

Accomplice-Witnesses and Organized Crime: Theory and Evidence from Italy*

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Abstract

Since 1991 the Italian Legislator grants amnesties, protection and even economic benefits to former mobsters cooperating with the justice. These incentives were introduced to break down *omertà* and weaken external complicities. What is the economic logic behind this policy? Did the program succeed? To address these issues we develop a model accounting for the main trade-offs involved by the introduction of accomplice-witnesses regulations. We argue that rewarding informants is sometimes necessary to fight organized crime and show how the optimal amnesty varies with the effectiveness of the protection program, the reliability of the informants' testimonies, the strength of external complicities, and the internal cohesion between criminal partners. The optimal policy stifles the crime diffusion, spurs prosecution and induce a negative relationship between the number of talkers and the conviction rate. The available evidence supports the model's predictions.

Keywords: Accomplice-witnesses, Criminal Organizations, Leniency, Whistle-Blower.

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1 Introduction

Since the pioneering work by Becker (1968), organized crime has attracted considerable attention by economists, and for good reasons. The diffusion of organized crime has forced governments to reform their legal and judicial systems in an attempt to strengthen deterrence and investigation agencies. These reforms have often promoted the approval of special laws changing the rules according to which sanctions and imprisonment policies are settled for mafia members. Among them ‘accomplice-witnesses regulations’ (also known as leniency programs), which are designed to encourage former mobsters to cooperate with prosecutors in exchange of reduced sanctions and sometimes even economic incentives, are perhaps the most relevant.

Our paper has two main goals. First, in order to shed new light on the determinants of accomplice-witnesses regulations, we develop a model with hierarchical criminal organizations and dishonest officials where, to break down *omertà*, the Legislator grants lenient punishments to low-rank criminals who decide to cooperate with the justice. Second, by using data collected for Italy, we wish to provide evidence supporting our theoretical predictions. We argue that the Italian accomplice-witnesses program introduced in 1991 did affect in a significant manner organized crime in those Italian regions where the mafias have been historically more pervasive: we identify the positive effect of the policy on prosecution and argue that it also strengthened deterrence. We also provide evidence consistent with the prediction that the efficiency of the judicial system affects in a non-negligible way the incentive to become an informant.

The game involves a Legislator, a criminal organization and a continuum of public officials. The Legislator must decide whether to introduce a leniency program and, in case it does so, chooses the amnesty granted to talkers. The criminal organization is formed by two mobsters: a principal (boss) and an agent (*picciotto*), each with specific skills. The boss – the ‘mind’ – plans the crime and delegates its execution to the agent – the ‘arm’ of the organization. After the crime is committed and an investigation starts, the agent decides whether to face the trial or to cooperate with the justice by providing information which will be used by prosecutors to convict the boss. The prize for such a cooperation is the amnesty announced by the Legislator at the outset of the game. Finally, in order to model the extent of external complicities between criminal organizations and public officials, we also assume that there exists a fraction of dishonest officials in the economy that always acquit criminals ended up under investigation.

We show that granting amnesty to former criminals willing to cooperate with the justice has two countervailing effects on the crime rate. On the one hand, it encourages entry into the illegal business by lowering the agent’s expected sanction and thus the compensation

that the boss has to pay to hire the agent – this brings out the dark side of leniency programs. On the other hand, rewarding flipping criminals with lower sanctions exacerbates conflicts within criminal organizations: a more generous amnesty program may induce criminals under investigation to cooperate more often, whereby increasing the prosecution risk faced by their boss – this is the bright side of leniency programs.

The analysis also shows that the optimal policy stifles the crime rate and spurs prosecution relative to the ‘status quo’ where cooperation is not rewarded. We identify the determinants of the optimal amnesty rate granted to informants and show that more generous amnesties or even rewards are necessary to fight organized crime when the prosecution stage is not very effective, criminal organizations feature low cohesion between their members, the information provided by accomplice-witnesses has a valuable investigative content and there exist strong external complicities between public officials and criminal organizations.

The available historical evidence offers ample support to this comparative statics. For instance, our model predicts that rewards are optimal when the criminal organization exhibits excessively strong internal cohesion. This insight might explain why very few accomplices belong to the Calabrian ‘Ndrangheta, whose members are mainly linked by blood relationships. Differently, the case of Tommaso Buscetta, the first important *pentito*, underlines the relevant role played by the informative content of testimonies in determining the amnesties granted to talkers. Buscetta was allowed to live in the USA under a new identity after his testimony in the ‘New York Pizza Connection Trial’ in the mid-1980s. The importance of this link was recognized also by the Italian Parliament who reformed the accomplice-witnesses program in February 2001. The new law strengthened the criteria for eligibility in the program and tailored the amnesty to the relevance of the testimony provided by the informant.¹ Finally, the need for more generous amnesties in environments where criminal organizations have strong external complicities, is well exemplified by the long abscondence of the dangerous corleonesi heads Totò Riina and Bernardo Provenzano, whose early capture was prevented by the complicity of Bruno Contrada, a former head of the SISDE (the Italian Intelligence Agency), who was accused of informing the Sicilian mafia for upcoming police operations.

To support our theoretical predictions also on the empirical ground, we exploit a unique panel data set, relative to 95 Italian provinces and 26 judicial districts, providing information not only about many important aspects of organized crime in Italy, but also on some relevant features of the Italian leniency and accomplice-protection program. We use

¹This reform introduced a preliminary period of six months during which the accomplice must reveal all the information he is aware of. It is only after this period, and upon an evaluation of the reliability of the testimony, that he can be admitted into program.

these data to report evidence about the positive correlation between the introduction of the Italian leniency program and the number of mafia related crimes prosecuted, the negative correlation between the introduction of the program and the crime rate, and the positive correlation between the inflow of accomplices into the program and an efficiency proxy of the Italian judicial system.

The rest of the paper is organized as follows. Section 2 provides an overview of organized crime and accomplice-witnesses regulation in Italy. In Section 3 we provide some preliminary and motivating evidence about the deterrence effect on mafia crimes produced by the Italian leniency program. Section 4 sets up the theoretical model and develops the main characterization results along with the comparative statics. Section 5 presents some more elaborated evidence about the model's main predictions. Section 6 relates our work to the earlier literature. Section 7 concludes. All proofs are in the Appendix.

2 The Italian experience: historical overview

Italy offers a shining example of the revolutionary role played by accomplice witnesses in the fight against organized crime. In this section we report some anecdotal evidence about Italian criminal organizations and their history which motivate the theoretical approach taken in Section 5.

2.1 Criminal organizations and leniency in Italy

Criminal organizations have historically characterized some areas of Italy. In 1982, the Italian Legislator recognized the pervasive role of 'mafia-type criminal associations' through the article 416-bis of the Penal Code: as stated by its third clause, the typical methodology of the mafia association is "the exploitation of the force of intimidation of the associative tie and of the condition of subjugation and silence (*omertà*) which derives from it". Since then, people may be prosecuted because of being members of mafia families.²

From 1982 to 2001, the new offence determined the convictions of 5,443 Italian citizens. Data at regional level show that 5,069 individuals, that is more than 93% of the total number of convicted mobsters, were sentenced by Courts having jurisdiction within 4 out of the 20 Italian regions: Sicily and Campania are the regions with the highest number

²A number of common crime offences constitutes the illicit activity of a criminal association (for instance, illicit traffic of drugs, loan sharking, murder, and extortion). However, the crime offence designated as mafia association refers to the possibility to induce fear in one's behavior through the force of intimidation of the entire organization. Thus, a common crime offence like the extortion is considered in a different way in the sentencing if it is committed using mafia intimidation. Moreover, also a licit goal may be prosecuted if it is achieved through the force of subjugation.

of convictions, followed by Puglia and Calabria (Table 1).³ These regions are historically troubled by different mafia groups: the Camorra in Campania, the 'Ndrangheta in Calabria, the Sacra Corona Unita (SCU) in Puglia, and the Mafia in Sicily.⁴ Each group consists of a number of mafia associations, the most 'famous' being the Cosa Nostra in Sicily and, recently, the Casalesi in Campania.

Table 1: CONVICTIONS FOR MAFIA AFFILIATION

	Number of people convicted				
	1982-1991	1992-1996	1997-2001	1982-2001	
Campania	970	332	420	1722	31.7%
Calabria	150	168	229	547	10.0%
Puglia	35	245	396	676	12.4%
Sicily	229	681	1214	2124	39.0%
Rest of Italy	61	202	111	374	6.9%
Total	1445	1628	2370	5443	100.0%

The strength of the Italian criminal organizations, as well as their increasing influence on the legal economic activity, rest on a diffuse external complicity, namely, the growing relationships between various bosses and public officials such as national or local politicians, judges, public local administrators and members of the police force (Dickey, 2004). In order to break down *omertà* and weaken such external complicities, the Italian Legislator reacted by setting harsher punishments for mafia affiliates and, at the same time, by granting full or partial amnesty to those accomplices who provide information leading to further mafia prosecutions or revealing external complicity, (D.L. 13/05/1991 n. 152). After an intense political debate, in 1991 the Legislator also introduced the accomplice-witness protection program, aimed at taking care of those who endanger themselves because of the information provided to the judicial authority, (D.L. 15/01/1991 n. 8).⁵

Table 2 reports the 2008 distribution of former mafia affiliates who were taking part in the protection program (they are grouped on the basis of the criminal association they provided information about). On the whole, 729 out of 833 accomplices (i.e., 87% of the

³The strong concentration of convictions within those regions also emerges if we look at subperiods of the sample investigated.

⁴In the following we sometimes refer to those regions as core-regions.

⁵This program provides for the health, safety, and welfare of informants and their families; in some cases it even grants rewards by securing minimum wages, housing and other financial needs. The ability of a witness to give testimony in a judicial setting or to cooperate with law enforcement investigations without fear of intimidation or reprisal is essential to maintaining the rule of law. Police officers, prosecutors, and defence advocates tend to agree that 'flipping' criminals had often chosen to accept the penalties for not testifying rather than risk serious injury.

Table 2: FORMER MAFIA AFFILIATES (TALKERS) AND CONFISCATION

	Talker		Confiscation	
	2008		1992-2007	
Camorra	294	35%	3,018	52%
'Ndrangheta	101	12%	308	5%
SCU	95	11%	190	3%
Sicilian Mafia	239	29%	1,878	32%
Others	104	13%	431	7%
Total	833	100%	5,826	100%

Note: Accomplice denotes the number of former mafia accomplices who were taking part the protection program at the end of 2008. Confiscation denotes the value (million of euros) of total assets confiscated.

total), provided relevant information on the four mostly known mafia associations; the Sicilian mafia and the Camorra are each concerned by roughly one third of dissociates. The relevance of the above criminal associations also comes out when considering the amounts of illegal proceeds that were confiscated. Table 2, second column, shows that 93% of total proceeds confiscated are related to Camorra, Sicilian mafia, 'Ndrangheta, and SCU. As for the number of accomplices, the Camorra and the Sicilian mafia are those mostly concerned by the effect of the confiscation laws.

2.2 Buscetta meets Falcone: the roots of accomplice-witnesses

The first mafia member acknowledging the existence of 'Cosa Nostra' was Joseph Valachi; his testimony was key for the opening of the first important Italian mafia trial in 1967. In the 1970s another two mafia fellows, Beppe Di Cristina and Leonardo Vitale, publicly talked about the existence of a group of people from the town of Corleone – among which Vito Ciancimino, Luciano Liggio, Bernardo Provenzano and Totò Riina – leading illicit traffics in Sicily. Yet, Tommaso Buscetta is widely recognized as the first important former criminal breaking *omertà* in Italy. During the 1980s he helped the judges Giovanni Falcone and Paolo Borsellino to achieve significant successes in the fight against organized crime. He was the key witness in the Maxi Trial that sent almost 350 Mafia members to prison. Buscetta exposed the existence and workings of the 'Sicilian Mafia Commission'.⁶ His cooperation enabled Falcone to argue that *Cosa Nostra* was a unified hierarchical structure ruled by a Commission, and that its leaders could be held responsible for criminal activities that

⁶The Commission is a body of leading Mafia members deciding on important questions concerning the actions of, and settling disputes within the Sicilian Mafia.

were committed to benefit the organization. This premise became known as the ‘Buscetta theorem’ and was at the root of the Maxi Trial sentence in January 1992. His testimony in the ‘New York Pizza Connection Trial’ in the mid-1980s also allowed the conviction of hundreds of mobsters in Italy and the United States. As a reward for his help, Buscetta was allowed to live in the USA under a new identity in the Witness Protection Program.

Before the 1990’s, there were very few, albeit significant ‘*pentiti*’ following Buscetta’s example.⁷ However, this changed significantly during the early 1990’s, especially from 1991 on when, thanks to the intense activity of Falcone’s group, the Italian Legislator introduced the accomplice-witnesses protection program. Since then, over a thousand mafiosi have agreed to collaborate with Italian justice not only in Sicily. For instance the information provided by Camorra fellows such as Carmine Alfieri, Domenico Bidognetti, Guglielmo Giuliano and Carmine Schiavone, deeply supported the *antimafia* activity in Campania.

A few final remarks are worthwhile about some intriguing features of the Italian experience. First, accomplices rarely decide to cooperate before being under investigation. Second, strikingly enough, many among the most dangerous and influential mafia heads never cooperated with the justice although being charged of several life sentences: Raffaele Cutolo, Luciano Liggio, Bernardo Provenzano, Totò Riina and Francesco Schiavone, for instance, repeatedly refused any type of collaboration with prosecutors to protect – they claimed – their status of ‘man of honor’. Finally, as a matter of fact, the program has poorly performed in Calabria, where there are relatively few *pentiti*.⁸ This puzzle seems to rest on the specific organizational form of the ‘Ndrangheta, which shows a greater cohesion between its members relative to the other Italian criminal organizations. The principal difference with the organization of Cosa Nostra or Camorra lies in the recruitment methods. The ‘Ndrangheta recruits members on the criterion of blood relationships, which results in a tight cohesion within the family clan that presents a major obstacle to investigation (Paoli, 2003).

2.3 Accomplice-witnesses and mafia trials

The first important Italian trial against the Sicilian Mafia opened in 1967 and concerned its growing involvement in the heroin trade. The trial, based on the sparse evidence provided by Joseph Valachi, and ended one year later with the acquittal of all defendants. In the same period, judge Cesare Terranova sent to trial 114 defendants, with the view that the

⁷For instance, the collaboration of Francesco Mannoia was extremely important because he was the first *pentito* from the winning family of the second mafia war. Salvatore Contorno also played a key role in the Palermo Maxi Trial.

⁸At the end of 2008, there only were 95 former affiliates to the ‘Ndrangheta in the protection program.

crimes and those accused of carrying them out were all linked and should be treated as an organized body. The defendants were accused of crimes relating to the first mafia war, the charges including multiple murder, kidnapping, tobacco smuggling, theft, public massacre and organized crime (see Gambetta, 1992). The trial lasted for a year and resulted in only ten convictions, several of those were just for organized crime.

The third trial began in February 1969. There were sixty-four defendants, all from the town of Corleone. The charges related to a mafia war in Corleone that started in 1958, and resulting in over fifty murders. There was significant evidence tampering during the trial, which experienced the first public intimidation act.⁹ All sixty-four defendants were acquitted. Whilst there was undoubtedly witness intimidation and evidence tampering, a lot of the evidence was fairly thin. There were no *pentiti* at the time and few non-Mafiosi willing to risk death by testifying for the prosecution.

During the early 1980s, the Corleonesi boss Totò Riina decimated other Mafia families, resulting in hundreds of murders, including several high-profile authority figures such as Carlo Alberto Dalla Chiesa: a period known as the second mafia war. The growing public revulsion at such killings provided the necessary premise to the ‘Palermo Maxi Trial’, whose preliminary phase was headed by judges Giovanni Falcone and Paolo Borsellino. Never before so many Mafiosi were on trial at the same time in Italy. A total of 474 defendants were facing charges, which included 120 murders, drug trafficking and extortion; the new law made it moreover an offence to be a member of the Mafia. Most of the crucial evidence came from Tommaso Buscetta and Salvatore Contorno. The trial ended on December 1987, almost two years after its beginning. Of the 474 defendants 360 were convicted; 2,665 years of prison sentences were shared out between the guilty, not including the life sentences handed to the nineteen leading Mafia bosses and killers.

The major Italian trial against organized crime not involving Sicilian mobsters was the ‘Spartacus Maxi Trial’, which was specifically directed against the activities of the powerful Casalesi clan of the Camorra and its boss Francesco Schiavone. The trial was opened on July 1998 and continued until June 2008, when its final verdict was read. The 10-year legal trial charged 36 members of the clan with a string of murders and other crimes. All were found guilty and 16 sentenced to life imprisonment including the Casalesi bosses Francesco Schiavone and his chief lieutenant, Francesco Bidognetti. More than 500 witnesses and 25

⁹As the jury retired in July, they and the judge received an anonymous note that read: “To the President of the Court of Assise, and members of the Jury: You have not understood, or rather, you don’t want to understand, what Corleone means. You are judging honest gentlemen of Corleone, denounced through caprice by the Carabinieri and Police. We simply want to warn you that if a single gentleman from Corleone is convicted, you will be blown sky high, you will be wiped out, you will be butchered and so will every member of your family. We think we’ve been clear. Nobody must be convicted. Otherwise you will be condemned to death - you and your families. A Sicilian proverb says: ‘A man warned is a man saved’. It’s up to you. Be wise”.

informants testified in the trial which saw a total of 700 years of imprisonment with nearly 6 billions euros confiscated to the defendants by the Italian Financial Police and Customs Police (Anselmo and Braucci, 2008).

3 Motivating evidence

In order to motivate our theoretical analysis and show that it is important to develop a model where the recognition of amnesties to former mobsters willing to cooperate with the justice has a non trivial impact on the way criminal organizations perform, it might be useful to have a look at some preliminary evidence about the deterrence effect of the Italian accomplice-witnesses program on mafia related crimes.

Is it possible to show that the introduction of this program had a significant effect on the evolution of mafia crimes? If so, how does this effect compare to the evolution of non-mafia related crimes before and after 1991? Was this effect stable across the Italian regions historically more troubled by mafia groups? In this section we argue that the 1991 reform seems to have produced an interesting impact on mafia related crimes, while it did not have much influence on non-mafia crimes.

Let us start with some important considerations about the main empirical issues at stake. Since illegal acts do not typically take place in broad daylight, providing evidence of the deterrence effect of new reforms is generally a difficult task. More precisely, if the policy affects negatively the crime population (deterrence) and positively the share of uncovered crimes, identifying deterrence can be very hard, if not impossible, as long as only the number of prosecuted crimes is observed. In principle, an highly successful policy, which would completely deter crime, might be indistinguishable from an ineffective policy whenever the detection rate is small.¹⁰

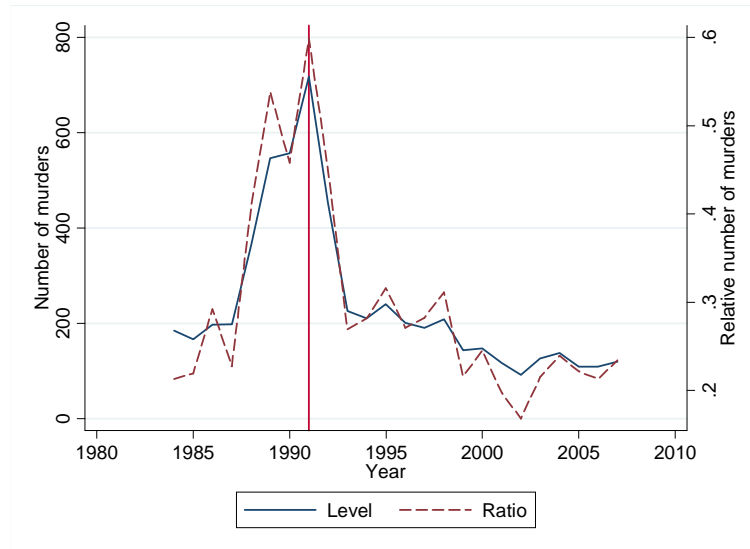
In the case of criminal organizations data on murders allow to overcome this obstacle. Differently from other crimes, almost all murders are uncovered: *measured* murders reflect the amount of *effective* ones.¹¹ Figure 1 illustrates the number of mafia-related murders reported by the police forces in Italy, *MURDER*, both in absolute level and relative to the number of malicious (intentional) murders committed for reasons different than the mafia one.¹²

¹⁰A similar problem arises in the literature dealing with the empirical analysis of collusive agreements among firms (see, for instance, Harrington, 2006, and Miller, 2009).

¹¹The dataset that we shall use includes all mafia related murders (i.e., the number of people killed for mafia purposes), including those for which the executor is prosecuted and those for which it remains unknown.

¹²The Italian penal code distinguishes between two categories of murders: (i) malicious or intentional murders, whose executor had the deliberate will to commit the crime, and (ii) non-intentional or involuntary

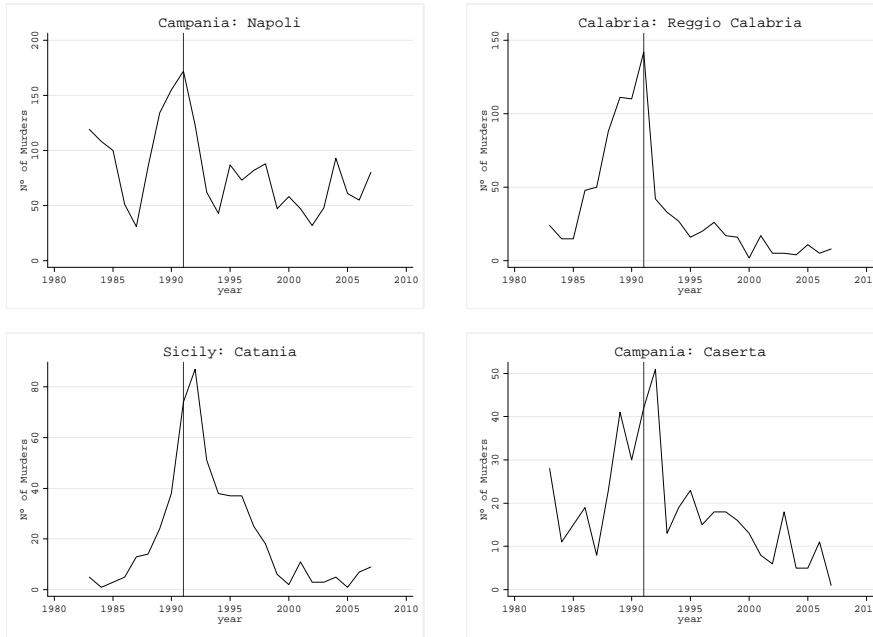
Figure 1: MAFIA MURDERS IN ITALY



The vertical bar marks the introduction of the leniency program in 1991. Strikingly enough, after an increasing trend ended in 1991 with 719 mafia murders, which corresponded to roughly 50% of all other malicious murders, a downward sloping path started one year after the introduction of the Italian leniency program. In 2007 the number of mafia murders in Italy decreased up to 119, that is roughly 20% of the rest of murders. More importantly, the aggregate path is neither due to some composite effects, nor to a specific mafia association: A similar path characterizes provinces within the same region and across the core-regions. As shown in Figure 1-bis, deterrence is detected within all the 4 provinces — Naples, Reggio Calabria, Catania and Caserta — with the largest numbers of mafia murders in 1991-92.

murders, which are committed without an intentional purpose.

FIGURE 1-BIS: PROVINCES WITH MOST MAFIA-RELATED MURDERS



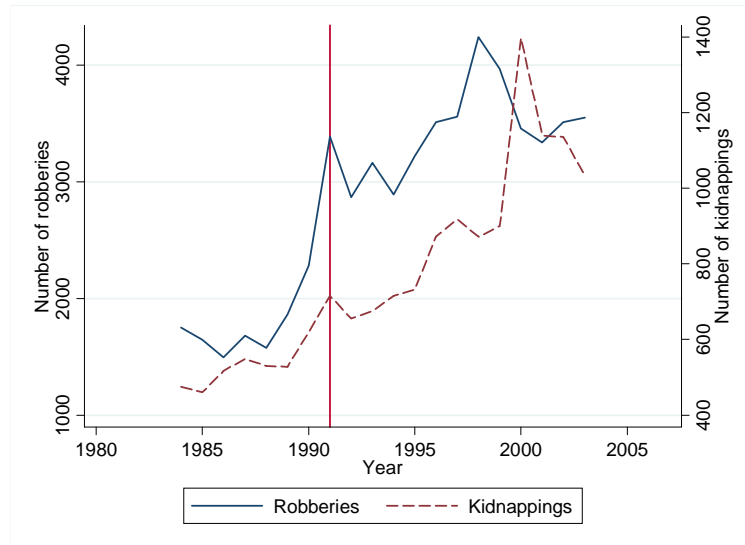
Do other crimes feature the same pattern? As a robustness check, it seems interesting to look at the evolution of non-mafia crimes such as robberies in banks and post offices, and kidnappings whose ultimate purpose is not extortion. Arguably, like for the case of murders, observed values of these crimes reflect to a large extent the corresponding population. But, it is well known that robberies and kidnappings are usually unrelated to mafia associations.¹³ In this case we should thus not observe a drop after the 1991. Accordingly, Figure 2 shows that both variables feature an increasing path during the 1990s.

Although not conclusive, this evidence supports the idea that the introduction of the Italian leniency program deterred mafia murders, and thus crime. Clearly, there might have been other different factors explaining the sharp drop of murders after 1991. But, the overall picture does provide an encouraging preliminary step towards the development of a formal approach to accomplice-witnesses regulation, and it certainly calls for further empirical exercises aimed at testing the main predictions of such a model. The reminder of the paper will be devoted to pursue these two tasks.

Let us conclude the section with some remarks about the variable ‘number of murders’ – which we have used to proxy the crime rate – and its link with the volume of the organized

¹³We have excluded the kidnapping aimed at extortion because one cannot be sure that these crimes are completely unrelated to mafias. Note indeed that Reggio Calabria, which is the Calabrian area featuring the highest concentration of ‘Ndrangheta clans, is one of the four provinces — Torino, Reggio Calabria, Milano and Roma — with the largest numbers of kidnappings aimed at extortion. Incidentally, we have verified that only in Reggio Calabria, among these four provinces, the number of kidnappings features a strong drop after 1991.

Figure 2: ROBBERIES AND KIDNAPPINGS IN ITALY



crime business – a variable that will pertain more closely to our model. To what extent the number of mafia murders is positively correlated with the expansion of the organized crime activity? In order to motivate our approach, we shall appeal to the historical evidence. Many among the most important mafia wars originated by the raise of new opportunities in illicit traffics.¹⁴ The second mafia war that decimated in the early 1980s several Sicilian families, for instance, blew when the group lead by Luciano Liggio – the so called ‘*corleonesi*’ – took over the new business opportunities originated by the expanding heroin trade and the real estate boom around the city of Palermo. Similarly, during the late 1970s, in Campania, the emerging group lead by Raffaele Cutolo – from whom ‘*i cutoliani*’ – took over the illicit traffics stemming from the huge increase in the unauthorized tobacco smuggling and the new business opportunities in the reconstruction sector that emerged after the devastating earthquake in 1980. Cutolo and his fellows decimated most of the older Camorra clans, which reorganized in the early 1980s to fight back and start one of the bloodiest mafia wars in Italy. More recently, in late 1990s the expansion of the narcotic trade was again at the root of a wide and bloody conflict in Campania – the so called ‘*Faida di Scampia*’ – that took place between several camorra families located in the neighborhood of Scampia, the largest narcotic ‘market’ in Naples.

¹⁴See, among others, Lodato (2006) and Cantone (2008) for evidence relative to, respectively, the Mafia and the Camorra.

4 The model

Drawing on the historical evidence reported above, in this section we derive a formal model to describe in the simplest possible way the main trade-offs generated by the introduction of the leniency program.

Players and environment: The game involves a benevolent Legislator, a criminal organization and a continuum of public officials. The Legislator, having forbidden welfare reducing criminal acts, designs an accomplice-witnesses program. The criminal organization is formed by two mobsters: a boss and a fellow.¹⁵ The boss (the mind of the organization) plans the crime and delegates it to the agent (the arm) who materially commits the illegal act.¹⁶ Public officials manage the prosecution of criminals infringing the law.¹⁷

The crime yields a revenue R which is stochastic and distributed over the compact support $[0, \bar{R}]$ according to the cumulative distribution function $F(R)$. The crime harms the rest of society by H , with $H > \bar{R}$ so that it is always socially detrimental. The principal hires the agent after having observed the realization of R ; he has full bargaining power and makes a take-it or leave-it offer, which entails a wage w paid by the principal to the agent after the crime is committed but before the investigation takes place. For simplicity, we normalize the agent's outside option to zero.

Prosecution: Committing the crime triggers an investigation, which opens with probability α . We assume that two types of public officials may be in charge of the judicial and investigative process. Building on the historical evidence discussed in Section 2, we assume that there are *honest* officials, which do not have links with the criminal group and thus always seek to convict the mobsters under investigation, and *dishonest* officials, which are instead ready to acquit the defendants whenever possible. There is an overall measure 1 of officials in the economy, a fraction β of which is honest. The official's type is observed only by the principal but not by the agent, who is unaware of the hidden links between the former and law enforcers.¹⁸

¹⁵We focus on this two-people structure only for tractability reasons. All our insights would carry on in a more complex framework where the boss leads more than one agent.

¹⁶These are the bottom of the chain of command: the *picciotti d'onore* or soldiers, who are expected to perform tasks with blind obedience until they are promoted to the next level, where they will be granted command over their own group of soldiers.

¹⁷In our setting, public officials can be either prosecutors, heading the prosecution phase, or members of the police force, whose investigative effort heavily influence the probability of convicting a defendant.

¹⁸The available historical evidence offers ample support for this hypothesis. For instance, security concerns have led to the creation in the 'Ndrangheta of a secret society within the secret society: La Santa. Membership

Dishonest types can be either interpreted as those individuals who are strongly linked to the criminal organization for cultural and personal reasons – Vito Ciancimino, for instance, was born in Corleone and already in the youth used to be close friend with Riina and Provenzano – or those individuals that are willing to accommodate criminals because they fear their intimidation power. In both cases, the parameter β reflects an inverse measure of the influence of the organization into the public domain and will be a key comparative statics parameter. Mafia associations frequently tried to manipulate court decisions by bribing, threatening, and, occasionally, even murdering judges and prosecutors. Tommaso Buscetta was the first to expose in detail the secret exchanges that linked politicians to the Sicilian mafia. On November 1992, he testified in front of the Antimafia Commission about the links between Cosa Nostra and Salvo Lima, indicating Lima as the politician to whom Cosa Nostra turned most often to resolve problems for the organization whose solution lay in Rome.¹⁹ Judge Corrado Carnevale became famous instead for his alleged, but never proved, collusion with the mafia,²⁰ while Bruno Contrada, a former head of the Italian Intelligence Agency, was sentenced to ten years for collusion with Cosa Nostra. He was accused of informing the Sicilian mafia for upcoming police operations, preventing in particular an early capture of the fugitive Totò Riina.²¹ For simplicity, here we do not explicitly model the corruption and the intimidation process that generates the official's types.²²

Legal regimes: There are two legal regimes, with and without leniency:

- **No leniency:** if the public official is honest, the agent is convicted with probability p and bears a sanction S_a , whereas the principal is convicted with probability $\underline{\theta} \leq p$ and

in the Santa is only known to its members. Bosses belonging to the Santa have precisely the objective of establishing close connections with state representatives, and simple soldiers are unaware of these connections. Assuming that the official's type is observed by both the principal and the agent would not add new key insights to our analysis, however. In that case, the agent's reporting strategy would depend on the official's type (only when the official is honest would the agent possibly report evidence against the boss) but the basic insight would be similar: a more lenient policy makes agents facing honest officials more willing to cooperate.

¹⁹Buscetta also claimed that Lima was killed on March 1992 because he had outlived his usefulness. On January 1992 an appeal court had upheld the convictions of dozens of mobsters after a team of anti-mafia judges had taken control of the case. Lima had originally wished to appoint a judge of his own choice, instead, Giovanni Falcone had taken charge of the appeal and confirmed the sentences of many mobsters. Lima was therefore of no further use to the Mafia.

²⁰See the recent books by prosecutors Ayala (2008), Anselmo and Braucci (2008) and Cantone (2008).

²¹“Audizione del collaboratore di giustizia Gaspare Mutolo”, Antimafia Commission, February 9, 1993.

²²In an earlier version of the paper we have formally developed a ‘bribing’ stage to generate the fraction of dishonest officials. In both, the current and that previous version, the main characterization results and the comparative statics are qualitatively the same.

bears the sanction S_p ; this assumption simply reflects the idea that convicting the boss (i.e., the crime instigator) in the absence of testimonies is less likely than convicting the agent who has materially committed the crime. Otherwise, both mobsters are acquitted.

- **Leniency:** when the investigation starts, the agent can opt to cooperate with the justice, by testifying against his boss. The prize for this cooperation is a reduction by ϕ of the sanction S_a . If the agent cooperates, the boss bears the sanction S_p with probability $\bar{\theta} \geq \underline{\theta}$, irrespective of the official's type.²³ In practice, there can be no conviction solely on the basis of what is attested by an accomplice witness, there must be evidence from an unrelated source to corroborate the witness's testimony; we therefore interpret $\bar{\theta}$ as a measure of the reliability of the informant.²⁴ Finally, for the historical reasons explained in Section 2, we rule out the possibility that the boss talks as well as the possibility that the agent decides to cooperate before an investigation is opened.

Trial-reluctance, cohesion and retaliation: In order to model conflict within the organization in the simplest possible way, we assume that if an investigation is launched, the agent discovers his reluctance (δ) to face the trial. This parameter is drawn from the compact support $[\underline{\delta}, \bar{\delta}]$, according to the atomless and twice continuously differentiable cumulative distribution function $G(\delta)$. There are various interpretations for this parameter. Differences in δ could be either due to psychological costs resulting from the fear and apprehension of imprisonment, which materialize only when the agent is about to face the trial;²⁵ or, they might reflect those emotional costs the mobster incurs in when he realizes that the trial will publicly attach to their relatives the 'Mafia stigmata'.²⁶ As observed by judge

²³We assume that a dishonest official can no longer manipulate the trial when the agent cooperates. This is consistent with the evidence discussed in Section 2.

²⁴This parameter might measure the status of the informant into the organization or its proximity to the leader: mobsters at a higher level in the hierarchy constitute a better source of information than simple 'soldiers' who typically execute orders blindly.

²⁵In mafia trials the imprisonment of defendants is often mandatory even before the definitive verdict for precautionary reasons. And the trial can be very long depending on the importance of the charges and the number of defendants (the Spartacus Maxi Trial, for example, lasted ten years).

²⁶According to judge Lia Sava, many informants decide to talk for the sake of their children well being: for instance, Giusy Vitale and Carmela Iuculano decided to talk mainly because they did not want their sons to experience the same destiny (imprisonment or even premature death) of their brothers and fathers (Narcomafie, dossier n. 10, October, 2005 – available at http://www.narcomafie.it/articoli_2005/dos_10_2005.htm). Similarly, when asked about the motivations behind his cooperation, Calogero Ganci, one of Falcone's and Dalla Chiesa's killers, testified "...I will talk in order to guarantee a better future to my children..." (Lodato, 2006, pg. 402). Relatives of publicly known Mafia members are also often subject to discrimination on the labor market. For instance, in an interview

Falcone in one of his last interviews (1991), the willingness to cooperate may also reflect an unanticipated low degree of trust and cohesion inside the organization. For example, internal fights between formerly allied clans and partners (see Gambetta, 1992, pg. 162) might encourage the losers to have their revenge by cooperating with the justice rather than facing the trial and then eventually seek the fight on the military ground.²⁷

We also assume that criminal organizations seek to punish whistle-blowers, a feature that we model with a retaliation loss L suffered by the informant. The ability of a witness to give testimony in a judicial setting or to cooperate with law enforcement investigations without fear of intimidation or reprisals is essential. Increasingly, countries are enacting legislation or adopting policies to protect witnesses whose cooperation with law enforcement authorities or testimony in a court of law would endanger their lives or those of their families. Accordingly, we shall interpret a lower value of the loss L as the result of better witness protection programs.

Timing: We follow the literature in assuming that the Legislator moves first.²⁸ The precise sequence of events unfolds as follows:

t=0 The Legislator decides whether to launch a leniency program and accordingly commits to an amnesty rate ϕ .

t=1 Uncertainty about R resolves and the organization decides whether to commit the crime; if it chooses not to commit the crime, the game ends, otherwise the principal pays the wage w to the agent once the crime is committed and the game then proceeds to the next stage.

t=2 With probability α an investigation opens. The public official in charge of the case is honest with probability β and dishonest with probability $1 - \beta$. The type of the public official is not observed by the agent.

t=3 The agent learns his personal costs of facing the trial, δ , and, if a leniency program is in place, decides whether to cooperate with the justice.²⁹ Depending on the legal

with an Italian newspaper, the daughter of the boss Totò Riina complained of being often discriminated at the job application stage simply because of her last name (Repubblica, 28 January, 2009).

²⁷The testimonies of Buscetta and Contorno against the Corleonesi were an example of the revenge role played by the leniency program. However, this was not always the case, the informants Francesco Mannoia and Calogero Gancia were both former members of the winning Corleonesi family.

²⁸See e.g. Motta and Polo (2003), Spagnolo (2003) and Rey (2003).

²⁹As explained above, assuming that the agent discovers his type δ only when the investigation starts fits the available evidence. However, our results would not change in case this uncertainty realizes ex ante and the principal cannot use very complex revelation mechanisms that condition the wage on the behavioral type.

regime, the trial uncertainty resolves, and sanctions (including the retaliation loss) are imposed.

In the Appendix we provide a detailed illustration of the game tree.

Actions and equilibrium concept: An action profile for the principal involves a wage offer w . An action profile for the agent involves a participation rule, which depends on the difference between the wage and his expected sanction, and a confession decision, i.e., whether to cooperate or not, which will depend on his type δ . The Legislator simply announces ϕ . We shall look for the subgame perfect Nash equilibrium (SPNE) of this game.

Technical assumptions: The analysis will be conducted under the following simplifying conditions:

A1 Monotone and (strictly) increasing hazard-rate:

$$\delta > \delta' \Rightarrow \frac{g(\delta)}{1 - G(\delta)} > \frac{g(\delta')}{1 - G(\delta')}. \quad (\mathbf{A1})$$

As shown in the Appendix, **A1** ensures that the Legislator's program is single peaked. It is adopted in many economic applications and satisfied by usual standard distributions.³⁰

A2 Cooperation:

$$g(\delta) < \frac{1}{(\bar{\theta} - \beta\theta)S_p}. \quad (\mathbf{A2})$$

This condition rules out the uninteresting case where no agent ever talks in equilibrium. It can be easily satisfied by standard distribution functions.

Finally, following the literature, all sanctions will be interpreted as the monetary equivalent of the imprisonment terms, fines, damages, and so forth, to which the criminals expose themselves. This assumption is made only for the sake of simplicity. Our insights readily extend to non-monetary sanctions as long as their cost is not excessively large, in which case granting a positive discount is still optimal.³¹

4.1 Equilibrium characterization

We now characterize the equilibrium of the game. We shall first characterize the no leniency case and then turn to the more interesting case where the Legislator considers granting amnesties to informants.

³⁰For instance, the uniform distribution satisfies **A2**.

³¹See Garoupa (1997) for an overview on optimal law enforcement with non-monetary sanctions.

4.1.1 No leniency

We consider first the subgame with no leniency. If an investigation opens, the agent must face the trial. The principal's expected gain is then:

$$u = R - w - \alpha\beta\theta S_p,$$

where w is the expected wage paid by the principal; this expected wage will be set so as to compensate the agent for his participation into the criminal business:

$$w = \alpha(p\beta S_a + \mathbb{E}[\delta]), \quad (1)$$

where

$$\mathbb{E}[\delta] = \int_{\underline{\delta}}^{\bar{\delta}} \delta dG(\delta)$$

represents the expected cost that the agent bears from the trial, while $p\beta S_a$ is the agent's expected sanction.³²

The principal will decide to go on with the crime if and only if the return R is larger than the expected costs, that is:

$$R \geq \alpha(\beta(pS_a + \theta S_p) + \mathbb{E}[\delta]) \equiv \widehat{R}_n.$$

The crime becomes less profitable, the higher is the probability that an investigation is opened (α large), the more severe and efficient is the prosecution system (p , S_a and S_p large), the larger is the fraction of honest officials (β large) and the higher is the agent's expected cost from the trial or the lower is the cohesion between the members of the organization ($\mathbb{E}[\delta]$ large). In the absence of leniency, the economy crime rate is thus given by:

$$r^n = \Pr(R \geq \widehat{R}_n) = 1 - F(\widehat{R}_n).$$

We shall see below how the possibility of launching a leniency program affects this rate.

4.1.2 Leniency and the optimal policy

In this section we derive the optimal leniency policy. The analysis has two main objectives. First, we characterize the optimal amnesty rate. Second, we wish to understand the comparative statics with respect to the main underlying parameters. The game can be solved with a simple backward-induction logic. Once an investigation is launched, not cooperating

³²Our qualitative insights remain unchanged if we assume that, instead of capturing an aversion to the trial, the parameter δ measures an unanticipated cost associated to the enforcement of the sanction, such as the psychological cost of the conviction. In this case $\mathbb{E}[\delta]$ simply needs to be weighted by the probability of being convicted, $p\beta$.

exposes the agent to the cost of the trial, δ , and to an expected sanction, $p\beta S_a$; in contrast, cooperating reduces the sanction to $(1 - \phi) S_a$, but exposes the agent to a retaliation loss, L . The agent's payoff are thus:

$$u = \begin{cases} -(1 - \phi) S_a - L & \text{if he cooperates} \\ -p\beta S_a - \delta & \text{if does not,} \end{cases} \quad (2)$$

he will therefore cooperate as long as his type δ is larger than a threshold $\widehat{\delta}(\phi)$ equal to:

$$\widehat{\delta}(\phi) \equiv (1 - \phi - \beta p) S_a + L. \quad (3)$$

The expression of the threshold shows that the agent is more keen to talk the more generous the amnesty ϕ is, the higher the proportion of honest officials in the economy is, and the more efficient the prosecution stage is. It is interesting to observe that the efficacy of a leniency program strengthens if this is complemented with an efficient witness protection program. In our setting the parameter L will measure the effectiveness of such protection program: an accomplice who feels well protected (low L) is more inclined to cooperate with the justice.

Assuming that $\widehat{\delta}(\phi)$ lies in the interior of the support $[\underline{\delta}, \bar{\delta}]$ – a condition that will be checked in the Appendix – the agent's participation constraint can be written as:

$$u(w) = w - \alpha \left[\int_{\widehat{\delta}(\phi)}^{\bar{\delta}} ((1 - \phi) S_a + L) dG(\delta) + \int_{\underline{\delta}}^{\widehat{\delta}(\phi)} (p\beta S_a + \delta) dG(\delta) \right] \geq 0.$$

Clearly, this constraint will be binding, so that the equilibrium wage $w(\phi)$ makes the agent just indifferent between committing the crime and enjoying his reservation utility, that is:

$$w(\phi) = \alpha \left[\int_{\widehat{\delta}(\phi)}^{\bar{\delta}} ((1 - \phi) S_a + L) dG(\delta) + \int_{\underline{\delta}}^{\widehat{\delta}(\phi)} (p\beta S_a + \delta) dG(\delta) \right].$$

Equipped with this characterization, we can now turn to define the principal's expected utility from committing the crime, we have:

$$v(R) = R - w(\phi) - C(\phi),$$

where $C(\phi)$ represents his expected loss:

$$C(\phi) = \alpha\beta \left[\int_{\widehat{\delta}(\phi)}^{\bar{\delta}} \bar{\theta} S_p dG(\delta) + \int_{\underline{\delta}}^{\widehat{\delta}(\phi)} \underline{\theta} S_p dG(\delta) \right] + \alpha(1 - \beta) \int_{\widehat{\delta}(\phi)}^{\bar{\delta}} \bar{\theta} S_p dG(\delta).$$

The Legislator sets the amnesty rate ϕ so as to maximize social welfare. Using the fact that $H > \bar{R}$, this objective can be written as:

$$\max_{\phi \in \mathbb{R}_+} \int_{\max\{0, w(\phi) + C(\phi)\}}^{\bar{R}} (R - H) dF(R), \quad (4)$$

which amounts to maximize the principal's expected costs, i.e., the sum of the wage $w(\phi)$ and the expected loss $C(\phi)$:

$$\mathcal{L} : \max_{\phi \in \mathbb{R}_+} \widehat{R}_l(\phi) \equiv \alpha \int_{\widehat{\delta}(\phi)}^{\bar{\delta}} ((1 - \phi) S_a + L + \bar{\theta} S_p) dG(\delta) + \alpha \int_{\underline{\delta}}^{\widehat{\delta}(\phi)} (\beta (p S_a + \underline{\theta} S_p) + \delta) dG(\delta).$$

The next proposition describes the solution of \mathcal{L} and characterizes the optimal amnesty rate. Let $h(\delta) \equiv (1 - G(\delta)) / g(\delta)$, we have:

Proposition 1 *Assume **A1** and **A2**, then there exists a unique interior optimal amnesty rate ϕ^* which maximizes the Legislator's program \mathcal{L} and that solves the following necessary and sufficient first-order condition:*

$$h(\widehat{\delta}(\phi^*)) = (\bar{\theta} - \beta \underline{\theta}) S_p. \quad (5)$$

The first-order condition (5) has a simple economic interpretation. The optimal amnesty ϕ^* must balance (at the margin) the social gains and the social costs associated with the introduction of the accomplice-witnesses program. On the one hand, increasing the amnesty ϕ reduces the agent's expected sanction, whereby making entry into the organization less costly for the principal. On the other hand, a higher amnesty makes the agent more willing to cooperate by lowering the threshold $\widehat{\delta}(\phi)$, this increases the probability of convicting the principal, whereby stifling his incentive to commit the crime.

While the latter effect brings out the *bright side* of a leniency program, the former one underscores its *dark side*. Obviously, the relative strength of these two effects depends on the underlying parameters of the model: namely, the severity of the legal system, as measured by higher sanctions S_a and S_p , the efficiency of the prosecution system, as measured by larger probability of prosecution for both the agent and the principal, respectively p and $\underline{\theta}$, the quality of the information provided by the accomplice-witness $\bar{\theta}$, the fraction of honest public officials in the economy β and the retaliation power of the organization L .

The next corollary shows how the optimal policy characterized above affects both the prosecution and the crime rates.

Corollary 2 *Under **A1** and **A3**, the optimal policy ϕ^* shifts upward the boss's prosecution risk from β to $\beta + (1 - \beta)(1 - G(\widehat{\delta}(\phi^*)))$ and stifles the crime rate relative to the regime with no leniency, that is, $\widehat{R}_l(\phi^*) > \widehat{R}_n$.*

The optimal policy shifts the informant's testimony onto the boss' prosecution risk. In fact, while β can be interpreted as the rate of the boss's prosecution in the absence of leniency, the additional term $(1 - \beta)(1 - G(\widehat{\delta}(\phi^*)))$ reflects the variation of such a rate as implied by the inflow of new information provided by the mass $1 - G(\widehat{\delta}(\phi^*))$ of informants.

To explain why the leniency program also deters crime, note that a too low amnesty would replicate the same outcome as in the absence of leniency: in this case, even the more trial-averse agent (i.e., type $\bar{\delta}$) would prefer not to cooperate. In short, $\widehat{\delta}(\phi^*)$ must not exceed $\bar{\delta}$. Indeed, since the Legislator's objective function is concave in ϕ and has a maximum at ϕ^* (which under **A2** exceeds $\underline{\phi}$), it is suboptimal to induce no cooperation at all. On the other hand, note that the Legislator never wants to grant an amnesty rate so high that all agents cooperate. Indeed, such an amnesty rate would lower the principal's expected costs and spur the crime rate: the optimal policy cannot induce $\widehat{\delta}(\phi^*)$ to fall short of $\underline{\delta}$.

In the next proposition we summarize the comparative statics of the optimal policy:

Proposition 3 *The optimal amnesty ϕ^* satisfies the following properties:*

- *it increases with respect to the quality of the evidence provided by the informant $\bar{\theta}$, the principal's sanction S_p and the retaliation loss L ;*
- *it decreases with respect to the fraction of honest officials β and the efficiency of the prosecution system, $\underline{\theta}$ and p ;*
- *it increases with respect to the agent's sanction S_a as long as the optimal amnesty rate ϕ^* is lower than the probability of being acquitted if the agent decides to face the trial, $1 - \beta p$; the converse holds otherwise.*

A more intense amnesty is needed, the more reliable is the evidence provided by the informant and the more harshly the legal system punishes the boss of the criminal organization. This is because both these parameters spur the principal's conviction risk, whereby making the crime less profitable. The same conclusion holds with regard to the retaliation loss L : if the organization can punish the whistle-blower more harshly, or if the witnesses protection program is not very effective, a more generous amnesty is needed for the agent to find cooperating convenient. There is, however, less need for a generous amnesty when the fraction of honest officials in the economy gets larger, and if the prosecution system becomes more efficient. Intuitively, an increase in any of these parameters makes the crime less convenient even in the absence of a leniency program, whereby calling for lower discounts.

The impact of the agent's sanction S_a on the optimal amnesty is ambiguous: it depends only on the effect that harsher sanctions produce on the agent's propensity to talk, that is, on the equilibrium threshold $\widehat{\delta}(\phi^*)$. Essentially, if the optimal amnesty ϕ^* is lower than the probability of being acquitted if the agent decides to face the trial $1 - \beta p$, the fraction of informants decreases ($\widehat{\delta}(\phi^*)$ increases), therefore the Legislator is forced to increase the

amnesty rate in order to counterbalance the positive effect that a higher S_a has on the principal's profits via fewer informants. Otherwise, the opposite result obtains.

These insights also explain the following comparative statics about the fraction of flipping agents:

Proposition 4 *The fraction of agents who talk at the equilibrium satisfies the following properties:*

- *it increases with respect to the quality of the evidence provided by the informant $\bar{\theta}$ and the principal's sanction S_p ;*
- *it decreases with respect to the fraction of honest officials β and the efficiency of prosecution system vis-à-vis the boss, $\underline{\theta}$.*

As discussed in Section 2, the anti-Mafia programs not only offer leniency to informants, but often also secure them stable wages, health insurance, housing and other financial supports. It is therefore interesting to see when it is optimal to grant rewards (that is, $\phi^* > 1$). To address this question, we will assume here that the parameter δ is uniformly distributed over a support $[0, \bar{\delta}]$.

Under **A2**, which here implies $\bar{\delta} > S_p(\bar{\theta} - \beta\underline{\theta})$, there is a positive fraction of “talkers” at equilibrium; the first-order condition (5) yields:

$$\phi^* = 1 - p\beta + \frac{L}{S_a} - \frac{\bar{\delta} - S_p(\bar{\theta} - \beta\underline{\theta})}{S_a}. \quad (6)$$

A simple inspection of this condition yields:

Proposition 5 *When δ is uniformly distributed over $[0, \bar{\delta}]$, then it is optimal to offer a reward (i.e., $\phi^* > 1$) whenever:*

$$L > \underline{L} \equiv p\beta S_a + \bar{\delta} - S_p(\bar{\theta} - \beta\underline{\theta}). \quad (7)$$

Thus, if the retaliation loss L is excessively large, the optimal leniency program must reward accomplices. Since the lower-bound \underline{L} is increasing in $\bar{\theta}$, this is more likely to be necessary when the informant's testimony is highly reliable ($\bar{\theta}$ large), as exemplified by the case of Tommaso Buscetta, the first important *pentito*, who was allowed to live in the USA under a new identity in the Witness Protection Program after his testimony in the ‘New York Pizza Connection Trial’ in the mid-1980s.³³ Moreover, as \underline{L} is also decreasing in $\bar{\delta}$, the

³³Rewards are nowadays also granted to former members of the Japanese *Yakuza* cooperating with prosecutors. In exchange of information, the State helps them to find a job (Corriere della Sera, 2 June, 1992).

optimal policy must feature rewards also when the criminal organization exhibits a strong internal cohesion ($\bar{\delta}$ low); this is, for instance, the case of organizations such as the Calabrian 'Ndrangheta, whose members are mainly linked by blood relationships.

5 Evidence

In order to provide further empirical support to our theoretical predictions, in this section we exploit a panel data set relative to the 95 administrative provinces and 26 judicial districts which characterized Italy during the 1990s. The data rely on important aspects of organized crime in Italy as well as on some features of the leniency and accomplice-protection program introduced by the Italian Legislator in 1991.³⁴ The program grants lower sanctions, as well as protection, to those accomplices of mafia associations who provide information that might turn useful for prosecuting their former clans, and, more generally, for shedding new light on their internal organization and external complicities.³⁵

The main objective here is to argue that the available evidence points in the direction of our analysis. More precisely, besides predicting a negative correlation between leniency and mafia crimes, as reported in Section 3, our model delivers two additional testable implications about: the direct impact of leniency on the rate of prosecution of criminal organizations; and on the determinants of the criminals' propensity to join the protection program.

- (i) As stated in Proposition 1, our analysis implies that, for a given 'stock' of crimes committed, the introduction of a leniency program granting an amnesty ϕ shifts upward the prosecution rate from β to $\beta + (1 - \beta)(1 - G(\hat{\delta}(\phi)))$ – the term $(1 - G(\hat{\delta}(\phi)))$ measuring the mass of informants. This observation, together with the fact that, by law, any new accomplice must provide fresh information to be eligible for the program, imply that the rate of prosecution of mafia crimes should have increased after the 1991, thanks to the inflow of the accomplices joining the program.
- (ii) The theoretical model also suggests that four variables are mainly relevant for the decision of former accomplices to cooperate with prosecutors. As shown by equation (3), for a given level of trial reluctance δ , the individual is more inclined to talk the higher the amnesty rate ϕ , the higher the probability βp to be convicted and the

³⁴The number of provinces has been recently extended up to 103 since some old provinces have been split. See Appendix 2 for details on data.

³⁵It is important to stress that laws relative to the leniency program are nationwide and, as such, cannot induce any differential implementation across provinces or mafia associations.

stronger the effectiveness of the protection program – as reflected by a lower L . In the following we will mainly provide evidence on the impact of βp .

5.1 Did leniency spur prosecution?

Two distinct articles of the Italian penal code deal with criminal organizations: **art. 416** refers to the crime of ‘criminal association’, while **art. 416-bis** refers to the crime of ‘mafia-type association’. These articles regulate different types of crimes, but share some common features. For instance, associations of at least three people may be prosecuted both as criminal or as mafia-type associations. Moreover, both criminal and mafia-type associations are generally involved in the same kind of illicit activities. Nevertheless, the peculiarity of mafia-type associations, as stated by the third clause of art. 416-bis, is the exploitation of the force of intimidation, the condition of silence (*omertà*) which derives from it and the perverse relationships that they have with public officials. For our purpose, the key difference is that the Italian legislator allowed the possibility to enjoy lighter sentences in exchange of valuable information only to mafia affiliates (art. 8 D.L. 13/05/1991 n.152).

Prosecutions for both crimes are recorded according to the year in which the judicial authority begins the penal action and the province in which the crime has been committed. The time period begins in 1993 and lasts until 2005 since data before 1993 have not been collected by the Italian Statistical Office (ISTAT).

As expected, the provinces located in Sicily, Calabria and Campania exhibit the largest shares of prosecutions for the mafia association crime – see Table 3 which shows the top-5 provinces with most prosecutions for both crimes. The prosecutions for criminal association, instead, feature a higher degree of dispersion across the country (note that Milan is in the north and Rome in the center of Italy). Naples and Palermo are the provinces with the highest numbers of prosecutions for mafia; incidentally, Naples is also the province featuring the greatest number of prosecutions for generic criminal association.

In Italy prosecutions can be triggered either by the police forces³⁶ or by prosecutors themselves. Therefore, the total number of prosecuted crimes must reflect the sum of the subset of crimes reported to the judicial authority by the police forces which result in a prosecution, and those crimes brought into the spotlight by prosecutors themselves. Actually, for any crime reported by the investigation forces, the judicial authority may eventually prosecute more than one crime, possibly because the investigation and prosecution process may generate fresh information about other crimes. As a result, both the level and the evolution of the ratio between total crimes prosecuted and those reported by the police forces, appear as good proxies for identifying the impact of the testimonies of ‘flipping’ criminals on the

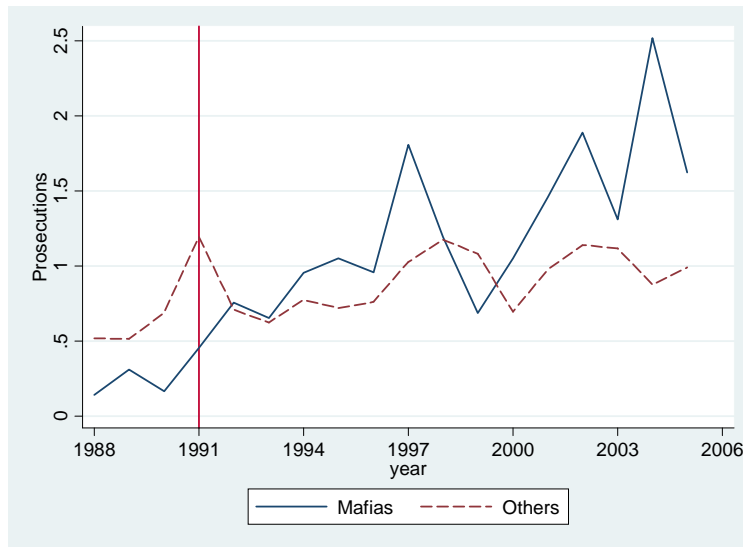
³⁶Namely, the *Carabinieri*, the Police and the Customs Police.

Table 3: TOP-5 PROVINCES WITH MOST PROSECUTIONS

Mafia-type association (art. 416-bis)		Criminal association (art. 416)	
Provinces	Prosecutions	Provinces	Prosecutions
Caltanissetta (Sicily)	255	Bari (Puglia)	382
Catanzaro (Calabria)	262	Palermo (Sicily)	422
Catania (Sicily)	286	Milano (Lombardia)	720
Napoli (Campania)	401	Roma (Lazio)	1125
Palermo (Sicily)	476	Napoli (Campania)	1306

Note: The table reports the total number of crimes prosecuted during 1993-2005, relative to artt. 416 and 416-bis of the Italian penal code.

Figure 3: ‘PROSECUTIONS’ AGAINST ORGANIZED CRIME IN ITALY



rate of prosecution. This is because the information provided by the accomplices officially participating to the protection program is handled exclusively by the judicial authority and not by the police forces. Hence:

- **Empirical prediction 1:** *The introduction of the leniency program should generate an increment in the ratio of crimes prosecuted by the judicial authority to the number of crimes reported by the police forces.*

Figure 3 illustrates the evolution of the ratios between the crimes prosecuted and those reported by the police forces in Italy from 1988 to 2005, for both mafia-type and other criminal organizations.³⁷ A first important point to emphasize is that in 1988 the ratio

³⁷Note that each prosecution must last at most one year, after which either the trial begins, provided that

related to mafia associations, labelled as *Mafias*, was well below that related to other criminal groups – *Others*. The former, however, registered a discrete shift upward in 1992, thus reaching the latter, and then did increase up to values around 2; differently, for the period of interest the ratio related to other criminal groups fluctuated around 1.

A more formal evidence of the peculiar pattern of prosecutions for mafia associations since 1993 can be provided by estimating the following equation:

$$PROSECUTION_{i,t} = a_i + cT_{i,t} + \varepsilon_{i,t},$$

where $PROSECUTION_{i,t}$ is the prosecution ratio relative to *Mafias* or *Others* in province i and year t , a_i is the province fixed effect, $T_{i,t}$ is a deterministic trend, and $\varepsilon_{i,t}$ is an error term. OLS estimates are reported in Table 4. The column labelled “Core-regions” refers to a restricted sample, which contains only the provinces belonging to Campania, Puglia, Calabria and Sicily. Instead, the column labelled “Rest of Italy” is relative to the other Italian provinces. The positive and significant coefficient for the trend clarifies that prosecutions relative to mafia association strongly increased after the introduction of leniency within the core-regions, i.e., those in which mafia type organizations have been historically more pervasive. A positive trend also emerges if we look at prosecutions related to criminal groups different from the mafia ones. However, the point estimate of c is now about one fourth of the corresponding coefficient for mafia-type associations. Differently, for the rest of Italy the path of the prosecution ratio does not feature a statistically significant trend.³⁸

Further evidence available only for Italy as a whole, might help clarifying that the peculiar pattern of prosecutions for mafia associations should not be driven by the time variation in the output of the judicial authority. Interestingly, an index of the prosecutors’ activity against mafia crimes suggests a decrease rather than an increase in the total output during the last fifteen years. Figure 4 displays the evolution of the ratio between the number of procedures completed in a given year — that is, those cases which are filed or end up with prosecutions — and the sum of total procedures pending at the beginning of the year

there is enough evidence, or the case is closed. Therefore, we construct our ratio by using the average value of crimes reported to the judicial authority by the police forces in two adjacent years as the denominator. Results do not change however if we use only the contemporaneous value.

³⁸Note that mafia association crime prosecutions within Campania, Puglia, Calabria and Sicily are significantly positively correlated with, respectively, the total number of former affiliates to Camorra, Sacra Corona Unita, ‘Ndrangheta and Mafia who benefit from the protection program. Such correlation instead does not hold when prosecutions refer to other criminal associations. Unfortunately, detailed data on accomplices during the 1990s are not available.

Table 4: CRIMES PROSECUTED AFTER LENIENCY

	Mafia-type associations: art. 416-bis			Criminal associations: art. 416		
	Italy	Core-regions	Rest of Italy	Italy	Core-regions	Rest of Italy
Trend	0.053*	0.116***	-0.019	0.015	0.029*	0.011
	(2.05)	(3.62)	(-0.52)	(1.23)	(2.15)	(0.69)
N	620	281	339	1212	286	926

Note: Dependent variable is the number of crimes prosecuted expressed as ratio with respect to the number of crimes accused by the police forces. For any t , the latter is the average of current and lagged accusations. Provincial dummies (not reported) are allowed. Time span: 1993-2005. Standard errors are robust to heteroschedasticity and intraprovince serial correlation (t-values are in parentheses). Significant coefficients are indicated by * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$.

and those starting during the year. The index changed from 0.46 in 1997 (when the data becomes to be available) to 0.38 in 2007, whereas during the same period the number of new procedures was mainly constant.³⁹ At the same time, it is interesting to point out that, during 2000-07, the number of people that prosecutors asked for prosecutions for mafia crimes as a share of the total number of people formally investigated by the judicial authority – variable Share in Figure 4 – increased from 0.31 up to 0.47.

In short, this suggests that although the rate at which prosecutors handle cases has not increased in the period under consideration, the final outcome of the investigation activity has featured an increase in the share of people prosecuted – a pattern which is strongly consistent with the evidence produced in Figure 3 and Table 4.

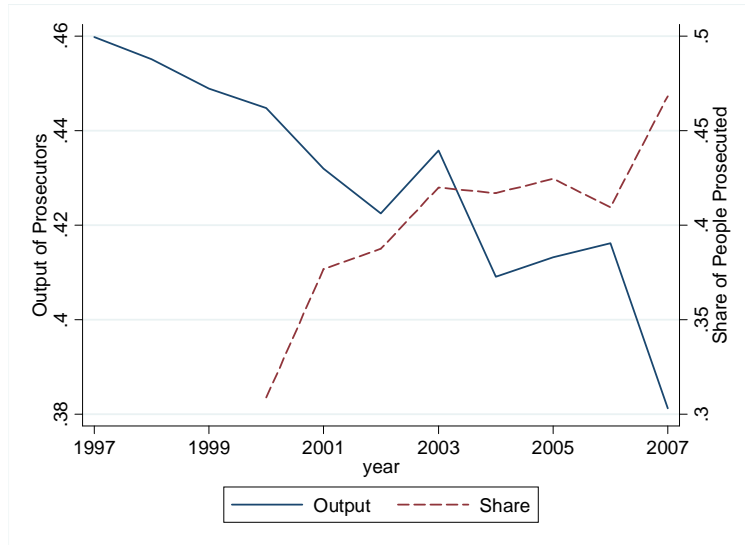
Taken together, the previous findings strongly suggest that after the introduction of the leniency policy more and more mafia crime cases were opened by prosecutors themselves thanks to the information provided by previous accomplices: a significant impulse to the prosecution activity against mafia association crimes was provided by the larger and more reliable information managed by the judicial authority thanks to the informants' testimonies. Thus, like in antitrust cases (Rey, 2003, and Miller 2009, among others), in addition to investigation activities, the design of leniency programs is an important tool also in fighting organized crime.

5.2 On the determinants to talk

We now provide some evidence about the determinants of the agents' incentive to talk. The starting point of the regression result is the definition of the 'indifference' threshold $\hat{\delta}(\cdot)$ as

³⁹The index is relative to the set of mafia crimes as indicated by the '*Codice di Procedura Penale*', art. 51. comma 3 bis.

Figure 4: PROSECUTORS ACTIVITY AND PEOPLE PROSECUTED



expressed by equation (3), which reflects the link between the number of accomplices and the underlying parameters of the theoretical model.⁴⁰ Actually, during the period in which data are available, the Italian Legislator did not modify the amnesty rate ϕ , thus its effect on $\hat{\delta}$ is not empirically identifiable. Instead, we are able to assess the impact of the efficiency of the judicial system, as measured by βp , on the inflow of accomplices. Hence:

- **Empirical prediction 2:** *The higher is the ‘perceived’ probability to be acquitted $1 - \beta p$, the lower is the number of flipping criminals.*

Starting from 2000, yearly information about the number of mafia accomplices entering the protection program is available. In particular, the data allow to associate each accomplice to his former mafia group – labelled as Camorra, ’Ndrangheta, Sacra Corona Unita, Mafia, or Others — as well as to the judicial district where he was prosecuted. This defines the number of talkers. Moreover, we use the share of people acquitted in mafia trials to proxy for $1 - \beta p$. The variation in such a share is exploited to determine the effects of the perceived probability of being convicted on the number of former accomplices who become talkers. The basic regression to deal with the empirical prediction is the following:

$$TALKERS_{i,t} = a_0 + a_1 ACQUITTANCE_{i,t} + a_{2,t} DT_t + \varepsilon_{i,t} \quad (8)$$

where $TALKERS_{i,t}$ is the number of former accomplices prosecuted in the judicial district i and entering the protection program in year t , $ACQUITTANCE_{i,t}$ is the share of people

⁴⁰As already discussed above, since we cannot be sure that the amnesty rate set by the Italian Legislator is the optimal one, we shall conduct our analysis by taking ϕ as given, i.e., we shall not evaluate equation (3) at ϕ^* as determined in Proposition 1.

involved in mafia trials who end up to be acquitted — that is people acquitted over the sum of people acquitted and convicted — and $t = 2000, \dots, 2007$. We introduce year dummies DT_t to control for nation-wide shocks. Under the assumption that $ACQUITTANCE_{i,t}$ is uncorrelated with $\varepsilon_{i,t}$, the coefficient a_1 identifies the effect of $1 - \beta p$ on the number of flipping criminals, thus we expect $a_1 < 0$.

Although we indeed believe that the propensity to become an informant is affected by the accomplice’s perceived probability to be convicted, we cannot neglect that *TALKERS* and *ACQUITTANCE* might be correlated because the cross-sectional variability of the former, which is partly due to historical differences among mafia groups, affects that of the latter. As noticed above, for instance, during the 1990s affiliates to the ’Ndrangheta had a very low propensity to collaborate with prosecutors when compared to the Mafia and Camorra accomplices. Thus, it might be reasonable to assume that

$$\varepsilon_{i,t} = v_i + \eta_{i,t}$$

where v_i is a district-specific time-invariant component correlated with $ACQUITTANCE_{i,t}$. We address such problem through the inclusion of district dummies among the regressors of equation (8) or by taking the first-differences of the variables of interest. By allowing for district dummies we control for mafia-specific fixed factors, so that only within-district variability in talkers contribute to the estimation of the acquittance’s effect. A similar argument applies when first-differences are considered. Hence, the two approaches should address the most likely endogeneity concern.

Table 5 reports the main results relative to all judicial districts characterized by at least 1 crime per year on average for *ACCUSATION* (that is, a total value during the period greater than 8) and to the subset of 10 districts strongly troubled by the four main mafia groups. The first two columns rely on district dummies while the third and fourth columns refer to the first-difference specification. As shown the coefficient a_1 is always estimated to be negative although not statistically significant (5% level) when the total sample is considered. Point estimates relative to the restricted sample are very similar between specifications.

Although allowing for fixed effects eliminates a potential channel of endogeneity, previous estimates may still be biased. If the information provided by the informants at time t not only affect the prosecution rate, as argued in the previous section, but also the outcomes of future trials in $t + s$, then it is more appropriate to assume feedbacks from current *TALKERS* to future *ACQUITTANCE*. In this circumstance, both the dummy variables and first-difference approaches might deliver inconsistent estimates. In particular, first-difference estimates would be consistent if $v_{i,t}$ is (eventually) correlated with $ACQUITTANCE_{i,t+s}$ for $s > 1$. Conversely, if talkers in t affected the sentences of trials in $t + 1$ – a possibility that by the way we cannot rule out – then $\Delta v_{i,t}$ would be positively correlated with

Table 5: INCENTIVES TO BECOME TALKERS

	Levels specification		First-difference specification	
<i>ACQUITTANCE</i>	-1.72	-11.31*	-2.80	-10.80**
	(-1.23)	(-2.54)	(-1.68)	(-3.10)
Obs. (Districts)	133 (17)	80 (10)	115 (17)	70 (10)

Note: Dependent variable is the number of former mafia accomplices who become informants. Results reported in the first two columns are based on variables in levels allowing for judicial districts as well as calendar year dummies. Results reported in the last two columns are based instead on first-difference variables. The t-values are in parentheses (standard errors are robust to heteroskedasticity); significant coefficients are indicated by * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$.

$\Delta ACQUITTANCE_{i,t}$ thus implying a toward to zero bias of the OLS estimate. In this case, however, a suitable instrumental variable for $\Delta ACQUITTANCE_{i,t}$ is $ACQUITTANCE_{i,t-1}$.

The results of the first-stage regression are reported in the first row of table 6. Clearly, the lagged level of *ACQUITTANCE* is strongly correlated with its first-difference; the partial R2 is around 15% and the F-statistics for the exclusion restriction is above 10. The second row reports results of the second-stage regression. Consistently with previous results a higher share of people acquitted generates a lower number of talkers. The IV coefficient is substantially higher in absolute value than the OLS ones (-29.03 instead of -10.80 or -11.31), whereby suggesting that previous estimates were indeed biased toward zero. Finally, we also report the Anderson-Rubin test — the F-statistics and the p-value — for the null hypothesis that the coefficient a_1 is statistically not different from zero. The test is robust to potentially weak instruments. It confirms that the estimated coefficient for the effect of the probability to be acquitted on the number of talkers is significant at the 1% significance level.

We close the section discussing some further results. Our main conclusion is robust to the inclusions of a number of controls. Equation (8) has been also estimated including the variables *MURDER* and *ACCUSATION*, the ratio between the number of mafia trials completed in a given year and the number of trials pending at the beginning of the year, *TRIAL*, and the total number of talkers in the protection program at the beginning of the year. According to the theoretical model, any event which somehow affects the shape or the range of the distribution of δ implies a shift in the propensity to become informant, everything else being kept constant. This outcome may be a short-lived consequence of mafia wars among different clubs of the same main group.⁴¹ The variable *MURDER* should

⁴¹Note that there is no historical evidence at all of conflicts between the four main mafia groups, that is, for instance, between the Camorra and the 'Ndrangheta or the former and the Mafia.

Table 6: INCENTIVES TO BECOME TALKERS: IV REGRESSION

	First stage coefficient and statistics		
$ACQUITTANCE_{i,t-1}$	-0.36***	Partial R2	0.15
	(-3.36)	F-test (p-value)	11.27 (0.001)
	Second stage coefficient and statistics		
$\Delta ACQUITTANCE_{i,t}$	-29.03**	Anderson_Rubin (H0: $a_1 = 0$)	7.25
	-2.68	p-value	0.009

Note: The dependent variable is the first-difference of the former mafia accomplices who become informants. The t-values are in parentheses (standard errors are robust to heteroskedasticity). The Anderson-Rubin statistics for the hypothesis that the coefficient on is not significant corresponds to the statistics $F(1,62)$. Statistical significance is indicated by * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$.

capture such shocks; the role of other controls is straightforward. The IV estimated $ACQUITTANCE$ coefficient remains statistically significant and is only slightly altered by the inclusion of controls; the point estimate is -27.70 and the p-value of the Anderson-Rubin test is 0.015. In the first stage regression the t-ratio relative to the instrument is -3.29 .

At least two different pieces of evidence are available on the relationship between public officials and mafia organizations. Overall they imply that the various mafias are able to influence the public sector activity at local levels and are consistent with the idea that, by means of their external complicities, criminal organizations may indeed affect the efficiency of the judicial system and thus the variation in $1 - \beta p$. First, table 7 reports the provincial distribution of local governments shut down since 1991 because of relationships between administrators and the mafias. Such relationships may substantiate as direct infiltrations of mobsters into the local administrations or through indirect influence, whereby proxying the size of the criminal network between mafia groups and the public domain. Within the sample 172 municipalities have been shut down by the central government: 75 in Campania, 49 in Sicily, 38 in Calabria, 7 in Puglia, and only 3 municipalities in the rest of Italy. The second evidence relies on the number of public officials convicted for bribing at regional level, $CORRUPTION$. Regressing $\Delta ACQUITTANCE$ on $\Delta CORRUPTION$ lagged (per capita) it follows a negative and statistically significant coefficient (p-value less than 5%) which is robust to the inclusion of year dummies, the lagged level of $ACQUITTANCE$ and the above set of controls. Thus, variations in convictions for corruption and mafia crimes tend to be related. Given that, as a final step of our analysis we have used the lagged difference of corruption as a further instrument in the IV regression. The estimate of a_1 without controls is now -30.61 , very similar to the previous one; the null hypothesis of the Hansen overidentification test is not rejected (p-value is 0.78), thus supporting the validity of the results.

Table 7: MUNICIPALITIES AND MAFIAS

Napoli	44	Palermo	23	Reggio C.	23	Bari	5
Caserta	22	Catania	9	Catanzaro	7	Lecce	2
Salerno	5	Trapani	5	Vibo V.	5		
Avellino	3	Caltanissetta	5	Crotone	3		
Benevento	1	Agrigento	4				
		Messina	2				
		Ragusa	1				
Campania	75	Sicily	49	Calabria	38	Puglia	7

Note: Data refers to municipalities shutted down by the central government because of relationships between administrators and the mafias.

6 Related Literature

Our theoretical analysis is related to the literature on antitrust law enforcement studying the effects of leniency programs on cartel formation in oligopolistic markets. The first paper explicitly addressing the effects of leniency programs on cartels is Motta and Polo (2003). They analyze the impact of reduced fines for cartel members that inform the antitrust authority and show that it can be efficient to reduce fines even when the authority has already started an investigation, but has not yet obtained evidence of misbehavior. Besides other differences, this paper takes leniency rules as exogenous, while the identification of the optimal leniency is a key point in our analysis. Following Rey (2003) and Spagnolo (2003), we also take into account the role of rewards to former criminals by studying their determinants and social value.⁴² Perhaps, the spirit of our paper is closer to Chen and Rey (2007), which study the optimal design of leniency programs in a standard oligopoly framework. As Chen and Rey, we also take a mechanism design approach to leniency, but in a very different context. Finally, in an antitrust setting, Aubert et al. (2006), analyze a model where leniency programs could have a positive social value insofar as they create a conflict of interests between members of different organizations (cartels or firms). They also discuss informally the idea that leniency programs could be desirable insofar as generate conflicts between the members of the same organizations (e.g., firms). Our model is built precisely on this intuition but, in contrast to them, it fully develops the formal arguments, and it identifies the main trade-offs at stake by shedding novel light on the available historical and empirical evidence.

Another strand of literature our paper relates to is that on organized crime. Tradition-

⁴²Contrary to Motta and Polo (2003), Spagnolo (2003) assumes that when a cartel is detected it is also convicted. This allows to focus on the impact of leniency on cartels which are not already under investigation.

ally, this literature has stressed welfare comparisons between monopoly and competitive supply of bads, as for instance in Buchanan (1973) and Backhaus (1979), while more recently Jennings (1984), Polo (1995), Konrad and Skaperdas (1994, 1997) and Garoupa (2000) started to model a criminal organization as a vertical structure where the principal has the necessity to discipline its members.⁴³ However, these models have neglected two relevant aspects. First, members at various levels of the criminal chain have different bargaining power and, perhaps more importantly, face different prosecution risks and are possibly treated in a different manner by the law. Second, they overlook the role of accomplice-witness programs as a tool to generate conflict within criminal organizations and their optimal design, which are key to our analysis.

Our empirical results on the evolutions of prosecution rates and mafia murders are closely related to the evaluation of leniency in cartel enforcement by Miller (2009).⁴⁴ In general, the present evidence is fully consistent with Miller’s results. However, whereas our evidence on increased prosecutions is in the same spirit of that on the enhanced detection capabilities of cartels after leniency, differently from Miller we also provide some evidence about deterrence by noting that the unique feature of murders, with respect to many other crimes, is that measured and effective amounts are almost the same. This implies that discovered murders are representative of the entire population and that the usual difficulty of ascertaining deterrence, when the confounding effect of increased rate of detection also holds, does not apply.⁴⁵ Moreover, as a further difference with Miller, we would like to stress that our results rely on a panel data set at provincial level. This feature should assure more robust identification than that based on a single time-series.

7 Concluding remarks

We have identified the determinants of accomplice-witnesses programs by underscoring the beneficial role that granting amnesty to informants plays on the crime and prosecution rates. Our theoretical analysis has shown that the necessity of dealing with former criminals willing to cooperate with the justice, becomes more intense as long as the prosecution system is poorly efficient, criminal organizations have strong ties with public officials and the information provided by “flipping criminals” is highly reliable. Consistent with the available historical evidence, the analysis has also shown that the degree of cohesion between

⁴³See also Fiorentini and Peltzman (1995), Kugler, Verdier and Zenou (2005) and Mansour et al. (2006).

⁴⁴Miller (2009) relies on data generated by the leniency program introduced by the U.S. Department of Justice in 1993 with the intent of destabilizing existing cartels and deterring new cartels.

⁴⁵On the deterrence and incapacitation effects of the criminal justice system see Ehrlich (1973) and Levitt (1996, 1997 and 1998).

the members of a criminal organization is key for the design of the optimal leniency policy: rewards or monetary benefits to informants are indeed sometimes necessary in the presence of organizations featuring strong cohesion between their members.

The evidence supports the idea that accomplice-witnesses regulations have a positive effect on prosecution as well as on deterrence. We have also tested some implications of our theoretical analysis on the determinants of the criminals' incentive to cooperate. According to our model, the estimates show that the inflow of accomplices is negatively correlated with a proxy of the inefficiency of the judicial system and positively correlated with a proxy of conflicts within and between criminal organizations.

Appendix 1

Proof of Proposition 1: Differentiating $\widehat{R}_l(\phi)$ with respect to ϕ and using the fact that $\partial\widehat{\delta}(\phi)/\partial\phi = -S_a$, we have the first-order condition:

$$-S_a(1-G(\widehat{\delta}(\phi))) + S_a((1-\phi)S_a + L + \bar{\theta}S_p)g(\widehat{\delta}(\phi)) - S_a(\beta(pS_a + \underline{\theta}S_p) + \widehat{\delta}(\phi))g(\widehat{\delta}(\phi)) = 0.$$

Collecting terms and using the definition of $\widehat{\delta}(\phi)$, the above equation immediately implies (5). In order to prove uniqueness we need to show two preliminary results. Specifically, we must verify that the Legislator cannot gain by setting the amnesty rate neither so large that all agents will talk, that is $\widehat{\delta}(\phi) \leq \underline{\delta}$, nor so small that no one will talk, that is $\widehat{\delta}(\phi) \geq \bar{\delta}$. Suppose first that δ satisfies $\widehat{\delta}(\phi) = \underline{\delta}$, so that $G(\widehat{\delta}(\phi)) = 0$. The sign of the first-order derivative of $\widehat{R}_l(\phi)$ with respect to ϕ is determined by:

$$\text{sign} \left. \frac{\partial\widehat{R}_l(\phi)}{\partial\phi} \right|_{\widehat{\delta}(\phi)=\underline{\delta}} = \text{sign} [-1 + (\bar{\theta} - \beta\underline{\theta}) S_p g(\underline{\delta})],$$

and under **A2** this sign is negative, implying that setting ϕ so large to induce all agents to talk is not optimal. Consider now the case where $\widehat{\delta}(\phi) = \bar{\delta}$, so that $G(\widehat{\delta}(\phi)) = 1$. The sign of the first-order derivative of $\widehat{R}_l(\phi)$ with respect to ϕ is determined by:

$$\text{sign} \left. \frac{\partial\widehat{R}_l(\phi)}{\partial\phi} \right|_{\widehat{\delta}(\phi)=\bar{\delta}} = \text{sign} [(\bar{\theta} - \beta\underline{\theta}) S_p g(\bar{\delta})],$$

implying immediately that setting ϕ so small to induce no agent to talk is also not optimal.

Now, showing that \mathcal{L} features a unique interior solution identified by (5) amounts simply to verify that $\widehat{R}_l(\phi)$ is single peaked (or strictly quasi-concave): this implies that for all $\phi \geq \phi^*$ the derivative of $\widehat{R}_l(\phi)$ must be negative. Therefore, given the link between the function $\widehat{\delta}(\cdot)$ and ϕ it must be true that:

$$-(1 - G(\delta)) + (\bar{\theta} - \beta\underline{\theta}) S_p g(\delta) < 0 \text{ for all } \delta \leq \widehat{\delta}(\phi^*). \quad (9)$$

Using the fact that by (5) it must be $(\bar{\theta} - \beta\underline{\theta}) S_p = h(\widehat{\delta}(\phi^*))$, and substituting into (9) we will have uniqueness if:

$$-(1 - G(\delta)) + h(\widehat{\delta}(\phi^*))g(\delta) < 0 \text{ for all } \delta \leq \widehat{\delta}(\phi^*),$$

which, in turn, implies $h(\widehat{\delta}(\phi^*)) < h(\delta)$ for all $\delta \leq \widehat{\delta}(\phi^*)$, but this inequality is directly implied by **A1** stating that the hazard rate $g(\delta)/(1 - G(\delta))$ is strictly increasing in δ . Hence the result. ■

Proof of Corollary 2: Showing that the crime rate always reduces under leniency relative to the no leniency regime requires a simple revealed preference argument. In fact, the

Legislator could obtain the same outcome as in the no leniency case by setting a rate such that $\widehat{\delta}(\phi) \geq \bar{\delta}$. But, as shown above, this is never optimal under **A1** and **A2**. Finally, showing that the introduction of the leniency program shifts upward the prosecution rate from β to $\beta + (1 - \beta)(1 - G(\widehat{\delta}(\phi^*)))$ is immediate: for $\delta \geq \widehat{\delta}(\phi^*)$ agents might talk even though matched to a dishonest official. ■

Proof of Proposition 3: The comparative statics results illustrated in this proposition can be obtained by a simple application of the Implicit Function Theorem. Let

$$\dot{h}(\delta) = \frac{\partial}{\partial \delta} \left(\frac{1 - G(\delta)}{g(\delta)} \right),$$

which is negative under **A1**. Differentiating with respect to $\bar{\theta}$ we have:

$$\text{sign} \frac{\partial \phi^*}{\partial \bar{\theta}} = \text{sign} \frac{S_p}{|\dot{h}(\widehat{\delta}(\phi^*))| \left| \frac{\partial \widehat{\delta}(\phi^*)}{\partial \phi} \right|},$$

which directly implies $\partial \phi^* / \partial \bar{\theta} > 0$.

Differentiating with respect to S_p on has:

$$\text{sign} \frac{\partial \phi^*}{\partial S_p} = \text{sign} \frac{\bar{\theta} - \beta \underline{\theta}}{|\dot{h}(\widehat{\delta}(\phi^*))| \left| \frac{\partial \widehat{\delta}(\phi^*)}{\partial \phi} \right|},$$

which, implies $\partial \phi^* / \partial S_p > 0$ since $\bar{\theta} \geq \beta \underline{\theta}$.

By using the same logic one has:

$$\text{sign} \frac{\partial \phi^*}{\partial L} = \text{sign} \frac{\frac{\partial \widehat{\delta}(\phi^*)}{\partial L}}{\left| \frac{\partial \widehat{\delta}(\phi^*)}{\partial \phi} \right|},$$

which implies $\partial \phi^* / \partial L > 0$ since $\partial \widehat{\delta}(\phi^*) / \partial L = 1 > 0$.

Differentiating with respect to β and rearranging one has:

$$\text{sign} \frac{\partial \phi^*}{\partial \beta} = -\text{sign} \frac{|\dot{h}(\widehat{\delta}(\phi^*))| \left| \frac{\partial \widehat{\delta}(\phi^*)}{\partial \beta} \right| + \underline{\theta} S_p}{|\dot{h}(\widehat{\delta}(\phi^*))| \left| \frac{\partial \widehat{\delta}(\phi^*)}{\partial \phi} \right|},$$

where by definition of $\widehat{\delta}(\cdot)$ it must be $\partial \widehat{\delta}(\phi^*) / \partial \beta = -p S_a < 0$. It then follows that $\partial \phi^* / \partial \beta < 0$.

Differentiating with respect to p we have:

$$\text{sign} \frac{\partial \phi^*}{\partial p} = -\text{sign} \frac{\left| \frac{\partial \widehat{\delta}(\phi^*)}{\partial p} \right|}{\left| \frac{\partial \widehat{\delta}(\phi^*)}{\partial \phi} \right|},$$

which implies $\partial\phi^*/\partial p > 0$ since $\partial\widehat{\delta}(\phi^*)/\partial p = -\beta S_a < 0$.

Differentiating with respect to $\underline{\theta}$ we have:

$$\text{sign} \frac{\partial\phi^*}{\partial\underline{\theta}} = -\text{sign} \frac{\beta S_p}{|h(\widehat{\delta}(\phi^*))| \left| \frac{\partial\widehat{\delta}(\phi^*)}{\partial\phi} \right|},$$

which immediately shows that $\partial\phi^*/\partial\underline{\theta} > 0$. Finally, differentiating with respect to S_a and using the first-order condition (5) one gets:

$$\text{sign} \frac{\partial\phi^*}{\partial S_a} = \text{sign} \frac{\frac{\partial\widehat{\delta}(\phi^*)}{\partial S_a}}{\left| \frac{\partial\widehat{\delta}(\phi^*)}{\partial\phi} \right|}.$$

Now, since $\partial\widehat{\delta}(\phi^*)/\partial S_a = 1 - \phi^* - p\beta$ it follows:

$$\text{sign} \frac{\partial\phi^*}{\partial S_a} = \text{sign} (1 - \phi^* - p\beta),$$

the proof is then concluded. ■

Proof of Proposition 4: Let $\bar{\delta} - \widehat{\delta}(\phi^*)$ be the fraction of informants at the equilibrium. The proof of this result follows from Proposition 3 and the fact that $\widehat{\delta}(\phi^*) = h^{-1}((\bar{\theta} - \beta\underline{\theta}) S_p)$ with $h^{-1}(\cdot)$ being increasing by **A1**. ■

Proof of Proposition 5: Consider equation (6), simple algebra allows to show that $\phi^* > 1$ if the inequality in (7) holds. ■

Appendix 2: Data

Mafia (malicious or intentional) murders: number of mafia murders reported by the police forces to the judicial authority. Source: Italian Institute of Statistics (ISTAT), Statistiche giudiziarie penali (several issues).

Malicious or intentional murders: total number of malicious murders, for reasons different than mafia, reported by the police forces to the judicial authority. Source: ISTAT, Statistiche giudiziarie penali (various issues).

Robberies in banks and post offices: number of robberies in banks and post offices reported by the police forces to the judicial authority. Source: ISTAT, Statistiche giudiziarie penali (various issues).

Kidnappings: number of kidnappings excluding those related to extortion reported by the police forces to the judicial authority. Source: ISTAT, Statistiche giudiziarie penali (various issues).

Prosecution of mafia-type association cases: number of cases of mafia association (art. 416-bis of the Italian penal code) prosecuted. Each prosecution is recorded according to the starting year, that is when the judicial authority begins the penal action. For each year the spatial distribution reflects the province where the crime prosecuted is presumed to be committed. Source: ISTAT, Statistiche giudiziarie (various issues).

People prosecuted for mafia crimes: total number of people prosecuted because of mafia crimes as indicated by the ‘Codice di Procedura Penale’, art. 51. comma 3 bis. Source: Italian Department of Justice.

Prosecution of criminal association cases: number of cases of criminal association (art. 416 of the Italian penal code) prosecuted. Each prosecution is recorded according to the starting year, that is when the judicial authority begins the penal action. For each year the spatial distribution reflects the province where the crime prosecuted is presumed to be committed. Source: ISTAT, Statistiche giudiziarie (various issues).

Mafia-type association accusation: number of cases of mafia association (art. 416-bis of the Italian penal code) reported by the police forces to the judicial authority. Source: ISTAT, Statistiche giudiziarie (various issues).

Criminal association crime accusation: number of cases of criminal association (art. 416 of the Italian penal code) reported by the police forces to the judicial authority. Source: ISTAT, Statistiche giudiziarie (various issues).

Talkers: number of former mafia affiliates participating to the Italian accomplice-witnesses protection program. The dataset associates each accomplice with his former criminal orga-

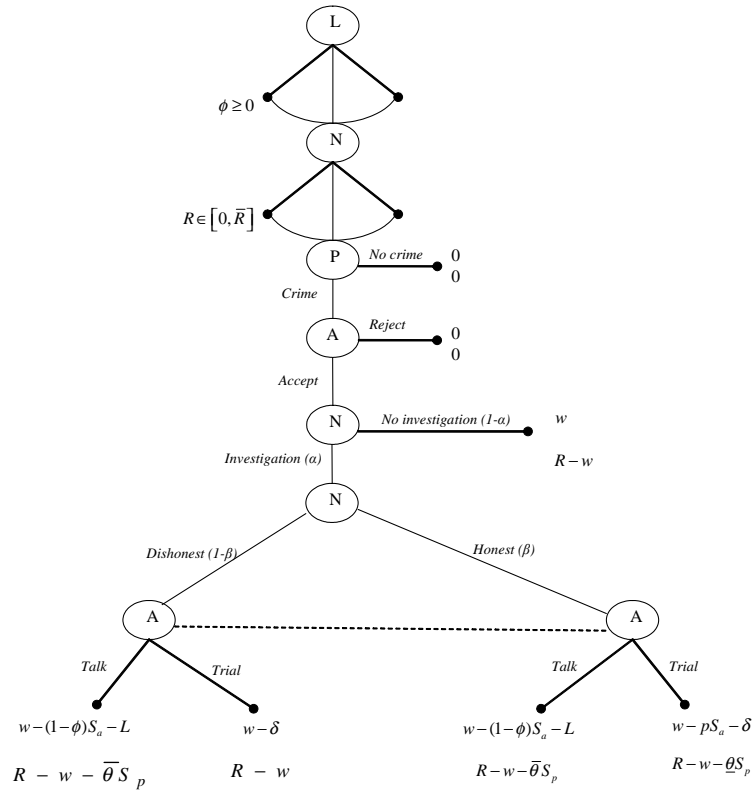
nization (labelled as Camorra, 'Ndrangheta, Sacra Corona Unita and Mafia) and the judicial district of prosecution. Source: Commissione parlamentare d'inchiesta sul fenomeno della criminalità organizzata mafiosa o similare, technical report (various issues).

People convicted for mafia crimes and people acquitted: the number of people involved in trials — relative to mafia crimes as indicated by the 'Codice di Procedura Penale', art. 51. comma 3 bis — who end up to be convicted or acquitted. Spatial variability: 26 judicial districts. Source: Italian Department of Justice.

Trials pending and completed: the number of trials pending at the initial year or completed during the year — relative to mafia crimes as indicated by the 'Codice di Procedura Penale', art. 51. comma 3 bis. Spatial variability: 26 judicial districts. Source: Italian Department of Justice.

Municipality: local governments dismissed by the central government because of ties between administrators and the Mafia either through direct infiltrations of mobsters into the local administrations or by indirect influence. Source: Commissione parlamentare d'inchiesta sul fenomeno della criminalità organizzata mafiosa o similare, technical report (various issues).

Corruption: Public officials convicted because of bribery. Source: Alto Commissariato per la Lotta alla Corruzione. Data are relative to Italian regions during 1996-2006. Note that according to the Italian Penal Code, corruption crimes may be only committed by public officials and persons in charge of a public service.



GAME TREE

Bibliography

- Aubert, C., Kovacic, W., and Rey P. (2006), “The Impact of Leniency and Whistleblowing Programs on Cartels”, *International Journal of Industrial Organization*, 24: 1241-1266.
- Ayala, G. (2008), *Chi ha Paura Muore ogni Giorno*, edited by Mondadori, Milano.
- Anderson, A. (1979), *The Business of Organized Crime: A Cosa Nostra Family*, Stanford, The Hoover Institution.
- Anselmo, M., and Braucci, M. (2008), *Questa Corte Condanna: Spartacus, il Processo al Clan dei Casalesi*, edited by L’Ancora, Naples.
- Backhaus, J. (1979), “Defending Organized Crime? A note,” *Journal of Legal Studies*, 8: 623-631.
- Buchanan, J. (1973), “A Defense of Organized Crime?”, in *The Economics of Crime and Punishment*, edited by S. Rottenberg, American Enterprise Institute.
- Becker, G. (1968), “Crime and Punishment: an Economic Approach,” *Journal of Political Economy*, 76: 169-217.
- Cantone, R. (2008), *Solo per Giustizia*, edited by Mondadori, Milano.
- Cassese, S. (1977), “Regionalizzazione del 1977: Un primo bilancio”, *Politica ed Economia*, 8: 37-40.
- Cassese, S. (1983), “Espansione e controllo della spesa pubblica: Aspetti istituzionali”, *Rivista di Politica Economica*, 73: 153-171.
- Chen, Z., and Rey, P. (2007), “On the Design of Leniency Programs,” mimeo TSE.
- Dickey, J. (2004), *Cosa Nostra: A History of the Sicilian Mafia*, edited by Hodder & Stoughton.
- Ehrlich, I. (1973), “Participation in Illegitimate Activities,” *Journal of Political Economy*, 81: 521-565.
- Falcone, G., (1991), *Cose di Cosa Nostra*, edited by Rizzoli, Milano.
- Fiorentini G., and Peltzman, S., (1995), *The Economics of Organized Crime*, Cambridge University Press, Cambridge, and CEPR, 1-30.
- Fisman, R., and Svensson, J. (2007), “Are Corruption and Taxation Really Harmful to Growth? Firm Level Evidence,” *Journal of Development Economics*, 83: 63–75.

- Gambetta, D. (1992), *La Mafia Siciliana*, edited by Einaudi, Torino.
- Garoupa, N. (1997), “The Theory of Optimal Law Enforcement,” *Journal of Economic Surveys*, 11: 267-295.
- Garoupa, N. (2000), “The Economics of Organized Crime and Optimal Law Enforcement,” *Economic Inquiry*, 38: 278-288.
- Golden, M. (2003), “Electoral Connections: The Effects of the Personal Vote on Political Patronage, Bureaucracy and Legislation in Postwar Italy,” *British Journal of Political Science*, 33: 189-212.
- Harrington, J. E., (2006), “Modelling the Birth and Death of Cartels with an Application to Evaluating Antitrust Policy”, mimeo.
- Konrad, K., Skaperdas, S. (1998), “Extortion,” *Economica*, 65: 461-477.
- Konrad, K., Skaperdas, S., (1997), “Credible Threats in Extortion,” *Journal of Economic Behavior and Organization*, 33: 23-39.
- Kugler, M., Verdier, T., and Zenou, Y., (2005), “Organized Crime, Corruption and Punishment,” *Journal of Public Economics*, 89: 1639-1663.
- Jennings, W., (1984), “A Note on the Economics of Organized Crime,” *Eastern Economic Journal*, 3: 315-321.
- Levitt, S. (1996), “The Effect of Prison Population Size on Crime Rates: Evidence from Prison Overcrowding Litigation,” *Quarterly Journal of Economics*, 111: 319–51.
- Levitt, S. (1997), “Using Electoral Cycles in Police Hiring to Estimate the Effect of Police on Crime,” *American Economic Review*, 87: 270–90.
- Levitt, S. (1998), “Juvenile Crime and Punishment,” *Journal of Political Economy*, 106: 1156-1185.
- Lodato., S. (2006), *Trent’Anni di Mafia*, edited by Rizzoli, Milano.
- Mansour, A., Marceau, N., and Mongrain, S. (2006), “Gangs and Crime Deterrence,” *Journal of Law Economics and Organization*, 22: 315-339.
- Miller, N. H. (2009), “Strategic Leniency and Cartel Enforcement”, *American Economic Review*, 99: 750–68.
- Motta, M., and Polo, M. (2003), “Leniency Programs and Cartel Prosecution,” *International Journal of Industrial Organization*, 21: 347-379.

- Paoli, L. (2003), *Mafia Brotherhoods: Organized Crime, Italian Style*, New York, Oxford University Press.
- Polo, M., (1995), “Internal Cohesion and Competition among Criminal Organizations”, in *The Economics of Organized Crime*, edited by G., Fiorentini and S. Peltzman, Cambridge University Press, Cambridge, and CEPR, 87-109.
- Portes, A. (1998), “Social Capital: Its Origins and Applications in Modern Sociology,” *Annual Review of Sociology*, 24: 1-24.
- Posner, R. (1992), *The Economic Analysis of Law*, 4th Edition. Boston: Little Brown.
- Rey, P. (2003), “Toward a Theory of Competition Policy,” in *Advances in Economics and Econometrics: Theory and Applications*, Eighth World Congress, M. Dewatripont, L. P. Hansen, S. J. Turnovsky eds, Cambridge University Press.
- Spagnolo, G. (2003), “Optimal Deterrence Mechanisms against Cartels and Organized Crime,” mimeo, Mannheim.