since given these beliefs E also pays in the second period (region 2). If E refuses to pay then there are two cases:

(i) $\mu(\text{no violence}) \geq \frac{m}{Dp}$. $U_E(\text{no pay}) = \mu(\text{demand})p(-D-m) + (1 - \mu(\text{demand})p)(0-m)$. Thus, $\sigma_E^{t=1} = 1$.

(ii) $\mu(\text{no violence}) < \frac{m}{Dp}$. $U_E(\text{no pay}) = \mu(\text{demand})p(-D-m) + (1 - \mu(\text{demand})p)(0 - Dp\mu(\text{no violence}))$, where $\mu(\text{demand}) = \theta$ and $\mu(\text{no violence}) = \frac{\theta(1-p)}{\theta(1-p)+(1-\theta)}$. Hence, $U_E(\text{no pay}) = \theta p(-D-m) + (1 - \theta p)(0 - Dp\frac{\theta(1-p)}{\theta(1-p)+(1-\theta)}) = -(2D+m-Dp)\theta p$

Thus, if $\theta \geq 2\frac{m}{p(2D+m-Dp)}$ then E's best response is to pay given that $\mu(\text{demand}) = \theta \geq 2\frac{m}{p(2D+m-Dp)}$. Therefore, $\sigma_E^{t=1} = 1$.

Next consider F's decision to punish: $U_F(\text{punish}) = -R + m - r$ and $U_F(\text{no punish}) \geq -r + 0$ (F's payoff in the second period is 0 if $\mu(\text{no violence}) = \frac{\theta(1-p)}{\theta(1-p)+(1-\theta)} < \frac{m}{pD}$, region 3). If $R \geq m$ then F prefers not to punish. Obviously, F prefers not to punish if $\mu(\text{no violence}) \geq \frac{m}{pD}$.

Does M punish when the police presence is high? $U_M(\text{punish|high}) = -1+m$ and $U_M(\text{no punish|high}) = 0+r+p-\frac{pr}{m}$. ($r+p-\frac{pr}{m}$ is M's expected payoff in the second period for region 3). Thus, if $p \geq \left(\frac{m}{r-m}\right)(r+1-m)$ then M does not punish during a high police presence.

Finally, consider the initial decision to demand money. Since E always pays demands, both types prefer to make demands. QED.

6.3 Equilibrium Ib.

If $p \geq \left(\frac{m}{r-m}\right)(r+1-m)$, $R \geq m$ and $\theta < \frac{2m}{p(2D+m-Dp)}$ then the strategy profile $\sigma_F^{t=1} = x = \frac{\theta(p-2)(m-pD)}{2m(1-\theta)}$, $\sigma_M^{t=1} = 1$, $\sigma_E^{t=1} = \frac{r}{(-r+2m)}$, $s_F^{t=1} = 0$, $s_M^{t=1}(\text{high}) = 0$ and $s_M^{t=1}(\text{low}) = 1$ is a sequential equilibrium with beliefs

$\mu(\text{demand}) = \frac{\theta}{\theta+(1-\theta)x} = \frac{2m}{p(2D+m-Dp)}$, $\mu(\text{no demand}) = 0$, $\mu(\text{violence}) = 1$ and $\mu(\text{no violence}) = \frac{2}{p}m \frac{-1+p}{m-2D+Dp} < \frac{m}{pD}$.

Proof: Note that the beliefs are all consistent with Bayes' rule. Therefore, we simply need to check that every player is utility maximising given their type, their beliefs and the strategy of the other players.

Consider E's decision to pay in the first period. Given F's strategy, $\mu(\text{demand}) = 2\frac{m}{p(2D+m-Dp)} > \frac{m}{Dp}$ and $\mu(\text{no violence}) < \frac{m}{Dp}$. Therefore, $U_E(\text{pay}) = -2m$. $U_E(\text{no pay}) = \mu(\text{demand})p(-D-m) + (1-\mu(\text{demand})p)(0 - Dp\mu(\text{no violence}))$, where $\mu(\text{no violence}) = \frac{\mu(1-p)}{\mu(1-p)+(1-\mu)} < \frac{m}{Dp}$. Hence, $U_E(\text{no pay}) = \mu p(-D-m) + (1-\mu p)(0 - Dp\frac{\mu(1-p)}{\mu(1-p)+(1-\mu)}) = -(2D+m-Dp)\mu p$. Hence, E should pay if $\mu(\text{demand}) \geq \left(2\frac{m}{p(2D+m-Dp)}\right)$. Hence, randomising is a best response for E.

Therefore, $\sigma_F^{t=1} = x = \frac{\theta(p-2)(m-pD)}{2m(1-\theta)}$.

Next consider F's decision to punish: $U_F(\text{punish}) = -R + m - r$ and $U_F(\text{no punish}) \geq -r + 0$ (F's payoff in the second period is 0 since $\mu(\text{no violence}) < \frac{m}{pD}$, region 3). If $R \geq m$ then F prefers not to punish.

Does M punish when the police presence is high? $U_M(\text{punish}|\text{high}) = -1 + m$ and $U_M(\text{no punish}|\text{high}) = 0 + r + p - \frac{pr}{m}$ ($r + p - \frac{pr}{m}$ is M's expected payoff in the second period for region 2). Thus, if $p \geq \left(\frac{m}{r-m}\right)(r+1-m)$ then M does not punish during a high police presence.

Finally, consider the initial decision to demand money. $U_F(\text{demand}) = -r + \sigma_E^{t=1}(m-r+m)$ and $U_F(\text{no demand}) = 0$. Thus, providing $\sigma_E^{t=1} = \frac{r}{(-r+2m)}$ randomising in the first period is optimal. QED.

6.4 Equilibrium IIa.

If $p \leq m - 1$, $R \geq m$ and if either (i) $\theta \geq \frac{2m}{m+D}$ and $\theta \geq \frac{m}{pD}$ or (ii) $\theta \geq \frac{m}{D+m-Dp}$ and $\theta < \frac{m}{pD}$ then the strategy profile $\sigma_F^{t=1} = 1$, $\sigma_M^{t=1} = 1$, $\sigma_E^{t=1} = 1$, $s_F^{t=1} = 0$, $s_M^{t=1}(\text{high}) = 1$, $s_M^{t=1}(\text{low}) = 1$ is a sequential equilibrium with beliefs $\mu(\text{demand}) = \theta$, $\mu(\text{no demand}) = 0$, $\mu(\text{violence}) = 1$ and $\mu(\text{no violence}) = 0$.

Proof: Note that the beliefs are all consistent with Bayes' rule. Therefore, we simply need to check that every player is utility maximising given their type, their beliefs and the strategy of the other players.

Consider E's decision to pay in the first period. There are two cases:

(i) $\theta \geq \frac{m}{pD}$. In this case, if E pays in the first period E would also

pay in the second period. $U_E(\text{pay}) = -2m$. If E refuses to pay then $U_E(\text{no pay}) = \mu(-D-m) + (1-\mu)(0+0) = \mu(-D-m)$, where $\mu = \mu(\text{demand}) = \theta$. If $\theta \geq \frac{2m}{m+D}$ then E should always pay: $\sigma_E^{t=1} = 1$.

(ii) $\theta < \frac{m}{pD}$. In this case, Es would be in region 3 in the second period if they paid in the first. Hence E's second period payoff is $-Dp\mu(\text{demand}) = -Dp\theta$. Therefore, $U_E(\text{pay}) = -m - Dp\theta$ and $U_E(\text{no pay}) = \mu(-D-m) + (1-\mu)(0+0) = \theta(-D-m)$. Therefore, E should pay if $\theta \geq \frac{m}{D+m-Dp}$. Note that lines $\theta = \frac{m}{D+m-Dp}$, $\theta = \frac{m}{pD}$ and $\theta = \frac{2m}{m+D}$ all intersect at the same point: $p = \frac{m+D}{2D}$ and $\theta = \frac{2m}{m+D}$. Therefore, E should pay if either (i) $\theta \geq \frac{2m}{m+D}$ and $\theta \geq \frac{m}{pD}$ or (ii) $\theta \geq \frac{m}{D+m-Dp}$ and $\theta < \frac{m}{pD}$.

Next consider F's decision to punish: $U_F(\text{punish}) = -R + m - r$ and $U_F(\text{no punish}) \geq -r + 0$ (F's payoff in the second period is 0 since $\mu(\text{no violence}) = 0 < \frac{m}{pD}$, region 3). If $R \geq m$ then F prefers not to punish.

Does M punish when the police presence is high? $U_M(\text{punish|high}) = -1 + m$ and $U_M(\text{no punish|high}) = 0 + p$ (p is M's expected payoff in the second period since E's beliefs $\mu(\text{no violence})$ mean that E never pays). Thus, if $p \leq m - 1$ then M punishes during a high police presence.

Finally, consider the initial decision to demand money. $U_F(\text{demand}) = m - r + \zeta$, where ζ is $m - r$ if $\theta \geq \frac{m}{pD}$ (region 2) and $\zeta = 0$ else (region 3). $U_F(\text{no demand}) = 0$. Therefore, F always demands money. QED.

6.5 Equilibrium IIb.

If $p \leq m - 1$, $R \geq m$ and $\theta < \min\{\frac{2m}{m+D}, \frac{m}{m+D-Dp}\}$ then the strategy profile $\sigma_M^{t=1} = 1$, $s_F^{t=1} = 0$, $s_M^{t=1}(\text{high}) = 1$, $s_M^{t=1}(\text{low}) = 1$, $\sigma_F^{t=1} = x = \begin{cases} \frac{\theta(D-m)}{2m(1-\theta)} & \text{if } p \geq \frac{m+D}{2D} \\ \frac{\theta D(1-p)}{m(1-\theta)} & \text{if } p \leq \frac{m+D}{2D} \end{cases}$ and $\sigma_E^{t=1} = \begin{cases} \frac{r}{2m-r} & \text{if } p \geq \frac{m+D}{2D} \\ \frac{r}{m} & \text{if } p < \frac{m+D}{2D} \end{cases}$ is a sequential equilibrium with beliefs $\mu(\text{demand}) = \frac{\theta}{\theta+(1-\theta)x} = \frac{2m}{m+D}$, $\mu(\text{no demand}) = 0$, $\mu(\text{violence}) = 1$ and $\mu(\text{no violence}) = 0$.

Proof: Note that the beliefs are all consistent with Bayes' rule. Therefore, we simply need to check that every player is utility maximising given their type, their beliefs and the strategy of the other players.

Consider E's decision to pay in the first period. There are two cases:

(i) $p \geq \frac{m+D}{2D}$. In this case $U_E(\text{pay}) = -2m$ if $\mu(\text{demand}) \geq \frac{m}{pD}$ and $U_E(\text{pay}) = -m - pD\mu(\text{demand})$ if $\mu(\text{demand}) < \frac{m}{pD}$. If E refuses to pay then $U_E(\text{no pay}) = \mu(-D-m) + (1-\mu)(0+0) = \mu(-D-m)$, where

$\mu = \mu(\text{demand}) = \frac{\theta}{\theta+(1-\theta)x}$. If $\mu(\text{demand}) = \frac{2m}{D+m}$ and hence $x = \frac{\theta(D-m)}{2m(1-\theta)}$ then **E** is indifferent to paying: $\sigma_E^{t=1} \in [0, 1]$. (Note that we require that $\theta < \frac{2m}{m+D}$ in order that $x < 1$.)

(ii) $p < \frac{m+D}{2D}$. In this case $U_E(\text{pay}) = -2m$ if $\mu(\text{demand}) \geq \frac{m}{pD}$ and $U_E(\text{pay}) = -m - pD\mu(\text{demand})$ if $\mu(\text{demand}) < \frac{m}{pD}$. If **E** refuses to pay then $U_E(\text{no pay}) = \mu(-D - m) + (1 - \mu)(0 + 0) = \mu(-D - m)$, where $\mu = \mu(\text{demand}) = \frac{\theta}{\theta+(1-\theta)x}$. First note that if $\mu(\text{demand}) \geq \frac{m}{pD}$ then **E** strictly prefers to pay. But then all types of thugs demand money, a contradiction. Therefore, $\mu(\text{demand}) < \frac{m}{pD}$. **E** is indifferent between paying and not if $\mu(\text{demand}) = \frac{m}{m+D-Dp} = \frac{\theta}{\theta+(1-\theta)x}$. Thus, if $\sigma_F^{t=1} = x = \frac{\theta D(1-p)}{m(1-\theta)}$ then **E** randomises his choice.

Next consider **F**'s decision to punish: $U_F(\text{punish}) = -R + m - r$ and $U_F(\text{no punish}) \geq -r + 0$. If $R \geq m$ then **F** prefers not to punish.

Does **M** punish when the police presence is high? $U_M(\text{punish}|\text{high}) = -1 + m$ and $U_M(\text{no punish}|\text{high}) = 0 + p(\text{pis M's expected payoff in the second period since E's beliefs, } \mu(\text{no violence}), \text{mean that E never pays})$. Thus, if $p \leq m - 1$ then **M** punishes during a high police presence.

Finally, consider the initial decision to demand money.

Case (i) $p \geq \frac{m+D}{2D}$ and $\theta < \frac{2m}{m+D}$. In order that **F** randomises, **F** must be indifferent. $U_F(\text{demand}) = -r + \sigma_E^{t=1}(m + m - r)$ and $U_F(\text{no demand}) = 0$. Therefore, if $\sigma_E^{t=1} = \frac{r}{2m-r}$ then **F** is indifferent and randomising is optimal.

Case (ii) $p \leq \frac{m+D}{2D}$ and $\theta < \frac{m}{m+D-Dp}$. In order that **F** randomises, **F** must be indifferent. $U_F(\text{demand}) = -r + \sigma_E^{t=1}(m)$ and $U_F(\text{no demand}) = 0$. Therefore, if $\sigma_E^{t=1} = \frac{r}{m}$ then **F** is indifferent and randomising is optimal. QED.

6.6 Equilibrium IIIa.

If $R \leq m$, $p \leq m - 1$ and $\theta \geq \frac{m^2}{pD^2}$ then the strategy profile $\sigma_F^{t=1} = 1$,

$$\sigma_M^{t=1} = 1, \sigma_E^{t=1} = 1, s_F^{t=1} = \begin{cases} 1 & \text{if } \theta \geq \frac{m}{pD} \\ y = \theta \frac{-m+Dp}{m(1-\theta)} & \text{if } \theta < \frac{m}{pD} \end{cases} 1, s_M^{t=1}(\text{high}) = 1,$$

$s_M^{t=1}(\text{low}) = 1$ and $\sigma_E^{t=2}(\text{violence}) \begin{cases} 1 & \text{if } \theta \geq \frac{m}{pD} \\ \frac{R}{m} & \text{if } \theta < \frac{m}{pD} \end{cases}$ is a sequential equilibrium with beliefs $\mu(\text{demand}) = \theta$, $\mu(\text{no demand}) = 0$, $\mu(\text{violence}) =$

$$\begin{cases} \theta & \text{if } \theta \geq \frac{m}{pD} \\ \frac{m}{pD} & \text{if } \theta < \frac{m}{pD} \end{cases} \text{ and } \mu(\text{no violence}) = 0.$$

Proof: Note that the beliefs are all consistent with Bayes' rule. Therefore, we simply need to check that every player is utility maximising given their type, their beliefs and the strategy of the other players.

Consider E's decision to pay in the first period. There are two cases:

(i) if $\theta \geq \frac{m}{pD}$ then $U_E(\text{pay}) = -2m$ (E would also pay in the second period given these beliefs). Since all types punish, E learns nothing from punishment and so also pays in the second period. If E refuses to pay then $U_E(\text{no pay}) = -D - m$. Therefore, $\sigma_E^{t=1} = 1$.

(ii) if $\theta < \frac{m}{pD}$ then $U_E(\text{pay}) = -m - \mu(\text{demand})pD$. If E refuses to pay then $U_E(\text{no pay}) = -D - m + (1 - \mu(\text{demand}))(1 - y)(m + D)$. Since $y = \theta \frac{-m+Dp}{m(1-\theta)}$, $U_E(\text{no pay}) = -D - m + (1 - \theta)(1 - \theta \frac{-m+Dp}{m(1-\theta)})(m + D) \leq U_E(\text{pay})$ if $\theta \geq \frac{m^2}{pD^2}$.

Therefore, $\sigma_E^{t=1} = 1$ is a best response.

Next consider F's decision to punish. There are two cases:

(i) $\theta \geq \frac{m}{pD}$. $U_F(\text{punish}) = -R + m - r$ and $U_F(\text{no punish}) \geq -r + 0$. If $R \leq m$ then F prefers to punish.

(ii) $\theta < \frac{m}{pD}$. $U_F(\text{punish}) = -R + \sigma_E^{t=2}(\text{violence})m - r$ and $U_F(\text{no punish}) \geq -r + 0$. Since $\sigma_E^{t=2}(\text{violence}) = \frac{R}{m}$ then F is indifferent and $s_F^{t=1} = \theta \frac{-m+Dp}{m(1-\theta)}$ is a best response. Note that given $s_F^{t=1} = \theta \frac{-m+Dp}{m(1-\theta)}$, $\mu(\text{violence}) = \frac{m}{pD}$ and E is indifferent about paying in the second period.

Does M punish when the police presence is high? There are two cases:

(i) $\theta \geq \frac{m}{pD}$. $U_M(\text{punish|high}) = -1 + m$ and $U_M(\text{no punish|high}) = 0 + p$ (is M's expected payoff in the second period since E's beliefs $\mu(\text{no violence})$ mean that E never pays). Thus, if $p \leq m - 1$ then M punishes during a high police presence.

(ii) $\theta < \frac{m}{pD}$. $U_M(\text{punish|high}) = -1 + \sigma_E^{t=2}(\text{violence})m + (1 - \sigma_E^{t=2}(\text{violence}))p = -1 + \frac{R}{m}m + (1 - \frac{R}{m})p = \frac{-m+Rm+pm-pR}{m}$ and $U_M(\text{no punish|high}) = 0 + p$. Since $p \leq \frac{m}{R}(R - 1)$ then punishing is a best response.

The punishment decision depends upon whether or not $\theta \geq \frac{m}{pD}$. However, the equilibria are operationally equivalent since E always pays.

Finally, consider the initial decision to demand money. Since E always pays it is always optimal to demand money. QED.

6.7 Equilibrium IIIb.

If $R \leq m$, $p \leq m - 1$ and $\theta < \frac{m^2}{pD^2}$ then the strategy profile $\sigma_F^{t=1} = x = \theta \frac{pD^2 - m^2}{m^2(1-\theta)}$, $\sigma_M^{t=1} = 1$, $\sigma_E^{t=1} = \frac{r}{m}$, $\sigma_E^{t=2}(\text{violence}) = \frac{R}{m}$, $s_F^{t=1} = y = m \frac{-m + Dp}{pD^2 - m^2}$, $s_M^{t=1}(\text{high}) = 1$, $s_M^{t=1}(\text{low}) = 1$ is a sequential equilibrium with beliefs $\mu(\text{demand}) = \frac{\theta}{\theta + (1-\theta)x} = \frac{m^2}{pD^2}$, $\mu(\text{no demand}) = 0$, $\mu(\text{violence}) = \frac{\mu}{\mu + (1-\mu)y} = \frac{m}{pD}$ (where $\mu = \mu(\text{demand})$) and $\mu(\text{no violence}) = 0$.

Proof: Note that the beliefs are all consistent with Bayes' rule. Therefore, we simply need to check that every player is utility maximising given their type, their beliefs and the strategy of the other players.

Consider E's decision to pay in the first period. $U_E(\text{pay}) = -m - \mu(\text{demand})Dp$, since $\mu(\text{demand}) = \frac{\theta}{\theta + (1-\theta)x} < \frac{m}{Dp}$, E plays the semi-pooling equilibrium in the second period. If E refuses to pay then $U_E(\text{no pay}) = (-D - m)(\mu + (1 - \mu)y) + (1 - \mu)(1 - y)0$, where $\mu = \mu(\text{demand}) = \frac{\theta}{\theta + (1-\theta)x}$. Thus, if $-m - \mu Dp = (-D - m)(\mu + (1 - \mu)y)$ then $y = \frac{-\mu D - \mu m + m + Dp\mu}{(1 - \mu)(D + m)}$ makes E indifferent: $\sigma_E^{t=1} \in [0, 1]$.

Next consider F's decision to punish: $U_F(\text{punish}) = -R + \sigma_E^{t=2}(\text{violence})m - r$ and $U_F(\text{no punish}) = -r + 0$. If $\sigma_E^{t=2}(\text{violence}) = 1$ then F always punishes; if $\sigma_E^{t=2}(\text{violence}) = 0$ then F never punishes; and if $\sigma_E^{t=2}(\text{violence}) = \frac{R}{m}$ then F is indifferent. In order that E randomises in the second period we require that $\mu(\text{violence}) = \frac{m}{pD} = \frac{\mu}{\mu + (1-\mu)y}$. Hence, $y = \mu \frac{pD - m}{m(1-\mu)} = \frac{-\mu D - \mu m + m + Dp\mu}{(1-\mu)(D+m)}$. This implies that $\mu(\text{demand}) = \frac{m^2}{pD^2} = \frac{\theta}{\theta + (1-\theta)x}$ and hence that $x = \theta \frac{pD^2 - m^2}{m^2(1-\theta)}$ and $y = m \frac{-m + Dp}{pD^2 - m^2}$.

Does M punish when the police presence is high? $U_M(\text{punish}|\text{high}) = -1 + \sigma_E^{t=2}m + (1 - \sigma_E^{t=2})p = -1 + R + (1 - \frac{R}{m})p$ and $U_M(\text{no punish}|\text{high}) = 0 + p$. Thus, if $p \leq \frac{Rm - m}{R} = \frac{m}{R}(R - 1) > 1$ then M punishes during a high police presence.

Finally, consider F's decision to demand money. $U_F(\text{demand}) = \sigma_E^{t=1}(m - r + 0) + (1 - \sigma_E^{t=1})(-R + \sigma_E^{t=2}(\text{violence})m - r)$. $U_F(\text{no demand}) = 0$. Therefore, if F randomises his demand decision, $\sigma_E^{t=1} = \frac{r}{m}$, F is indifferent and randomising is a best response. QED.

7 References

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Figure 1: The Mafia/Entrepreneur Game

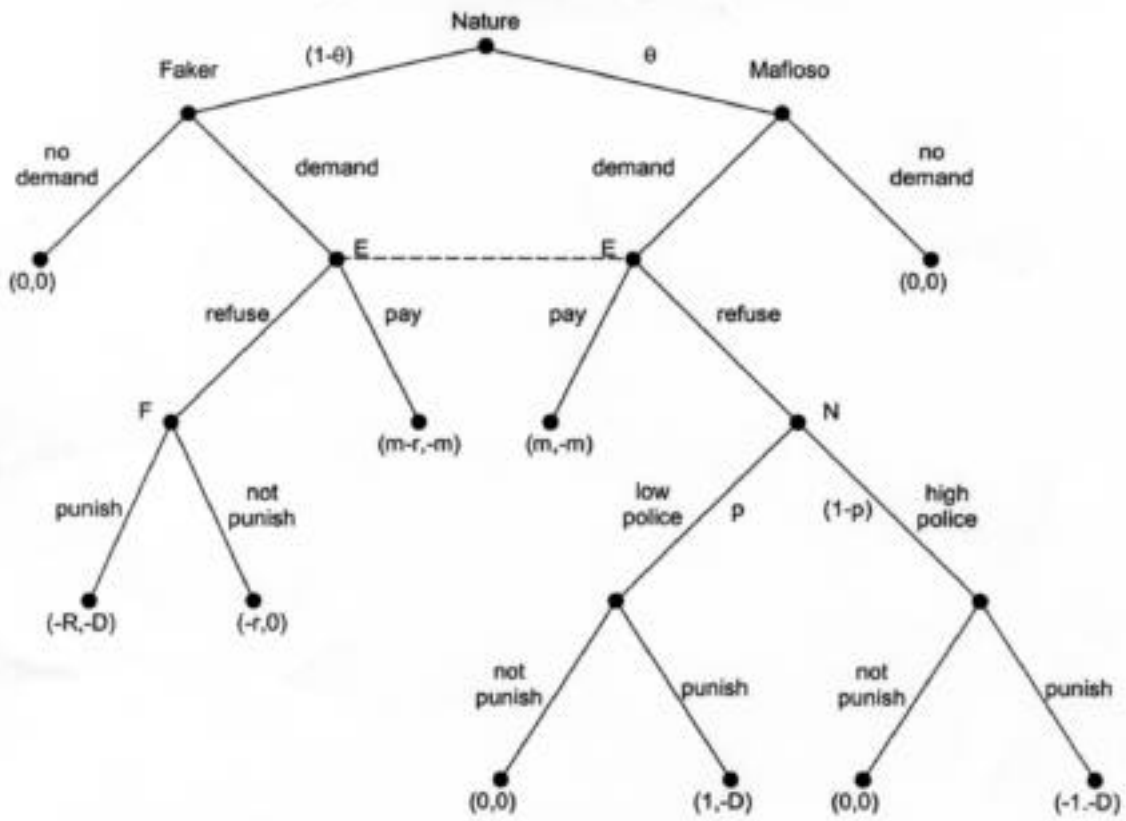


Figure 2: Outcomes in the Mafia Game

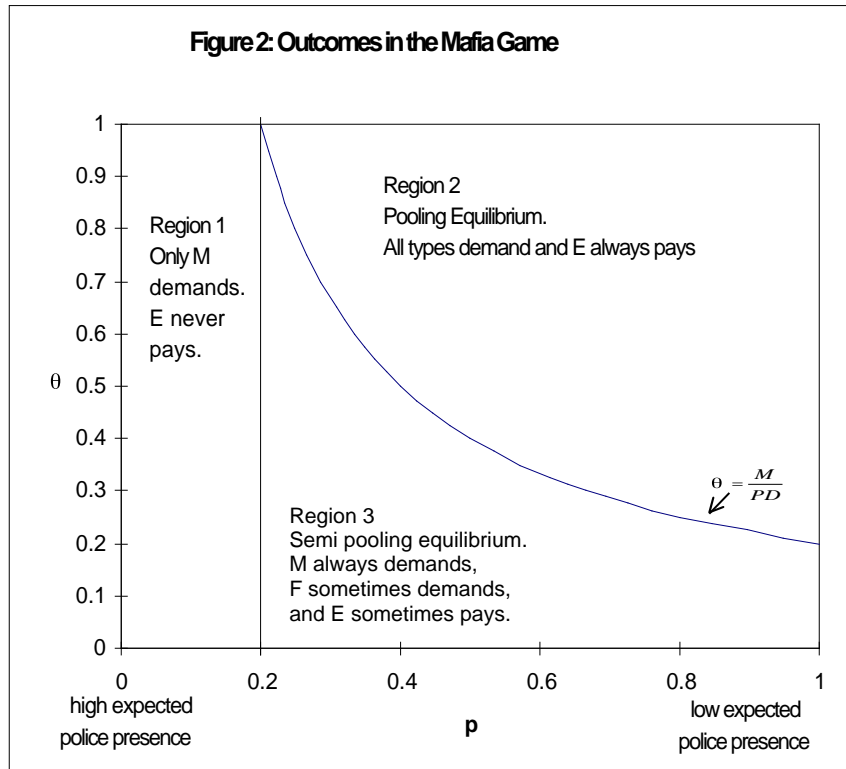


Figure 3: Equilibrium Ia and Ib in the twice repeated Mafia/Entrepreneur game

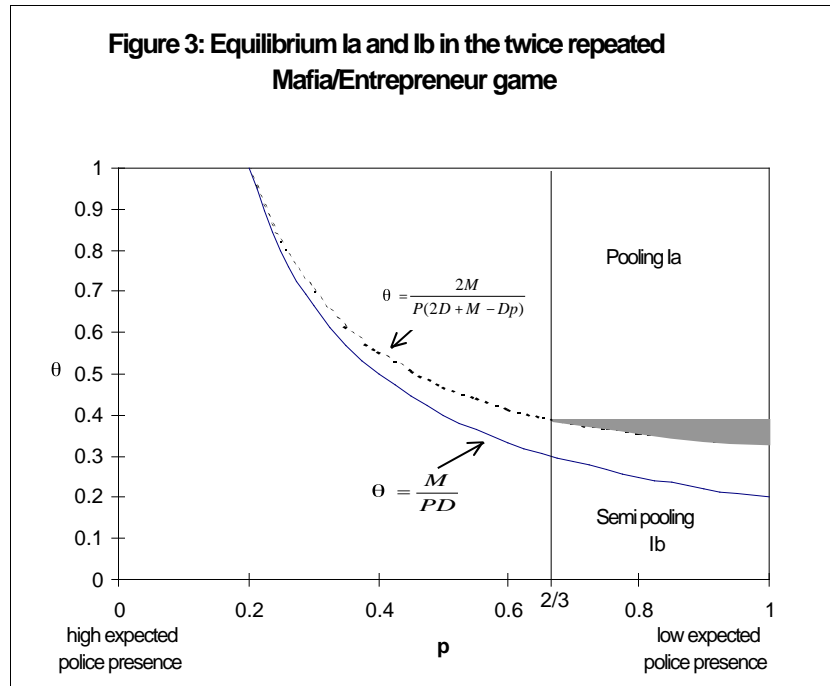


Figure 4: Equilibria Ia and Ib in the twice repeated Mafia/Entrepreneur game

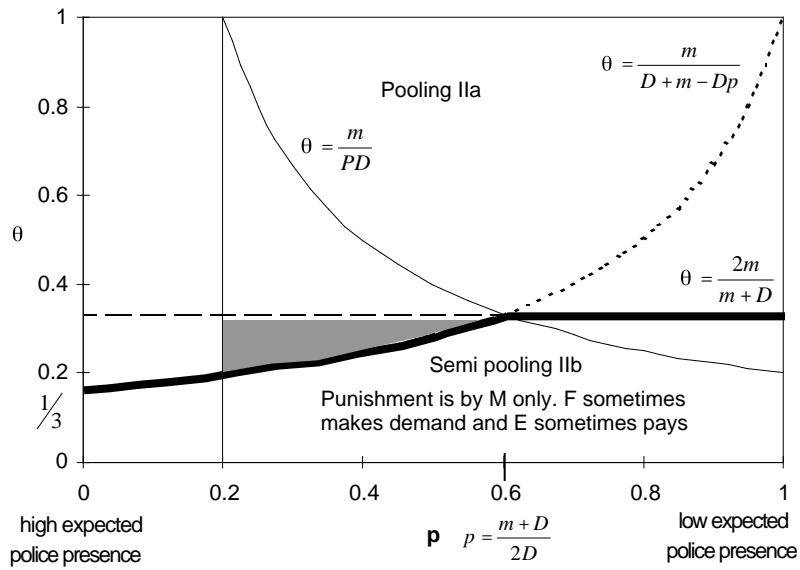


Figure 5: Equilibria IIIa and IIIb in the twice repeated Mafia/Entrepreneur game

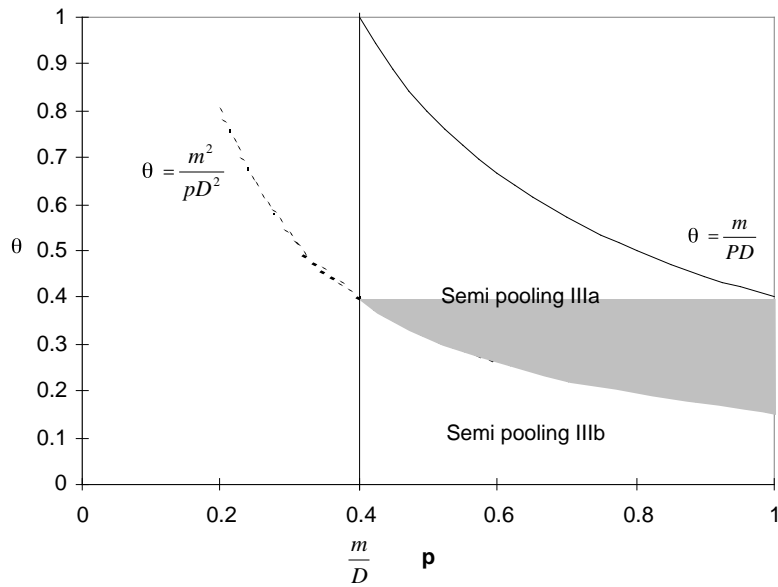


Figure 6: The effect of changing the level of policing on the occurrence of violence in the dynamic setting

