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Astrid Gamba

Università degli Studi di Milano Bicocca

Giovanni Immordino

Università di Napoli Federico II and CSEF

Salvatore Piccolo

Università Cattolica del Sacro Cuore

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Dipartimento di Economia e Finanza
Università Cattolica del Sacro Cuore
Largo Gemelli 1 - 20123 Milano – Italy
tel: +39.02.7234.2976 - fax: +39.02.7234.2781
e-mail: dip.economiaefinanza@unicatt.it

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Organized Crime and the Bright Side of Subversion of Law*

ASTRID GAMBA[†] GIOVANNI IMMORDINO[‡] SALVATORE PICCOLO[§]

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Abstract

When Legislators introduce laws that award amnesties to ‘low-rank’ criminals cooperating with the justice, top criminals may bribe public officials to subvert the law. Legislators should anticipate this reaction and fight it back by introducing policies that bundle amnesties for low-rank criminals with amnesties to corrupt officials who plea guilty. In fact, the threat of being betrayed by their fellows may induce top-criminals to rely on corruption (to avoid sanctions). However, a suitable amnesty for corrupt officials may increase the conviction risk not only for top-criminal but also for low-rank ones. This *domino* effect can deter crime more than a policy based only on amnesties to low-rank criminals would: a bright side of subversion of law.

Keywords: Criminal Organizations, Corruption, Leniency.

JEL classification: K14, K42, D73, D78

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[†]Università degli Studi di Milano-Bicocca.

[‡]Università di Napoli Federico II and CSEF.

[§]Università Cattolica.

1 Introduction

The use of insider information in criminal proceedings is one of the most effective instruments to fight organized crime. Yet, when Governments promote leniency programs to disrupt trust among criminal partners and stimulate cooperation between prosecutors and whistleblowers, kingpins — i.e., criminals who push their own participation up to behind-the-scenes control and guidance — may use their political, military and financial influence to intensify corruption and capture public officials (police officers, prosecutors, local politicians and judges). Bribery, in fact, allows top criminals to *minimize* the risk of conviction not only for themselves, but also for their fellows, who may otherwise flip and turn informants. This form of ‘avoidance’ (Malik, 1990) or ‘subversion of law’ (Glaeser and Shleifer, 2003) often neutralizes the beneficial effects of the policy and may, paradoxically, even intensify illegal activities.

Corruption and organized crime are deeply connected phenomena. Evidence on the links existing between organized crime, politics and state officials is abundant — see, e.g., Acemoglu *et al.* (2013), Alesina *et al.* (2016) and De Feo and De Luca (2013) among many others. Corruption of police officials, local politicians and prosecutors is common, for instance, in Latin America — e.g., in Mexico and Colombia — where the Narcos use their financial and military power to build a network of state complicities that favor their business and protect the major drug transit routes — i.e., the so called ‘*plata or plomo*’ strategy (Dal Bò *et al.*, 2006). In Italy, the Sicilian Mafia has been historically connected to center-right politicians mainly to *fix* trials and avoid mass convictions, which could have undermined the entire organization from the bottom to the top.

Surprisingly, in spite of the potential subversive role of corruption, and the overwhelming evidence of the hidden ties between organized crime and the public domain, little is known of the forces that shape leniency programs when corruption is a concrete danger. How should these programs be designed when corruption can neutralize, or even subvert, their scope? Should amnesties be granted in a world with corruption? Is it a good idea to introduce complementary laws that grant amnesties also to corrupt officials that plea guilty? And, if so, how intense these amnesties should be?

To address these issue we study a simple game between a Legislator, a hierarchical criminal organization and a continuum of public officials (prosecutors) that are heterogeneous with respect to their moral of being bribed. The Legislator, having forbidden some illegal activities, sets up a leniency program that awards reduced sanctions to law-breakers, who can decide to plea guilty and cooperate with the justice. The criminal organization

is formed by two mobsters that are in a ‘principal-agent’ type of relationship: a boss (*the mind* of the organization) and his fellow (the *harm* of the organization). After the crime has been committed, the fellow can disclose his insider information (about the boss and his illicit activities) to the prosecutor and obtain, as a reward, a lighter sanction chosen by the Legislator at the outset of the game. To prevent the harm of such cooperation, the boss may decide to capture the prosecutor who, upon accepting a bribe, may either acquit both criminals and face the risk of being charged for corruption, or self-report and induce both criminals to be convicted with a given probability. As a reward for this, the official is charged a reduced sanction chosen by the Legislator at the outset of the game.

We show that, with hierarchical criminal organizations, subversion of law might have a bright side when enforcement against members, especially low-rank ones, of these organizations is relatively weak. Specifically, we characterize conditions under which, to optimally deter crime, the Legislator designs a policy that purposefully encourages the boss to bribe the official by awarding an excessively lenient amnesty to corrupt officials that self-report. Hence, in order to minimize the equilibrium amount of crime, the Legislator is willing to tolerate some degree of corruption which is induced by a coordinated policy that awards an amnesty not only to low-rank criminals that flip and turn informants, but also to prosecutors that first accept a bribe from the boss, and then self-report.

In this context, the social value of corruption is determined by the interplay between three effects that an increase in the official’s amnesty generates on the organization’s cost of crime — i.e., the sum of the fellow’s reservation wage, the official’s expected bribe and the boss’ expected sanction. Obviously, stimulating corruption by choosing a too generous amnesty for self-reporting officials tends to increase the crime rate for two reasons: first, *ceteris paribus*, subversion of law occurs more often, which allows the boss to avoid being sanctioned with higher probability; second, a higher rate of corruption also leads the fellow to blow the whistle less often, which reduces the probability of enjoying the amnesty, whereby reducing the fellow’s reservation wage, and increasing the crime rate. Both these effects determine the dark side of subversion of law, and are in line with the standard negative view of corruption. However, by increasing corruption, the Legislator also makes it more likely to convict the fellow when the official self-reports. This effect increases the fellow’s reservation wage, since it increases his conviction risk, and makes it more costly for the boss to hire people willing to work for him. This is what we will call *the bright side of subversion of law* that, as it will be argued, provides a novel bridge between leniency rules for former members of criminal organizations that cooperate with the justice and public officials that favoured these organizations but, at some point, decide to self-report.

We show that the third effect bites, and induces the Legislator to purposefully induce corruption in equilibrium, if the fellow’s conviction risk when he remains loyal to the boss

is small enough — i.e., when enforcement against criminal organizations and their members (even low-rank ones) is relatively weak. In this case, the Legislator uses optimally both policy instruments — i.e., leniency for the fellow and the official — which are complementary one with the other. By contrast, when enforcement against criminal organizations is relatively strong, the net effect of an increase of corruption on the fellow’s reservation wage is negative. In this case, the Legislator prefers not to induce corruption in equilibrium and only the fellow is allowed to blow the whistle: the two policy instruments are substitutes since the Legislator only relies on the fellow’s testimony to deter crime.

Our comparative statics also shows that the crime minimizing level of corruption is increasing with the influence of the corrupt official, with the accuracy of the information that he is able to provide against the boss and with the severity of the charges against the fellow; while it is decreasing in the efficacy of conviction and investigative technology against the fellow. We also show that, sometimes it is in the Legislator’s interest to even reward cooperation by public officials, especially when the accuracy of the fellow’s insider information is not too high, when the evidence offered by the official is strong enough and when the fellow’s conviction risk is low.

Noteworthy, these results hinge on the specific hierarchical structure of criminal organizations, and hence do not apply to common crimes, whose execution does not require the association of two or more people. Moreover, our analysis is related and offers a novel point of view to the recent and intense policy debate, initiated by the India’s chief economic adviser Kaushik Basu,¹ on harassment bribes² and the social desirability of forms of asymmetric liability — i.e., legal mechanisms where bribe-takers are culpable but bribe-givers have legal immunity (see, e.g., Basu 2011, Basu *et al.*, 2014, Dufwenberg and Spagnolo, 2011, Rose-Ackerman, 2010, among many others).³ The idea behind Basu’s proposal is simple: after the act of bribery is committed, the interests of the bribe giver and the bribe taker diverge owing to asymmetric liability. In fact, the bribe giver will be willing to cooperate in getting the bribe taker caught. Anticipating that this will happen, the bribe taker will not accept the bribe. Differently from harassment bribes, where only two parties are involved, in our framework corruption is not the final offence but it is rather an *input* for a more dangerous crime, which involves the participation of more than two parties. In fact, the hierarchical nature of organized delinquency makes our problem different than a simple bilateral relationship. Hence, it should not be surprising that our policy implications are

¹See, e.g., http://blogs.wsj.com/indiarealtime/2011/03/30/kaushik-basu-says-make-bribe-giving-legal/#:wg_o1/-NuhEkGA.

²Bribes that people often have to give to get what they are legally entitled to.

³For experimental evidence on the effects of leniency for bribe givers on harassment bribery see for example Abbink *et al.* (2014) and Engel *et al.* (2012).

quite different than Basu’s proposal: in our a framework, it is the bribe taker that should be partially or even completely immune (provided that he reports the bribe giver). Moreover, while Basu’s argument does not require corruption to happen in equilibrium, in our model a salient feature of the optimal policy is that bribery occurs along the equilibrium path.

Hence, taken together, our results suggest that being too severe with corrupt officials might not be a good idea when dealing with organized crime, especially if enforcement against the members of these organizations is weak relative to the investigative support that an official’s testimony could provide in trial. Lastly, it should be emphasized that the somewhat positive view of corruption that emerges from our analysis should be confined in the context of our model, and therefore taken as a theoretical possibility, which might be however of some help to policymakers when considering the introduction of leniency programs for corrupt officials.

The rest of the paper is organized as follows. In the next section (Section 2) we review the related literature and highlight the contribution of our paper. In Section 3 we discuss some useful anecdotal evidence on organized crime, corruption and leniency programs that helps framing the problem into a formal model. Accordingly, in Section 4 we set up the baseline model and characterize the optimal policy for the case in which there is no amnesty for a corrupt official. In Section 5, we consider a more general policy that awards reduced sanctions both to the fellow and to a self-reporting public official. Section 6, we discuss some extensions. Section 7 concludes. Proofs are in the Appendix.

2 Related Literature

In addition to the recent literature on harassment bribes cited before, our analysis is obviously related to the strand of literature on organized crime. Traditionally, this literature has developed welfare comparisons between monopoly and competitive supply of bads — see, e.g., Buchanan (1973) and Backhaus (1979). More recently, Jennings (1984), Polo (1995), Konrad and Skaperdas (1997, 1998) and Garoupa (2000) started to model criminal organizations as vertical structures, whose heads need to discipline their fellows with implicit rewards and credible threats (see, e.g., also Baccara and Bar-Isaac, 2008, who consider both vertical and horizontal organizations).⁴ But, these models have overlooked the role of leniency programs as a policy tool to generate conflict within criminal organizations, which is instead the building block of our analysis.

The idea of applying leniency programs to criminal organizations builds upon the antitrust law enforcement literature, which studies the effects of reduced sanctions on cartel

⁴See also Fiorentini and Peltzman (1995) and Mansour et al. (2006).

formation in oligopolistic markets — see, e.g., Motta and Polo (2003) and Spagnolo (2003), Rey (2003), Spagnolo (2008), Aubert *et al.* (2006), Chen and Harrington (2007), Chen and Rey (2007) and Harrington (2008). The main difference between this literature and papers that deal with organized crime is that while cartels are horizontal institutions, criminal organizations are typically hierarchical. The optimal design of leniency programs meant to fight organized crime and collective delinquencies has recently been discussed in Acconcia *et al.* (2014), who also provide an empirical analysis of the phenomenon, and Piccolo and Immordino (2016), who emphasize the benefits and the costs of these programs. Yet, none of these papers has discussed the effect of corruption on leniency. Our paper fills this important gap by showing that, when dealing with organized crime and collective delinquency, ‘avoidance’ (Malik, 1990) or ‘subversion of law’ (Glaeser and Shleifer, 2003) may not necessarily lead to weaker enforcement (less leniency), as it typically happens in the case of individual crimes.

Our analysis also shares important features with the literature on corruption.⁵ Stemming from Becker and Stigler (1974) the law and enforcement literature has acknowledged that bribery reduces punishment and thus deterrence. To contrast this fall in deterrence they propose the payment of efficiency wages to prevent bribe taking.⁶ Bowles and Garoupa (1997) focus on the effects of bribery on the optimal allocation of public resources and they show that the maximal fine may not be optimal.⁷ Polinsky and Shavell (2001) consider the dilution of deterrence caused by corruption not only due to bribing by criminals but also extortion of the innocent by enforcers. They propose rewards for corruption reports to mitigate the breakdown of deterrence. In a recent paper, Dufwenberg and Spagnolo (2015) develop a model of ‘harassment bribes’ paid for services one is entitled to, to analyze the proposal to legalize paying these bribes while increasing fines on accepting them. While a similar mechanism is politically viable for small crimes, it is difficult to imagine that people would approve a law where bribing public officials to fix trials is legal. Finally, Kugler,

⁵International comparisons relying on opinion surveys suggest that perceived corruption turns out to increase with ethnic fragmentation (Mauro, 1995) and appears to be affected by countries’ cultural traditions and the long exposure to democracy (Treisman, 2000). Glaeser and Saks (2006) confirm that ethnic heterogeneity matters by exploiting U.S. cross-state variation in the number of government officials convicted for corrupt practices. Strong and robust evidence that more educated states have less corruption also emerge. When we focus instead on the impact of corruption on growth, mixed results emerge depending upon the level of analysis. Looking at the micro data, corruption depresses firms’ growth and reduces the efficacy of redistribution for development (see, for instance, Fisman and Svensson, 2007; Olken, 2006). However, no robust evidence emerges that corruption negatively affects long run growth across countries (Svensson, 2005). A plausible explanation for the mismatch between the micro and macro evidence is that some types of corruption may be efficiency enhancing, by determining competition for government resources and by speeding up administrative procedures.

⁶Besley and McLaren (1993) and Mookherjee and Png (1995) also propose efficiency wages to deter bribery.

⁷See also Basu *et al.* (1992), Marjit and Shi (1998), Chang *et al.* (2000) and Garoupa and Jellal (2002).

Verdier and Zenou (2005) analyze an oligopoly model in which criminal organizations compete on criminal activities and engage in corruption. Differently from Bowles and Garoupa (1997), where a higher fine may deter crime but will encourage corruption, they find that the maximal fine is not optimal because results in more rather than less crime. The role of corruption is not only in diluting deterrence, but also as a strategic complement to crime, as a catalyst to crime. Our paper is the first that combines the leniency and corruption literatures. To the best of our knowledge none of the existing papers analyzes policies that jointly offer amnesties to accomplice-witnesses and corrupt public officials, a key feature to find a bright side in the subversion of law.⁸

3 Historical Background and Anecdotal Evidence

Before setting up the model, we first survey some anecdotal evidence that motivates the analysis and its underlying assumptions.

3.1 Italy, corruption and the Sicilian Mafia

The existence of deep connections between the Sicilian Mafia (Cosa Nostra) and many Italian politicians, public officials and prosecutors, is widely covered in the press. In the 1970s, for example, while in office, many Sicilian politicians (who were subsequently prosecuted for mafia related crimes) publicly denied the existence of the Mafia (see, e.g., Lodato, 2006), and in fact it was not until 1982 that being a member of the Mafia became a formal crime.

Cosa Nostra frequently tried to manipulate court decisions by bribing, threatening, and, occasionally, even murdering judges, prosecutors and police officers. Tommaso Buscetta was the first former mafia member to expose in detail the secret ties that linked politicians to this powerful and radicated organization. On November 1992, he testified in front of the Antimafia Commission about the links between Cosa Nostra and Salvo Lima (an important Christian Democrat politician at that time), indicating that Lima was in charge of fixing problems for the organization whose solution laid in Rome — i.e., bribe and or intimidate prosecutors to fix or even avoid trials, mitigate sanctions, prevent investigations, gather consensus to oppose national laws hurting the business, delay special measures intended to strengthen enforcement in Sicily, etc. He also claimed that Lima was killed on March 1992 because he had outlived his usefulness. In fact, on January 1992 an appeal court had upheld

⁸There are very few studies relating corruption to institutional changes or, more in general, to particular event. Two experiences of corruption-crackdowns have been documented by Skidmore (1996) and Di Tella and Schargrodsky (2003). The former refers to the well-known example of the successful performance of the Independent Commission Against Corruption in Hong Kong; the latter instead focuses on the program of monitoring the price levels of a number of goods in the public hospitals of Buenos Aires.

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 took charge of the appeal and confirmed the sentences. Lima was therefore of no further use to the Mafia.

The first important example of an Italian politician convicted for Mafia membership was Vito Ciancimino, many times mayor of Palermo and traditionally involved in illicit affairs. In 2001 he was declared guilty of being involved in several Mafia crimes. Giulio Andreotti, a prominent Italian politician of the Christian Democratic party, was investigated for alleged ties to the Mafia. In 2003 the court of Palermo acquitted him of ties to the Mafia. But, as reported by *The Independent* (26 July, 2003) “(...) although Mr. Andreotti’s acquittal on charges of conspiring with the Mafia was upheld by appeal judges in Palermo, they said for many years Mr. Andreotti had enjoyed ‘authentic, stable and amicable’ relations with Mafiosi”. Between 1991 and 1999, more than half of the deputies of the Sicilian regional Parliament and 17 Sicilian deputies of the national Parliament were charged of mafia association and corruption.

There are various examples of opaque relationships between judges, prosecutors and Cosa Nostra. For instance, Corrado Carnevale became famous for his close connection with Lima and an alleged collusion with the Mafia: the Appeal Court where he was president overturned a large number of Mafia cases that other Courts had previously filed with convictions. Cases of corruption also involved members of the Italian police forces and intelligence services.⁹ For example, Bruno Contrada, a former head of the SISDE (the Italian Intelligence Agency) was sentenced to ten years for collusion with Cosa Nostra. On the basis of testimonies provided by the some informants, Contrada was accused of informing the Mafia for upcoming police operations, preventing in particular an early capture of the fugitive Totò Riina, one of the most violent leader in the history of Cosa Nostra.¹⁰

Similar patterns of connections between organized crime, politicians, prosecutors and police forces can be easily found in other regions of Italy where criminal organizations are active — i.e., Campania, Calabria and Puglia.

The Italian Criminal Code provided for partial or total immunity from punishment if the offender cooperated with authorities in cases of political conspiracy or gang-related activities already in 1930. Moreover, in the 1970s, as a direct consequence of the violent actions of the Red Brigades a series of laws to encourage dissociation from terrorist groups and collaboration with the authorities were enacted. However, it was not until 1984, when

⁹See e.g., Ayala (2008), Anselmo and Braucci (2008) and Cantone (2008).

¹⁰See, e.g., “Audizione del collaboratore di giustizia Gaspare Mutolo”, Antimafia Commission, February 9, 1993.

Tommaso Buscetta turned against the Mafia and in exchange for his help was relocated under a new identity, that witness protection became formalized. Those events induced more Mafia members to cooperate, with the result that by the end of the 1990s the Italian authorities had benefited from the services of more than 1,000 justice collaborators. At the same time, the Italian process was increasingly being criticized for the questionable credibility of witnesses and their motivations, and there were allegations of disorganization and mismanagement of the witness protection programme. In response, a comprehensive revision to Decree-Law No. 82 of 15 March 1991 was undertaken and entered into force in January 2001. One of the main components of the revised legislation was to create within the witness protection programme a separate structure for justice collaborators (see UNODC, 2008).

3.2 Not only Italy...

The links between criminal organizations and the public domain are features displayed not only by the Sicilian Mafia. They are widespread. Other examples are in Latin America. Solís and Floglesong (2009) collect a series of interviews to more than thirty experts in Mexico, Guatemala, Costa Rica, Panama, Dominican Republic, and the United States. Among these were academic experts, high ranking officials of police forces, members of the General Attorney's Office and members of the Human Rights Offices, leaders of non-government organizations, lawyers and local council authorities. When asked about the links between criminal organizations and the State, the majority of the interviewees agreed that there is a mutually beneficiary and reciprocal relationship between drug trafficking and at least some people that have leadership positions in institutions in Mexico, Dominican Republic and Central America.

Corruption and intimidation characterized, for example, Pablo Escobar's dealings with the Colombian system. He managed to bribe a long list of government officials, judges and other politicians. The strategy was the so called 'plata or plomo' deal, according to which either a public official would accept a bribe and live in peace, or he would refuse it, but accept the risk of being killed. The greatest threat posed to the Medellín Cartel and the other traffickers was the implementation of an extradition treaty between the United States and Colombia. It allowed Colombian authorities to extradite suspects of drug trafficking to the US to be put on trial there. This was a major problem for the cartel since the drug traffickers had little influence in the US, and a trial there would most likely lead to imprisonment. Then, once again the cartel applied a 'plata or plomo' strategy towards several supporters of the extradition treaty, using bribery, extortion or violence.

Colombia's witness protection programme has its origins in the Constitution of 1991, which listed among the main functions of the Office of the Attorney General the obligation

to provide protection for witnesses, victims and other parties to criminal proceedings. A special team of investigators is responsible for evaluating criminal investigations, studying witness participation in proceedings and ultimately assessing the level of risk and threat that arises as a direct consequence of such participation. For witnesses in cases involving drug trafficking, the programme provides for the permanent relocation inside Colombia and change of identity for witnesses at risk. Witnesses receive financial assistance to start a new life, together with psychological support, medical care, counselling and assistance with resettlement and the issuance of new personal documents (see UNODC, 2008).

Mexican cartels are also well known to base their operations on a radicated network of complicities with law enforcement officials. For example, Mexican municipal, state, and federal government officials, along with the police forces, often work together with the cartels in an organized network of corruption. Serious concerns have been recently expressed by the International Narcotics Control Board, reporting that, although the central government of Mexico has made concerted efforts to reduce corruption in recent years, it remains a deep problem. Many agents of the Federal Investigations Agency (AFI) are suspected to work as enforcers for various cartels: according to the Attorney General, in 2015, nearly 1500 of AFI's 7000 agents were under investigation for suspected criminal activity, and 457 were convicted. Between 2008 and 2009 several police agents and top officials were arrested and accused of selling information or protection to drug cartels. Among those there were some with a high institutional profile — e.g., chiefs of the Federal Police, ex-chiefs of the Organized Crime Division and ex-directors of Mexico's Interpol office.¹¹

Mexico is characterized by a very poorly functioning witness program. In 2012 Mexican President Felipe Calderon attempted to make it more effective signing into law a measure authorizing benefits, including new identities, for people who find themselves at risk due to their participation in judicial proceedings. However, the Mexican justice system is still unable to exploit the opportunities presented by whistleblowers. Well known problems are faulty testimonies (a recent example in a high profile case is that of Roberto Lopez Najera, whose testimony helped advance some of the most important cases of the Calderon presidency, but the lack of veracity to his claims led them to all fall apart) and the lack of protected witnesses. The Attorney General's Office used just 379 such witnesses during Calderon's administration (the figure was just 80 in 2006). In a nation where the government estimates that 500,000 people earn their living from the drug trade this is a very small number. Mexico has also proved unable to protect the (few) witnesses in its custody on a number of occasions. In one of the most famous examples, two witnesses into an investigation against Ismael 'El Mayo' Zambada died in quick succession in late 2009. The first, Reyes Reinado Zambada Garcia, allegedly hung himself, while the second, Edgar Enrique Bayardo

¹¹<http://edition.cnn.com/2009/WORLD/americas/07/15/mexico.violence/>.

del Villar, was shot to death in a crowded Starbucks.

3.3 Leniency for organized crime and corruption

In this section we provide some evidence to back our choice of studying a coordinated policy that awards an amnesty not only to criminals that flip and turn informants, but also to prosecutors that first accept a bribe from the boss and then self-report. Two separate United Nations Convention, against Transnational *Organized Crime* and against *Corruption* (General Assembly resolution 58/4, annex) provide that States parties should take appropriate measures to protect witnesses in criminal proceedings related to organized crimes and corruption (articles 32, 33 and 37, para. 4). Indeed, “although witnesses in serious corruption cases may occasionally face a threat to their lives, they are more often subjected to harassment at work, covert threats of retaliation, demotion or similar action. As a result, the criteria used for assessing the level of threat against witnesses in the majority of corruption cases are less exclusive than in organized crime cases, where the threat to the witness’s life that would give cause for inclusion in the witness protection programme is likely to be much higher. To address those problems and ensure that corruption is tackled effectively, a number of countries have chosen to establish separate protection programmes for witnesses in corruption cases” (see UNODC, 2008 pg. 25). We formalize the difference between the two leniency programs allowing for potentially different amnesties for the mobster and the public official (see Section 5).

4 The baseline model

In this section we lay down the simplest possible model that allows us to show under which conditions the Legislator designs a policy that induces criminal organizations to subvert the law in order to optimally deter crime. We will first describe the model, then we analyze the no-corruption benchmark that allows us to illustrate the simple logic of subversion of law, finally we characterize the optimal policy that combines leniency for law-rank criminals that blow the whistle and leniency for corrupt officials that self report.

Players and environment. The game involves a benevolent Legislator, a criminal organization and a public official. The Legislator, having forbidden socially harmful acts, designs a leniency program. The criminal organization is formed by two members: a principal (boss) and an agent (fellow or soldier).

The crime yields a random monetary return π , distributed on the support $[0, +\infty]$ with cdf $G(\pi)$ and pdf $g(\pi)$. The fellow is hired after the monetary return π realizes by the boss who has full bargaining power and offers him a wage w . This wage is paid after the

crime is committed, but before the investigation takes place. For simplicity, we normalize the fellow’s outside option to zero.

Once the crime is committed, the public official detects it with probability 1. The boss can, however, decide to bribe the official in order to subvert the law — i.e., upon receiving the bribe, hereafter x , the corrupt official acquits the organization members. The official’s moral cost of infringing the law, hereafter m , is a random variable that distributes on the support $[0, +\infty]$ with cdf $F(m)$ and pdf $f(m)$. At the time the bribe is offered, the boss knows m .

Conviction technology. The conviction *technology* depends on the Legislator’s policy, the fellow’s reporting behavior and the boss’ corruption decision.

As mentioned above, when the official is corrupt, neither the boss nor the fellow are sanctioned: the official may, in fact, prevent or discontinue investigations, ignore a police or victim report, or interpret the evidence in a light favorable to the defendants (this assumption is relaxed in Section 6.1). A corrupt official is convicted with probability q : in this case, he is charged a sanction S_o . For the moment, we assume that the official is not allowed to self-report (this assumption is removed in Section 5 where we characterize the general policy that combines leniency for both to the fellow and the corrupt official).

By contrast, when the official is not corrupt, the fellow is ‘pivotal’ in determining the expected sanctions.

- If the fellow remains loyal to the organization, he is fully accountable for the crime: he is convicted with probability p and is charged a sanction S_a . The boss is not sanctioned.
- If the fellow blows the whistle, he is charged a (certain) discounted sanction $(1 - \phi) S_a$, where ϕS_a is the penalty that is waived by the Legislator. In exchange of this reduced sanction, the whistleblower provides information against the organization that leads the judicial authority to convict the boss with probability α and charge him S_p .

In this baseline model we assume that the fellow is unable to provide information against the public official (when he has been bribed) since being the boss is in charge of corruption, the fellow has no hard evidence to report against the official (we will discuss this assumption in Section 6.2). For simplicity, and with no loss of insights, we assume that the boss does not retaliate on whistleblowers (we will discuss the role of this normalization in Section 6.3).

Timing and solution concept. The timing of the game is as follows:

$\tau=0$ The Legislator commits to an amnesty ϕ .

$\tau=1$ The crime return materializes. The boss decides whether to commit the crime. He offers a wage w to the fellow. If the offer is rejected the game ends. Otherwise, once the illegal act is committed, the wage is paid and the game proceeds to the next stage.

$\tau=2$ The investigation opens and the boss decides whether to bribe the public official.

$\tau=3$ The fellow, knowing if the official has been corrupt, decides whether to cooperate with the justice.

$\tau=4$ The trial uncertainty resolves and sanctions are imposed.

The solution concept is Subgame Perfect Nash Equilibrium.

Assumptions. All players are risk neutral, so that sanctions can be interpreted as the monetary equivalent of the imprisonment terms, fines, damages, and so forth, to which the criminals expose themselves. In addition, we impose the following technical and simplifying assumptions.

A1 The Legislator's objective is to minimize crime.

This assumption is imposed in most of the existing literature — see, e.g., Piccolo and Immordino (2016). We relax it in Section 6.4.

A2 When the fellow is indifferent between blowing the whistle and remaining loyal to the boss, he chooses the former option.

This is a necessary tie breaking condition that guarantees the uniqueness of a policy that induces the fellow to report in equilibrium.

A3 The boss is never charged less than the official and the fellow — i.e., $S_p \geq \max \{S_a, S_o\}$.

This assumption seems appealing for criminal organizations: the most dangerous and culpable criminals are those that operate behind the scenes (see, e.g., Jeffries and Gleeson, 1995).

A4 The information reported by the fellow is more accurate than that offered by the official — i.e., $\alpha \geq \beta$.

The assumption that the fellow's information is more valuable than that offered by the official seems somewhat natural since the fellow is supposed to know better the boss, his traffics, habits and involvement into crimes.

A5 The inverse hazard rate $h(m) \equiv \frac{F(m)}{f(m)}$ is increasing and satisfies the following Inada condition

$$h(+\infty) > (\beta - p) S_a. \quad (1)$$

Imposing an increasing inverse hazard rate is a standard condition in many regular screening problems. The Inada condition stated in (1), instead, guarantees that the Legislator's maximization problem is single peaked.

4.1 The 'no corruption' benchmark

To begin with, consider the benchmark in which the official is too honest to be bribed. Clearly, if the fellow is not allowed to blow the whistle, the crime is committed as long as its monetary return π exceeds the fellow's expected sanction pS_a , which defines his reservation wage. Hence, the crime rate is

$$r^\varnothing \equiv 1 - G(pS_a),$$

which is decreasing with the fellow's expected sanction: the higher the fellow's expected sanction, the lower the boss net return from crime since he has to pay a higher reservation wage to the fellow.

Next, suppose that a leniency program is introduced. The fellow blows the whistle if and only if the probability of conviction p is larger than the share $1 - \phi$ of the sanction that is not waived by the policy — i.e.,

$$(1 - \phi) S_a \leq pS_a \quad \Leftrightarrow \quad \phi \geq 1 - p.$$

Hence, in this case the crime is committed if and only if

$$\pi \geq \pi^* \equiv (1 - \phi) S_a + \alpha S_p,$$

where $(1 - \phi) S_a$ is the fellow's reservation wage, and αS_p is the boss' expected sanction when the fellow blows the whistle. Note that, other things being equal, a higher amnesty tends to make the crime more profitable because it reduces the fellow's reservation wage and increases the boss' net return from crime.

The optimal policy solves the following minimization problem

$$\min_{\phi \in [1-p, 1]} \Pr[\pi \geq \pi^*],$$

whose solution is summarized in the next proposition.

Proposition 1 *When corruption is not viable, the optimal policy induces the fellow to blow the whistle and grants an amnesty $\phi^* = 1 - p$.*

Without corruption it is always optimal to induce the fellow to blow the whistle. In so doing, however, the Legislator chooses the lowest possible amnesty: granting an amnesty larger than $1 - p$ would only have the effect of reducing the fellow’s reservation wage, whereby increasing the boss’ net return from crime and reducing the crime rate — see, e.g., Piccolo and Immordino (2016) for a more general analysis of the costs and benefits of leniency programs for criminal organizations.

4.2 The simple logic of ‘subversion of law’

What is the impact of corruption on the simple result highlighted in Proposition 1? Does corruption lead to subversion of law? If so, under what conditions? How should the Legislator react to this threat? In the rest of the paper we address these issues. To this purpose, in this section we first revisit the simple logic of subversion of law and then explain, in the next section, why it does not necessarily harm the Legislator.

Suppose that the official can be bribed when his moral cost is sufficiently low. In this case, the boss can choose whether to trust the fellow and count on his loyalty, or bribe the official. To characterize the optimal policy it is useful to start from the last stage of the game and consider first the fellow’s confession choice, and then move back to the boss’ bribing decision.

Since we assumed that the agent knows whether the official is corrupt or not, and that a corrupt official always manage to acquit both members of the organization, blowing the whistle is profitable for the fellow only when the public official has not been bribed. Hence, the rule according to which the fellow is induced to cooperate is the same as in the benchmark — i.e., the fellow blows the whistle if and only if $\phi \geq 1 - p$. Note that if $\phi < 1 - p$ the boss does not bribe the official since the fellow does not blow the whistle — i.e., there is no law to be subverted.

Consider the most interesting case in which the Legislator sets an amnesty $\phi \geq 1 - p$ so that the fellow blows the whistle (if he can do so). In this case, the bribe x that the boss is willing to pay in order to avoid conviction must be such that

$$x \leq \alpha S_p. \tag{2}$$

That is, the bribe that the boss is willing to pay must be lower than his expected sanction in case of no corruption, which depends on the quality of the information reported by the fellow (as reflected by α). Yet, in order to satisfy the official’s participation constraint, the

bribe x must cover the sum of the official's moral cost m and the official's expected sanction qS_o — i.e.,

$$x \geq \underbrace{m + qS_o}_{\text{Reservation bribe}}. \quad (3)$$

Taken together, conditions (2) and (3) imply the following useful lemma.

Lemma 2 *If $\alpha \leq \frac{qS_o}{S_p}$, there is no corruption in equilibrium. Otherwise, the boss bribes the official when his moral cost is small enough — i.e., $m \leq \bar{m} \equiv \alpha S_p - qS_o$.*

Essentially, when the fellow's insider information is not too accurate, the boss prefers not to bribe the official since the cost of counting on the fellow's loyalty is lower than the cost of rewarding the official for his risk of conviction. By contrast, when the fellow's insider information is accurate enough, the boss prefers to bribe the official in order to subvert the law. To focus on the most interesting case for our purposes assume that $\bar{m} > 0$, so that there is always a sufficiently dishonest official that is bribed by the boss in equilibrium — i.e., $m \leq \bar{m}$. Note that, the region of parameters in which this happens expands when the information disclosed by the fellow is relatively more productive — i.e., when α is high — when the judicial system is relatively more severe with the boss — i.e., when S_p is large — when the probability of convicting the official is not too high — i.e., when q is relatively low — and when corruption is not sanctioned too severely — i.e., when S_o is not too large.

In the region of parameters under consideration, the crime is committed if and only if

$$\pi \geq \hat{\pi} \equiv \underbrace{\int_0^{\bar{m}} (m + qS_o) dF(m)}_{\text{Official's expected bribe}} + \underbrace{(1 - F(\bar{m})) \alpha S_p}_{\text{Boss' expected sanction}} + \underbrace{(1 - F(\bar{m})) (1 - \phi) S_a}_{\text{Fellow's reservation wage}},$$

whose right-hand side reflects the total cost of committing the crime. That is, the sum of the official's expected reservation bribe, the boss' expected sanction and the fellow's reservation wage.

We can state the following result.

Proposition 3 *Suppose that $\bar{m} > 0$. The Legislator allows the fellow to blow the whistle and grants him the lowest possible amnesty ϕ^* if and only if*

$$pS_a - qS_o \leq \mathbb{E}[m | m \leq \bar{m}] + \frac{1 - F(\bar{m})}{F(\bar{m})} \alpha S_p. \quad (4)$$

Otherwise, it is optimal not to allow the fellow to blow the whistle.

Note that, regardless of whether a leniency program is introduced or not, when corruption is viable the crime rate is always higher than in the benchmark. This result illustrates

the simple logic of ‘subversion of law’: since the boss can avoid being sanctioned by bribing the official, the introduction of a leniency program may trigger socially harmful acts that undermine the effect of the law, and may even subvert it — i.e., when (4) does not hold. When this happens, the Legislator finds it optimal not to allow the fellow to blow the whistle because corruption not only allows him to avoid being sanctioned, but it also reduces the reservation wage that the fellow is willing to accept since his conviction risk is lower. Hence, pursuing strong enforcement goals may harm welfare insofar as this may trigger subversion of law.

5 Optimal policy and the bright side of subversion of law

In this section we derive the main result of the paper, which highlights the bright side of subversion of law. To this purpose, we now allow the Legislator to grant a lighter sanction also to a corrupt official that plea guilty and self-reports. Hence, in addition to setting a reduced sanction for the fellow when he blows the whistle, the policy also specifies an amnesty, hereafter φ , that is awarded to a self-reporting official.

In order to create scope for self-reporting by the public official we assume that when he reports, the probability of sanctioning both members of the organization is β . The idea is that once the boss has ‘fallen’ also his ‘soldiers’ do: a sort of domino effect that echoes Baccara and Bar-Isaac (2008). Consistently with the previous assumptions, we now posit that in $\tau = 3$ a corrupt official decides whether to self-report or not. The rest of the model remains unchanged.

As already mentioned before, one important simplification that we impose is that if the official is corrupt, the fellow cannot blow the whistle, even if he wants. This assumption seems realistic when the official is the prosecutor or the judge ruling the case against the fellow. In both these cases, the official can easily manage to convince the fellow not to blow the whistle either because he can file away the case, even before the trial starts, or because, he can negatively evaluate the quality of the evidence offered by the fellow at the trial, file the case and prevent the latter being accepted in the leniency program. Of course, things may change if the official is neither a prosecutor nor a judge, but a police member in charge of the investigative activity against the organization. In that case, fellow may still be able to cooperate with the justice and accuse both the boss and the corrupt official (of course, provided that the prosecutor leading the case is honest). In Section 6.1 we discuss more in depth the role of this assumption and its implications.

In order to solve the model, consider the sub game in which the official has accepted a

bribe x . He will self-report if and only if

$$qS_o \geq (1 - \varphi) S_o \quad \Leftrightarrow \quad \varphi \geq 1 - q.$$

Moving back to the corruption stage, we now characterize the boss' decision to bribe the official. Clearly if $\varphi < 1 - q$, the condition under which the boss bribes the official is the same as that obtained in Lemma 2. Hence, consider the most interesting case in which $\varphi \geq 1 - q$. The bribe x that the boss is willing to pay in order to avoid conviction must be such that

$$x \leq (\alpha - \beta) S_p. \quad (5)$$

That is, the bribe x must be lower than the difference between the boss' expected sanction when the fellow's blows the whistle — i.e., αS_p — and the boss' expected sanction when the corrupt official self reports — i.e., βS_p . Yet, in order to satisfy the official's participation constraint, the bribe x must cover the sum of the official's moral cost m and the official's discounted sanction $(1 - \varphi)S_o$ — i.e.,

$$x \geq \underbrace{m + (1 - \varphi) S_o}_{\text{Reservation bribe}}. \quad (6)$$

Note that the official's reservation bribe is decreasing in φ : the more lenient the Legislator is with a self-reporting official, the lower is the bribe that the latter is willing to accept in order to subvert the law. Hence, other things being equal, a higher φ induces more corruption in equilibrium.

Taken together, conditions (5) and (6) imply the following useful lemma.

Lemma 4 *If $\phi < 1 - p$ the boss never bribes the official. By contrast, if $\phi \geq 1 - p$ there is corruption in equilibrium if and only if*

$$1 - \varphi \leq [\alpha - \beta] \frac{S_p}{S_o}.$$

In this region of parameters, the boss bribes the official when his moral cost is small enough — i.e., if

$$0 \leq m \leq m(\varphi) \equiv (\alpha - \beta) S_p - (1 - \varphi) S_o.$$

As already argued before, corruption is worthless for the boss when the fellow does not blow the whistle. Hence, an equilibrium in which the official is bribed can exist only if the Legislator sets an amnesty that triggers the fellow's cooperation. In that case, corruption emerges in equilibrium if the amnesty granted to the official is large enough: this, in fact, reduces the official's reservation bribe and makes it less costly for the boss to approach the official when his moral cost is not too large.

Hence, we can show that

Lemma 5 *In the region of parameters where*

$$q \geq (\alpha - \beta) \frac{S_p}{S_o}, \quad (7)$$

the level of φ that solves $m(\varphi) = 0$, hereafter denoted by $\underline{\varphi}$, is always larger than $1 - q$.

Essentially, condition (7) guarantees that the Legislator can always choose a φ such that the official self-reports, and the boss does not find it optimal to bribe him (even when the official's moral cost is zero) because the reservation bribe is too large relative to the sanction that the boss avoids when the official is corrupt. This means that, in the region of parameters where (7) holds — i.e., when the enforcement against corruption is relatively weak — the Legislator can always implement the outcome of the no-corruption benchmark by setting the official's amnesty equal to $\underline{\varphi}$. To simplify the analysis, with no loss of insights, in what follows assume that (7) holds and determine the conditions under which the Legislator relies on corruption to optimally deter crime. The case in which (7) is not met is discussed in Section 6.2, where we show that results hold qualitatively even in that region and are actually even stronger.

Accordingly, consider a policy such that $\varphi \geq \underline{\varphi}$ and $\phi \geq 1 - p$. The fellow's reservation wage is

$$\int_0^{m(\varphi)} \beta S_a dF(m) + \int_{m(\varphi)}^{+\infty} (1 - \phi) S_a dF(m),$$

which is decreasing in ϕ . The higher is the fellow's ex post utility, the lower is the wage that he is willing to accepted ex ante.

The boss' expected sanction is

$$\int_0^{m(\varphi)} \beta S_p dF(m) + \int_{m(\varphi)}^{+\infty} \alpha S_p dF(m),$$

which is decreasing in φ since we assumed that the fellow's information is more accurate than that of the official — i.e., $\alpha \geq \beta$ as stated in assumption A4.

Finally, the official's (expected) reservation bribe is

$$\int_0^{m(\varphi)} (m + (1 - \varphi) S_o) dF(m),$$

whose derivative with respect to φ has an ambiguous sign. In fact, on the one hand, a higher φ reduces the actual bribe that the official is willing to accept — i.e., $m + (1 - \varphi) S_o$. On the other hand, a higher φ also increases the mass of official types that is bribed in equilibrium — i.e., the threshold $m(\varphi)$ — which tends to increase the expected bribe that the boss pay in equilibrium.

Summing up, the crime is committed if and only if

$$\pi \geq \tilde{\pi} \equiv \int_0^{m(\varphi)} (m + (1 - \varphi) S_o + \beta (S_a + S_p)) dF(m) + \int_{m(\varphi)}^{+\infty} ((1 - \phi) S_a + \alpha S_p) dF(m).$$

Since we assumed that (7) holds, the optimal policy solves

$$\min_{\phi \geq 1-p, \varphi \geq \underline{\varphi}} \Pr[\pi \geq \tilde{\pi}].$$

Note that if the Legislator chooses the amnesty $\underline{\varphi}$ for the official, there is no corruption in equilibrium and, as discussed above, the optimal policy and the corresponding crime rate are the same and as in the benchmark without corruption. In other words, (7) guarantees that the Legislator has always the possibility to prevent subversion of law by setting a sufficiently low amnesty for the official, that raises the reservation bribe up to the level that makes corruption never worthwhile for the boss.

Note that, in order to induce a given corruption rate in equilibrium (say m'), the Legislator needs to grant an amnesty to the official equal to

$$\varphi' = 1 - \frac{(\alpha - \beta) S_p - m'}{S_o},$$

which is increasing in m' . Quite intuitively, the higher the rate of corruption that the Legislator wants to induce in equilibrium, the more generous the amnesty granted to the self-reporting official must be (other things being equal). The reason is that since the official's reservation bribe is decreasing in φ , a more generous amnesty makes it less costly for the boss to subvert the law.

Therefore, holding φ constant and letting $y \equiv m(\varphi)$, a simple change of variable allows to write the Legislator's problem as

$$\max_{\phi \geq 1-p, y \in [0,1]} \int_0^y (m - y) dF(m) + F(y) (\beta - (1 - \phi)) S_a + (1 - \phi) S_a + \alpha S_p.$$

Differentiating with respect to ϕ , we have

$$-(1 - F(y)) S_a < 0 \quad \forall y \geq 0.$$

As in the benchmark, the crime rate is decreasing in ϕ . Hence, it is optimal to set the lowest possible amnesty for the fellow — i.e., $1 - p$. Moreover, differentiating with respect to y and substituting for $\phi = 1 - p$, we have

$$-F(y) + f(y) S_a (\beta - p) \leq 0 \quad \Leftrightarrow \quad h(y) \geq S_a (\beta - p). \quad (8)$$

This derivative shows that a higher rate of corruption has three effects on the Legislator's objective function. Two of these effects determine the dark side of corruption — i.e., they

increase the crime rate — while the third one determines its bright side — i.e., this effect decreases the crime rate. In fact, by increasing corruption — i.e., by setting a higher y , and thus a higher φ — the crime rate increases for two reasons: (i) ceteris paribus, subversion of law occurs more often, which allows the boss to avoid being sanctioned with higher probability, and (ii) a higher rate of corruption also leads the fellow to blow the whistle less often, which reduces the likelihood of being charged the discounted sanction $(1 - \phi) S_a = pS_a$. This effect reduces the fellow's reservation wage, whereby increasing the crime rate. Both these effects determine the dark side of subversion of law. However, by increasing corruption, it is also more likely to convict the fellow when the official self-reports and charge him βS_a . This effect increases the fellow's reservation wage, since it spurs his conviction risk, and tends to lower the crime rate: the bright side of subversion of law.

We can state the following result.

Proposition 6 *If $\beta > p$ the Legislator is willing to tolerate a positive level of corruption $\tilde{m} > 0$ in equilibrium, with \tilde{m} being solution of*

$$h(\tilde{m}) = (\beta - p) S_a. \quad (9)$$

The optimal amnesty for the official is

$$\tilde{\varphi} = 1 - \frac{(\alpha - \beta) S_p - h^{-1}((\beta - p) S_a)}{S_o}.$$

By contrast, if $\beta \leq p$ the optimal policy features no corruption in equilibrium — i.e., $\tilde{m} = 0$. In this case the crime rate is equivalent to that obtained in the benchmark.

This proposition provides the central result of the paper: it highlights the conditions under which the bright side of subversion of law is so strong to induce the Legislator to tolerate some degree of corruption in equilibrium in order to optimally deter crime. This result hinges on the hierarchical structure of criminal organizations and holds true when $\beta > p$. The intuition is as follows: when β is larger than p , the negative effect of a marginal increase of corruption on the crime rate, through, the positive impact of the official's reporting behavior on the fellow's reservation wage (as reflected by the term βS_a in (8)) — offsets the positive effect of increased corruption on the crime rate through the reduction of the fellow's reservation wage (as reflected by the term $-pS_a$ in (8)). Hence, when the enforcement against criminal organizations is relatively weak, the optimal degree of corruption that the Legislator implements in equilibrium trades off the social cost of allowing the boss to subvert the law and avoid being sanctioned, which increases his willingness to commit the crime, and the net benefit that corruption has on the fellow's ex ante wage (which is positive when $\beta > p$). In addition, in this case, the two leniency instruments are

complements: the higher is p — i.e., the more generous is the amnesty granted to the fellow — the lower is the amnesty granted to the official $\tilde{\varphi}$.

By contrast, in the region of parameters where $\beta \leq p$, the net effect of an increase of corruption on the fellow's reservation wage is negative. In this case the Legislator prefers not to induce corruption in equilibrium and implements the outcome of the benchmark where only the fellow is allowed to blow the whistle. Hence, when the prosecution ability and/or the enforcement technology *vis-à-vis* the criminal organization is relatively strong, the two leniency instruments are substitutes: the Legislator only relies on the fellow's testimony to deter crime.

In the next proposition we highlight some interesting comparative statics and show when the bright side of subversion of law is so strong to induce the Legislator to provide a bonus for an official that self-reports.

Proposition 7 *Suppose that $\beta > p$. Then: (i) \tilde{m} is increasing in β and S_a and decreasing in p ; (ii) $\tilde{\varphi}$ is increasing in β and S_a and decreasing in p , α and S_p . Moreover, $\tilde{\varphi} > 1$ if and only if*

$$(\beta - p) S_a > h^{-1} ((\alpha - \beta) S_p).$$

This comparative statics has some interesting empirical implications. First, the amount of corruption that is required to minimize crime is increasing with the accuracy of the information provided by the official and is increasing with the sanction charged to the fellow. Second, using corruption in equilibrium to deter crime is less effective when the fellow is more likely to be convicted in trial, when the fellow's information is more accurate, and when the boss (once convicted) is charged very severe sanctions.

Of course, when the bright side of subversion of law is strong enough, in order to stimulate corruption in equilibrium, the Legislator may find it optimal to even provide rewards to self-reporting public officials.

6 Extensions and robustness

In this section we discuss some extensions of the model and show that the results obtained in the baseline analysis hold, qualitatively, if the main assumptions imposed throughout are relaxed.

6.1 Imperfect corruption

Up to this point, we assumed that the fellow cannot blow the whistle if the official is corrupt. This assumption is clearly restrictive since it identifies the official with the prosecutor in

charge of the case. Yet, in some cases, especially when approaching prosecutors is too hard, criminal organizations fold up bribing members of the police forces, who then eventually plea guilty and testify against them (see the anecdotal evidence discussed in Section 3). Hence, it seems natural to check robustness of results by enabling the fellow to testify against both the boss and the corrupt official. Accordingly, assume that at $\tau = 3$ the fellow and the corrupt official can both blow the whistle. To simplify exposition, assume (without loss of insights) that the fellow moves first and denote by $z \in [0, 1]$ the probability that he is allowed to testify even if the official is corrupt (the limiting case where $z = 0$ is equivalent to the baseline model). We interpret z as a proxy of the official's influence — i.e., the higher z , the less influential the official. To simplify notation, assume that when the fellow blows the whistle, the official and the boss are convicted with probability 1 — i.e., α is normalized to 1 — and that $\beta > p$ in order to restrict attention to the most intriguing case in which subversion of law has a bright side in the baseline model.

Note that, as before, also in this new setting the game has a trivial outcome that features no corruption if the fellow is never willing to blow the whistle. Hence, to make things interesting, consider an equilibrium candidate in which the fellow blows the whistle. Again, to solve the model, we need to consider two main subgames: one in which the official is corrupt, and the other in which he is not corrupt. The equilibrium of the latter subgame is the same as that characterized above — i.e., the fellows blows the whistle if and only if $\phi \geq 1 - p$. Therefore, let us focus on the more relevant case in which the official has been bribed and the fellow must decide whether to report or not. Clearly, the official's self-reporting strategy is crucial to determine the fellow's incentive to blow the whistle. Suppose that $\varphi \geq 1 - q$, so that the official self reports. Then, the fellow blows the whistle if and only if

$$z(1 - \phi)S_a + (1 - z)\beta S_a \leq \beta S_a \quad \Leftrightarrow \quad \phi \geq 1 - \beta. \quad (10)$$

This condition implies that when the official is corrupt and is expected to self report, the fellow is willing to accept a lower amnesty than in the baseline model (recall that we assumed $\beta > p$).

Hence, for $\phi < 1 - \beta$ the fellow always remains loyal to the boss; for $\phi \in [1 - \beta, 1 - p)$ he blows the whistle only if the official is corrupt; for $\phi \geq 1 - p$ he always blows the whistle. For any $\varphi \geq 1 - q$ and $\phi \geq 1 - \beta$, the bribe x that the official is willing to accept is

$$x \geq m + zS_o + (1 - z)(1 - \varphi)S_o = m + (1 - \varphi(1 - z))S_o, \quad (11)$$

which is increasing in z : the lower the official's influence — i.e., a z grows large — the larger the reservation bribe is because the official's conviction risk is higher. Of course, the boss never finds it optimal to bribe the official when $\phi \in [1 - \beta, 1 - p)$ because in that case, the fellow reports only if the official is corrupt, which makes corruption impossible to happen

in equilibrium. Hence, for any $\phi \geq 1 - p$ the boss finds it optimal to pay the bribe if and only if his expected sanction by doing so is larger than the sum of the official's bribe and the expected sanction triggered by the official's report — i.e.,

$$S_p \geq x + zS_p + (1 - z)\beta S_p \Leftrightarrow x \leq S_p(1 - z)(1 - \beta). \quad (12)$$

The right-hand side of this condition is again increasing in z : as the official becomes less influential, corruption loses its appeal.

Taken together, conditions (11) and (12) imply that, when $\varphi \geq 1 - q$ and $\phi \geq 1 - p$, there is corruption in equilibrium if and only if

$$m \leq m_z(\varphi) \equiv (1 - \beta)(1 - z)S_p - (1 - \varphi(1 - z))S_o.$$

with $m_z(\varphi)$ being decreasing in z and $m_{z=0}(\varphi) = m(\varphi)$. Hence, as intuition suggests, other things being equal, there is less corruption in equilibrium when the official's influence is weaker. Note that, in the region of parameters where

$$q \geq (1 - \beta) \frac{S_p}{S_o} - \frac{z}{1 - z}, \quad (13)$$

the level of φ that solves $m_z(\varphi) = 0$, hereafter denoted by $\underline{\varphi}_z$, is larger than $1 - q$. Hence, (13) is weaker than (7): as the official's influence falls, it is easier for the Legislator to induce no corruption in equilibrium because the official requires a higher reservation bribe in order to cope with the risk of being accused by the fellow.

In sum, assuming that $\varphi \geq 1 - q$ and $\phi \geq 1 - p$, the crime is committed if and only if

$$\begin{aligned} \pi \geq \tilde{\pi}_{z,p} &\equiv \int_{m_z(\varphi)}^{+\infty} ((1 - \phi)S_a + S_p) dF(m) + \\ &+ \int_0^{m_z(\varphi)} (m + z(S_p + S_o + (1 - \phi)S_a) + (1 - z)((1 - \varphi)S_o + \beta(S_a + S_p))) dF(m). \end{aligned}$$

By contrast, assuming that $\varphi \geq 1 - q$ and $\phi \in [1 - \beta, 1 - p)$, the boss never finds it optimal to pay the bribe as he can count on the fellow's loyalty (guaranteed by $\phi < 1 - p$). Hence, the Legislator is indifferent between setting an amnesty $\phi < 1 - \beta$ and an amnesty $\phi \in [1 - \beta, 1 - p)$. Indeed, in both cases there is never corruption in equilibrium and the cost of crime is equal to pS_a .

A leniency program that does not induce the fellow to blow the whistle when the official is not corrupt — i.e., $\phi < 1 - p$ — is never optimal for the Legislator. By setting $\phi = 1 - p$ she can always better deter crime. The cost of crime under such a leniency policy becomes

$$\begin{aligned} \tilde{\pi}_{z,p} &\equiv \int_{m_z(\varphi)}^{+\infty} (pS_a + S_p) dF(m) + \\ &+ \int_0^{m_z(\varphi)} (m + z(S_p + S_o + pS_a) + (1 - z)((1 - \varphi)S_o + \beta(S_a + S_p))) dF(m). \end{aligned}$$

that, under the assumption that $\beta > p$, is strictly larger than pS_a .

Thus, given that the cost of crime when $\varphi \geq 1 - q$ and $\phi \geq 1 - p$ is decreasing in ϕ , the optimal leniency program prescribes an amnesty for the fellow exactly equal to $1 - p$, the minimum amnesty level that induces him to blow the whistle independently of whether corruption occurs or not. Then, letting $y_z \equiv m_z(\varphi)$, it can be shown, by a standard change of variables, that the optimal leniency policy for the official solves the following maximization problem

$$\max_{y_z \geq 0} \int_0^{y_z} (m - y_z + S_p + S_a(\beta + z(p - \beta))) dG(m) + \int_{y_z}^{+\infty} (pS_a + S_p) dG(m).$$

Differentiating with respect to y_z , and rearranging, in an internal solution, the optimal degree of corruption that the Legislator induces in equilibrium, solves

$$-F(y_z) + f(y_z)(\beta - p)(1 - z)S_a = 0$$

We can state the following result.

Proposition 8 *If $\beta > p$ the Legislator is willing to tolerate a positive level of corruption $\tilde{m}_z > 0$ in equilibrium, where \tilde{m}_z solves*

$$h(\tilde{m}_z) = (\beta - p)(1 - z)S_a. \quad (14)$$

Hence, the bright side of subversion of law is decreasing in z , and it actually vanishes when $z = 1$. Comparing condition (14) with (9), it follows that $\tilde{m}_z < \tilde{m}$. Intuitively, the complementarity between the two types of leniency programs is increasing with the official's influence. In other words, other things being equal, the Legislator is relatively more willing to tolerate corruption in equilibrium as the influence of the official that is bribed grows large.

6.2 Weak enforcement

We now develop the analysis for the region of parameters where condition (7) is not satisfied. As discussed above, this condition enables the Legislator to choose a feasible amnesty φ that is sufficiently generous to induce the official to plea guilty and self report and, at the same time, not too generous so to make it excessively costly for the boss to bribe the official. What happens when this assumption does not hold? In what follows we show that results remain qualitatively unaltered in this region of parameters. Actually, they are even stronger.

Recall that, as shown in Lemma 5, when condition (7) does not hold it must be true that $m(\varphi) > 0$ for every $\varphi \geq 1 - q$ — i.e., for every amnesty that induces the official to self

report. As a consequence, in this region of parameters, the Legislator can mainly choose between one of the following strategies:

- (i) Induce corruption in equilibrium by setting $\phi \geq 1 - p$ and $\varphi \geq 1 - q$.
- (ii) Deny leniency to the fellow in order to hinder corruption.

In fact, it is never optimal for the Legislator to induce only the fellow to blow the whistle — i.e., the Legislator cannot reduce the crime rate by choosing $\phi \geq 1 - p$ and $\varphi < 1 - q$. Intuitively, in the region of parameters under consideration, the Legislator can always better deter crime by setting $\varphi = 1 - q$, other things being equal. Therefore, while the official's reservation bribe and the fellow's reservation wage do not change (relative to the case in which $\varphi < 1 - q$), the boss' expected sanction is higher since the corrupt official in this case self-reports, which increases the boss' expected sanction and reduces the crime rate (see the Appendix for a formal proof).

Hence, in order to determine the optimal policy, we must compare the crime rate under (i), that is

$$\Pr \left[\pi \geq \max_{\phi \geq 1-p, y \in [m(1-q), 1]} \int_0^y (m-y) dF(m) + F(y) (\beta - (1-\phi)) S_a + (1-\phi) S_a + \alpha S_p \right],$$

with the crime rate under (ii), that is

$$\Pr [\pi \geq p S_a].$$

Direct comparison of these two expressions yields the following result.

Proposition 9 *When (7) is not met, the Legislator still prefers to induce corruption in equilibrium as long as $\beta - p > 0$: in this region of parameters the optimal policy is the same as in Proposition 6. By contrast, if $\beta - p < 0$ there is corruption in equilibrium if and only if*

$$(p - \beta) S_a \leq \mathbb{E} [m | m \leq m(1-q)] + \frac{1 - F(m(1-q))}{F(m(1-q))} + \beta S_p + q S_o,$$

otherwise, it is optimal not to allow the fellow to blow the whistle so to deter corruption.

Hence, the main qualitative insights of the baseline model carry over. They are actually even stronger because the Legislator may now wish to induce corruption in equilibrium even when β is lower than p .

6.3 The role of retaliation

Up to this point, we have assumed that the boss does not punish disloyalty — i.e., we assumed that both the fellow and the official are not punished by the boss once they decide to cooperate with the justice. What happens when this possibility is taken into account? Of course, the danger of being curtailed, makes the fellow and the official less willing to cooperate with the justice: as a prize for their testimony they request an amnesty that covers not only the risk of conviction that they face when remaining loyal to to boss, but also the punishment after defection. Denoting by $R \geq 0$ such a retaliation loss, the conditions under which the fellow and the official cooperate with the justice are $\phi \geq 1 - p + R$ and $\varphi \geq 1 - q + R$, respectively. How does R impact the optimal policy? Clearly, if R is very large — i.e., if the boss has a strong military power and he is willing to use it in order to punish disloyalty — it might be impossible for the Legislator to induce the fellow and the official to blow the whistle because this would require rewards rather than lighter sanctions for the informants — i.e., $\phi > 1$ and $\varphi > 1$. In fact, it might be difficult to implement such a rule because the public opinion may be reluctant to use public funds to reward former criminals or corrupt officials. In this case, using leniency programs cannot benefit the Legislator — see, e.g., Piccolo and Immordino (2016). Yet, when R is not excessively large so that leniency programs are still viable, the presence of a retaliation loss after cooperation has two less obvious effects on the optimal policy. On the one hand, it becomes easier for the Legislator to induce corruption in equilibrium because the higher amnesty that the official enjoys when he self-reports translates into a lower reservation bribe, which makes corruption cheaper for the boss, and therefore easier to induce in equilibrium for the Legislator. On the other hand, the bright side of subversion of law strengthens because the fellow also requires a higher amnesty. In fact, a higher amnesty lowers the fellow's reservation wage when the official is not corrupt and magnifies the positive impact of inducing corruption in equilibrium. Taken together, both these effects tend to magnify the bright side of subversion of law, and imply that its positive effect on welfare is increasing with the military power of the criminal organization that the State fights — i.e., inducing costly corruption is, other things being equal, more efficient when the retaliation power of the organization gets stronger.

Hence, while strong organizations (very high R) may impede leniency programs (both for the fellow and the corrupt official) to bring potential social benefits, for relatively moderate values of R the bright side of inducing subversion of law in equilibrium may actually be higher than in the baseline model.

6.4 Alternative social goals

In the model developed so far, corruption generates only an indirect social cost — i.e., it enables the boss to avoid the sanction, which may lower the ex-ante cost of crime and reduce welfare. Yet, in real life, corruption may also generate direct welfare costs, which can either reflect the moral harm that the honest crowd of a society attributes to corruption, or it can capture the obvious drawbacks deriving from the loss of a moral code by corrupt public officials, who are likely to impose further negative externalities on the judicial system, their colleagues and the people that interact with them in cases that do not necessarily involve the boss or its organization.

Do our results survive when these extra costs are taken into consideration? To answer this question, one can slightly modify the Legislator’s objective function by assuming that, despite minimizing crime, his objective function also weights (negatively) the amount of corruption that emerges in equilibrium. For example, if \underline{m} denotes the marginal type of public official — i.e., the one that is indifferent between accepting the bribe and remaining loyal to the state — one can imagine that the Legislator minimizes the following utility

$$\Pr [\pi \geq \tilde{\pi}] - \gamma G(\underline{m}),$$

where $\gamma \geq 0$ reflects the importance of the direct cost of corruption.

Then, it can be shown that, in this case, corruption has an obvious new dark side, which may offset the bright side emphasized above if γ is sufficiently larger than the difference $\beta - p$. Yet, as long as γ is not too large, our main results hold qualitatively.

An alternative specification for the social welfare function could take into account career concerns. Essentially, instead of minimizing crime, politicians in charge of designing the law may want to maximize the rate of conviction in order to increase their reputation and, hence, the likelihood of being reappointed. In this case, there could be an even stronger incentive to induce corruption in equilibrium in order to maximize the domino effect generated by the official’s confession.

7 Concluding Remarks

The introduction of lighter sanctions for low-rank criminals that cooperate with the justice are widely recognized as one of the most effective tools in the worldwide fight against organized crime. Yet, these policies seem to be extremely fragile when corruption allows top criminals to subvert the law by capturing their prosecutors. This threat, whose danger is widely corroborated by the anecdotal evidence, calls for a better understanding of how Governments should design leniency programs that internalize criminal organizations’

corruption decisions, and fight them back optimally.

Following this point of view, in this paper we have argued that tolerating some degree of corruption may not have negative effects on crime deterrence. Specifically, we have shown that a Legislator may want to award amnesties also to corrupt public officials that self-report and exploit corruption to her own advantage. The main channel through which such programs may turn effective is the hierarchical structure of criminal organizations. By inducing corrupt public officials to testify against the criminal organization, the Legislator can exploit the increase in the fellow's reservation wage, due to the higher risk of conviction, to minimize the crime rate. The official's testimony determines indeed a domino effect that allows to convict the entire organization, a bright side of subversion of law.

Appendix

Proof of Proposition 1. When corruption is not viable, granting an amnesty $\phi < 1 - p$ to the fellow is never optimal. Such policy induces the fellow to remain loyal to the boss so that the ex ante cost of crime is equal to pS_a . The Legislator would be better off by setting an amnesty $\phi = 1 - p$, that is just enough to induce the fellow to blow the whistle. Indeed, the higher risk of conviction of the boss, due to the fellow's testimony, increases the cost of crime, which becomes $(1 - \phi)S_a + \alpha S_p = pS_a + \alpha S_p$.

Thus, it must be the case that the optimal policy grants an amnesty $\phi \geq 1 - p$ that induces the fellow blows the whistle. However, the cost of crime is decreasing in ϕ (as $\frac{\partial \pi^*}{\partial \phi} = -S_a$): when the amnesty increases, the fellow's reservation wage decreases (due to the lower expected sanction), and thus, the burden on the boss also decreases, making the crime more profitable. Hence, the optimal policy grants the minimum level of amnesty that induces the fellow to blow the whistle, i.e., $\phi^* = 1 - p$. ■

Proof of Lemma 2. If $\alpha \leq \frac{qS_o}{S_p}$ then there does not exist any bribe x that meets both the boss' participation constraint and the participation constraint of officials with positive moral cost $m \in (0, +\infty]$ (conditions (2) and (3), respectively). Thus, there is no corruption in equilibrium. In contrast, if $\alpha > \frac{qS_o}{S_p}$ then there are dishonest officials that can be corrupted, with a reservation bribe that meets the boss' participation constraint, i.e., those with moral cost m that satisfies:

$$m \leq \bar{m} \equiv \alpha S_p - qS_o,$$

where $\bar{m} > 0$. ■

Proof of Proposition 3. If the Legislator sets an amnesty $\phi < 1 - p$ the fellow does not blow the whistle and the boss does not find it profitable to spend resources to capture public officials, i.e., $m + qS_o$, when, due to the fellow's loyalty, his risk of conviction is zero. Thus, the ex ante cost of crime is equal to pS_a .

Suppose that the Legislator sets an amnesty $\phi \geq 1 - p$, that induces the fellow to blow the whistle. Due to Lemma 2, assuming that $\bar{m} > 0$ implies that there is corruption in equilibrium and the boss bribes officials with moral cost $m \leq \bar{m}$. Thus, the ex ante cost of crime is

$$\hat{\pi} \equiv \int_0^{\bar{m}} (m + qS_o) dF(m) + (1 - F(\bar{m})) \alpha S_p + (1 - F(\bar{m})) (1 - \phi) S_a. \quad (15)$$

By comparing the ex ante costs of crime under the two policies, it is immediate to see that, under the assumption that $\bar{m} > 0$, the Legislator prefers to set an amnesty $\phi = 1 - p$ rather than $\phi < 1 - p$ if, and only if

$$\int_0^{\bar{m}} (m + qS_o) dF(m) + (1 - F(\bar{m})) \alpha S_p + (1 - F(\bar{m})) pS_a \geq pS_a$$

which holds true if, and only if

$$\int_0^{\bar{m}} m dF(m) + (1 - F(\bar{m})) \alpha S_p \geq F(\bar{m}) (pS_a - qS_o).$$

Dividing both sides by $F(\bar{m})$, we obtain condition (4). Notice that the alternative policy with an amnesty $\phi > 1 - p$ is never optimal as the Legislator is better off by deviating to $\phi = 1 - p$. This is due to the fact that the cost of crime (in equation (15)) is decreasing in ϕ , as $\frac{\partial \tilde{\pi}}{\partial \phi} = -(1 - F(\bar{m}))S_a < 0$. Thus, when condition (4) is satisfied, the optimal policy is to grant an amnesty $\phi = 1 - p$ to the fellow. In contrast, when condition (4) does not hold, the optimal policy is to set an amnesty $\phi < 1 - p$ that does not induce whistleblowing. ■

Proof of Lemma 4. If $\phi < 1 - p$, the fellow does not blow the whistle, as the probability of conviction p is larger than the share $1 - \phi$ of the sanction that is not waived by the policy. In this case, the boss does not find it profitable to bribe the official. Indeed, if he relies on the fellow's loyalty, he does not face any risk of being sanctioned; if instead he bribes the official, he bears the cost of the bribe and, possibly, the risk of conviction due to the official's testimony. If $\phi < 1 - p$, the fellow blows the whistle and the boss expects to pay αS_p if he does not corrupt the public official. If he bribes the official instead he bears the cost of the reservation bribe (from the official's participation constraint in condition (6)), i.e., $m + (1 - \varphi)S_o$, and the risk of conviction due to the official's testimony, i.e., equal to βS_p . Thus, the boss bribes the official if his moral cost is small enough, i.e., if

$$m \leq (\alpha - \beta)S_p - (1 - \varphi)S_o \equiv m(\varphi).$$

Hence, there will be corruption in equilibrium provided that $m(\varphi) > 0$. ■

Proof of Proposition 6. Suppose that the optimal program induces the fellow to blow the whistle, i.e., $\phi \geq 1 - p$, and grants an amnesty for the official that is generous enough to induce him to self-report when corruption occurs i.e., $\varphi \geq 1 - q$. We first characterize the optimal leniency policies under these conditions and then show that the Legislator has no incentive to deviate to either a program that does not induce the fellow to blow the whistle at all ($\phi < 1 - p$), nor to a program that does actually induce the fellow to blow the whistle but does not induce the official to self-report ($\phi \geq 1 - p$ and $\varphi < 1 - q$).

Hence, assume that $\phi \geq 1 - p$ and $\varphi \geq 1 - q$. The ex ante cost of crime is equal to:

$$\tilde{\pi} \equiv \int_0^{m(\varphi)} (m + (1 - \varphi)S_o + \beta(S_a + S_p)) dF(m) + \int_{m(\varphi)}^{+\infty} ((1 - \phi)S_a + \alpha S_p) dF(m),$$

where $m(\varphi) = (\alpha - \beta)S_p - (1 - \varphi)S_o$ is the official's type that makes the boss indifferent between corruption and no corruption. Under condition (7) of Lemma 5, i.e., $q \geq (\alpha - \beta)\frac{S_p}{S_o}$, the optimal policy solves

$$\max_{\phi \geq 1 - p, \varphi \geq \underline{\varphi}} \tilde{\pi}.$$

where $\underline{\varphi}$ is the level of amnesty for the official that makes corruption not profitable for the boss ($m(\underline{\varphi}) = 0$) and that under condition (7) is larger than $1 - q$.

By applying a change of variable $y = m(\varphi)$, with y increasing in φ , we can rewrite the cost of crime as

$$\tilde{\pi} \equiv \int_0^y (m - y) dF(m) + F(y)(\beta - (1 - \phi))S_a + (1 - \phi)S_a + \alpha S_p$$

Taking the derivative of $\tilde{\pi}$ with respect to ϕ we obtain

$$\frac{\partial \tilde{\pi}}{\partial \phi} = -(1 - F(y))S_a < 0$$

for all $y \geq 0$.

Thus, the Legislator has to set the lowest possible amnesty that induces the fellow to blow the whistle, i.e., $\phi = 1 - p$, as part of her optimal program. Differentiating with respect to y and substituting for $\phi = 1 - p$, we obtain:

$$\frac{\partial \tilde{\pi}}{\partial y} = -F(y) + f(y)S_a(\beta - p),$$

whose sign is ambiguous and depends on the sign of $(\beta - p)$.

If $\beta < p$, then the cost of crime is decreasing in y , thus in φ , as $\frac{\partial \tilde{\pi}}{\partial y} < 0$. Hence, it is optimal for the Legislator not to induce corruption in equilibrium, by setting an amnesty $\tilde{\varphi}$ such that $y = m(\tilde{\varphi}) = 0$. By Lemma 5, the amnesty $\tilde{\varphi}$ for the official that solves $m(\tilde{\varphi}) = 0$ is larger than $1 - q$. Thus, the official self-reports when given the opportunity, but the boss decides not to corrupt him as his low amnesty makes the reservation bribe too high.

If instead $\beta \geq p$, then it is optimal for the Legislator to induce corruption in equilibrium, whereby the optimal amount of corruption \tilde{m} solves

$$\frac{F(\tilde{m})}{f(\tilde{m})} = (\beta - p)S_a$$

and the corresponding amnesty for the official is $\tilde{\varphi}$ such that $m(\tilde{\varphi}) = \tilde{m}$.

Next, we need to show that it cannot be the case that $\phi < 1 - p$, as such policy is dominated by a policy that grants $\phi = 1 - p$ to the fellow. When $\beta \leq p$, the optimal policy is such that there is no corruption in equilibrium and the fellow blows the whistle, so that the ex ante cost of crime is $pS_a + \alpha S_p$. In this case, the Legislator is worse off by deviating to a policy that does not induce the fellow to blow the whistle, i.e., $\phi < 1 - p$, as the cost of crime (pS_a) would be obviously lower. When $\beta \geq p$ the optimal policy induces corruption in equilibrium and the equilibrium expected cost of crime $\tilde{\pi}$ satisfies

$$\tilde{\pi} > \int_0^{\tilde{m}} (m + (1 - \tilde{\varphi})S_o + p(S_a + S_p)) dF(m) + \int_{\tilde{m}}^{+\infty} (pS_a + \alpha S_p) dF(m) > pS_a.$$

Thus, the Legislator does not have any incentive to deviate to a program that does not induce the fellow to blow the whistle.

Finally, we need to show that, given a policy that induces the fellow to cooperate with the justice, i.e., $\phi \geq 1 - p$, the Legislator always prefers to induce the official to self-report. Indeed, assuming that $\phi \geq 1 - p$ implies that, when the amnesty for corrupt officials is not generous enough to induce them to self-report, i.e., $\varphi < 1 - q$, the boss bribes public officials with moral cost $m \leq \bar{m} \equiv \alpha S_p - qS_o$ and the expected cost of crime is equal to

$$\hat{\pi} \equiv \int_0^{\bar{m}} (m + qS_o) dF(m) + (1 - F(\bar{m}))\alpha S_p + \int_{\bar{m}}^{+\infty} (1 - \phi)S_a. \quad (16)$$

In contrast, if the Legislator grants the minimum amnesty that induces corrupt officials to self-report – i.e., $\varphi = 1 - q$ – then the boss corrupts public officials with moral cost $m \leq m(1 - q) \equiv (\alpha - \beta)S_p - qS_o$ and the expected cost of crime is equal to

$$\tilde{\pi} \equiv \int_0^{m(1-q)} (m + qS_o + \beta(S_a + S_p)) dF(m) + \int_{m(1-q)}^{+\infty} ((1 - \phi)S_a + \alpha S_p) dF(m). \quad (17)$$

Notice that since, due to A4 ($\alpha \geq \beta$), the following relation holds true

$$m(1 - q) = (\alpha - \beta)S_p - qS_o \leq \alpha S_p - qS_o \equiv \bar{m},$$

we can re-write equations (16) and (17) as follows

$$\hat{\pi} \equiv \int_0^{m(1-q)} (m + qS_o) dF(m) + \int_{m(1-q)}^{\bar{m}} (m + qS_o) dF(m) + \int_{\bar{m}}^{+\infty} (1 - \phi)S_a + \alpha S_p dF(m),$$

and

$$\tilde{\pi} \equiv \int_0^{m(1-q)} (m + qS_o + \beta(S_a + S_p)) dF(m) + \int_{m(1-q)}^{\bar{m}} ((1 - \phi)S_a + \alpha S_p) dF(m) + \int_{\bar{m}}^{+\infty} ((1 - \phi)S_a + \alpha S_p) dF(m).$$

From the comparison of these two expressions, we obtain that $\tilde{\pi} > \hat{\pi}$ as the following inequality holds true

$$\int_0^{m(1-q)} \beta(S_a + S_p) dF(m) + \int_{m(1-q)}^{\bar{m}} ((1 - \phi)S_a + \alpha S_p) dF(m) > \int_{m(1-q)}^{\bar{m}} (m + qS_o) dF(m)$$

given that for $m \leq \bar{m}$, $m + qS_o \leq (1 - \phi)S_a + \alpha S_p$. Thus, a policy that induces the fellow to blow the whistle should be coordinated with a policy that induces corrupt officials to self-report. ■

Proof of Proposition 7. The proof is trivial and follows from assumption A4 that the inverse hazard rate $h(m) \equiv \frac{F(m)}{f(m)}$ is increasing in m . ■

Proof of Proposition 8. Let us assume that the equilibrium candidate is a program that prescribes $\varphi \geq 1 - q$, so that the corrupt official self-reports. Suppose that $\phi \geq 1 - \beta$, i.e., in the subgame with corruption the fellow blows the whistle. By backward induction the official will accept any bribe x that satisfies

$$x \leq m + (1 - \varphi(1 - z))S_o$$

Then, the boss' decision on whether to corrupt the official will depend on the fellow's behavior in the subgame without corruption. If $\phi < 1 - p$, the fellow does not blow the

whistle, so that the boss will not be sanctioned. In this case the boss will never bribe the public official and the ex ante cost of crime is pS_a . By contrast, if $\phi \geq 1 - p$ the fellow blows the whistle and the boss expects to pay S_p in the subgame without corruption. Thus, there will be some corruption in equilibrium and the ex ante cost of crime is $\tilde{\pi}_{z,p}$ with $p = 1 - \phi$, the minimum amnesty that induces the fellow to blow the whistle (as $\tilde{\pi}_{z,p}$ decreases with ϕ), that is

$$\begin{aligned} \tilde{\pi}_{z,p} \equiv & \int_{m_z(\varphi)}^{+\infty} (pS_a + S_p) dF(m) + \\ & + \int_0^{m_z(\varphi)} (m + z(S_p + S_o + pS_a) + (1 - z)((1 - \varphi)S_o + \beta(S_a + S_p))) dF(m). \end{aligned}$$

Under the assumption that $\beta > p$, it can be easily shown that $\tilde{\pi}_{z,p}$ is strictly larger than pS_a , as

$$\begin{aligned} F(m_z(\varphi))(zpS_a + (1 - z)\beta S_a) + (1 - F(m_z(\varphi)))pS_a > \\ F(m_z(\varphi))(zpS_a + (1 - z)pS_a) + (1 - F(m_z(\varphi)))pS_a = pS_a. \end{aligned}$$

Hence, the cost of crime under a policy that grants an amnesty $\phi \geq 1 - p$ inducing the fellow to blow the whistle in every subgame is larger than the cost of crime under a policy that grants $\phi \in [1 - \beta, 1 - p)$ and induces the fellow to blow the whistle only when the official is corrupt. Thus, the Legislator will set a program that coordinates a leniency for the official with $\phi = 1 - p$, the minimum amnesty that induces whistleblowing independently of whether corruption occurs. In turn the optimal leniency for the official is the one that maximizes $\tilde{\pi}_{z,p}$, i.e., \tilde{m}_z that solves condition (14).

Obviously, a leniency policy that grants an amnesty $\phi < 1 - \beta$ to the fellow is not optimal. In this case, the fellow remains loyal to the boss even when the official is corrupt and willing to self-report (given that $\varphi \geq 1 - q$). Thus, given that the boss can count on the fellow's loyalty while the official self-reports, he never finds it profitable to bribe him, and the cost of crime will be pS_a . It can be easily shown that pS_a is smaller than the cost of crime induced by the policy \tilde{m}_z .

Last, we need to show that $\varphi < 1 - q$ is suboptimal. Consider the subgame with corruption. If the official does not self-report, the fellow does not blow the whistle, whichever ϕ . Thus, the boss' decision on whether to corrupt or not the official depends on whether the fellow blows the whistle in the subgame without corruption. If $\phi < 1 - p$ so that the fellow does not blow the whistle, the boss will not corrupt the official, so that the ex ante cost of crime will be pS_a , which is smaller than the cost of crime induced by the policy \tilde{m}_z . If $\phi \geq 1 - p$ the fellow blows the whistle in the subgame without corruption, thus the boss will corrupt officials with moral cost $m \leq S_p - qS_o$. Notice that in this case there will be more corruption than \tilde{m}_z , but it can be easily shown that the cost of crime is lower. This is due to the fact that the reservation bribe is cheaper (as the official does not bear any risk of being sanctioned) and, as the boss can afford to bribe more officials, he avoids the sanction more often – thanks to the official's cooperation – and saves on the fellow's reservation wage.

Proof of Proposition 9. Setting $\phi = 1 - p$, it follows immediately that policy (i) has to

be preferred to policy (ii) if and only if

$$\max_{y \in [m(1-q), 1]} \int_0^y (m - y) dF(m) + F(y) (\beta - p) S_a + \alpha S_p > 0$$

which is always true as long as $\beta - p > 0$.

Hence, in this region of parameters, the optimal policy is either that described in Proposition 6 if

$$h(m(1-q)) < (\beta - p) S_a, \quad (18)$$

or it requires a minimal amount $m(1-q)$ of corruption in equilibrium. Hence, the condition for subversion of law to deter crime becomes tighter. When condition $\beta > p$ does not hold, the optimal strategy for the Legislator is (i) with $\varphi = 1 - q$, if and only if

$$(p - \beta) S_a \leq \mathbb{E}[m | m \leq m(1-q)] + \frac{1 - F(m(1-q))}{F(m(1-q))} + \beta S_p + q S_o.$$

We need to show that not to induce the official to self-report is suboptimal. Indeed, the Legislator is better off by setting $\varphi = 1 - q$. In this case, corruption occurs when $m \leq m(1-q) \equiv (\alpha - \beta) S_p - q S_o$; when instead $\varphi < 1 - q$ corruption occurs when $m \leq \bar{m} \equiv \alpha S_p - q S_o$, $m(1-q) < \bar{m}$. We need to show that the cost of crime when $\varphi = 1 - q$ is larger, which holds true if, and only if

$$\begin{aligned} \int_0^{m(1-q)} (m + q S_o) dG(m) + G(m(1-q)) (\beta(S_a + S_p)) + \\ + (1 - G(m(1-q))) [(1 - \phi) S_a + \alpha S_p] > \int_0^{\bar{m}} (m + q S_o) dG(m) + \\ + (1 - G(\bar{m})) ((1 - \phi) S_a + \alpha S_p) \end{aligned}$$

that yields

$$\begin{aligned} \int_0^{m(1-q)} \beta(S_a + S_p) dG(m) + \int_{m(1-q)}^{\bar{m}} [(1 - \phi) S_a + \alpha S_p] dG(m) + \\ - \int_{m(1-q)}^{\bar{m}} [m + q S_o] dG(m) > 0 \quad (19) \end{aligned}$$

which obviously holds true due to

$$m + q S_o < (1 - \phi) S_a + \alpha S_p.$$

Thus, even if corruption occurs less often when the official is induced to self-report, the ex ante cost of crime is larger. The effect of the lower (expected) reservation bribe (third term on the lhs of condition (19)) is more than compensated by the higher (expected) reservation wage and the higher expected sanction due to the larger number of contingencies where the fellow blows the whistle (second term) and by the domino effect when the corrupt official self-reports (first term). ■

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