

# Accomplice-Witness 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*. 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 in the introduction of accomplice-witness 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 crime, spurs prosecution and induces a positive relationship between the number of whistleblowers and the conviction rate. The available evidence supports the model's predictions.

**Keywords:** Accomplice-witness, Criminal Organizations, Leniency, Whistleblower.

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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 enhance the effectiveness of investigation agencies and strengthen deterrence. These reforms have promoted the approval of special laws changing the rules according to which sanctions and imprisonment policies are settled. Among them those introducing ‘accomplice-witness 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-witness regulations, we develop a model with hierarchical criminal organizations and dishonest officials where, to break down *omertà*, the Legislator grants lenient punishments to those 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-witness program introduced in 1991 has been a relevant tool for fighting mafia associations in those Italian provinces where they have been historically more pervasive: we identify the positive effect of the policy on prosecution and show that it also strengthened deterrence. Moreover, we also provide evidence 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 whistleblowers. 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.<sup>1</sup> 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 who always acquit criminals ended up under investigation.

We point out 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

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<sup>1</sup>For instance, in 1992, former Camorra accomplice Pasquale Galasso revealed information crucial for the arrest of his boss Carmine Alfieri.

into the illegal business by lowering the agent’s expected sanction and thus the compensation that the boss has to pay to hire him – 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 shows that the optimal policy stifles the crime rate, spurs prosecution relative to the ‘status quo’ where cooperation is not rewarded, and induces a negative relationship between the number of whistleblowers and the conviction rate. We also 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 judicial system 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 needed 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 the first important *pentito* Tommaso Buscetta, who 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, underlines the relevant role played by the informative content of testimonies in determining the amnesties granted to former accomplices. The importance of this link was recognized by the Italian Parliament who reformed the accomplice-witness 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.<sup>2</sup> 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 on upcoming police operations.

To support our theoretical predictions, we exploit a unique panel data set, relative to 95 Italian provinces and 26 judicial districts, providing information not only about many

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<sup>2</sup>This 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.

important aspects of organized crime in Italy, but also on some relevant features of the Italian leniency and accomplice-protection program. We use these data to document 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. To the best of our knowledge, this is the first paper to address these empirical issues in the context of organized crime.<sup>3</sup>

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

## 2 The Italian experience: historical and motivating evidence

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 been a characteristic in several areas of Italy. In 1982, the Italian Legislator, recognizing the pervasive role of ‘mafia-type criminal associations’, adopted the article 416-bis of the Penal Code, which defines a mafia association as “the exploitation of the force of intimidation of the associative tie and of the condition of subjugation and silence (*omertà*) which derives from it” and makes it a crime offense to belong a mafia family.<sup>4</sup>

From 1982 to 2001, the new offence led to the convictions of 5,443 Italian citizens.

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<sup>3</sup>Fyfe and Sheptycki (2005) provide a review of the existing evidence on this topic.

<sup>4</sup>Many offences correspond to the illicit activity of criminal associations (for instance, drug traffic, loan sharking, murder, and extortion). However, the mafia association offence refers specifically to the use of fear through the force of intimidation by the entire organization. Thus, a common crime offence such as extortion is sentenced in a different way when it is committed through mafia intimidation. Moreover, even a licit goal may be prosecuted if it is achieved through the force of subjugation.

Data at regional level show that 5,069 individuals, that is, more than 93% of the convicted mobsters, were sentenced in 4 out of the 20 Italian regions: Sicily and Campania exhibit the highest number of convictions, followed by Puglia and Calabria (Table 1). These regions have historically been 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.<sup>5</sup> 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, special relationships between mafia 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 these external complicities, the Italian Legislator decided to set harsher punishments for mafia affiliates and, at the same time, to grant full or partial amnesty to 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 an accomplice-witness protection program, aimed at protecting those who endanger themselves because of the information provided to the judicial authority (D.L. 15/01/1991 n. 8).<sup>6</sup>

Table 2 reports the 2008 distribution of former mafia accomplices who took 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 total),

<sup>5</sup>In the following we sometimes refer to those regions as core-regions.

<sup>6</sup>This 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 prosecutors without fear of intimidation or reprisal has been perceived as essential to maintain 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: WHISTLEBLOWERS AND CONFISCATION

	Whistleblowers		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: Whistleblowers 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.

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. Table 2 also shows that 93% of the proceeds confiscated concern the Camorra, Sicilian mafia, 'Ndrangheta, and SCU. As for the number of accomplices, the Camorra and the Sicilian mafia are those mostly affected by the confiscation laws.

## 2.2 Buscetta meets Falcone: the emergence of accomplice-witnesses

The first mafia member acknowledging the existence of 'Cosa Nostra' was Joseph Valachi; his testimony was key for the first important Italian mafia trial in 1967. In the 1970s two other 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 – running 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. In particular, Buscetta exposed the existence and the workings of the 'Sicilian Mafia Commission'.<sup>7</sup> 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 the criminal activities 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

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<sup>7</sup>The Commission was a body of leading Mafia members deciding on important questions concerning the actions of, and settling disputes within the Sicilian Mafia.

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.

Until the 1990's, few '*pentiti*', albeit significant ones, followed Buscetta's example.<sup>8</sup> This changed significantly when, thanks to the intense activity of Falcone's group, the Italian Legislator introduced in 1991 the accomplice-witness protection program. Since then, over a thousand mafiosi have agreed to collaborate with Italian justice – primarily in Sicily, but in other regions as well; 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.

Several other features are worth noting. First, accomplices rarely decided to cooperate before being under investigation. Second, strikingly enough, many among the most influential mafia heads never cooperated with the justice – even when being charged with several life sentences: Raffaele Cutolo, Luciano Liggio, Bernardo Provenzano, Totò Riina and Francesco Schiavone, for instance, repeatedly refused any collaboration with prosecutors in order to protect – or so they claimed – their status of 'man of honor'. Finally, the program poorly performed in Calabria, where relatively few pentiti came out.<sup>9</sup> The 'Ndrangheta thus exhibits a greater cohesion than the Cosa Nostra or the Camorra, which can be related to differences in 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 investigations (Paoli, 2003).

### 2.3 Accomplice-witness 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 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 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, with 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 being only for organized crime.

The third trial began in February 1969. There were sixty-four defendants, all from the

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<sup>8</sup> Francesco Mannoia was for example the first whistleblower from the winning family of the second mafia war. Salvatore Contorno also played a key role in the Palermo Maxi Trial.

<sup>9</sup> At the end of 2008, only 95 former 'Ndrangheta affiliates were in the protection program.

town of Corleone. The charges related to a mafia war in Corleone that started in 1958, and resulted in over fifty murders. There was significant evidence tampering during the trial, which experienced the first public intimidation act.<sup>10</sup> All sixty-four defendants were acquitted. Whilst there was undoubtedly witness intimidation and evidence tampering, much 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, extortion, and, under the new law, being 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 lasted for ten years (July 1998 - June 2008) and charged 36 members of the clan with a series of murders and other crimes. All were found guilty and 16 sentenced to life imprisonment, including the Casalesi boss Francesco Schiavone and his chief lieutenant, Francesco Bidognetti. More than 500 witnesses and 25 informants testified in the trial, which ended with a total of 700 years of imprisonment and nearly 6 billions euros confiscated (Anselmo and Braucci, 2008).

## 2.4 Motivating evidence

In order to motivate our theoretical analysis of leniency, it is useful to review some preliminary evidence about the deterrence effect of the Italian accomplice-witness program.

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<sup>10</sup>As 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”.

Did it have a significant effect on the evolution of mafia crimes? How does this evolution compare to that of non-mafia related crimes? Was this effect similar across the Italian regions historically more troubled by mafia groups? We argue that the 1991 reform seems to have produced an impact on mafia related crimes, and does not appear to have had much influence on non-mafia crimes.

Let us start with some empirical issues. 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. In particular, the number of prosecuted crimes does not tell much, since a policy that deters crimes, and increases the fraction of those that are successfully prosecuted, will have an ambiguous impact on the number of prosecuted crimes. A highly successful policy, which would completely deter crime, might then be indistinguishable from an ineffective policy with no detection.<sup>11</sup>

In the case of criminal organizations, data on murders however allow to overcome somewhat this obstacle. In contrast to other crimes, almost all murders are uncovered: the number of reported murders thus reflects that of committed ones.<sup>12</sup> Figure 1 illustrates the number of mafia-related murders reported by the police forces in Italy, both in absolute level and relative to (intentional) murders unrelated to criminal organizations.<sup>13</sup>

The vertical bar marks the introduction of the leniency program in 1991. Strikingly, in the previous years the trend was rapidly increasing and culminated in 1991 with 719 mafia murders, corresponding to roughly 50% of all other malicious murders. The trend is instead decreasing after the introduction of the Italian leniency program. In 2007 the number of mafia murders in Italy is down to 119, which is roughly 20% of the rest of murders. More importantly, this pattern is due neither to composite effects, nor to a specific mafia association. Figure 2 exhibits similar patterns in all 4 provinces — Naples, Reggio Calabria, Catania and Caserta — which have the largest records of mafia murders in 1991-92.

In contrast, non-mafia murders do not feature such decreasing trend after 1991, as shown by Figure 3 (where FVG and TTA stands for, respectively, Friuli Venezia Giulia and Trentino Alto Adige). Since murders related to mafia activity may not be recognized as such, to avoid any confusion we present in that Figure the evolution of non-mafia murders across a set of non-mafia regions, featuring at most one mafia murder on average per year.

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<sup>11</sup>A similar problem arises in the empirical literature on cartels (see, for instance, Harrington, 2006, and Miller, 2009).

<sup>12</sup>The 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.

<sup>13</sup>The 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 murders, which are committed without an intentional purpose.

Figure 1: MAFIA MURDERS IN ITALY

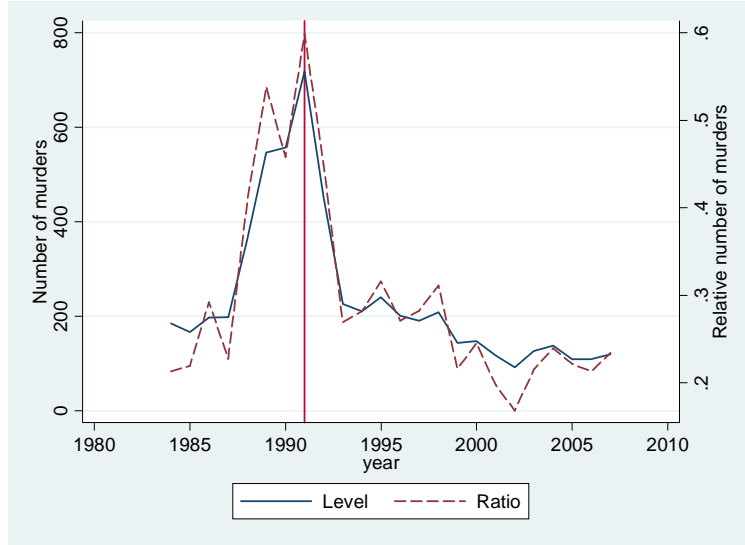


Figure 2: PROVINCES WITH MOST MAFIA-RELATED MURDERS

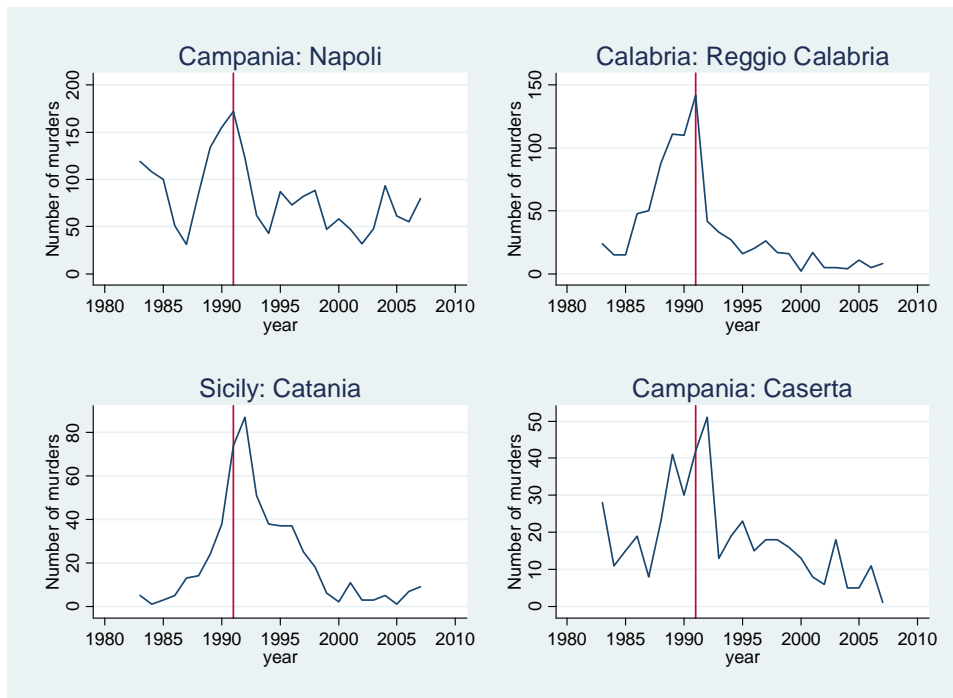
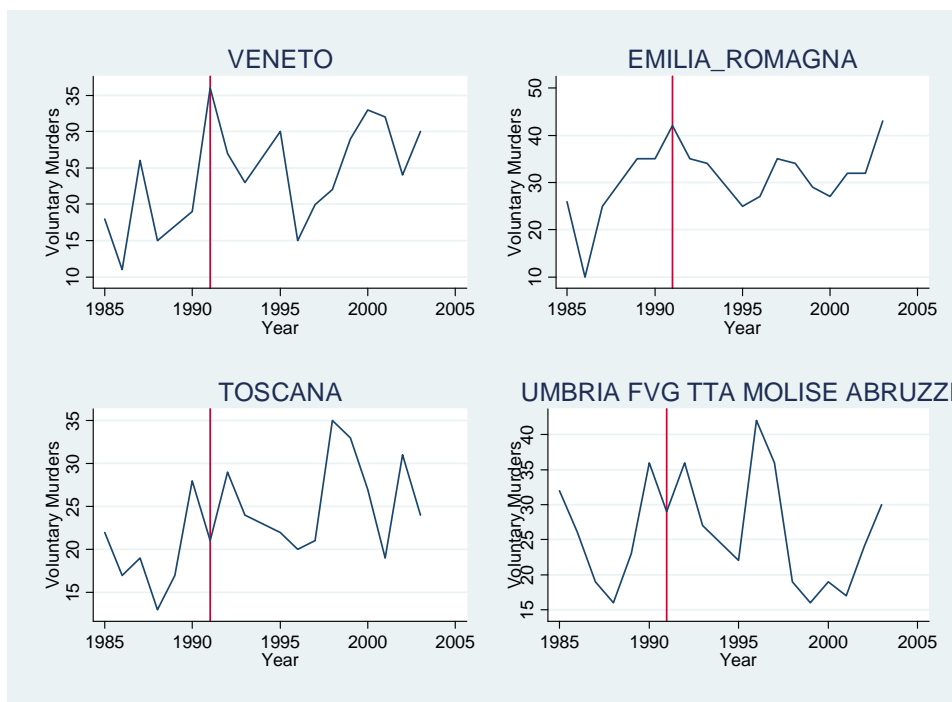


Figure 3: MURDERS UNRELATED TO MAFIAS



The pattern described above for mafia murders differs also from the evolution observed for crimes that are usually unrelated to mafia activities, such as robberies in banks and post offices, as well as kidnappings whose ultimate purpose is not extortion.<sup>14</sup> Arguably, as for murders, the observed population reflects to a large extent the underlying population of these crimes. Figure 4 shows that both variables do not feature a drop after 1991; robberies and kidnappings actually exhibit instead an increasing path during the 1990s.

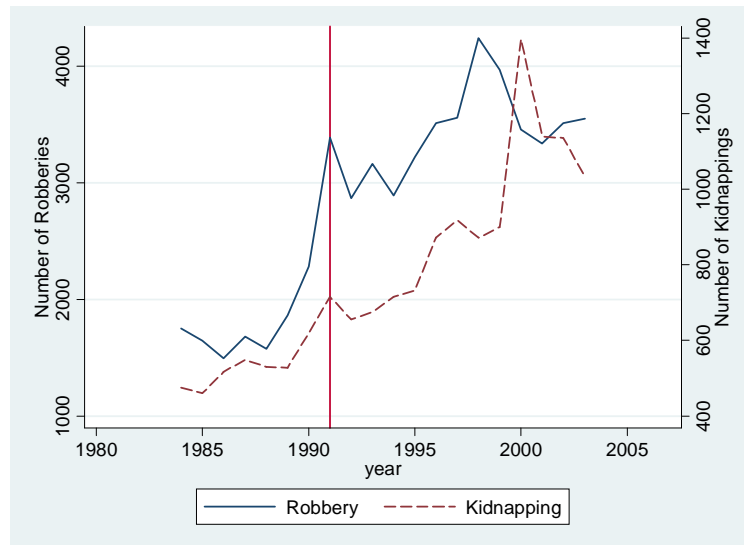
Although not conclusive, this evidence supports the idea that the introduction of the Italian leniency program deterred mafia murders but had little impact on non mafia murders or crimes. Clearly, other factors may explain the sharp drop of mafia murders after 1991. But, the overall picture does encourage analyzing further the impact of accomplice-witness programs. The remainder of the paper therefore develops a formal model to this aim and then tests its main predictions.

Let us conclude the section with some remarks about using the number of ‘mafia murders’ as a proxy for the volume of the organized crime business – a variable that will pertain more

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<sup>14</sup>Robberies and kidnappings are usually unrelated to mafia associations. In contrast, kidnappings aimed at extortion may be related to mafias. Indeed, Reggio Calabria, 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, among these four provinces, only in Reggio Calabria does the number of kidnappings feature a strong drop after 1991.

Figure 4: ROBBERIES AND KIDNAPPINGS IN ITALY



closely to our model. The historical evidence does suggest that the number of mafia murders is positively correlated with the expansion of organized crime activity. Many among the most important mafia wars originated by the apparition of new illicit traffics.<sup>15</sup> The second mafia war that decimated several Sicilian families in the early 1980s, for instance, started when the group lead by Luciano Liggio – the so called ‘*corleonesi*’ – took over the new business created by the expanding heroin trade and the real estate boom around the city of Palermo. Similarly, during the late 1970s, in Campania, the group lead by Raffaele Cutolo – from whom ‘*i cutoliani*’ – took over the illicit traffics stemming from the huge increase in unauthorized tobacco smuggling and the new business opportunities in the reconstruction sector that followed a 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 the 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. Interestingly, in the early eighties onwards the Italian Government started to concentrate public spending for infrastructures in the ‘building sector’ which is historically one of the main business sources of mafias.<sup>16</sup> This may explain the sharp increase in mafia related murders before

<sup>15</sup>See, among others, Lodato (2006) and Cantone (2008) for evidence on, respectively, the Mafia and the Camorra.

<sup>16</sup>For instance, in Campania, Puglia, Calabria, and Sicily, the share of public spending for public buildings such as houses, schools and hospitals with respect to total infrastructure spending, increased from 0.15 in 1986 up to 0.36 in 1999.

1991 and suggests that the introduction of the leniency program did have a role in inverting this tendency.

### 3 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-witness program. The criminal organization is formed by two mobsters: a boss (the principal) and a fellow (the agent). The boss is the mind of the organization, who plans the crime; the agent is the arm, who materially commits the illegal act.<sup>17</sup> Public officials manage the prosecution of criminals infringing the law.<sup>18</sup>

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 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.<sup>19</sup> 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  $\beta$  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.<sup>20</sup>

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<sup>17</sup>At the bottom of the chain of command, the *picciotti d'onore*, or soldiers, 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.

<sup>18</sup>In 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.

<sup>19</sup>It is straightforward to extend the analysis to account for the possibility that crimes do not always trigger an investigation (but only with some probability  $\alpha$ , say).

<sup>20</sup>The available historical evidence offers ample support for this hypothesis. For instance, security concerns

The parameter  $\beta$  reflects the influence of the organization and will be a key comparative statics parameter. Dishonest types can be either interpreted as linked to the criminal organization for cultural and personal reasons – Vito Ciancimino, for instance, was born in Corleone and in his youth was a close friend of Riina and Provenzano – or as being bribed or intimidated. Mafia associations moreover 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.<sup>21</sup> 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 on upcoming police operations, preventing in particular an early capture of the fugitive Totò Riina.<sup>22</sup> For simplicity, here we do not explicitly model the corruption and the intimidation process that generates the official’s type.<sup>23</sup>

**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 bears the sanction  $S_p$  – that is, convicting the boss (i.e., the crime instigator) is not more 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 and testify against his boss. The reward for this cooperation is a reduction

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have led to the creation in the 'Ndrangheta of a secret society within the secret society: La Santa. Membership 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.

<sup>21</sup>Buscetta 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.

<sup>22</sup>“Audizione del collaboratore di giustizia Gaspare Mutolo”, Antimafia Commission, February 9, 1993.

<sup>23</sup>An earlier version of the paper formally introduced a ‘bribing’ stage to determine the fraction of dishonest officials. The main comparative statics were qualitatively the same.

by  $\phi$  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.<sup>24</sup> In practice, to obtain a conviction the witness' testimony needs corroboration from unrelated sources; we can therefore interpret  $\bar{\theta}$  as a measure of the reliability of the informant.<sup>25</sup> Finally, in the light of the evidence reported 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 a simple way, we assume that the agent is reluctant to face a trial, which translates into a private cost  $\delta$ . This parameter is drawn from a compact support  $[\underline{\delta}, \bar{\delta}]$ , according to the atomless and twice continuously differentiable cumulative distribution function  $G(\delta)$ , and the agent learns its value in the event of an investigation.<sup>26</sup> For example,  $\delta$  can reflect the psychological costs resulting from the fear and apprehension of imprisonment, which materialize only when the agent is about to face the trial;<sup>27</sup> or, it might reflect the emotional costs the mobster incurs when he realizes either the danger to which children are exposed, or the consequences of the 'Mafia stigmata'.<sup>28</sup> As observed by judge 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

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<sup>24</sup>We 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.

<sup>25</sup>This parameter may for example reflect the status of the informant in 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 execute orders blindly.

<sup>26</sup>The analysis applies unchanged if the uncertainty realizes before any investigation but the principal cannot use revelation mechanisms that condition the wage on the agent's type.

<sup>27</sup>In 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).

<sup>28</sup>According 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](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 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).

to have their revenge by cooperating with the justice.<sup>29</sup>

We also assume that criminal organizations seek to punish whistleblowers, a feature that we model as 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.<sup>30</sup>

**Timing:** We follow the literature in assuming that the Legislator moves first.<sup>31</sup> 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  $\phi$ .

**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 investigation stage.

**t=2** The public official in charge of the case is honest with probability  $\beta$  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,  $\delta$ , and, if a leniency program is in place, decides whether to cooperate with the justice. Depending on the legal 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, based on the wage

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<sup>29</sup>The 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, for example, were both former members of the winning Corleonesi family.

<sup>30</sup>For simplicity we assume that this loss is exogenous. In a concluding section we explain why our conclusions would not change were this choice endogenous.

<sup>31</sup>See e.g. Motta and Polo (2003), Spagnolo (2003) and Rey (2003).

offered, and a confession decision, i.e., whether to cooperate or not, which will depend on his type  $\delta$ . The Legislator simply announces  $\phi$ . We shall look for the subgame perfect Nash equilibrium (SPNE) of this game.

**Technical assumptions:** For ease of exposition we will maintain the following conditions, where  $h(\delta) \equiv (1 - G(\delta)) / g(\delta)$  denotes the inverse hazard rate:

**A1** Monotone hazard rate:

$$\delta > \delta' \Rightarrow h(\delta) < h(\delta'). \quad (\mathbf{A1})$$

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.<sup>32</sup>

**A2** Cooperation:

$$h(\underline{\delta}) > (\bar{\theta} - \beta\underline{\theta}) S_p. \quad (\mathbf{A2})$$

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 exposition purposes. 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.<sup>33</sup>

### 3.1 Equilibrium characterization

We now characterize the equilibrium of the game. We shall first consider the no leniency case before introducing leniency.

#### 3.1.1 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:

$$v = R - w - \beta\underline{\theta}S_p,$$

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<sup>32</sup>For instance, the uniform distribution satisfies **A1**.

<sup>33</sup>See Garoupa (1997) for an overview on optimal law enforcement with non-monetary sanctions.

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:

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

where

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

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

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:

$$R \geq R_n \equiv \beta(pS_a + \theta S_p) + E[\delta].$$

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

$$r_n = \Pr(R \geq R_n) = 1 - F(R_n).$$

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

### 3.1.2 Leniency

In this section we derive the optimal leniency policy, using a simple backward-induction logic. Once an investigation is launched, not cooperating exposes the agent to the cost of the trial,  $\delta$ , 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:

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

He will therefore cooperate as long as his type  $\delta$  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 keener to talk the more generous the amnesty rate,  $\phi$ , the higher the proportion of honest officials in the economy,  $\beta$ , and the more effective the prosecution stage, as measured by  $p$ . Cooperation is also more attractive when leniency is complemented with an effective witness protection program that reduces the loss from retaliation,  $L$ .

The leniency rate  $\phi$  thus determines the cooperation threshold  $\widehat{\delta}$ . Without loss of generality we can restrict attention to  $\widehat{\delta} \in [\underline{\delta}, \bar{\delta}]$ ; indeed, any program leading to  $\widehat{\delta} > \bar{\delta}$  is ineffective (and formally equivalent to  $\widehat{\delta} = \bar{\delta}$ ), whereas any program leading to  $\widehat{\delta} < \underline{\delta}$  is too generous: compared with  $\widehat{\delta} = \underline{\delta}$ , it reduces further the expected sanction from committing a crime (by offering a reduction  $\phi$  exceeding what is needed to convince all types of agent to cooperate), without any offsetting benefit in terms of cooperation (since all types of agent cooperate anyway). Conversely, for any  $\widehat{\delta} \in [\underline{\delta}, \bar{\delta}]$ , the agent's participation constraint can be written as:

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

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

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

The last term illustrates the dark side of leniency: by reducing the expected sanction from committing the crime, it allows the boss to offer a lower wage and thus makes the criminal activity more lucrative. The bright side of the leniency program comes from the increased likelihood of prosecution: whenever the agent is sufficiently reluctant to face a trial ( $\delta \geq \widehat{\delta}$ ), his cooperation with the justice increases the probability of successfully prosecuting the boss from  $\beta\underline{\theta}$  to  $\bar{\theta}$ . As a result, the principal's expected sanction is now equal to:

$$C(\widehat{\delta}) = \beta\underline{\theta} S_p + \int_{\widehat{\delta}}^{\bar{\delta}} (\bar{\theta} - \beta\underline{\theta}) S_p dG(\delta).$$

The principal's expected utility from the criminal activity is now given by:

$$v = R - w(\widehat{\delta}) - C(\widehat{\delta}).$$

The Legislator sets the amnesty rate  $\phi$ , or equivalently the cooperation threshold  $\widehat{\delta} = \widehat{\delta}(\phi)$ , so as to minimize the crime rate:<sup>34</sup>

$$r_l = 1 - F(R_l(\widehat{\delta})),$$

where  $R_l(\widehat{\delta})$  is the revenue threshold above which the criminal activity is profitable:

$$R_l(\widehat{\delta}) \equiv w(\widehat{\delta}) + C(\widehat{\delta}) = R_n + \int_{\widehat{\delta}}^{\bar{\delta}} [(\bar{\theta} - \beta\underline{\theta}) S_p - (\delta - \widehat{\delta})] dG(\delta).$$

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<sup>34</sup>This is socially desirable whenever the criminal activities harm society by an amount  $H > \bar{R}$ .

The Legislator' program thus amounts to solve:

$$\mathcal{L} : \max_{\widehat{\delta} \in [\underline{\delta}, \bar{\delta}]} R_l(\widehat{\delta}).$$

Letting  $h(\delta) \equiv (1 - G(\delta))/g(\delta)$  denote the inverse hazard rate, we have:

**Proposition 1** *Under **A1** and **A2**, the Legislator's program  $\mathcal{L}$  has a unique solution,  $\widehat{\delta}^* = \widehat{\delta}(\phi^*)$ , that is interior and characterized by the first-order condition:*

$$h(\widehat{\delta}^*) = (\bar{\theta} - \beta\underline{\theta}) S_p. \quad (4)$$

*Proof.* See Appendix 1. ■

The first-order condition (4) reflects the balance between the bright and dark sides of leniency. On the one hand, increasing the amnesty  $\phi$  reduces the agent's expected sanction for the  $1 - G(\widehat{\delta})$  agents who apply for leniency; this makes running criminal activities less costly for the principal. On the other hand, a higher amnesty convinces  $g(\widehat{\delta})$  additional agents to cooperate with the justice, increasing the probability of convicting the principal, whereby stifling his incentive to engage in criminal activities.

This trade-off shows that it is always optimal to adopt a leniency program: starting from  $\widehat{\delta} = \bar{\delta}$ , an increase in  $\phi$ , inducing a small reduction in  $\widehat{\delta}$ , generates a benefit in terms of enhanced likelihood of prosecution, without any offsetting cost in terms of reduced sanctions – since no agent was initially applying for leniency. By construction, this implies that, compared with the benchmark case of no leniency:

- the probability of convicting the principal is increased, by  $(\bar{\theta} - \beta\underline{\theta})(1 - G(\widehat{\delta}^*))$ ;
- the principal's expected costs is also higher, and the crime rate is lower:  $r_l^* < r_n$ .

The next proposition discusses the main drivers of the optimal policy:

**Proposition 2** *The optimal policy is such that:*

- *the fraction of agents who cooperate, as well as the amnesty rate:*
  - *increases with the quality of the evidence provided by the informant,  $\bar{\theta}$ , or the sanction for the principal,  $S_p$ ;*
  - *decreases when the fraction of honest officials,  $\beta$ , or the probability of convicting the boss,  $\underline{\theta}$ , increase;*

- *in addition, the amnesty rate:*
  - *increases with the retaliation loss  $L$ ;*
  - *decreases when the probability of convicting the agent,  $p$ , increases;*
  - *increases with the agent's sanction  $S_a$  if  $\phi^*$  is lower than the probability of acquittal in case of trial,  $1 - \beta p$ ; the converse holds otherwise.*

**Proof.** See Appendix 1. ■

The amnesty program should be more generous, the more effective is the evidence provided by the informant for convicting the boss of the criminal organization, the less likely the boss would be convicted in the absence of cooperation and the harsher the punishment for the boss. Indeed, all these parameters increase the value of cooperation, measured by the deterrence factor  $(\bar{\theta} - \beta\theta) S_p$ . Also, in order to maintain an appropriate level of cooperation, higher amnesty rates are needed to offset an increase in the retaliation loss,  $L$ , or a decrease in the probability of convicting the agent,  $\beta p$ . Note in particular that an increase in the proportion of honest officials calls for reducing the amnesty rate, since a higher  $\beta$  fosters cooperation but lowers its deterrence factor. Finally, the impact of the agent's sanction  $S_a$  on the optimal policy depends on the effect that harsher sanctions produce on the agent's propensity to cooperate. If the optimal amnesty  $\phi^*$  is lower than the probability of acquittal  $1 - \beta p$ , increasing the sanction  $S_a$  discourages cooperation; the Legislator must then counterbalance this by increasing the amnesty rate. Otherwise, the opposite result obtains.

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, suppose that the parameter  $\delta$  is uniformly distributed over a support  $[\bar{\delta} - \Delta, \bar{\delta}]$ . **A2** then requires  $\Delta > (\bar{\theta} - \beta\theta) S_p$  and the first-order condition (4) becomes:

$$\phi^* = 1 - \beta p + \frac{(\bar{\theta} - \beta\theta) S_p + L - \bar{\delta}}{S_a}. \quad (5)$$

A simple inspection of this condition yields:

**Proposition 3** *Suppose that  $\delta$  is uniformly distributed over  $[\bar{\delta} - \Delta, \bar{\delta}]$ ; it is then optimal to offer a reward (i.e.,  $\phi^* > 1$ ) whenever  $\Delta > (\bar{\theta} - \beta\theta) S_p$  and:*

$$L - \bar{\delta} > \beta p S_a - (\bar{\theta} - \beta\theta) S_p. \quad (6)$$

It is therefore optimal to reward accomplices when the criminal organization exhibits a strong internal cohesion ( $L$  large and/or  $\bar{\delta}$  low); this is, for instance, the case of organizations such as the Calabrian 'Ndrangheta, whose members are mainly linked by blood relationships. Since the threshold is decreasing in  $\bar{\theta}$ , this is also more likely to be the case when the informant's testimony is highly reliable, 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.<sup>35</sup>

## 4 Evidence

In order to test our analysis, in this section we exploit a panel data set relative to the 95 administrative provinces and the 26 judicial districts that characterized Italy during the 1990s.<sup>36</sup> The data rely on specific aspects of the Italian judicial system as well as on some features of the accomplice-witness program introduced in 1991, which grants lower sanctions, as well as protection, to mafia accomplices who provide information that can be used for prosecuting their former clans and, more generally, sheds some light on their internal organization and external complicities.<sup>37</sup>

While the introduction of the leniency program provides a useful natural experiment, testing its adequacy would require identifying such parameters as the distributions of the illegal revenue  $R$ , of officials' honesty and of subjective costs of facing trial or going to jail, as well as the probability that criminal activities trigger inquiries or the relative effectiveness of retaliation and protection means. Since the available data do not allow such detailed analysis, we propose here an empirical analysis that focuses on the impact of the accomplice-witness program on the prosecution of criminal organizations, as well as on the determinants of accomplices' propensity to join the program:

- (i) Our analysis predicts that the introduction of an accomplice-witness program shifts upward the prosecution rate, from  $\beta$  to  $\beta + (1 - \beta)(1 - G(\hat{\delta}(\phi)))$  – the term  $(1 - G(\hat{\delta}(\phi)))$  measuring the mass of informants. We should therefore observe an increase in the rate of prosecution of mafia crimes after 1991.

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<sup>35</sup>Rewards are nowadays also granted to former members of the Japanese *Yakuza* cooperating with prosecutors, in particular by helping them to find a job (Corriere della Sera, 2 June, 1992).

<sup>36</sup>The number of provinces has been recently increased to 103 by splitting some former provinces. See Appendix 2 for details on data.

<sup>37</sup>It is important to stress that the laws relative to the leniency program are nationwide and, as such, cannot induce any differential implementation across provinces or mafia associations.

- (ii) A key ingredient of our framework – see equation (3) – is that the number of whistleblowers increase with the amnesty rate  $\phi$ , the effectiveness of the protection program – as reflected by a lower  $L$  – and the probability of being convicted,  $\beta p$ . The Italian experience does not provide any variation in the first parameter, and we lack evidence on the second one, but regional variations in the conviction rate allow us to study the impact of that parameter.

#### 4.1 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 associations. Moreover, both criminal and mafia associations are generally involved in the same kind of illicit activities. Nevertheless, the peculiarity of mafia 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 types of criminal associations 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 1988 for the country as whole and in 1993 at province level, the years in which the Italian Statistical Office (ISTAT) started to collect the data, and lasts until 2005.

Table 3 shows the top-5 provinces with most prosecutions for both types of crimes. As expected, the provinces with the largest numbers of prosecutions for mafia association crime are all located in Sicily, Calabria and Campania. In contrast, prosecutions for criminal association are more dispersed across the country.<sup>38</sup> 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, police forces<sup>39</sup> report crimes to prosecutors, who then decide whether to prosecute. Therefore, a crime reported by the police does not necessarily result in prosecution. However, it may also result in more than one prosecution if the investigation generates fresh

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<sup>38</sup>Milan is in the North and Rome in the center of Italy, whereas Calabria, Campania and Sicily are all in the South.

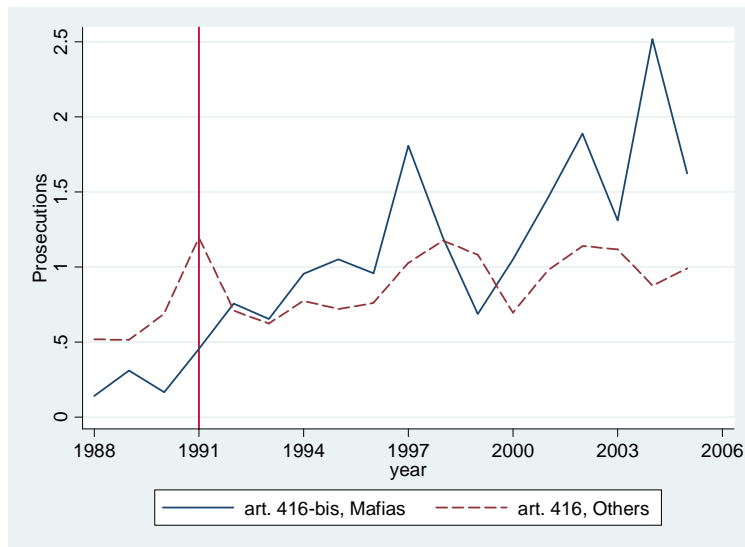
<sup>39</sup>Namely, the *Carabinieri*, the *Polizia* and the *Guardia di Finanza*.

Table 3: TOP-5 PROVINCES WITH MOST PROSECUTIONS

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

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 5: ‘PROSECUTIONS’ AGAINST ORGANIZED CRIME IN ITALY



information about other crimes. In particular, the information provided by the accomplices participating to the protection program is handled by the judicial authority and not by the police. As a result, the ratio between the crimes prosecuted and those reported by police forces appears as a good proxy for assessing the impact of ‘flipping’ criminals’ testimonies on the rate of prosecution:

- **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 police forces.*

Figure 5 illustrates the evolution of the ratio between the number of prosecutions and the number of crimes reported by the police forces in Italy from 1988 to 2005, for both mafia

associations (“Mafias”) – i.e., art. 416-bis – and other criminal organizations (“Others”) – i.e., art. 416.<sup>40</sup> A first point to emphasize is that in 1988 the ratio was well lower for mafia associations than for other criminal groups. The former ratio, however, registered a discrete shift upward in 1992, thus reaching the latter, and then increased up to values around 2; in contrast, for the period of interest the ratio relative 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, i.e., those in which mafia type organizations have been historically more pervasive. The column labelled “Rest of Italy” refers instead to the other Italian provinces. Within the core-regions, the positive and significant coefficient for the trend shows that prosecutions for mafia association strongly increased after the introduction of the accomplice-witness program. A positive trend also emerges for the prosecutions related to other criminal groups, but the point estimate of the coefficient is divided by four. In contrast, there is no statistically significant trend for the rest of Italy.<sup>41</sup>

Note that this pattern of prosecutions for mafia associations should not be driven by variations in the output of the judicial authority. First, evidence available for Italy as a whole and relative to the entire set of mafia related crimes, suggests that the number of yearly cases handled by prosecutors has not increased in the period under consideration.<sup>42</sup> Moreover, since typically investigation of new cases of mafia association cannot last for more than a year before either a trial begins or the case is filed, the trend in  $PROSECUTION$  found above cannot be explained by variations in productivity of the judicial authority. In addition, we find that the final outcome of the investigation activity has featured an

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<sup>40</sup>A prosecution cannot last for more than a year before either a trial begins, if there is enough evidence, or the case is closed – in few special cases an extra period of six months might be allowed. 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. The qualitative results do not change, however, if we consider only the contemporaneous year or the lagged one.

<sup>41</sup>In Campania, Puglia, Calabria and Sicily, the prosecutions for mafia association crime are significantly positively correlated with the number of accomplices-witness from, respectively, Camorra, Sacra Corona Unita, 'Ndrangheta and Mafia. In contrast, no such correlation exists for the prosecutions related to other criminal associations. Unfortunately, detailed data on accomplices during the 1990s are not available.

<sup>42</sup>Data available upon request.

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: The dependent variable is the ratio of the number of crimes prosecuted 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 \*  $p < 0.05$  and \*\*  $p < 0.01$ .

increase in the share of people prosecuted. Actually, during the period 2000-07 the number of people prosecuted for mafia-related crimes, as a share of the total number of people formally investigated by the judicial authority, smoothly increased from 0.31 up to 0.47.<sup>43</sup>

Taken together, the previous findings strongly suggest that, after the introduction of the accomplice-witness program, more and more mafia crime cases were directly opened by prosecutors, thanks to the information provided by former 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, as in cartel cases, leniency programs provide an effective complement to investigations for fighting organized crime.

## 4.2 On the determinants to whistle

We now provide some evidence about the determinants of the agents' incentive to cooperate. As mentioned above, our starting point is the definition of the threshold  $\widehat{\delta}$ , expressed by equation (3), which relates the number of accomplices to the underlying parameters, and in particular to the efficiency of the judicial system, as measured by  $\beta p$ :

- **Empirical prediction 2:** *The higher is the 'perceived' acquittal probability,  $1 - \beta p$ , 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 with his former mafia group – labelled as Camorra, 'Ndrangheta, Sacra Corona Unita,

<sup>43</sup>Data are relative to the set of mafia related crimes as indicated by the 'Codice di Procedura Penale', art. 51. comma 3 bis.

Mafia, or Others — as well as to the judicial district where he was prosecuted. This defines the number of whistleblowers. In order to proxy for  $1 - \beta p$ , we use the proportion of acquittals in mafia trials. Variations in this proportion are exploited to determine the effects of the perceived probability of being convicted on the number of whistleblowers. The basic regression to deal with the empirical prediction is the following:

$$WHISTLEBLOWERS_{i,t} = a_0 + a_1 ACQUITTANCE_{i,t} + a_{2,t} DT_t + \varepsilon_{i,t} \quad (7)$$

where  $WHISTLEBLOWERS_{i,t}$  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 proportion of people involved in mafia trials<sup>44</sup> who end up being acquitted — that is, the number of acquittals divided by the sum of acquittals and convictions — 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  $a_1 < 0$ .

We cannot neglect a possible reverse causality between  $WHISTLEBLOWERS$  and  $ACQUITTANCE$  since the cross-sectional variability of the former, which is partly due to historical differences among mafia groups, affects that of the latter. As noted above, during the 1990s 'Ndrangheta affiliates had for instance a very low propensity to cooperate with prosecutors compared to 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 this problem in two ways: by including district dummies among the regressors of equation (7), or by considering 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 whistleblowers contribute to the estimation of the acquittance's effect. When first-differences are considered, instead, the time-invariant component is removed from the estimated equation. Hence, both 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, more than 8 crimes during the period) and to the subset of the 10 districts strongly troubled by the 4 main mafia groups. The first two columns rely on district dummies while the third and fourth columns refer to the first-difference specification. The estimated coefficient  $a_1$  is always negative but statistically significant (5% level) only for the core districts, for which the point estimates are moreover very similar across specifications.

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<sup>44</sup>Crimes regulated by the *Codice di Procedura Penale* art. 51, comma 3 bis.

Table 5: INCENTIVES TO BECOME WHISTLEBLOWERS

	Levels specification		First-difference specification	
<i>ACQUITTANCE</i>	-1.85	-9.09*	-2.35	-8.44**
	(-1.36)	(-2.03)	(-1.49)	(-2.59)
Obs. (Districts)	133 (17)	80 (10)	115 (17)	70 (10)

Note: The dependent variable is the number of whistleblowers. Results reported in the first two columns are based on variables in levels allowing for judicial districts; results reported in the last two columns are based instead on first-difference variables. Calendar year dummies are not reported. The t-values are in parentheses (standard errors are robust to heteroskedasticity); significant coefficients are indicated by \*  $p < 0.05$ , \*\*  $p < 0.01$ , and \*\*\*  $p < 0.001$ .

Although allowing for fixed effects eliminates a potential channel of endogeneity, previous estimates may still be biased. If the information provided by whistleblowers at time  $t$  affect not only the prosecution rate but also the outcomes of future trials in  $t + s$ , then there can be some feedback from current *WHISTLEBLOWERS* to future *ACQUITTANCE*. In this circumstance, both the dummy variables and first-difference approaches might deliver inconsistent estimates. In particular, if whistleblowers in period  $t$  affect the sentences of trials in  $t + 1$  then  $\Delta v_{i,t}$  could be positively correlated with  $\Delta ACQUITTANCE_{i,t}$  thus implying a toward to zero bias of the OLS estimate.<sup>45</sup> 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 first-difference of *ACQUITTANCE* is strongly correlated with its lagged level; 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. Consistent with previous results a higher proportion of acquittals generates a lower number of whistleblowers. The IV coefficient is substantially higher in absolute value than the OLS ones ( $-22.72$  instead of  $-9.09$  or  $-8.44$ ), thus suggesting that previous estimates were indeed biased toward zero. 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 whistleblowers is significant at the 1% significance level.

We close the section discussing some further results. Our main conclusion is robust to the inclusion of a number of controls. Equation (7) has been also estimated including the variables *MURDER*, 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, as well as the total number of

<sup>45</sup>First-difference estimates would be consistent if  $v_{i,t}$  is (eventually) correlated with  $ACQUITTANCE_{i,t+s}$  for  $s > 1$ .

Table 6: INCENTIVES TO BECOME WHISTLEBLOWERS: 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		
$\Delta ACQUITTANCE_{i,t}$	-22.72*	Anderson_Rubin (H0: $a_1 = 0$ )	5.57
	(-2.34)	p-value	0.009

Note: The dependent variable is the first-difference of whistleblowers. 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 \*\*\*  $p < 0.001$ .

whistleblowers in the protection program at the beginning of the year. According to the theoretical model, any event which affects the distribution of  $\delta$  implies a shift in the propensity to become informant, everything else being kept constant. This shift may be a short-lived consequence of mafia wars among different factions of the same criminal organization.<sup>46</sup> The variable *MURDER* should 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  $-23.24$  and the p-value of the Anderson-Rubin test is 0.02. In the first stage regression the t-ratio relative to the instrument is  $-3.29$ .

Finally, at least two different pieces of evidence are available on the relationship between public officials and mafia organizations. They imply that mafias are indeed able to influence the public sector at the local level and affect in this way the efficiency of the judicial system – and thus the probability of acquittals. First, the provincial distribution of local governments shut down since 1991 because of relationships between administrators and mafias – through the direct infiltration of mobsters into local administrations or through indirect influence – provides a proxy for the magnitude of the influence of mafia groups over 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 in the rest of Italy. The second piece of evidence relies on the number of public officials convicted for bribes at regional level, *CORRUPTION*. Regressing  $\Delta ACQUITTANCE$  on  $\Delta CORRUPTION$  lagged (per capita) shows a negative and statistically significant coefficient (p-value less than 5%), which is moreover 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

<sup>46</sup>Note that there is no historical evidence of conflicts between the four main mafia groups, that is, for instance, between the Camorra and the 'Ndrangheta or the former and the Mafia.

difference of corruption as a further instrument in the IV regression. The estimate of  $a_1$  in equation 7 is now  $-26.12$ , a bit higher than the previous one; the null hypothesis of the Hansen overidentification test is not rejected (p-value is 0.53), thus supporting the validity of the results.

## 5 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.<sup>47</sup> 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.

Our paper also relates to the literature on organized crime. This literature first focused on welfare comparisons between monopoly and competitive supply of bads – see for instance Buchanan (1973) and Backhaus (1979). More recently, Jennings (1984), Polo (1995), Konrad and Skaperdas (1997) and Garoupa (2000) have modelled criminal organizations as vertical structures where a principal must discipline its members.<sup>48</sup> We build on this literature by recognizing that members at various levels of the criminal chain have different bargaining

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<sup>47</sup>Contrary 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.

<sup>48</sup>See also Fiorentini and Peltzman (1995), Kugler, Verdier and Zenou (2005), Mansour *et al.* (2006) and Baccara and Bar-Isaac (2008).

power and, perhaps more importantly, face different prosecution risks, as they may be treated in different ways by the law, and by studying the role of accomplice-witness programs as a tool to exacerbate conflicts within criminal organizations.

Our empirical results on the evolutions of prosecution rates and mafia murders are closely related to and consistent with the evaluation by Miller (2009) of the leniency programs adopted to fight cartels.<sup>49</sup> However, our approach differs from Miller’s by using the fact that, contrary to many other crimes, the number of measured murders is close to the number of murders effectively committed. Thus, discovered murders are representative of the entire population, which eliminates the usual difficulty due to the confounding effect of the increased rate of detection.<sup>50</sup> Another difference with Miller’s approach is that we rely on a panel data set at the province level, which allows for a more robust identification than that based on a single time-series.

## 6 Concluding remarks

We have identified the determinants of accomplice-witness programs by underscoring the beneficial role that granting amnesty to informants plays on crime and prosecution rates. Our theoretical analysis has shown that inducing former criminals to cooperate with the justice is particularly useful when the prosecution system is poorly efficient, criminal organizations have strong ties with public officials and the information provided by “flipping criminals” is reliable. Consistent with the available historical evidence, the analysis has also shown that the degree of cohesion between 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-witness regulations have a positive effect on prosecution as well as on deterrence. We have also tested some implications of our 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.

Let us conclude with some remarks on the theoretical model and its robustness. Clearly, to keep it as simple as possible we have made quite a few simplifying assumptions. For instance, we considered an exogenous retaliation loss and, relying on the historical evidence,

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<sup>49</sup>Miller (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.

<sup>50</sup>On the deterrence effect see Ehrlich (1981) and Levitt (1998), among others.

we also assumed that the agent does not observe the official's type. Both these restrictions can be easily relaxed. For example, the retaliation loss could be made endogenous by assuming that intimidating the agent has a cost but may entail future reputation benefits: an organization punishing a whistleblower today might gain since other agents will cooperate less likely tomorrow. This can be easily accommodated in our framework and neither our theoretical insights nor the empirical predictions would change. The same conclusion applies if one assumes that the agent is aware of the official's type at the time he chooses whether to cooperate or facing the trial. As already noted before, in this instance the agent considers cooperating only if the official is honest, but the logic of the model does not change. Obviously, many other extensions remain to be explored; we kept the model simple in order to bring the main predictions smoothly to the data, but hope to take these further steps in future research.

# Appendix 1

**Proof of Proposition 1:** Differentiating the regulator's objective in  $\mathcal{L}$  with respect to  $\widehat{\delta}$  yields:

$$R'_l(\widehat{\delta}) = -(\bar{\theta} - \beta\underline{\theta}) S_p g(\widehat{\delta}) + (1 - G(\widehat{\delta})) = [h(\widehat{\delta}) - (\bar{\theta} - \beta\underline{\theta}) S_p] g(\widehat{\delta}),$$

where under **A1** the term in brackets is strictly decreasing. It follows that the regulator's objective is quasi-concave in  $\widehat{\delta}$ . Furthermore,  $R'_l(\bar{\delta}) = -(\bar{\theta} - \beta\underline{\theta}) S_p g(\bar{\delta}) < 0$  and  $R'_l(\underline{\delta}) = [h(\underline{\delta}) - (\bar{\theta} - \beta\underline{\theta})] S_p g(\underline{\delta}) > 0$  under **A2**. It follows that the optimum is interior and thus characterized by the first-order condition (4). ■

**Proof of Proposition 2:** The optimality condition (4) determines the proportion of informants:

$$1 - G(\widehat{\delta}^*) = 1 - G(h^{-1}((\bar{\theta} - \beta\underline{\theta}) S_p)),$$

where  $h(\cdot)$  is decreasing under **A1**. This proportion of informants thus depends only upon (and increases with)  $(\bar{\theta} - \beta\underline{\theta}) S_p$ ; that is, it increases with  $\bar{\theta}$  and  $S_p$  and decreases if instead  $\beta$  or  $\underline{\theta}$  increases.

From (3) and (4) we have:

$$\widehat{\delta}(\phi^*) = (1 - \phi^* - \beta p) S_a + L = h^{-1}((\bar{\theta} - \beta\underline{\theta}) S_p),$$

or

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

It follows that  $\phi^*$  increases with  $\bar{\theta}$ ,  $S_p$  and  $L$ , and decreases when  $p$ ,  $\beta$  or  $\underline{\theta}$  increases. As for  $S_a$ , the conclusion follows from:

$$\frac{\partial \phi^*}{\partial S_a} = -\frac{h^{-1}((\bar{\theta} - \beta\underline{\theta}) S_p) - L}{S_a^2} = -\frac{1 - \beta p - \phi^*}{S_a}.$$

■

## 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).

**Whistleblowers:** number of former mafia affiliates participating to the Italian accomplice-witness protection program. The dataset associates each accomplice with his former criminal

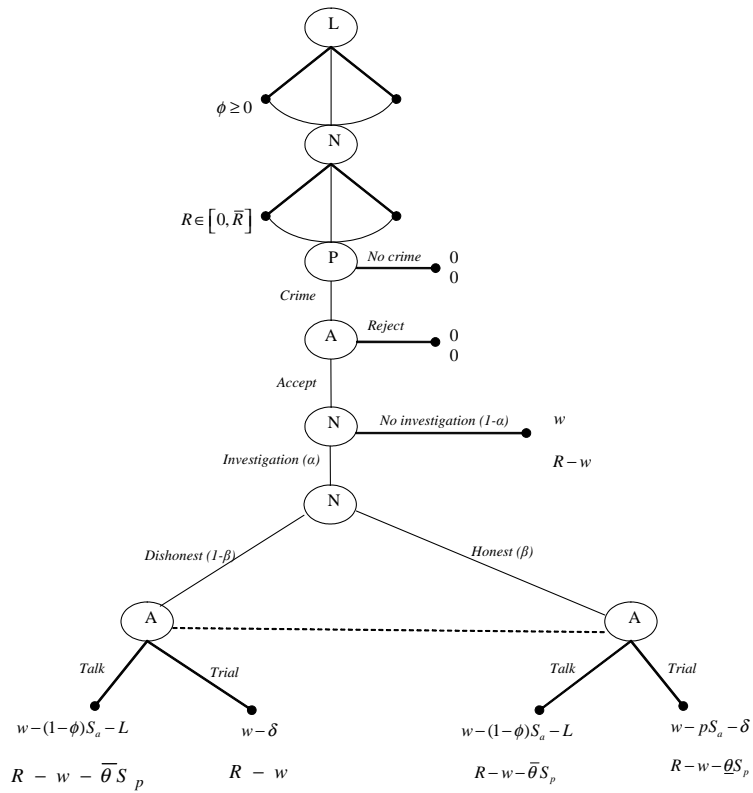
organization (labelled as Camorra, 'Ndrangheta, Sacra Corona Unita and Mafia) and the judicial district of prosecution. Source: Commissione parlamentare d'inchiesta sul fenomeno della criminalità organizzata mafiosa o similare, technical report (various issues).

**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

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