

# Private States and the Enforcement of Property Rights

## Theory and evidence on the origins of the Sicilian mafia

Oriana Bandiera\*

London School of Economics and CEPR

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### Abstract

Historical records show that the Sicilian mafia initially developed to protect land from predatory attacks, at a time when publicly provided security was scarce and banditry widespread. Using a common-agency model, the paper shows that: (i) it is optimal for each landowner to voluntarily buy protection even if this results in a worse equilibrium for the landowning class as a whole and (ii) other things equal, mafia profits are higher where land is more fragmented. The argument is based on the fact that protection involves an externality because by buying protection each landowner deflects thieves on others' properties. Because of the externality, for each landlord protection is more valuable if he is one of the few to receive it, thus each landlord will be willing to pay more if some landlords are left out. Land fragmentation increases the number of landlords who would pay to keep some out, which in turn increases mafia's profits. Using qualitative data from a parliamentary survey (1881), the paper also shows that in 19<sup>th</sup> century rural Sicily mafia was in fact more likely to be active in towns where land was more divided.

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*The mafia is, essentially, nothing but the expression of a need for order, for the control of a State.*

Giovanni Falcone<sup>1</sup>

## **1. Introduction.**

In most societies throughout history, property rights enforcement has been administered by a central authority, a “State”. While it is agreed that States typically emerge whenever a power vacuum occurs, the process through which this happens is still subject to debate.

The “contractual” view, dating back to Hobbes and Locke and recently taken by Nozick (1974), maintains that starting from a situation of anarchy individuals voluntarily delegate the task of enforcing property rights and, consequently, the monopoly over violence to a protection agency, a “minimal State”. One commonly accepted corollary of this view is that the establishment of a State must increase social welfare, otherwise individuals would not voluntarily agree to it.

In the alternative view, dating back to Hume and recently taken by Tilly (1985) and Olson (1993), the link is reversed: the groups that can organize the greatest capacity for violence impose their rule over other agents in the economy and then use their monopoly over violence to extract rents via taxation.

The existing evidence suggests that some organised crime groups initially emerged to enforce lawful property rights when formal authority was weak or altogether missing. The origin of these groups in many cases resembles that of States and does therefore raise similar issues. The purpose of this paper is to identify, model and test the conditions that promoted the rise of the Sicilian mafia in the 19<sup>th</sup> century, focussing in particular on the fragmentation of landholdings

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<sup>1</sup> Judge Giovanni Falcone devoted most of his career to fighting the Mafia, often very successfully. He was killed on May 23<sup>rd</sup>, 1992. The quote is from Falcone (1991).

that followed the abrogation of feudalism. The historical evidence reviewed below suggests that, after the abrogation of feudalism, monopoly over violence shifted from the class of large landowners to the mafia.

Based on this evidence, the paper builds a formal model that analyses the relationship between the mafia and the landowners and explores the link between land fragmentation and the rise of the mafia.

The predictions of the model are then tested using a 1881 parliamentary survey which contains qualitative data on land fragmentation and mafia activity at the town level. Although it is tailored to the Sicilian case, the theoretical framework can easily be adapted to analyse the rise of other groups, such as the Japanese and Russian mafias, that formed under surprisingly similar circumstances.<sup>2</sup> More importantly, understanding the origins of the Sicilian mafia can help identify the potential for mafia in other societies.

Historical records show that, after the abrogation of feudalism, large landowners willingly started paying the mafia to protect their properties from predatory attacks. The records suggest that landowners voluntarily passed on the monopoly over violence to the mafia, in line with the contractual view. That a conflict between the mafia and the landowners never took place provides further evidence in favour of this view. Indeed since at the time the class of large landowners retained most of its feudal power, the mafia could not have imposed its rule against their will without a fight. The fact that such a conflict never occurred and that, on the contrary, landowners often protected *mafiosi* from the police,<sup>3</sup> then suggest that the monopoly over

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<sup>2</sup>See e.g. Varese (1994), Milhaupt and West (2000).

<sup>3</sup> The relationship between the mafia and landowners resembled that between American gangs and the community they live in: gangs provide protection to the community and this, in return, tolerates the gang's illegal activities and protects it from the police. (see Jankowsky 1991)

violence was voluntarily transferred from the landowners to the mafia, rather than being usurped by the latter.

This, however, seems in contrast with the evidence suggesting that the mafia practised extortion and that the class of large landowners was ultimately damaged by its existence. The two views can be reconciled as follows. First, the mafia was both an enforcer and an extorter. It gained legitimacy through the enforcement services it provided to the upper classes and then exploited the power and violent reputation thus acquired to threaten others and extract rents via extortion. Second, that landowners willingly bought protection from the mafia is not necessarily inconsistent with the landowning class as a whole to be worse off as a result. Indeed, since by purchasing protection an agent deflects predators onto other properties, protection entails a negative externality that individuals do not take into account.<sup>4</sup> Due to the externality it was rational for every landlord to purchase protection even if that resulted in a Pareto-inferior equilibrium for the land-owning class as a whole.

This intuition is formalised using a common agency model that analyses the relationship between landlords and the mafia and the impact of land distribution on mafia's profits. The model shows that an equilibrium in which all landlords purchase protection always exists and that redistributing land among many increases mafia's profits and hence fosters its development.

Intuitively, since for each landlord protection is more valuable if he is one of the few to receive it, each landlord will be willing to pay more if some landlords are left out. It then follows that as number of landlords increase, there are more landlords who would pay to keep some out. Consequently, the surplus received by the mafia increases as landholdings get more divided.

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<sup>4</sup> Car alarms provide a simple illustration: two identical cars face the same probability of being stolen, if one owner installs the alarm the probability of his car getting stolen decreases while for the other owner it increases, if the second owner also installs the alarm the value of the first alarm falls because now both cars will again get stolen with the same probability.

Interestingly, the model shows that land fragmentation generates competition for protection even if the assets in need of protection are unchanged and that, as expected, mafia's revenues are higher if there are more assets in need of protection. The model also suggests that mafia is "more active", i.e. it offers more protection, in areas where landholdings are more divided. Finally, the model shows that even if the cost of protection is low, mafia will optimally choose not to offer full protection. This implies that, as observed in reality, some thefts will take place and thieves go unpunished even if properties are under the protection of the mafia.

Although data on mafia's profits are, not surprisingly, unavailable, information on mafia's presence in different towns can be used to assess whether the predictions of model are consistent with the empirical evidence. To the extent that higher potential profits increase the probability that mafia is active in a town, the variables that have a positive impact on profits increase the likelihood of observing mafia activity in that town. Qualitative information on the distribution of landholdings and on mafia activity in seventy Sicilian towns has been extracted and coded from a 1881 parliamentary survey. The coefficient estimates indicate that the mafia was more likely to be active in towns where land was more divided and land assets more valuable and that the intensity of mafia activity was positively correlated with the degree of land fragmentation. Although, due data limitations, a rigorous test of the theory is not feasible, the results clearly show that the predictions of the model are at least consistent with the available empirical evidence.

The remainder of the paper is organised as follows. Section 2 discusses the related literature. Section 3 describes the market for protection in 19<sup>th</sup> century rural Sicily and then draws from police reports and parliamentary inquiries to illustrate the relationship between mafia and the landlords. The formal model is introduced in Section 4. Section 5 presents the empirical results, Section 6 concludes.

## 2. Related Literature.

For more than a century the Sicilian mafia has been depicted, more or less accurately, in countless movies and novels whilst also attracting the attention of a broad range of scholars. Among these, Franchetti (1876) and Gambetta (1994) present the most lucid analysis of the origins of the mafia and most of the assumptions in this paper are based on their work.

The paper also relates to the rapidly growing economic literature on states, property rights enforcement and organised crime. Grossman (1997) provides a justification as to why a society might prefer protection from a "king" to decentralised protection, even if the king is "predatory", i.e. maximising his own welfare rather than society's. He analyses a general equilibrium model in which the predators' success rate, and hence the number of predators in equilibrium, depends on total resources devoted to protection. The result then follows from the fact that when choosing investment in protection the individual producers do not internalise this positive externality whereas the king does. Similarly, Olson (1993) argue that a predatory king would provide public goods that increase national output if doing so would allow him to extract more revenue. In a more general model, however, Moselle and Polak (1997) show that a predatory State can instead reduce social welfare. An implicit assumption in this literature is that the stability of such regimes ensues because all agents are better off than in anarchy. This paper, in contrast, shows that a predatory regime, the mafia, can emerge and last even if all agents would be better off in anarchy. The result here follows from the fact that when buying protection each agent ignores the negative externality he imposes on others and that agents cannot co-ordinate to play the Pareto-superior equilibrium. deMeza and Gould (1992) make a similar point by showing that because of the negative externality, decentralised purchase of protection might yield an inefficient outcome. Compared to theirs, this paper takes the

argument further by analysing the impact of alternative distribution of property rights on the surplus received by the group that sells protection.

Most of the economic literature on organised crime models these groups as states, selling protection in exchange of taxes. Both Schelling (1984) and Grossman(1995) argue that mafias act as “governments of the underworld”, that is enforce property rights in markets where, due to the illegality of transactions, the State cannot. That mafias enforce illegal deals is supported by a large body of empirical evidence<sup>5</sup> and raises a number of interesting issues, which, however, go beyond the scope of this paper. Skaperdas and Syropoulos (1995) aim, like this paper, to analyse how “gangs” can emerge out of anarchy and achieve a monopoly over violence within their territory. They assume that some agents have a comparative advantage in violence from which it follows that these agents will monopolise violence and employ it for extortion. In their paper gangs as States thus emerge through coercion. This paper, in contrast, analyses the complementary case in which monopoly over violence is voluntarily transferred from one group to the other even if this results in a worse equilibrium for agents in the first group.

### **3. The market for protection and the origins of the Sicilian mafia: historical evidence.**

The mafia first emerged in Western Sicily during the Bourbon rule, sometime after the abrogation of feudalism (1812) and before the creation of the Italian State (1861).<sup>6</sup> The land

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<sup>5</sup> See Gambetta(1993), Falcone(1991), Gambetta and Reuter (1995) for the Sicilian mafia; Firestone (1997) for the American mafia, Varese (1994) for the Russian mafia, Milhaupt and West (2000) for the Japanese mafia.

<sup>6</sup> The word itself was first used in a theatrical play written by Giuseppe Rizzotto (1863) “I mafiosi de la Vicaria” which describes the behaviour and the activities of a group of “*mafiosi*”, momentarily imprisoned in Palermo’s jail (the Vicaria). The word “*Mafia*” made its first official appearance in a report by the chief prosecutor in Palermo, Filippo Gualtieri, in 1865. Some scholars trace its origins back to the 17th and 18th centuries, identifying as mafiosi the armed guards who were paid by the barons to patrol their estates. Still, these guards were essentially employees

reforms that followed the abrogation of feudalism instituted private property rights, redistributed church and communal land and partially partitioned feudal fiefs. The reforms resulted in a sharp increase in the numbers of large landowners –from 2,000 to 20,000 according to Mack Smith(1964)—but failed to redistribute to the farmers.

The institution of private property rights was not accompanied by the creation of an adequate enforcement mechanism. Police forces were insufficient in number and generally ineffective, mostly because many policemen were recruited among bandits and usually did not persecute their former colleagues.

Predatory attacks to property were quite frequent, both because of the large number of bandits<sup>7</sup> and because there was no permanent human presence on land. Landowners typically lived in major towns and rented out their estates to large tenants who, in turn, hired casual workers to cultivate it or subleased to smaller farmers. Both the large tenants and the workers lived in nearby villages and travelled to the fields as needed.<sup>8</sup>

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of the barons and the practice of hiring criminals as private guards was not uncommon in other areas of Italy, where the Mafia did not develop. Other scholars maintain that the Mafia emerged only after Italian Unification (1860). This view is inconsistent with the fact that the first reports on the Mafia by Italian prosecutors already describe well-established organisations that could not possibly have developed in a few years. Furthermore, in 1838 the chief prosecutor in Trapani, don Pietro Ulloa, notified the Minister of Justice of the existence of Mafia activity.

<sup>7</sup> As their standard of life rapidly declined, many peasants turned to banditry. Mack Smith (1968) reports that between 1798 and 1861 population increased by 0.4 millions while, due to the unchanged production structure, agricultural output remained fairly constant. After the abrogation of feudalism, peasants were made even poorer by the abolition of common rights for which they received no compensation.

<sup>8</sup> Since the farming techniques did not require permanent workers, most workers were employed daily. Those who owned a mule and a plough could be hired seasonally to cultivate some small plots often distant from each other. Since they either had to travel between the different plots or had to be physically present at the market for daily workers, the peasants lived in the closest town and travelled daily to the fields.



Widespread banditry, the inadequacy of publicly provided security and the lack of permanent presence on the land generated a strong demand for private protection. On the other side of the market, the armed guards formerly at the service of the feudal lords had the skills and the willingness to provide it. The division of land that followed the abrogation of feudalism was crucial for the development of the mafia: the guards gained autonomy and offered their services to a larger number of clients. Franchetti (1876) writes: *“The difference in social relationships brought about by the abolition of feudalism came down to this: Just like wealth, tyrannical acts became accessible to a greater number of people, and the class of villains, who before had been at the service of the barons, became independent; so in order to obtain their services it became necessary to deal with them as equals.”* (p.81)<sup>9</sup>

Contemporary police reports, parliamentary surveys and scholarly writings<sup>10</sup> suggest that landowners paid the mafia to protect their properties from predatory attacks. As argued above, the fact that the mafia did not have to fight the landowners to impose its rule suggests that the latter voluntarily purchased protection. Most sources confirm that in fact landlords voluntarily hired the mafia, those who disagree argue on the grounds that landlords could not have voluntarily chosen a worse equilibrium.<sup>11</sup> As explained above, however, that landowners willingly bought protection from the mafia is not inconsistent with the landowning class as a whole to be worse off as a result because of the externality entailed in protection. The evidence

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<sup>9</sup> A decade after unification, the Italian Parliament devoted much attention to the issue of law enforcement in Sicily. After an intense debate, in 1875 the Lower Chamber approved a bill on the “Use of extraordinary measures to enforce public security” and instituted a Parliamentary Survey Commission to collect direct evidence on the state of the Sicilian society. At the same time, L. Franchetti and S. Sonnino, two social scientists both members of parliament, organised a parallel survey with the purpose of collecting and conveying information which, due to political constraints, the official survey was likely to omit.

<sup>10</sup> Most of these are reprinted in a book edited by Russo (1964).

also shows that the services<sup>12</sup> provided to the upper classes gave the mafia legitimacy and power, which it then used to start an independent career and pursue its own interests. The 1875 Parliamentary Inquiry on the Conditions of Sicily reads: “Eventually the landowners **preferred to hire** the best and most violent bandits as guardians of their properties, thus using the criminal reputation of one as a defence against the crimes of others and creating a sort of profession or career for the most daring criminals”.<sup>13</sup> In a report to the Ministry of Justice, a Sicilian magistrate wrote: “..at the same time the mafia gives and receives protection; and the more **people ask for mafia’s help** rather than for legitimate enforcement, the stronger it becomes”<sup>14</sup>. Most importantly, Franchetti (1876) shows that landlords willingly hired the mafia even if they ended up suffering from its rapidly acquired power: “indeed, notwithstanding the fact that the industry of violence has its own interests and independent reasons to exist, it is the upper classes that put it in these conditions and allow it to survive. If the upper classes wished to destroy such industry, they would have both the means and the moral authority to do so. Nor it can be maintained that either the fact that the upper classes are occasionally damaged by the mafia or the fact that they complain about how much power it has acquired can be taken as a proof that it has by now overpowered them. Because if **the ruling classes want to employ** the violent groups for their own purposes, they must let them pursue their own independent interests”.<sup>15</sup>

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<sup>11</sup> See for instance Sicilian magistrates’ reports in Russo (1964) p.32.

<sup>12</sup> The evidence also suggests that the ruling classes used the services of the mafia to other more or less legal purposes. For instance the mafia soon became involved in political elections and was paid to guarantee votes. In a report to the Ministry of Internal Affairs, the prefect of Palermo wrote: “The upper classes use it (the mafia) to protect themselves and their property from bandits but also as a mean to preserve their overbearing influence and preponderance, which they are afraid to lose as a consequence of liberal progress” (Russo (1964) p.12).

<sup>13</sup> Russo (1964), p.196, emphasis added.

<sup>14</sup> Russo (1964), p.34, emphasis added.

<sup>15</sup> Franchetti (1876) p.113-4, emphasis added

Finally, it is worth noting that the mafia was not a formal organisation regulated by rules or laws. The 1875 Parliamentary Inquiry on the Conditions of Sicily reads: “*The mafia is not an association that has established set forms or special structures; neither is it a temporary grouping of criminals with a transitory or precise aim; it does not have statutes, it does not pay dividends, it does not hold meetings, it does not have leaders.*”<sup>16</sup> Similar evidence can be found in police reports and other Parliamentary inquiries.<sup>17</sup> Although a centrally coordinated organisation did not exist, *mafiosi* operated in small groups called “*cosche*”. Generally there was only one group in each village, with the exception of larger towns where two or more groups shared the territory. Groups hardly interacted with one another, except for occasional co-operation (e.g. recovery of stolen goods) or for border wars.<sup>18</sup>

#### **4. The model: land division and the rise of the mafia.**

The analysis above suggests that the division of landholdings following the abrogation of feudalism played an important role for the development of the mafia. This section builds a formal model to analyse the market for protection and the link between land fragmentation and mafia activity. It is assumed that each landlord faces a positive probability of getting his income stolen and that he can buy protection from the mafia to decrease that probability. The interaction between mafia and landlords is modelled as game in two stages. In the first stage, identical landlords offer the mafia a monetary reward to protect their land income from theft. Since, as noted above, each landlord values protection more when he is one of the few to get it, the monetary reward each landlord offers will reasonably depend on how many other landlords

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<sup>16</sup> Russo (1964), p.182

<sup>17</sup> See reports from the prefects of Palermo, Trapani, Girgenti and Caltanissetta (reproduced in Russo (1964) p.14, p.18, p.21, p.25). See also Franchetti (in Russo (1964) p.352) and inspector Alongi’s report (Russo (1964) p.388)

<sup>18</sup> See e.g. Mosca (1900) in Russo p.450 and Gambetta (1994).

receive protection. Landlords will thus propose a menu of offers, one for each combination of protected/unprotected landlords.<sup>19</sup> In the second stage, the mafia looks at the landlords' offers and decides how many to protect in order to maximise the sum of contribution. It will be shown that an equilibrium where each landlord buys protection always exist and land fragmentation -- i.e. an increase in the number of landlords for a given extension of land-- generates competition for protection, which, in turn, promotes mafia activity.

#### **4A. Set up.**

Consider a fixed amount of land that yields income  $Y$  and that, after the reform, is equally divided among  $n$  landlords. Based on the evidence in section 2, I assume that there are constant returns to scale, that is, total income  $Y$  is independent of  $n$ .<sup>20</sup> Land is subject to predatory attacks by bandits, whose supply is assumed to be inelastic.<sup>21</sup>

Furthermore I assume that:

- (i) if a landlord is not protected he is always attacked and all his income is stolen;
- (ii) the mafia can successfully protect an exogenously fixed share  $\pi^*$  of total land income.

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<sup>19</sup> For instance, in the case of two landlords there are 4 such combinations: 1. A and B protected, 2. only A protected, 3. only B protected, 4. neither protected.

<sup>20</sup> Note that if, as a consequence of land fragmentation, total income were to rise, this would open an additional channel through which fragmentation would increase the demand for protection.

<sup>21</sup> The assumption is consistent with the historical evidence discussed in section 2. If bandit supply were elastic, the protection choice of the mafia would affect the number of bandits in equilibrium. This, in turn, would affect the equilibrium outcome but not the maximisation problem of the mafia, unless the latter were to internalise its effect on the supply of bandits.

Assumption (i) is without loss of generality<sup>22</sup>. (ii) is relaxed in Section 3.C where the mafia is allowed to choose  $\pi^*$ .

Denote by  $\mathbf{p}=(p_1, p_2 \dots p_n)$  a “protection vector” where  $p_j=1$ , if landlord  $j$  is protected and  $p_j=0$  if he is not. Let  $\mathbf{p}^k$  denote a protection vector such that  $(n-k)$  landlords are protected and  $k$  are not. Let  $(1-\pi^{n-k}(\mathbf{p}^k))$  denote the probability that a landlord gets his income stolen if he belongs to the group of the  $(n-k)$  protected landlords while  $(1-\pi^k(\mathbf{p}^k))$  denotes the probability that a landlord gets his income stolen if he belongs to the group of the  $(k)$  unprotected landlords. As shown in the Appendix, assumptions (i) and (ii) imply that

$$\begin{aligned} (1-\pi^k(\mathbf{p}^k)) &= 1 \\ (1-\pi^{n-k}(\mathbf{p}^k)) &= \max\left\{0, 1 - \frac{n}{n-k}\pi^*\right\} \quad k = 0, \dots, n-1 \end{aligned} \quad (1)$$

That is, if a landlord is not protected his income is stolen with probability one. If a landlord is protected and there are many unprotected landlords (that is if  $k > (1-\pi^*)n$ ) then the probability of his income being stolen is zero. If many landlords are protected (that is if  $k < (1-\pi^*)n$ ) each protected landlord gets his income stolen with probability  $(1-n/(n-k)\pi^*)$  which is higher the lower the number of unprotected landlords. Note that each landlord values protection more if he is the only one or one of the few to be protected because thieves would rather attack unprotected property. This implies that landlords compete for protection because

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<sup>22</sup> It is assumed that this is true for every choice of the other landlords. Assuming that when nobody buys protection, everybody is stolen with the same probability (different than one) yields similar results.

every protected landlord imposes a negative externality on the others, making their protection less valuable.<sup>23</sup>

Since the mafia protects property income rather than people, the cost of providing protection only depends on the extension of land protected rather than on the number of landlords who own it. Without loss of generality<sup>24</sup> the model assumes that the cost of protection is negligible, on the grounds that protection offered by mafia-groups was a matter of reputation rather than of effective patrolling. Blok(1968)'s interview with an former estate manager provides an illuminating example: “...cattle rustling were rampant at the time (...) when we employed a *campiere-mafioso*<sup>25</sup> the robberies stopped. We paid the man a regular yearly salary, but he only rarely inspected our farm. Now and again he would turn up. (...) he did not need to bother about much more than just these occasional visits, since he let it be known that he kept watch over that particular estate.” (p.146) Also: “...once the mafioso has succeeded in successfully playing the part of protector he is soon regarded as competent in those things...The smooth progress of his enterprise is guaranteed less by actual physical force and increasingly by this competence attributed to him” (Hess 1973).

The model does not deal with the acquisition of reputation. The evidence suggests that this was exogenously determined by the previous activity of the *mafiosi* as armed guards of the baron on the same land. For instance: “...frequently a field guard enjoys the reputation of having already

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<sup>23</sup> As an example, consider the case of two landlords. If landlord A buys protection and landlord B does not, bandits are more likely to attack B than A. If B buys protection as well, bandits are equally likely to attack him or A. It follows that when B buys protection, the value of the protection purchased by A decreases since his probability of being attacked increases.

<sup>24</sup> Note that the model does not crucially hinge this assumption; all the results carry through under the alternative assumption of increasing costs, see discussion below.

<sup>25</sup> “Campiere” is the traditional name for the armed guard.

*committed one or two murders. Once he is surrounded by this aura his career is made and he has become a person who must be feared... a necessary and therefore better paid person"* (Cutrera 1900)

#### **4B. Solution Concept and Results.**

Denote by  $f_i(p)$  landlord  $i$ 's contribution schedules. Landlord  $i$ 's net payoff is then equal to  $q(p) = \pi(p)y - f(p)$  where  $\pi(p)$  is defined by (1). The timing of the game is as follows: in the first stage each landlord chooses  $f(p)$ , in the second the mafia chooses  $p$  to maximise the sum of contributions.

The equilibrium concept used here is that of truthful Nash equilibrium (TNE). The analysis is based on Bernheim and Whinston (1986) and Laussel and Le Breton (2000).

Following Bernheim and Whinston,  $(\{f_i\}_{i=1}^n, p^*)$  is a Nash equilibrium if and only if<sup>26</sup>:

(i)  $f_i(p) \geq 0$  for every  $i$  and  $p$ ;

(ii)  $p^* = \arg \max \sum_{i=1}^n f_i(p)$ ;

(iii)  $p^* = \arg \max \left( \pi_i(p)y_i + \sum_{j \neq i} f_j(p) \right), \quad \forall i, p$ ;

(iv) there exists  $p_i$  that satisfy (ii) such that  $f_i(p_i) = 0$  for all  $i = 1, \dots, n$ .

Condition (ii) must hold since the mafia is assumed to maximise its payoff. Condition (iii) must hold otherwise landlord  $i$  could be better off by offering an infinitesimally bigger contribution for the  $p$  in which (iii) is violated. Finally condition (iv) is needed because if there was not such a value, landlord  $i$  could be strictly better off by lowering his offers for every choice without affecting the mafia's decision.

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<sup>26</sup> For the formal proofs of this and other general results see Bernheim & Whinston (1986).

Bernheim and Whinston show that every truthful Nash equilibrium --defined as a Nash Equilibrium supported by truthful strategies<sup>27</sup>-- is coalition-proof; that essentially truthful equilibria are the only coalition-proof equilibria; and that players can choose to play truthful strategies at no cost (i.e. every player's best response correspondence contains a truthful strategy). Formally,  $f_i(\cdot)$  is a truthful contribution schedule if and only if:

$$f_i(p, W_i) = \max(0, \pi_i(p)y - W_i),$$

where  $W_i$  is some base level of welfare. A truthful strategy is such that for every  $p$  the landlords offer their "net willingness to pay" that is, for every  $p$  they offer an amount that is equal to the difference between their gross payoff at  $p$  and some base level gross payoff.

The following lemmas characterise the solution. Proofs are reported in the Appendix.

**Lemma 1.** *The TNE vector of protection must satisfy:*

$$p^* = \arg \max \sum_{i=1}^n \pi_i(p)y$$

**Lemma 2.** *Every landlord buying protection ( $k=0$ ) is always a Truthful Nash Equilibrium. If  $n$  is small (i.e.  $n < 1/(1-\pi^*)$ ),  $k=0$  is the unique TNE. If  $n$  is large (i.e.  $n \geq 1/(1-\pi^*)$ ) and  $\exists k'$  s.t. for all  $k < k'$   $\pi^* < (n-k)/n$ ; then all the vectors such that  $k$  ( $< k'$ ) landlords are not protected are TNE protection vectors.*

Laussel and Le Breton (2000) show that if there is enough orthogonality between the interests of the principals the equilibrium payoffs are unique, even if the equilibrium is not (Proposition 3.3) Using their result, it can be shown that:

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<sup>27</sup> Formally,  $(\{f_i\}_{i=1}^n, p^*)$  is a Truthful Nash Equilibrium (TNE) if it is a Nash equilibrium and  $(\{f_i\}_{i=1}^n)$  are truthful strategies with respect to  $p^*$ .



**Lemma 3.** For any given  $n$  equilibrium payoffs are unique. Equilibrium contributions are equal to:

$$f(p^*) = (n-1)(y - \pi^* y) \quad \text{for } n < 1/(1-\pi)$$

$$f(p^*) = (n-k-1) \left( \frac{n}{n-k-1} \pi^* y - \frac{n}{n-k} \pi^* y \right) \quad \text{for } n \geq 1/(1-\pi), \quad \forall k = 0..k'$$

Equilibrium contributions are such that in every TNE each landlord's net payoff is equal to the variation in total surplus that occurs when he joins the equilibrium coalition. Intuitively, the marginal landlord has to pay enough to make the mafia indifferent between protecting him or not. That is, he has to compensate for the fact that the protected landlords are willing to pay more to leave him out. The term on the RHS represents the difference between what the protected landlords would pay if the marginal landlord were left out and what the protected landlords would pay if the marginal landlord were protected as well. When  $n < 1/(1-\pi^*)$  the  $(n-1)$  protected landlords would receive  $y$  if the marginal landlord were not to be protected and  $\pi^* y$  if he were. When  $n \geq 1/(1-\pi^*)$ , each landlord is "too small" so that even if one landlord is left out, something will be stolen from the protected landlords. It follows that when  $n \geq 1/(1-\pi^*)$ , the  $(n-k-$

1) <sup>28</sup> protected landlords would receive  $\frac{n}{n-k-1} \pi^* y$  if the marginal landlord were not to be protected and  $\frac{n}{n-k} \pi^* y$  if he were.

Lemma 1 to 3 yield the following:

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<sup>28</sup> Recall that in this case all protection vectors such that  $k < k'$  landlords are not protected are TNE protection vectors.

**Proposition 1:** *The payoff of the mafia-group is always non-decreasing in the number of landlords. For given  $Y$  and  $\pi^*$ , mafiosi's payoff is increasing in  $n$  until  $n=1/(1-\pi^*)$ , and constant thereafter.*

Proof:

Mafiosi's payoff in every TNE equals the sum of landlords' contribution. Using Lemma 3 it can be shown that:

$$\begin{aligned}
 S(p^*) &= \sum_{i=1}^n f_i(p^*) = (n-1)(1-\pi^*)Y & n < \frac{1}{1-\pi^*} \\
 &= \pi^* Y & n \geq \frac{1}{1-\pi^*}
 \end{aligned} \tag{2}$$

Taking the derivative of (2) with respect to  $n$  proves the result.

### Insert Figure 1.

Intuitively, the mafia's payoff depends on  $n$  in two ways. First, as  $n$  increases the number of landlords willing to pay to keep just one without protection increases (this is captured by the  $(n-1)$  term in (2)). Second, the probability of getting one's income stolen when all but one landlord are protected is increasing in  $n$  for  $n$  large. That is, when the land is divided among a few, the share of each is such that if only  $(n-1)$  are protected they face zero probability of getting their income stolen. In other words the income of the unprotected landlord is greater than what the mafia can successfully protect. Then, the difference in gross payoff for each of the  $(n-1)$  protected landlords in the case when the  $n^{\text{th}}$  is not protected and when he is, equals  $(1-\pi^*)y_i$ . For  $n$  sufficiently large the share of the last unprotected landlord is too small and something must get stolen from those who are protected. In this case the difference in gross payoffs is equal to

$\left( \frac{n}{n-k-1} \pi^* - \frac{n}{n-k} \pi^* \right) y$ , which is decreasing in  $n$ . Since when  $n$  is small relative to  $\pi^*$  the first

effect prevails, for  $n$  small the mafia's payoff is increasing in  $n$ . When  $n$  is large the surplus received by the mafia is constant in  $n$  because the increase in the number of landlords who are willing to pay to keep just one out is exactly matched by the decrease in the difference of gross payoffs.

From (2) it follows that:

**Fact 1.** *Given  $n$  and  $\pi^*$ , an increase in land income ( $Y$ ) increases the payoff of the mafia.*

Fact 1 implies that if, as a consequence of land fragmentation, land income increases, the effect of land fragmentation on the profits of the mafia is even stronger.

Finally, it is important to note that in this model setting protection costs equal to zero is just a normalisation. Indeed, since the mafia protects properties rather than people, the cost of protection is just a function of the extension of land protected, regardless of the degree of fragmentation. The division of landholdings would not, therefore, have any effect on costs and similar results would obtain even if providing protection were costly.

#### **4C. Why does mafia tolerate (and may encourage) a positive level of thefts.**

The model can be extended to take into account that, even if in the short run the mafia's policing technology has an exogenous upper limit, in the long run the mafia will choose  $\pi^*$  in order to maximise its profits. Formally  $\pi^*$  can be endogenised by transforming the game into a three stage game in which the mafia chooses  $\pi^*$  in the first stage. Equation (1) leads to:

**Proposition 2.** *For any  $Y$ , the mafia-group's payoff is maximised when  $\pi^*=(n-1)/n$ . Hence the mafia will offer more protection (higher  $\pi^*$ ) when land is divided among many landlords.*

Intuitively, the mafia's surplus is increasing in the level of competition between landlords, which, in turn, is maximised when up to  $(n-1)$  landlords can receive their full income. It is interesting to note that the optimal  $\pi^*$  is always less than one, implying that there successful thefts will take place in equilibrium. In other words, it is optimal for the mafia to tolerate some

positive level of stealing because this keeps the demand for its services high. This also implies that in equilibrium the mafia itself might commission some thefts.

#### ***4D. Alternative explanations and other related issues.***

This paper assumes that, in line with the historical evidence, landowners willingly paid the mafia for its protection services. If, instead, one were to assume that the mafia extorted payment, the link between land fragmentation and mafia's profits would disappear. In fact, if the mafia were strong enough to force landowners to pay, it would also be able to extract the entire surplus regardless of the degree of land fragmentation.<sup>29</sup>

In this model, landlords "move first" by offering the mafia a menu of contributions. Reversing the order of moves does not alter the results as long as the mafia internalises the fact that each landlord's willingness to pay depends on how many other landlords receive protection.

The results of the model follow from the externality that characterises private protection, which, in turn, generates competition among landlords. Similar results would obtain if land reform were to increase land income as this would increase the demand for protection. This effect, however, was probably quite weak in 19<sup>th</sup> century Western Sicily. According to the

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<sup>29</sup> It could be argued that if landlords were just a few they could have co-ordinated to resist mafia's demands, while many landlords would have not been able to co-ordinate because of the standard free rider problem. In this case, land fragmentation would promote mafia activity even if this were an extorter rather than an enforcer. If this explanation were exact, however, we would expect landowners to co-operate with the police in persecuting *mafiosi*, since this would not require any co-ordination. The evidence, in contrast, suggests that landowners often protected *mafiosi* from the police.

historical evidence, in fact, the division of landholdings that took place after the abrogation of feudalism had no impact on productivity.<sup>30</sup>

The mafia is modelled as a single agent, thus ruling out the analysis of the internal structure of the groups and of the competition among different groups. The internal dynamics of the group bear no consequence for the analysis since the group interacted like a single entity towards other agents. Ruling out competition is of no consequence either. Indeed, although other groups sometimes tried to enter the market, disputes over territory would typically be resolved by violence rather than by price competition, implying that landowners would always deal with one group only, even if a different one from time to time.

Finally, since income is assumed to be fixed, the model does not deal with the impact of mafia on investment incentives and economic development. It is commonly accepted that the mafia deterred investment in Western Sicily since it would capture a considerable share of the potential returns. This has often been offered as an explanation for the lack of productive investments and the consequent economic under-development of Western Sicily. Still, if the increase in income was to be captured by the mafia, one should wonder why the mafia itself did not promote investment on the land. It is known that, instead, mafia members used the proceedings of their activity to rent land or to buy some of their own. Intuitively, investing might have been sub-optimal because it would have undermined the conditions that were at the basis of the mafia's existence. More productive farming methods required workers to reside permanently on the land: if these methods were adopted, patrolling needs and the demand for protection would have been reduced. Also, investment would have improved the living standards of the peasants thus reducing their need to steal. Since as a consequence of economic

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<sup>30</sup> The empirical results show that, in fact, land fragmentation affects mafia activity even after controlling for asset value.

development the demand for its services would have fallen drastically, promoting development was probably not in the mafia's best interest.

## 5. Some Empirical Evidence.

The model predicts that the profits of the mafia depend positively on the number of landlords ( $n$ ) and on land income ( $Y$ ). Because of the negative externality that each landlord imposes on others when he buys protection, landlords compete for protection and the competition is stronger when there are many landlords. It follows that an increase in the number of landlords increases the mafia's profits for any level of  $Y$ .

Data on profits are, not surprisingly, unavailable but since higher profits increase the probability that the mafia is active in a given town, the predictions of the model can be tested using data on the presence of mafia in different towns.

The 1881 Parliamentary Survey contains qualitative information on mafia activity and land fragmentation in seventy towns in Western Sicily. Based on that information, the following variables have been coded:

- (i) **presence of mafia-groups (mafiad).** mafiad=1 if there is evidence of mafia activity in the town. This information was extracted from interviews with the Chief Prosecutor of each town.<sup>31</sup>
- (ii) **intensity of mafia activity (mafia).** mafia=0,1,2,3 if there is no mafia activity, if there is some mafia activity, if there is mafia activity and if mafia activity is very strong. This information was extracted from interviews with the Chief Prosecutor of each town.

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<sup>31</sup> Since they were not asked to "name names", Prosecutors were not likely to deny the existence of Mafia out of fear.

- (iii) **proxy for number of landlords (*frag*)**. The information on the degree of land fragmentation is used as a proxy for the number of landlords in each town. Information on land fragmentation was extracted from interviews with town mayors, who were asked to report whether most of the land was concentrated in small, medium or large landholdings. The data is well suited for the purpose of this paper because it is possible to separate towns in which land was divided, that is where “small” and “medium” holdings prevailed, from towns in which land still belonged to a few –sometimes just one- noble families (“large” landholdings). Unfortunately, since different mayors had different opinions about the size of “small” and “medium” landholdings, the latter distinction might not be very reliable. In the regressions,  $frag = 1$  if the mayor reported that most of the land was concentrated in small or medium holdings.<sup>32</sup>
- (iv) **proxies for the need of protection (*vines*)**. *Vines* is the ratio of vineyards to total cultivated land. Since vines are more valuable than grain crops and hence need more protection, the variable *vines* is thus used as a proxy for Y.
- (v) **province dummies ( $prov_i$ )** The sample towns are located in four different provinces. Since justice and other State services were managed at the province level, province dummies are included in the regressions to control for different service quality.

Table 1 presents some descriptive statistics for the towns in the sample: it shows that mafia was active in more than half of the towns and very active in eleven cases. It also shows that mafia did not generally exist in towns where large landholdings prevailed. There is indeed

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<sup>32</sup> The author of the survey reports that on average small landholdings were smaller than 20ha, medium were larger than 20ha and smaller than 200ha and large were larger than 200ha (often larger than 1000ha). Unfortunately many of the mayors who used a different criterion did not report it precisely enough. In the regressions the coefficients of *small* and *medium* are never statistically different.

evidence of significant activity only in 3 towns out of 15. Conversely, the mafia was quite active in about 50% of the towns with medium and small landholdings.

**TABLE 2 – MAFIA ACTIVITY AND LANDSIZE**

<b>Land Distribution →</b>	<b>Small or Medium</b>	<b>Large</b>	<b>TOTAL</b>
<b>mafia Activity ↓</b>			
<b>None</b>	22 (40%)	9 (60%)	31 (44.3%)
<b>Some</b>	5 (9%)	3(20%)	8 (11.4%)
<b>Medium</b>	17 (31%)	3(20%)	20 (28.6%)
<b>Strong</b>	11 (20%)	0 (0%)	11 (15.7%)
<b>TOTAL</b>	55 (78.6%)	15 (21.4%)	70 (100%)

Table 3 presents probit and ordered probit estimates of mafia presence and mafia intensity, respectively. The first column of Table 3 estimates the probability of mafia being active as a function of the number of landlords and province dummies. The results show that mafia was more likely to be active in towns where land was more divided. The second column estimates the intensity of mafia activity as a function of the same variables. In line with the theoretical predictions, the results show that mafia activity was stronger where land was more divided. The third and fourth column of table 3 includes the variable *vines*, a proxy for land income. The results show that, as expected, mafia is more likely to be active where the need of protection is stronger. That the coefficient of fragmentation is smaller once *vines* is included in the regression also suggest that, to a certain extent, productivity was higher where land was more divided. Even after controlling for land income, land fragmentation has a positive effect both on the presence and on the intensity of mafia activity. The fragmentation coefficient, however, is significant at conventional levels only in the regression for the intensity of mafia activity.



**TABLE 3 – ESTIMATES OF MAFIA ACTIVITY**

**Columns (1) and (3):**

Probit Estimates. Dependent Variable *mafia<sub>d</sub>*, =1 if there is mafia activity in the town.

**Columns (2) and (4):**

Ordered Probit Estimates: Dependent Variable *mafia*, =0,1,2,3 if there is no mafia activity, if there is some mafia activity, if there is mafia activity and if mafia activity is very strong, respectively.

LHS Variable→	<i>mafia<sub>d</sub></i>	<i>mafia</i>	<i>mafia<sub>d</sub></i>	<i>mafia</i>
frag	.81 [.30] (1.96)	.75 (2.07)	.68 [.25] (1.61)	.64 (1.73)
vines			1.91 [.75] (1.83)	1.65 (1.75)
prov <sub>1</sub>	.24 (0.52)	.19 (0.49)	.38 (0.8)	.32 (.82)
prov <sub>2</sub>	-.26 (0.63)	-.49 (1.29)	-.31 (0.69)	-.54 (1.4)
prov <sub>3</sub>	-.03 (0.5)	-.57 (1.28)	-.16 (0.3)	-.68 (1.52)
p-value	0.16	0.03	0.06	0.02
NOBS	70	70	70	70

T-statistics in parenthesis, marginal effects in brackets.

The empirical analysis has two main limitations. First, all the variables, except *vines*, are based on subjective judgements and therefore are likely to be measured with error. It is,

however, hard to find a reason as to why the bias should go in a particular direction. Second, since there are no controls apart from the province dummies, omitted variables might be driving the results. For instance, similar estimates would be obtained if publicly provided security were systematically worse in towns where land was more divided, which might have occurred because larger landowners are more effective at lobbying for public resources, even if there were no competition among landlords. Conditional on these inevitable limitations, however, the available empirical evidence seems to be at least consistent, the predictions of the model. Finally, the results seem to support the “mafia as enforcer” against the “mafia as extorter” view, since, as argued above, the latter model would predict no relationship between land fragmentation and mafia activity.

## **6. Conclusions.**

According to historical records, the mafia developed in Western Sicily soon after the abrogation of feudalism and the following establishment of private property rights. It gained legitimacy and power by providing property enforcement services to the upper classes at a time when State provided security was scarce and predatory attacks very frequent. This paper has argued that, because of the negative externality that protection entails, every landowner rationally purchased protection even if this lead to an inferior equilibrium for the land-owning class as a whole. Using a common agency model, the paper has shown that in equilibrium every landlord pays for protection and that land fragmentation –i.e. an increase in the number of landlords— increases mafia’s profits and fosters its development. The evidence from a sample of 70 Western Sicilian towns in 1881 suggest that in fact the mafia was more likely to be active in towns where land was more divided.

Aside from historical interest, the analysis of the origins of the Sicilian mafia can provide valuable policy advice to societies that currently face similar institutional transitions. The Sicilian

experience shows that when the establishment of private property rights is not matched by the establishment of an adequate enforcement mechanism, independent groups might emerge to fill the gap. These groups gain legitimacy, power and reputation from the enforcement services they provide and can then exploit the power thus acquired to their own advantage, engaging in other, typically illegal, activities.

The Sicilian experience also shows that by the time the State had put into place an alternative enforcement service, the mafia had gained far too much power to be easily destroyed. Interestingly, both the Russian and Japanese mafias developed under strikingly similar circumstances. Like in post-feudal Sicily, both in post-communist Russia and in post-feudal Japan the creation of private property rights was not accompanied by effective law enforcement mechanisms. Like in Sicily, the groups that emerged to fill the void also exploited their power to gain from extortion and other illegal practices.<sup>33</sup>

Understanding the role of mafias as enforcers is crucial to devise effective policies, both in terms of prevention and confrontation. Judge Giovanni Falcone, a devoted opponent to the Sicilian mafia, once said: *“Sicily is a land where unfortunately the structures of the State are very deficient. The mafia has worked out how to fill this void in its own way [...] On exchange for the services it has offered (in its own interest of course) it has continued to increase its own power. To deny this reality only makes the fight more difficult.”* (Falcone 1991, p.)

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<sup>33</sup> Both the Japanese and the Russian mafia sell genuine protection of legitimate rights. For instance, eighty percent of the shopkeepers surveyed in Frye and Zhuravskaya (2001) reported that the main function of the racket is to protect their business from street crime. The Japanese mafia currently still engages in legal dispute settlement, especially in the areas of bankruptcy, debt collection, shareholders rights and financial services. This is due to the fact that, because of regulatory reasons, attorneys, accountants and credit rating agencies are quite scarce. See Milhaupt and West (2000).

## APPENDIX

### 1. PROOFS

#### DERIVATION OF EQUATION (1)

Denote by  $p^k$  the vector of protection such that  $k$  landlords are not protected and  $(n-k)$  are. Denote by  $(1-\pi^{n-k}(p^k))$  the probability that one of the  $(n-k)$  protected landlords gets his income stolen. Since landlords who are not protected get all their income stolen and since the mafia-group can at most protect a share  $\pi^*$  of total income, the income stolen from the unprotected landlords plus the income stolen from the protected landlords must be at least  $(1-\pi^*)Y$ . Thus when  $k$  landlords are not protected it must be true that:

$$ky + (n-k)(1-\pi^{n-k}(p^k))y \geq (1-\pi^*)Y$$

That is, what gets stolen from the unprotected landlords ( $ky$ ) plus what gets stolen from the protected landlords must be at least  $(1-\pi^*)Y$ , since mafia can at most protect  $\pi^*Y$ . This implies that if  $n-k$  landlords buy protection and  $k$  do not, each protected landlord gets his income stolen with probability:

$$\max\left\{0, 1 - \frac{n}{n-k} \pi^*\right\} \quad k = 0, \dots, n-1$$

#### PROOF OF LEMMA 1

From condition (ii) we know that  $p^* = \arg \max \sum_{i=1}^n f_i(p)$  which implies:  $\sum_{i=1}^n f_i(p^*) \geq \sum_{i=1}^n f_i(p)$ . From

the definition of truthful strategy we know that:  $\pi_i(p^*)y_i - \pi_i(p)y_i \geq f_i(p^*) - f_i(p)$  for all  $i, p$ .

Therefore the condition above implies that  $\sum_i \pi_i(p^*)y_i \geq \sum_i \pi_i(p)y_i \Rightarrow p^* = \arg \max \sum_i \pi_i(p)y_i$ .

**PROOF OF LEMMA 2:**

It must be proved that  $p^0$  (that is, every landlord buys protection) satisfies  $p^* = \arg \max \sum_{i=1}^n \pi_i(p)y$ .

That is, for every  $k=1\dots n$  it must be true that:

$$\sum_{i=1}^n \pi_i(p^{-0})y \geq \sum_{i=1}^{n-k} (\pi_i^{n-k}(p^{-k})y + \sum_{i=n-k}^n \pi_i^k(p^{-k})y)$$

Using (1) and the fact that landlords are symmetric the expression simplifies to:

$$n\pi^* y_i \geq (n-k) \min\left\{1, \frac{n}{n-k} \pi^*\right\} y_i \quad (6)$$

For  $\pi^* \geq \frac{n-k}{n}$  (6) reduces to  $n\pi^* \geq n-k$ , which is verified.

For  $\pi^* < \frac{n-k}{n}$ , (6) requires  $n\pi^* \geq n\pi^*$

Then:

1. if  $\pi^* > (n-1)/n$ ,  $n\pi^* y_i > (n-k) \min\left\{1, \frac{n}{n-k} \pi^*\right\} y_i$  for all  $k \rightarrow p^0$  is the unique TNE.
2. if  $\exists k'$  s.t. for all  $k < k'$   $\pi^* < (n-k)/n$ ; then for all  $k < k'$  (6) is verified with equality thus all the vectors such that  $k (< k')$  landlords are not protected are TNE protection vectors.

**PROOF OF LEMMA 3:**

**a. Uniqueness**

Define  $W(Z) = \max_p \left[ \sum_{i \in Z} (\pi(p)y_i - f_i(p)) - \sum_{i \in Z} f_i(p) \right] = \max_p [z\pi(p)y]$ , that is,  $W(Z)$  is the

highest possible joint monetary pay-off for the mafia and landlords in group  $Z$  (the last term on the RHS follows from symmetry). Laussel and Le Breton (2000) show that if  $W$  is strongly subadditive, the equilibrium payoffs are unique and equal to  $q_i = W(N) - W(N \setminus \{i\})$  for all  $i=1 \dots N$ , that is, each landlord

$W$  is strongly subadditive if for all  $S, T \subseteq N$  such that  $S \cup T = N$ ,  $W(N) \leq W(S) + W(T) - W(S \cap T)$ . Since all landlords are the same, in this model a group of landlords is uniquely identified by its size. Thus for any

two groups of size  $s (\leq n)$  and  $t (\leq n)$ , strong subadditivity requires  $W(n) \leq W(s) + W(t) - W(c)$  where  $c = (s+t) - n$ . Note that  $s \leq n$  and  $t \leq n \Rightarrow c < s$  and  $c < t$ . Note also that for any group of size  $r$ ,

$$W(r) = \begin{cases} ry & \text{if } r < n\pi^* \\ n\pi^* y & \text{if } r \geq n\pi^* \end{cases}$$

That is, if the group is sufficiently small (i.e. the combined incomes of landlords in the group is less than what the mafia can successfully protect) the group's highest possible monetary pay-off is its total income ( $ry$ ). If the group is large (i.e. the combined incomes of landlords in the group is larger than what the mafia can successfully protect) the group highest possible pay-off is the maximum income the mafia can successfully protect ( $n\pi^*y$ ). Note that, since  $\pi < 1$ ,  $W(n) = n\pi^*y$ . In what follows I show that for every possible group size combinations,  $W$  is strongly subadditive. Note that the group sizes such that  $(s < n\pi, t < n\pi, c > n\pi)$ ;  $(s > n\pi, t < n\pi, c > n\pi)$  and  $(s < n\pi, t > n\pi, c > n\pi)$  can be ruled out because  $c$  cannot be larger than  $s$  or  $t$ . This leaves five cases:

1.  $s < n\pi, t < n\pi, c < n\pi$ . In this case  $W(s) + W(t) - W(c) = (s+t-c)y = ny > W(n) = n\pi^*y$  (since  $\pi^* < 1$ )
2.  $s > n\pi, t > n\pi, c > n\pi$ . In this case  $W(s) + W(t) - W(c) = (s+t-c)\pi^*y = n\pi^*y = W(n)$
3.  $s > n\pi, t > n\pi, c < n\pi$ . In this case  $W(s) + W(t) - W(c) = 2n\pi^*y - cy > W(n) = n\pi^*y$  (since  $c < n\pi^*$ )
4.  $s > n\pi, t < n\pi, c < n\pi$ . In this case  $W(s) + W(t) - W(c) = n\pi^*y + ty - cy > W(n) = n\pi^*y$  (since  $c < t$ )
5.  $s < n\pi, t > n\pi, c < n\pi$ . In this case  $W(s) + W(t) - W(c) = sy + n\pi^*y - cy > W(n) = n\pi^*y$  (since  $c < s$ )

## b. Equilibrium Contributions.

Laussel and Le Breton (2000) show that  $W$  is strongly subadditive, the unique equilibrium payoffs are equal to  $q_i = \pi(p)y - f_i(p) = W(N) - W(N \setminus \{i\})$  for all  $i = 1 \dots N$ , where  $W(N)$  is the highest payoff attainable by the mafia and all landlords while  $W(N \setminus \{i\})$  is the highest payoff attainable by the mafia and all landlords excluding  $i$ . This implies that, in equilibrium, each landlord receives his marginal contribution, that is the

variation in total surplus due to his entering the coalition. Using the fact that landlords are symmetric and that the mafia's payoff is exactly equal to the sum of landlords' contributions, in this model we have:

$$W(N) = n\pi^*y$$

and

$$(n-1)y \quad \text{if } n < 1/(1-\pi^*)$$

$$W(N \setminus \{i\}) = (n-k-1)(n/n-k-1)\pi^*y \quad \forall k=0..k', \text{ if } n > 1/(1-\pi^*)$$

Substituting in

## 2. DATA SOURCES

I have coded the information contained in the "Inchiesta Iacini: Atti della Giunta per l'inchiesta agraria e sulle condizioni della classe agricola" Vol XIII part I and II, books 1 to 5 Relazione del delegato tecnico per la Sicilia Abele Damiani.

Pages and volumes number as reported below.

### 1. DATA ON MAFIA ACTIVITY, MAFIA ACTIVITY INTENSITY, AND THEFTS

Vol XIII, part 2, book A: pp 373-85 (Caltanissetta), pp 421-443 (Girgenti), pp 473-93 (Palermo), pp 509-520 (Trapani), pp521-543 (summary tables).

### 2. DATA ON LAND FRAGMENTATION

Vol XIII, part 2, book A: pp 1-35 (Caltanissetta), pp 95-147 (Girgenti), pp 205-267 (Palermo), pp 313-351 (Trapani).

Vol XII, part 1, book B: summary tables.

### 3. DATA ON VINEYARDS

Vol XII, part 1, book B: summary tables.

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**FIGURE 1**

Mafia's Payoff as a function of the number of landowners

