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The Virtuous Circle of Distrust: A Mechanism to Deter Bribes And Other Cooperative Crimes

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Abstract: Some crimes involve the cooperation of two or more criminals for mutual gain. Instead of deterring these crimes, the state can prevent them by creating distrust among criminals. The state should offer amnesty and a bounty to the criminal who first secures punishment of the other participant in a cooperative crime. We especially focus on bribes, which occur when someone pays an agent to violate a duty owed to the principal. To prevent bribes, the principal offers amnesty and a bounty to the debtor or agent who secures the other party's punishment. Under certain conditions, the game's equilibrium changes from cooperation to non-cooperation (prisoner's dilemma), so bribes disappear.

The Virtuous Circle of Distrust:
A Mechanism to Deter Bribes and Other Cooperative Crimes***

Economic analysis of crime focuses on deterring crimes by punishment, whereas this paper proposes to prevent crimes by rewards. Some crimes involve the cooperation of two or more criminals for mutual gain. Cooperation gives each criminal information needed to convict the other criminal. Various practices undermine trust among criminals by rewarding them for convicting each other. For example, prosecutors often reduce one person's punishment for helping to secure another's conviction, and this practice inspired the famous "prisoners' dilemma" game. In many countries, courts enforce offers by citizens or the state to pay rewards for information leading to the arrest of particular criminals. Similarly, some states reward "whistleblowers" who provide information leading to the recovery of money owed to the state. U.S. law goes one step further by creating a procedure called *qui tam* that allows whistleblowers, not just to supply information to the state prosecutor, but to initiate lawsuits and keep a fraction of the judgment against the wrongdoer who cheated the state.

Our model generalizes techniques already used to prevent cooperative crimes. We characterize precisely the reward needed to create enough distrust among criminals to prevent a particular cooperative crime. We interpret the reward as an amnesty and a bounty offered to the first criminal who secures his partner's conviction. Implementing rewards and bounties significantly extends current practices. Instead of merely bargaining with criminals after they are arrested for cooperative crimes, our proposal commits the state in advance to giving amnesty to one of them. Our proposal also commits the state in advance to a schedule of bounties.

We especially focus on bribing state officials. The principal-agent model allows a general characterization of bribes. Laws and contracts impose duties on agents. A bribe occurs when an agent (the state official) violates a duty by accepting payment from a debtor (the citizen) to discharge an obligation owed to the principle (the state). If the cost of performing the obligation exceeds the bribe, the debtor and the agent gain at the principal's expense. Here are some common examples:

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- Homeowner bribes tax assessor to undervalue property.
- Factory bribes environmental official not to enforce pollution standards.
- Second highest bidder bribes an official to secure a state contract.
- State official demands a bribe from applicant seeking a license.
- Speeding motorist bribes policeman not to issue a traffic citation.
- Policeman extorts a bribe for not citing a motorist who was not speeding.

Later we discuss our mechanism's ability to suppress crimes other than bribery, including blackmail and kidnapping.

To prevent bribes, the principal should offer a reward to the debtor or agent who secures the other's punishment. For example, if an official accepts a bribe from a citizen for not collecting a fine or not imposing a regulation, then the state should offer amnesty and a bounty to the citizen or official who secures the other's conviction. In many cases, the state can prevent bribes by setting the bounty equal to a fraction of the fine collected upon conviction of the criminal.

Section 1 of this paper reviews the relevant literature. Massive research in game theory concerns escaping from prisoners' dilemmas, but we know of no systematic research except ours on creating them. We describe actual legal practices most similar to our proposal. Section 2 develops our model of preventing bribery. We characterize bribery as a game in extensive form and find its general solution. Section 3 discusses our model's limitations, including moral objections. Our concluding remarks explain our contribution and its practical applications.

1. Related Literature

We briefly review some of the relevant economic literature on bribery and corruption. Economies operate within a framework of rules and norms that enhance cooperation and organize competition. When an official takes money to undermine these rules, everyone suffers except the parties to the bribe. Over time individuals adjust to norms, so the emergence of corruption at low levels can spread to high levels. The cost of deterring corruption today should be compared to the present value of future gains from eliminating corruption tomorrow.¹

Besides these good rules, states often over-regulate the economy, which increases the opportunity for officials to collect bribes and the need for businesses to pay them. Corruption, consequently, often accompanies government intervention in markets to limit prices or ration quantities. Bribery that circumvents harmful rules can create social benefits as well as costs. For example, when a businessman bribes an official to enter a market protected by anti-competitive rules, the social benefit from increased competition possibly exceeds the social cost from corrupting state officials. Besides reducing inefficiency, bribes sometimes alleviate the burden of discriminatory laws that subordinate disfavored groups.

Bribery occurs in every country and pervades some countries. Empirical research indicates that, on balance, corruption causes slower growth and lower development,² especially burdening developing countries (De Soto, 1989). Corruption also alters the

¹ Andvig and Moene (1990), Lui (1985, 1986).

² Bardhan (1997), Mauro (1995), Rose-Ackerman (1999), Treisman (2000).

priorities of officials in ways that distort the allocation of resources in the public sector.³ Being illegal and secret, bribery distorts the economy far more than legal means of paying officials such as taxation. Under certain conditions, legislators will gain from replacing bribery with taxation,⁴ but many countries apparently do not satisfy these conditions. In any case, bribery does not disappear because, as bribery diminishes, the principal is less willing to spend resources controlling the agent.⁵

Economic analysis takes several approaches to preventing bribery and corruption. First, the usual approach is deterrence. Monitoring and punishing deters rational people from offering or taking a bribe when the expected punishment exceeds the gain.⁶ Deterrence, however, has limitations. If detecting and punishing bribery is relatively costly, successful deterrence requires severe punishment.⁷ When the probability of conviction for bribery is low, liberal states may be unwilling to punish harshly enough to deter it. Also, deterrence probably requires some honest officials to do the punishing, and they may not exist in countries with endemic corruption.⁸

A second possible approach is to design salaries with incentives to eliminate corruption.⁹ To illustrate, selling a debt to its collector eliminates the bilateral incentive for corruption between collector and debtor, as noted by Becker and Stigler (1974). This argument favors tax farming instead of tax collecting by the state. Selling state debts to collectors, however, has obvious dangers, including fraudulent or overly zealous collectors.

A third approach enlists internalized morality to overcome shortcomings in administration, especially through direct democracy. The study of social norms suggests the important role that citizens play by helping police and prosecutors.¹⁰ In a series of empirical papers, Frey has shown that direct democracy causes more spontaneous support of the state by citizens, for example by greater tax compliance.¹¹ Similarly, Cooter argues that corrupt governments have less than the optimal number of elections.¹²

The fourth approach, which is ours, uses rewards to sew distrust among criminals so they cannot cooperate. In spite of the massive literature on overcoming prisoners' dilemmas, we know of no systematic research on creating them. Turning to related

³ Acemoglu and Verdier (1998, 2000), Benson (1988), Flatters and MacLeod (1995), Mauro (1998), Mui (1999), Rose-Ackerman (1975), Shleifer and Vishny (1993).

⁴ Rasmusen and Ramseyer (1994) develop a model where legislators accept bribes that are small compared to the value of the statutes they pass and allow bans against bribery to be enforced. In their model, bribes could be smaller than the cost the legislators incur in accepting bribes. Therefore, rather than risk this outcome, the legislators may be willing to suppress bribery.

⁵ Ades and Di Tella (1997, 1999), Bliss and Di Tella (1997), Prendergast (2000).

⁶ Cadot (1987), Bowles and Garoupa (1997), Chang, Lai and Yang (2000), Garoupa and Klerman (2000a, 2000b), Polinsky and Shavell (2000).

⁷ Becker (1968).

⁸ Basu, Bhattacharya and Mishra (1992).

⁹ Becker and Stigler (1974), Besley and McLaren (1993), Marjit and Shi (1998), Mookherjee and Png (1995).

¹⁰ Benson (1986).

¹¹ Frey (), Frey and Bohnet (1994), Frey, Oberholzer-Gee, et al. (1996), Oberholzer-Gee, Bohnet, et al. (1997), Pommerehne and Frey (1992).

¹² Cooter (2000), Part II. Also see "Optimal Number of Governments," [get ssrn cite to working paper].

topics, law and economics scholars have confronted the problem that sometimes injurer and victim can avoid paying a third party by keeping their dispute private. For example, private plaintiffs in criminal suits in medieval England settled out of court in order to save the defendant the cost of paying a fine to the king (Klerman, 2001). In general, “decoupling” liability by requiring the plaintiff to pay some damages to the state instead of paying all damages to the defendant, creates incentives for the parties not to report the injury to officials.¹³ Gravelle (1987) favors a mechanism similar to ours to solve the self-reporting problem when a negligence rule is applied for bilateral accidents (preventing the injurer and victim from cheating the insurance company). Arlen and Kraakman (1997) argue that strict vicarious liability of a corporation discourages it from detecting and reporting misconduct by firm's agents, whereas a negligence rule avoids this problem. Yadlin (2000) has independently and simultaneously proposed a mechanism similar to amnesty and a bounty for a variety of crimes, such as unlawful employment of illegal aliens. He stresses that criminals are the best informed about crime, so the law must enlist the help of criminals to lower the transaction costs of preventing crime.

The work by Koffman and Lawarree (1996a, 1996b) relates very much to our present work. They consider the case where a creditor hires two regulatory supervisors who monitor a firm. The two enforcers play a prisoner's dilemma where the one reporting that the firm has cheated gets a reward and the one reporting that the firm has not cheated is punished. The game is designed in such a way that inspectors always report if the firm is cheating.

A related literature concerns the privatization of criminal law. Benson (1986 and 1988) argues that victims of crime should be able to prosecute their injurers and obtain from the court a right to the proceeds of the criminal's involuntary labor. Becker and Stigler (1974), who argue that bounty hunters could replace police for some crimes, analyze the consequences of paying bounty hunters a fraction of the fines collected from criminals. They note that free entry can result in “over-fishing” of criminals by bounty hunters just as it results in over-fishing of the seas.¹⁴ In the U.S., criminal defendants who post bond set by the court are released while awaiting trial. Failure to appear for trial triggers the forfeit of the bond. In fact, most defendants pay a certain percent of the bond to a professional bondsman who posts the bond. When a defendant fails to appear for trial, the bail bondsmen often pays professional bounty hunters to track down and arrest the defendant so that the bondsman can recover the bond that he posted. Bounty hunters, who are currently unregulated and unlicensed in law, often work for 10% of bond recovered by the bondsman.¹⁵ Bounty hunters play an essential role in keeping down the cost of bail in the U.S., although they are also frequently accused of abuses.¹⁶ Unlike the current practice of paying bounties to recover fleeing defendants, we propose paying bounties to criminal who secure the

¹³ Polinsky and Che (1991), Polinsky and Shavell (2000).

¹⁴ With free entry, bounty hunters receive the average product of their labor, whereas efficiency requires them to receive the marginal product.

¹⁵ Elvin, J. (19 June 2000). *The Strong-Arm of the Law. Insight on the News*. News World Communications, Inc.: 22.

¹⁶ Chamberlain (1998) concludes that, on balance, the abuses are not so costly to society as the advantages.

conviction of other criminals. A practical difficulty with such a bounty system is that people may falsely accuse others in order to claim a reward.¹⁷

In using rewards to disorganize criminals, practice apparently leads theory. As exemplified by the prisoners' dilemma game, prosecutors routinely separate criminals and offer reduced punishments for those who cooperate in convicting the others. In a recent, dramatic example of this approach, special deals between prosecutors and criminals cracked open a price-fixing arrangement between Sotheby's and Christie's art auction houses. The result will be hundreds of millions of dollars in fines and civil liability, as well as prison sentences.¹⁸ As mentioned, most countries promote distrust among criminals by enforcing offers by the state or private citizens to pay a reward to anyone who provides information leading to the arrest of selected criminals. In common law, an offer to pay a reward is "accepted" by performing the condition of the offer, thereby creating an enforceable debt.¹⁹ Similarly, "whistleblowers" statutes often pay people who provide information leading to the recovery of money lost by the state from fraud. In this respect, U.S. *qui tam* statutes are especially interesting because of their proven effectiveness. We briefly describe them.²⁰

The term "qui tam," which abbreviates the Latin phrase "*qui tam pro domino rege quam pro sic ipso in hac parte sequitur*" meaning "who as well for the king as for himself sues in this matter," applies whenever a private person prosecutes a suit in place of the state prosecutor. In medieval English law, where the boundaries of civil and criminal law are unclear, private citizens brought criminal prosecutions. This practice fell into disuse over centuries and disappeared in the 19th century.²¹ In the False Claims Act of 1863, the U.S. Congress attempted to revive the practice of allowing private citizens to substitute for state prosecutors in certain kinds of cases. Its *qui tam* provisions were designed to combat widespread fraud by federal contractors during the American Civil War. The statute allows a citizen, known as a "relator," to sue on behalf of the federal government in cases involving false claims on the United States. The federal government has a period of time to investigate the case and decide whether to take over the suit or allow the private citizen to proceed alone. The False Claims Act was dramatically strengthened by amendments in 1986 that increased the whistleblower's share of the recovery to a maximum of 30%, increased the sanctions on defendants, and prevented state knowledge of the crime from pre-empting the relator. As amended, the government can exercise its right to

¹⁷ Cooter and Emons (2000), Garoupa (1997). If the conditional probability of convicting an offender is higher than that of an innocent for the same expenditure, false accusations can be eliminated or substantially reduced in principle.

¹⁸ Blumenthal, R. and C. Vogel (October 6, 2000). In Plea, Sotheby's Ex-Chief Points to Her Superior. New York Times. New York: Section C; Page 1; Column 2.

¹⁹ Cite relevant case from Eisenberg.

²⁰ An academic literature exists on *qui tam*, including the following law review notes:

The False Claims Act and the English eradication of *qui tam* legislation; *North Carolina Law Review* v 78 no3 Mar 2000. p. 539-642;

Qui tam suits: defining the rights and roles of the government and the relator under the False Claims Act; *Minnesota Law Review* v 82 no5 May 1998. p. 1357-90;

The standing of *qui tam* relators under the False Claims Act; *The University of Chicago Law Review* v 57 Spring 1990. p. 543-71.

²¹ Benson (1986), Klerman (2001).

assume primary responsibility for a *qui tam* suit, but the private plaintiff who initiated it has the right to remain a party to the suit.²²

Although the False Claims Act dates from 1863, its *qui tam* provisions were seldom used until the 1986 amendments. After 1986, the number of *qui tam* suits and U.S. Treasury recoveries of money owed to it increased sharply. A memorandum released by the Justice Department in 1995 asserts that the U.S. recovered over \$1 billion in civil fraud cases brought under the whistleblower provisions of the False Claims Act in the 9 years after 1986. By 1999, recoveries from *qui tam* suits had risen to \$2.5 billion, as indicated by the following table.²³ Whistleblowers averaged 18% of the total award in cases taken over by the government, which accounted for all but 3% of cases by dollar value. Whistleblowers averaged 28 percent of the proceeds in the 3% of case where they proceeded without the government. Approximately half of the cases by dollar value involved defense fraud, and the second largest category was health care fraud, but the exact percentage varied significantly from year to year. *Qui tam* recoveries were about one-third of total fraud recoveries by the federal government during the period 1987-1995. We know of no attempt to measure the deterrence effect of *qui tam*, which is presumably much larger than the recoveries.²⁴

Table 1: U.S. Treasury Recoveries from *qui tam* suits

Fiscal Year	Number of Suits	U.S. Treasury Recoveries
1987	33	\$200,000
1988	60	355,000
1989	95	15,000,000
1990	82	40,000,000
1991	90	72,000,000
1992	119	134,000,000
1993	131	173,000,000
1994	221	379,000,000
1995	279	244,000,000
1996	363	127,000,000
1997	530	625,000,000
1998	417	331,000,000
1999	483	458,000,000
TOTAL	2924	\$2,598,555,000

In addition to *qui tam*, the U.S. Internal Revenue Service also pays a bounty to citizens who provide information on tax fraud. As with *qui tam*, the bounty is a

²² See “Historical overview of *Qui tam* Law” at www.quitam.com/quitam, which is a web page of the Bauman & Rasor Group, Inc. Also see www.falseclaimsact.com/history.html, which is part of the web site of the False Claims Act Resource Center, a service of Miller, Alfano, and Raspanti, P.C. Another good source of information on the web is “The False Claims Act and Qui Tam Quarterly Review,” found at www.taf.org, which is published by a non-profit organization named Taxpayers Against Fraud that and the False Claims Act Legal Center. This publication provides an overview of major False Claims Act and *qui tam* developments, including case decisions, Department of Justice interventions, and settlements.

²³ Data reported in www.falseclaimsact.com/history.html, which is part of the web site of the False Claims Act Resource Center, a service of Miller, Alfano, and Raspanti, P.C. This data closely tracks data in “Justice Department Recovers over \$1 Billion in *Qui tam* Awards and Settlements,” Release of Wednesday, 18 October 1995, found at www.usdoj.gov/opa/pr/Pre_96/October95/542.txt.html.

²⁴ “Justice Department Recovers over \$1 Billion in *Qui tam* Awards and Settlements,” Release of Wednesday, 18 October 1995, found at www.usdoj.gov/opa/pr/Pre_96/October95/542.txt.html.

percentage of the taxes recovered by the state, often 10%. Some statistics on bounties are available.²⁵

Table 2: Claims for reward filed and allowed (IRS Informants)

Year	Number of Claims Filed	Number of Claims Allowed in Full or in Part	Percentage Allowed in Full or in Part	Taxes Recovered as Result of Informant Information
1989	11,754	519	4.42%	\$72,030,630
1990	10,757	635	5.90%	126,619,786
1991	9,907	732	7.39%	58,370,096
1992	10,966	671	6.12%	83,710,270
1993	11,393	829	7.28%	172,072,960
1994	9,063	669	7.38%	586,605,110
1995	7,996	681	8.52%	96,435,097
1996	9,430	650	6.89%	102,676,478
1997	7,152	187	2.61%	68,417,053
1998	6,687	737	11.02%	83,871,049
TOTAL	95,105	6,310	6.63%	\$1,450,808,529

Our proposal strengthens and generalizes *qui tam*. In the U.S., *qui tam* applies to money owed to the government, but not to bribes paid to state officials. Also, *qui tam* does not necessarily provide amnesty to a whistleblower who participated in defrauding the government. We propose to extend this type of law to all types of bribes paid to officials and also to commit the state to giving amnesty to the first participant in the crime who helps convict the others.

Bribery, which especially burdens international business in developing nations and corrupts their governments, has attracted increasing concern from large international agencies. Until recently, many developed countries did not prohibit their corporations from bribing foreign officials to obtain contracts, and the tax authorities in some nations allowed corporations to deduct bribes paid to foreigners as business expenses. An OECD Convention signed by 34 countries that became effective in 1999 combats these practices. The Convention obliges signatories to adopt national legislation criminalizing the bribing of foreign officials. The Convention obliges signatories to impose personal and corporate criminal responsibility. Those countries lacking the concept of criminal liability of companies are meant to find an equivalent kind of fine. While the Convention criminalizes the giving of bribes, it does not criminalize the taking of bribes. The Convention urges states to prohibit so-called “grease” payment, which means a payment made to induce an official to perform his ordinary duties.²⁶

²⁵ We are grateful to Eric Rakowski, who provided us with this information. He write, “The relevant section of the Internal Revenue Code is § 7623 and the accompanying regulations are at § 301.7623. They are reprinted, with some cases, in the CCH Federal Tax Reporter at paragraph 43,850. In general, rewards are paid entirely at the discretion of a district or service center director and are capped at 15% of amounts collected (not including interest) by reason of the information, although in practice the IRS will not pay more than 10%. The regulation sets forth a formal claim procedure... P.L. 104-168, the Taxpayer Bill of Rights 2 (1996), requires the IRS to report annually on its rewards program.” For the statistics, see Gutierrez, T. "Professor Questions Fairness of IRS Informants Reward Program (Section 7623 -- Expenses of Detecting Frauds)." 84 Tax Notes 1203 (August 23, 1999), which states that over \$6.6 million was paid out in bounties through 1993.

²⁶ This information is obtained from the OECD website at www.oecd.org.

We believe that incorporating our proposal into the Convention would make it more effective. To incorporate our proposal, the Convention should require states to pass laws allowing bribe-takers in foreign countries to receive amnesty and a bounty for successfully prosecuting bribe-givers. To illustrate, an official in a developing country who accepted a bribe from a U.S. company could initiate a *qui tam* proceeding in a U.S. court against the company. If successful, the foreign official would receive amnesty and a share of the fine assessed against the U.S. companies that bribe officials in developing countries.

2. The Model

We formulate a model of preventing cooperative crime. As illustrated in Figure 1, the simple bribery game has two stages. In Stage 1, a debtor owes a debt d to the principal. The agent is responsible for collecting the debt. Figure 1 depicts the game from the debtor's viewpoint. In Stage 1, the debtor can pay the principal d or bribe the agent. In exchange for a bribe b , the agent extinguishes the debt to the principal.

Figure 1: Simple Bribery Game in Two Stages

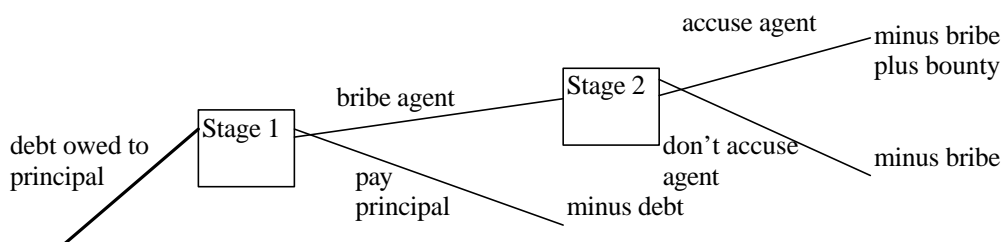


Table 3 summarizes the payoffs to the three parties in the first stage of the game. So long as $d > b > 0$, bribing is bilateral Pareto superior to paying the debt for the debtor and agent. The two of them gain from a bribe at the principal's expense.

Table 3: Payoffs in Stage 1

	<u>Debtor</u>	<u>Agent</u>	<u>Principal</u>
<u>Debt</u>	-d	0	+d
<u>Bribe</u>	-b	+b	0

After the bribe has been paid, the parties enter Stage 2 of the game, where debtor and agent have the opportunity of reporting to the principal. The first to accuse the other collects a bounty and the other pays the fine f . If both accuse at the same time, both pay $f/2$.

Table 4: Accusation Game

		<u>Agent</u>	
		<u>Not Accuse</u>	<u>Accuse</u>
<u>Debtor</u>	<u>Not Accuse</u>	0,0	-pf,pqf-c
	<u>Accuse</u>	pqf-c,-pf	-f/2-c,-f/2-c

When providing evidence, there is a cost c borne by the player that accuses. This cost could be the monetary loss from collecting and producing evidence. For

example, assume that a speeding motorist bribes a policeman not to issue a traffic citation. If the motorist pays in cash and the policeman tears up the ticket, then the cost c from collecting evidence would be high. Conversely, if the motorist has a passenger in the car with a hidden tape recorder, the cost c would be low.

Part of the cost of providing evidence is endogenous to the mechanism. Take the example of the speeding motorist and the policeman. Both know that after the bribe being paid there will be a race for the reward and the amnesty. Thus, each of them will try to keep as much evidence as possible in case the bribing takes place. Even though a traffic citation will not be issued, both parties will try to generate evidence for later accusations, e.g. by keeping track of the money paid or detailed records of the transaction.

The cost c could also include reputation sanctions or stigma from admitting publicly involvement in corruption. These sanctions could come from both (honest and dishonest) sides. Suppose a licensor demands a bribe from an applicant seeking a license, or a factory bribes an environmental official not to enforce pollution standards. If the facts became known, the licensor or the official might get fired and stigmatized. The cost c could even include the present value of lost future deals. To illustrate, assume that the second highest bidder secures a government contract by bribing an official. If the bidder then goes to the prosecutor seeking amnesty and a bounty, other corrupt officials will refuse to deal the bidder in the future.

In summary, cost c can be defined as the opportunity cost of participating in detection and conviction of individuals involved in corruption.

The probability of convicting the accused is p ; therefore, the probability that a bounty is paid is p . The fact that probability p is less than one can be interpreted as individuals are less likely to be convicted if only one of them admits being involved in the conspiracy. Given the difficulty of producing convincing evidence and proving the corrupt transaction beyond reasonable doubt, the probability of being rewarded is less than one. Even when evidence is strong, corrupt prosecutors, judges, and administrators who resist giving amnesties and bounties will cause a low probability p . Holding such considerations constant, convicting a debtor and agent is easiest when each one accuses the other. Consequently, the probability of conviction when each one accuses the other is normalized to one.

The bounty is a proportion q of the fine. The bounty is a policy instrument that allows the government to go beyond the usual sanctioning policy of the deterrence literature.²⁷ By allowing q to vary, the government is one more degree of freedom to offset the fact that producing evidence is costly and the reward is paid with a probability less than one. In essence the proportion q allows decoupling the fine from the bounty.

The symmetry of the game is for exposition and without loss of generality. Notice in particular we could re-write the parameters of the model such that the debtor pays d if accused and the fine and the reward are net of the debt. Thus, we should note

²⁷ See Kaplow and Shavell (1994) on self-reporting and Reinganum (1988) on plea-bargaining as examples of other mechanism on the same line of research within the deterrence literature.

that it is generally true that $f > 2d$ making the debtor worse off if detected avoiding debt and engaging in bribing.

We solve by backwards induction for subgame perfection in the bribery game. Assuming that $f > 0$, the general solution to the game depends on the specific parameters of the model. Our objective is to generate $\langle \text{Accuse}, \text{Accuse} \rangle$ as the only Nash equilibrium as in the prisoner's dilemma. When $p q f > c$ and $(p - 1/2) f > c$ $\langle \text{Accuse}, \text{Accuse} \rangle$ is the unique Nash equilibrium. As shown later, when one of these assumptions is not satisfied, $\langle \text{Accuse}, \text{Accuse} \rangle$ is no longer the unique Nash equilibrium. Given these two assumptions, Table 5 depicts the payoffs for the two stages of the game expected by the parties in Stage 1.

Table 5: Bribe Game

		<u>Agent</u>	
		<u>Collect Debt</u>	<u>Take Bribe</u>
<u>Debtor</u>	<u>Pay Debt</u>	-d, 0	...
	<u>Pay Bribe</u>	...	-b-f/2-c, b-f/2-c

As long as the bribe is bilateral Pareto superior we should be concerned with the possibility of collusion. However, given that $f > 2d > 2(d-c) > 2(b-c)$, $\langle \text{Pay Debt}, \text{Collect Debt} \rangle$ (no bribing) is the unique subgame Nash equilibrium. In other words, as long as the fine is sufficiently large to offset any gains from a bilateral agreement, collusion is deterred.

It is important to comment on the three assumptions that guarantee this result and grasp the economic intuition. First, we have $p q f > c$ and $(p - 1/2) f > c$, the expected bounty always covers the cost of providing evidence (having or not having been accused by the other party). Thus, accusing will still be the dominant strategy for both players. In second place, we must have $f > 2(d-c)$, the fine deters bribing. The debtor prefers to pay the debt rather than getting involved in bribing.

Our main comment to the needed assumptions is that as long as the fine, the reward, and the probability of conviction of the accused are sufficiently large, the result follows. There are several reasons why this might be problematic, i.e. why setting a large sanction or a large reward could be unfeasible, which we address at the end of present section. In turn, let us discuss what happens when we cannot satisfy the above assumptions.

There are three other possible cases to be considered. Suppose $p q f < c$ and $(p - 1/2) f < c$. Clearly $\langle \text{Not Accuse}, \text{Not Accuse} \rangle$ is the unique Nash equilibrium. It is a full coordination game. In any situation (being or not accused by the other player), each player loses from accusing and providing evidence. Not accusing is dominant for both. Our mechanism does not work in this particular case.

Consider a second possibility: $p q f > c$ but $(p - 1/2) f < c$. Each player wants to accuse if the other player does not accuse, but prefers not to accuse if the other player accuses. The characterization of the equilibria is more cumbersome than before: $\langle \text{Not Accuse}, \text{Accuse} \rangle$ and $\langle \text{Accuse}, \text{Not Accuse} \rangle$ are both Nash equilibrium in pure strategies. In mixed strategies, we have a Nash equilibrium where Accuse is played with probability $I = (p q f - c) / (f/2 - p f (1 - q))$. In evolutionary games, in the long run, a

proportion I plays Accuse and a proportion $1-I$ plays Not Accuse. Our mechanism does not completely deter bribing, but reduces the long-run likelihood of taking place. It corresponds to a partial distrust game.

Finally analyze the third possibility: $pqf < c$ and $(p-1/2)f > c$. Each player wants to accuse if the other player does accuse, but prefers not to accuse if the other player does not accuse. It is a partial coordination game.²⁸ The equilibria is the following: $\langle \text{Accuse, Accuse} \rangle$ and $\langle \text{Not Accuse, Not Accuse} \rangle$ are both Nash equilibrium in pure strategies. In mixed strategies, we have a Nash equilibrium where accuse is played with probability $I = (c-pqf) / ((pf(1-q)-f)/2)$. In evolutionary games, in the long-run, individuals play Accuse if $I > n$ and play Not Accuse if $I < n$, where n is the initial proportion of accusers in the population. Our mechanism might still work if we guarantee that the initial proportion of accusers in the economy is low enough.

When the policymaker cannot decide on a policy that satisfies the needed assumption for a prisoner's dilemma, we should investigate the next best alternative. If $p > 1/2$, the policy maker should set a high sanction and a high reward to generate the prisoner's dilemma. If that is not possible, we are dealing with cases like the ones described in the last paragraphs. A low sanction with a high reward could generate a partial distrust game, whereas a lower reward coupled with a higher sanction could generate the partial coordination case. Even if the sanction is small, a full coordination case can be avoided by setting a large reward (obtaining a partial distrust game).

In multiple equilibria games it is always difficult to make predictions about which of them will be observed. In large population games, the mixed strategies Nash equilibrium offers a nice interpretation (proportion of the population that will engage in a given strategy, i.e. a proportion I of the population will accuse). Let us take the the mixed strategies Nash equilibrium in both the partial coordination game and the partial distrust game. The expected payoff of a citizen and an official is given by $-Ipf$. Solving stage one the game, $\langle \text{No Bribe, Reject/Bribe} \rangle$ (no bribing) is still the subgame Nash equilibrium as long as $f > d/(pI)$.

In an evolutionary context, partial distrust and partial coordination differ because the mixed strategies Nash equilibrium is stable in the first case but not in the second. From that viewpoint, the partial coordination case is preferred to partial distrust if $I > n$ (in the long run everyone accuses), and otherwise if $I < n$ (in the long run no one accuses).

Suppose $0 < p < 1/2$. The policymaker must choose between full coordination or partial trust: It is unavoidable that each player does not accuse if the other player accuses (because the actual likelihood of being punished is very low). Nevertheless, it seems reasonable to accept that having each player accusing if the other does not is strictly preferred to no accusation. Thus because the partial distrust is preferred to full coordination, the policymaker should set a high reward.

The first limitation to our solution seems to be the feasibility of imposing a high sanction. The problem relates to a likely liquidity or wealth constraint. In such an

²⁸ Also known as the battle of the sexes in the game theory literature.

event, the sanction would consist in a monetary fine plus an imprisonment sentence. Since bribing is deterred, the sentence will not be applied. Nevertheless, some cost must be borne by the government to signal its commitment (e.g. building jails).

A second important remark relates the role played by the cost c . As we can see, the assumptions for a prisoner's dilemma are easier to satisfy as this term becomes smaller. The magnitude of the parameter c relates of course to different observations made along the paper, including the claim that within our mechanism debtors and agents will look for different methods to keep records of the transaction.

The cost of reporting could be high, in particular as the needed evidence to assure conviction could be very costly. This observation relates to the characteristics of the information relating to the underlying transaction. Some information is public or can be made public at lost cost (written documents or hard evidence that the transaction took place). However, in many instances, the information is private in the sense that is observable but not verifiable by a third party. Unverifiable information makes providing evidence extremely costly (since players cannot make any credible commitment to provide the government with information) eventually to the point of not being possible to get out of the full coordination game.

An alternative for the policymaker would be to make conviction easier by lowering the burden of proof so that less evidence is needed to secure a conviction. However, such policy makes legal errors and false accusations more likely to succeed a point we will come back later in the paper.

Figure 2 helps understanding the policy alternatives the government has when the opportunity cost c is high. A sufficiently large reward makes sure that we have a partial distrust game, rather than the full coordination, unless the opportunity cost is infinitely large. Notice that if $p < 1/2$ the vertical line in figure 2 is to the left of the origin, thus limiting the policy alternatives to partial distrust and full coordination. A prisoner's dilemma can only be generated when $p > 1/2$.

The credibility of the government plays an important role in the success of our result by affecting the probability p . In presence of a dishonest adjudicator, the probability p of collecting the reward could be very low and the cost of providing evidence c quite high. In this context, the best the policymaker can look for is a partial distrust game.

Figure 3 provides policy rules with respect to the magnitude of the probability of not being punished for corruption, $1-p$. Another way to see figure 3 is the feasibility of different policies with respect to the degree of corruption embedded in a given economy. As the policy announcements of the government become less credible, full coordination can only be avoided by setting a high reward. Note that when the probability of not being punished for corruption is high, the government can aim at best at generating a partial distrust situation.

From figures 2 and 3, we can see that limitations on rewards (e.g., for moral reasons) undermine the ability of the policymaker to avoid a full coordination game. Generally, low rewards constraint the government to choose between partial coordination (large sanction) or full coordination (low sanction).

3. Important Remarks and Limitations of Our Model

Having discussed the validity of our mechanism and how parameters of the model affect the solution, we proceed to assess the limitation of our model, namely repeated transactions, reputation loss, false accusations, honesty of judicial system, private enforcement, and other forms of corruption.

3.1. Repeated game

The bribing game we have so far explicitly modeled is one-shot. In many cases parties play a repeated game. In a repeated game, they may solve a prisoner's dilemma or any other game into a full coordination game. Thus our mechanism makes cooperation more difficult, but not impossible. Eventually for organizations of criminals and officials it will be easier to surpass this mechanism than for other types of disorganized or casual bribing.

Casual corruption can be defined as a one-shot game whereas long-run (also known as cultural) corruption is a multiple-shots game. In long-run corruption, bribing is part of internalized social norms. A possible interpretation of our parameter c is the net present value of future deals lost when accusing. The result proposes that for a given cost c and a given probability p , a fine f and a bounty fraction q can be defined so that both citizen and official prefer to accuse. From our assumptions, as the cost goes up, so should the fine and the bounty.

An alternative view on deterrence of long-run corruption is the following: The Folk theorem states that a necessary condition for cooperation is individuals being patient. Therefore, for a given profile of discount rates, we can always define a sanction and a bounty sufficiently large so that one of the parties is willing to break the agreement.

A consequence of this observation is that sanction and reward should be much higher for procurement fraud (where plausibly we have a long-run relationship) rather than for customs control of tourists at the airport (where plausibly we have a one-shot game).

Another point the policymaker should explore is that most repeated games have an end node, either because there is a last period or because the high uncertainty of the business environment implies that the likelihood of playing the same game next time is low. At final stages of the game, players can no longer credibly commit not to accuse and may start collecting evidence. If players anticipate this behavior (it will be more likely so if our mechanism is introduced and becomes common knowledge), the game could unravel to the first periods and undermine trust from the beginning.

3.2. Reputation loss and social norms

A consequence of coming out and accusing a citizen or an official of bribing is the loss of reputation for honesty. A possible interpretation for cost c is a measure of

loss of reputation. In an environment where honesty is the social norm, the loss of reputation could be high making the opportunity cost of accusing higher. Nevertheless, in an environment where dishonesty is the social norm, accusing the other player could also generate a large loss since it would reveal this player as a mutant within a corrupt population and subject the accuser to social punishment. Our result suggests that for a given loss of reputation, there is always a sufficiently large sanction and reward that induces parties to come out. The problem of course is how feasible is to set the sanction equal to such large value.

A change of social norms from dishonesty to honesty could improve the success of our mechanism at two different levels. First, in an environment where corruption is not well regarded the likelihood of punishing the sinner is higher (our p is large). In second place, the reputation loss even though eventually high, could be lower than the social punishment suffered by a mutant within a corrupt population.

An important consideration is that reputation losses are usually not symmetric. In the case of a tourist bribing a customs officer at an airport, it could be problematic for the foreigner tourist to accuse the local officer of bribing, but less so when the latter accuses the first. Within our mechanism, we should re-adjust the parameters of the model to take into consideration the asymmetry.

3.3. False accusations

A well-known problem with law enforcement mechanisms with a bounty system is false accusations. A citizen or an official could be tempted to false accuse aiming at the bounty.²⁹ When false accusations are produced by a group of individuals, including for example false witnesses or accomplices in forging evidence, our mechanism can be applied and as such deter or reduce the likelihood of these false accusations taking place. Those individuals involved in the business of making false accusation can no longer trust each other. In English legal history, the problem of false accusations has been documented. The evidence seems to be that false accusations and entrapment was usually produced by organized rings led by notorious thugs, rather than the product of individual behavior.

To tackle the problem of individual false accusations, one useful method is exploiting the differences in probability of succeeding in court. A dual approach is, for a given probability of succeeding in court, observe that the cost of producing evidence c is higher for a false case, say $c'' > c'$, where c' is the cost of producing evidence in a true case and c'' in a false case.

The government should define the sanction f and the reward fraction q to make sure that in a true case the Nash equilibrium is <Accuse, Accuse> (prisoner's dilemma) whereas in the false case is <Not accuse, Not accuse> (full coordination). Consequently, from previous discussion, we should have $c' < pqf < c''$ and $c' < (p-1/2)f < c''$. We must then define the sanction such that $c'/(p-1/2) < f < c''/(p-1/2)$. For a given sanction f , we must define $c'/(pf) < q < c''/(pf)$. The intuition is that by

²⁹ As Prendergast (2000) argues, false claims could also be a consequence of bureaucrats or agents becoming excessively interested in keeping the principal happy.

observing a probability differential, we can set a sanction and reward such that in a true case players have an incentive to accuse, but such incentive is absent when accusations are false. The sanction and the reward must be high enough to make worthwhile for true accusations, but not too high to make false accusations profitable.

There is a small caveat to this result. We have imposed $f > 2d > 2(d - c')$ to make sure that the debtor prefers to pay for the debt rather than engaging in bribing. Satisfying this assumption and the constraints discussed above could be problematic if d is much larger than c' or c'' . In order to solve this problem, we could introduce a sanction for false accusations to be collected when the accuser (honest or dishonest) cannot provide enough evidence. As Garoupa (1997) shows, false accusations could be eliminated this way. Note that an honest accuser who cannot provide evidence to convict an offender or a corrupt official would also have to pay this sanction.

3.4. Honesty of judicial system

It is reasonable to assume that if a policymaker introduces our mechanism, at least at some levels of the government and of the judiciary a certain degree of honesty is expected. Also there seems to be a general view that the judiciary is usually less corrupt than politicians. However we explore the possibility of introducing our mechanism in a corrupt environment. We propose that our mechanism still works even if many individuals within the political establishment and the judiciary are corrupt.

Our mechanism allows for dishonest prosecutors and judges, in the sense that they do not punish bribery effectively. An attractive way to tackle the issue is by extending our mechanism to prosecutors and judges: each actor must fear that anyone offering them a bribe will subsequently report the bribe to another prosecutor and judge. To sustain this fear, the party who wants to make the report must have the power to choose among various prosecutors and judges. Choice implies competition. Alternatively, if the prosecutor's office is a single bureaucratic pyramid, and the courts also form a single bureaucratic pyramid, then the highest prosecutor and highest judge have no one to fear when they accept bribes, and the whole system of deterrence can break down.

Our argument will be that as long as the system is fairly competitive, our mechanism will work. Fairly competitive means not only a fairly large pool of prosecutors and courts but also that they are not entangled into some hierarchical organization that controls and distorts decisions.

Suppose there are two prosecutors, A and B. Suppose both are dishonest in the extent that they are willing to be bribed to drop a case. When a debtor comes out, lays the accusation against the agent, and a bounty is claimed. The agent is willing to pay as much as f (the sanction to be paid) to have the case against him dropped. Prosecutor A compares payoffs: gets zero if prosecutes, and gets a bribe t paid by the agent if drops the case. Therefore, prosecutor A rules for the agent and drops the case. The debtor goes to prosecutor B claiming a bounty against the agent and prosecutor A. Prosecutor B gets a bounty from exposing Prosecutor A, say $s/2$ (where s is the sanction being paid by prosecutor A), if goes ahead with the case, and gets a bribe t'

if drops the case. Therefore, as long as $s > 2 t'$, the agent can never match the reward and prosecutor B takes the case to court. On the other hand, if $s < 2 t'$, prosecutor B drops the case. If that is so, prosecutor A should anticipate that and revise her assessment of payoffs: by dropping the case, the payoff is actually $t - s$ if $s > 2 t'$ and t otherwise.

To avoid prosecution, the agent must pay $t + t'$ so that both prosecutors are willing to cooperate. The agent also knows that t' must be greater than $s/2$ so that prosecutor B is willing to accept the bribe. Hence, as long as $s > 2f$, the agent will never pay the bribe and prosecutor A will never drop the case. But even if by mistake she does, prosecutor B will take the case.

Our example runs with two prosecutors and a sufficient condition that the sanction borne by prosecutors is sufficiently larger than the debt (now s being twice the debt f). By increasing the number of prosecutors, the sanction s can be smaller and smaller. The intuition is that to make sure there will be no prosecution, an agent must bribe all prosecutors. The bribe paid to each prosecutor must compensate her from being in a situation where another prosecutor can bring a case against her. If the pool of prosecutors is large, there will be a point where the total bribe to be paid is larger than the debt owed.

In summary, if one prosecutor can claim against the other a sufficiently large sanction for having dropped a case of corruption, no prosecutor will drop that case. In equilibrium, no prosecutor is punished or audited and the system is self-funding.

Of course, by introducing a bounty system within the design of prosecution, the problem of false accusations (now eventually charging and prosecuting honest prosecutors) also arises. As before, we would have to adjust sanctions and rewards for the cost differential.

The mechanism should first be applied to those who have more to lose from being exposed as corrupt. In our example the opportunity cost of being exposed is just the sanction to be paid. If we take into account the losses from being seen as corrupt, the number of prosecutors we need in the pool is smaller and the correspondent sanction is also smaller. Presumably judges and prosecutors have more to lose than minor bureaucrats or enforcement agents by being charged with corruption. So the virtuous circle of distrust should start with these people who have more to lose.

A more serious problem emerges if the judiciary opposes enforcing our mechanism, not because they are engaging in corruption, but largely based on ideological grounds or on the belief that paying a bounty to a corrupt agent or to a debtor is morally wrong. This position undermines the mechanism, because the incentive to accuse would be reduced. Furthermore, it would be difficult to penalize judges on the ground that they are colluding with offenders. These observations point to the possibility of having an agency independent of the judiciary dealing with the management of rewards. For example, in a case of collusion between taxpayers and tax inspectors, we could envisage a tax audit agency that also administers rewards. In the case of speeding motorists bribing police officers, we could allow an internal affairs department to decide on rewards. These agencies should be structured along

the lines we have discussed before to avoid collusion at higher layers of the government.

Having rewards administered by the policymaker (or her agents), and not by the judiciary, reduces but does not solve the underlying problem because the judiciary could for example disregard evidence obtained by means of our mechanism. The judiciary should realize that by enforcing rewards, fewer bribes will be paid and deterrence of the underlying offense would be greater. Thus, very few rewards will be actually paid.

3.5. Private prosecution

A particular case to consider is when the creditor is private. The ability of the creditor to punish is quite limited. In the case of an agent, because he is not an employee of the firm. In the case of a debtor, because a court will be unlikely to enforce a contract that precludes some kind of sanctioning. Most likely, the game is not symmetric and the recourse to sanctions is very limited.

However, the creditor can still use a bounty system and reward both. Therefore, our mechanism still applies even though possibly generating a partial distrust game. The debtor should anticipate this outcome and realize that there is a high probability that he will have pay the debt after bribing. Therefore, he will not be so much willing to engage in bribing as otherwise.

3.6. Other forms of corruption

While we focus on bribery, other crimes considered in the paper include extortion, blackmail, hostage taking, and kidnapping.³⁰ Unlike bribery, these crimes do not involve paying an agent of the state to violate his duty by not imposing an obligation on someone. A second feature of these types of corruption is the ability to make credible threats, where taking hostages or kidnapping is essentially a commitment device. The objective of our design is to undermine those commitment devices by providing the debtor with a commitment device not to pay. If sufficiently credible, our design reduces the incentives for an agent to engage on such corrupt activities *ex ante*.

Our rationale is based on the fact that deterring these activities are welfare improving as in the case of bribing. We do accept the view that it is not necessarily the case with extortion or blackmail. If these activities target offenses and deeds that have not been exposed or punished (that is, type II errors-false acquittals), deterring blackmail could be welfare diminishing.

Our mechanism concerns bribing insofar that the citizen should pay a debt to the government and pays a bribe to avoid it. We take the view that our result can also apply to other forms of corruption like extortion, blackmail, kidnapping, and hostage taking.

³⁰ For other references see Konrad and Skaperdas (1997 and 1998), Posner (1993), Werner and Keren (1993).

Essentially it is stage one that differs from the bribing game. The debt to the creditor or the government is zero and is artificially created by the agent to secure some gains. We no longer talk about a bribe, but rather of an extorted payment or a ransom. In a sense the debt is endogenous because it is created by the agent, and not set by the government. By creating distrust, this type of corruption is also deterred. However, the fundamental step is taken by the debtor when decides not to pay and consequently the agent does not ask for the payment recognizing that the debtor will never pay. In essence, the debtor is committed not to pay and should communicate the commitment device to the agent. The commitment device is more credible because is controlled by the creditor, and not by the debtor.

The fact that the creditor controls this device can potentially introduce some problems because the creditor might not be willing to enforce the sanctioning of victims. In the case of bribing, there is no problem because we have a debtor who is an offender. On the other examples, blackmailing and kidnapping, the citizen is a victim and not an offender.

4. Conclusion

This paper proposes a mechanism to deter cooperative crimes, especially bribery. The first party to report giving or taking a bribe receives amnesty and a bounty larger than the benefit from the bribe. Consequently, the debtor and the agent cannot trust each other to give or take a bribe. The mechanism converts a game where bribery is Pareto superior for agent and debtor into a prisoner's dilemma where mutual distrust inhibits bribery. Much of the game theory concerns escaping prisoners' dilemma, whereas this paper concerns creating them.

In the paper we have reviewed several problems with our framework, in particular, measurability and feasibility of sanctions, informational problems, repeated transactions, social norms, false accusations, and honesty of the judicial system.

Our mechanism generalizes practices and laws which are currently in use in the U.S. The effectiveness of our mechanism is an empirical open question. It has been loosely applied in some contexts, such as tax amnesties (with punishment of tax inspectors) or reforms of the judiciary intended at reducing corruption (in some South American countries). Governments seem however less happy to use the application of our mechanism more generally. Part of the reason has to do with objections based on moral arguments. Yadlin (2000) proposes two: reward the evil and encourage betrayal and treachery. In that respect, our mechanism is not much different from plea bargaining, criminal immunity or self-reporting.

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FIGURE 2

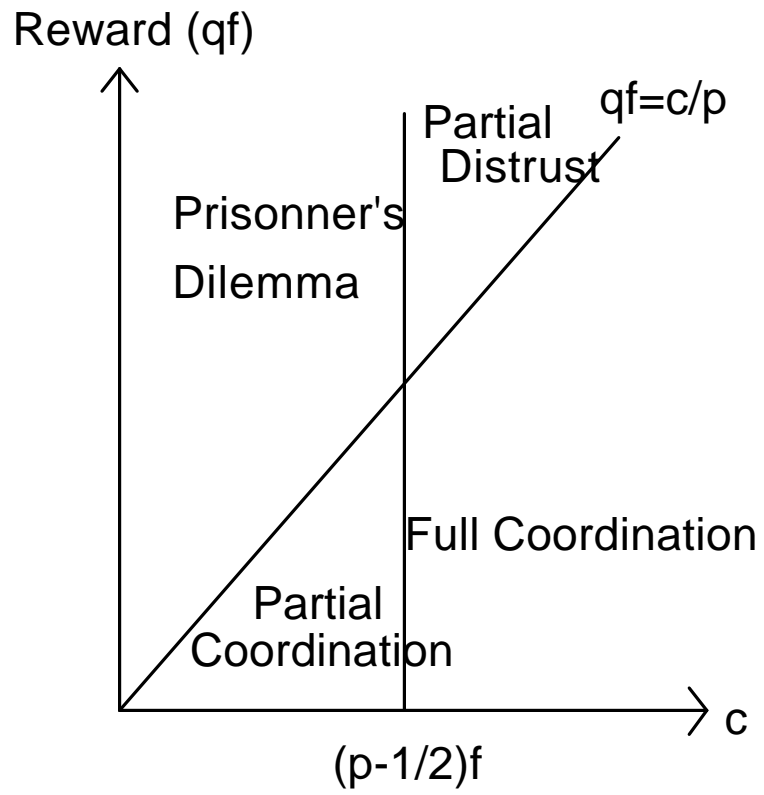


FIGURE 3

