Essays on the Spread and the Depth of Corruption and Anti Corruption

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Contents

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Abstract

This thesis comprises four essays revolving around the economic research of corruption.

Chapter 1 studies if higher wages prevent corruption (bribe taking). I investigate a setting where individuals who apply for public sector jobs are motivated by a mix of motivations: monetary incentives, intrinsic motivation and concern for the collective reputation of their profession. It shows that a higher salary creates doubt about individuals' true motive to be honest, resulting in the reduction of the collective reputation of the profession. This 'overjustification' effect may cause reputation-concerned individuals to be more prone to participate in corruption. The overall effect of monetary incentives on fighting corruption crucially depends on the composition of the pool of public sector workers.

Chapter 2 develops a microeconomic context of corruption decisions of an individual, notably decisions to accept bribes, when the individual is endowed with a range of alternative actions over which he may be bribed. This approach extends the study of corruption besides its spread to its depth, i.e., the level of distortion of the duties of corrupt officers. This paper models individuals' distortion of their duties which captures the variable degree of corruption of individuals. I derive the level of bribe that represents the 'reservation' monetary payoff for various degrees of corruption of an individual.

Chapter 3 uses the context of the degree of corruption to evaluate the effectiveness of alternative anti corruption policies. It elucidates the root of corruption: bribing the officer to take a specific action deviated from the task creates a positive surplus for the donor who pays the bribe, then there is room for a mutually beneficial deal between the two parties. It shows that salary increases may fail to extinguish corruption opportunities, but succeed in reducing the equilibrium distortion of duty. Finally, this paper examines the effect of competition among officers on the degree of corruption combining heterogeneity across corrupt officers.

Chapter 4 is a first attempt at proposing the development of indirect anti corruption policies inspired by the idea of triggering bribery market failures. Based on the varying degree of corruption among officers, knowledge of the type of officers is crucial for a corrupt exchange to occur. The uncertainty about the types of officers would inhibit corruption. Therefore, 'managing' this uncertainty provides fertile ground for anti corruption measures. To illustrate this point, I present a game setup that leads to the complete unravelling of the bribery market due to adverse selection.

Declaration

I declare that no portion of the work referred to in the thesis has been submitted in support of an application for another degree or qualification of this or any other university or other institute of learning.

Copyright

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Introduction

This thesis comprises four essays revolving around the economic research of corruption.

Corruption continues to be a central issue in the governance of institutions (public, private or mixed). It manifests with scandals that occasionally reach the news about malfunctioning or mismanagement of institutions due to some of its servants' unwarranted behavior. A common thread to the issue of corruption is that it involves decisions by humans to misbehave. Whatever checks and balances are established by societies for their well functioning, these are administered by humans who make decisions that, either intentionally or not, result in the malfunctioning of the purpose they are supposed to serve. While the latter can be forgiven (e.g. incompetence) the former reflects corruption. Human behavior is often subject to rules and regulations, which become binding when they conflict with the private interest of individuals. When this happens, individuals test the boundaries and attempt to cross the margins of regulations that conflict with their private interests.

On the other side, the role of administrative and managerial structures in organizations is to safeguard those rules and policies by enforcing them. In this sense, corruption grows on the same root with power and authority to affect private interests: it is the vehicle to cash in power and authority. The grain of corruption lies in this role of maintaining a situation that is inefficient relative to the private interests of individuals on both sides. In looking for ways to counter the incentives to be involved in corruption, as economists we are faced with a strange task of pursuing ways to maintain an inefficient situation, i.e., ways that counter the self-interest of individuals to carry out a mutually beneficial transaction, which is the opposite of my usual task of finding ways to facilitate such exchanges.

Notwithstanding the fact that corruption is associated with some type of misbehavior, it has the effect of undermining the trust of the public opinion to the governance of institutions and for this reason, it is a phenomenon dangerous to social cohesion. The World Bank considers anti corruption as the heart of the Sustainable Development

Goals and achieving the targets set for Financing for Development. The establishment of mechanisms that create incentive structures in order to avoid corruption phenomena is a formidable exercise which is by and large a learning process, because these need to be updated overtime in line with changing times. This thesis is motivated by the challenge of conceptualising corruption itself and identifying its root causes. Furthermore, I attempt to evaluate anti corruption policies through the prism of alternative conceptualisations of corruption in order to contribute a better understanding of their efficacy - or lack thereof. Finally, I employ my proposed approach to corruption to discuss the important role that it plays in reforming policies aimed at combating corruption.

This thesis develops microeconomic models of decision making to analyze the decision of an individual[1] to participate in corrupt activities that combine heterogeneity in individuals' motivations, i.e., monetary incentives and non-monetary motivations, and multiple possible actions over which an individual may have a choice and can be bribed in order to take. I introduce a new dimension into the discussion of corruption, namely, the degree of corruption. I use this model in order to view some well known conclusions in the literature regarding the effectiveness of various remedies to corruption when the degree of corruption is also taken into account. Finally, this thesis proposes the use of known market failures as anti corruption tools and demonstrates that the market for bribes can be conditioned in a way so that it completely unravels due to adverse selection.

Based on the fact that the root of corruption lies in the self-interests of individuals I propose that there is a need to develop a framework of individual decision making that will serve us in order to better understand the temptation of individuals to be corrupt. I recognize that there are many issues likely to be involved in corruption decisions (pressure, prestige, career prospect, and social issues, etc.). The utilitarian nature of a decision model is perhaps not the only driving force of such decisions and motives may not be purely materialistic, but I argue that these aspects are crucial. In this way I hope to contribute to the development of ways that such temptation can be countered.

Of course, corruption takes so many forms that it is unrealistic to propose that a single model can capture all of them. Here I focus on a specific and arguably the most usual form of corruption: bribing. Bribery is a corrupt transaction that involves quid pro quo; an exchange of a payoff for the abuse or misuse of office (Svensson, 2005; Nichlos and Robertson 2016), while Banerjee, Mullainathan, and Hanna (2012), define bribery as the breaking of a rule by a bureaucrat for a covert monetary bribe to provide a service to someone that he was not supposed to. Following these leads, I model bribing as a

[1] In this paper I use interchangeably the term 'officer' and 'individual'.

monetary payoff for a specified action that is required by the donor and must be executed by the officer who accepts the bribe.

Part One of this thesis consists of a single chapter, which investigates how heterogeneity in individuals' motivations affects policies targeting corruption (bribe taking), specifically, monetary incentives. Deficient salaries are often cited as a prime explanation of bureaucratic corruption. Therefore, a standard policy to fight bribery is raising the salary of public officers by increasing the cost of corruption. However, in addition to the fact that salary increases to fight corruption are costly because to discourage the individual from corruption requires substantial increases in wages, the effectiveness of salary increases on anti corruption is debatable. A puzzle is that providing rewards to encourage honest behavior sometimes has a perverse effect, increasing the propensity of the individual to participate in corruption.

Chapter 1 follows the statement from psychologists and sociologists, which argues that rewards and punishments are often counterproductive because they undermine individuals' 'intrinsic motivation'. This effect has been observed in a broad variety of social interactions. More recently, economists have recognised that not only the monetary incentives, but also other motivations, like moral values, and the love of praise drive individuals' behavior. Therefore, to acknowledge heterogeneity in an individual's motivation is important to study individuals' response to incentives. Do individuals with different motivations respond differently to incentives? Do others' behavior have impacts on an individual's decision to accept a bribe? With the viewpoint of a mix of motivations, what policy would be useful to fight corruption?

In studying these questions, this chapter examines a setting where individuals who apply for public sector jobs are motivated by a mix of motivations: monetary incentives, intrinsic motivation and concern for the collective reputation of their profession. When collective reputation is viewed as the actual level of corruption (i.e., the proportion of honest individuals) - that is, collective reputation increases (decreases) when more (less) individuals are honest due to higher salary - then a salary increase would always have the beneficial effect of reducing corruption.

However, in this model, the collective reputation is defined as the expected level of intrinsic motivation of honest officers, i.e., it corresponds to citizens' beliefs about the degree of intrinsic motivation of honest officers. When salaries are high (low), collective reputation is low (high) because citizens correctly perceive that an honest behavior is induced by personal interest and not by strong intrinsic motivation. In other words, higher salary creates doubt about individuals' true motive to be honest, resulting in the

reduction of the collective reputation of the profession. Such an 'overjustification' effect by monetary incentives may cause reputation-concerned individuals to be more prone to participate in corruption. The overall effect of monetary incentives on fighting corruption crucially, depends on the composition of the pool of public sector workers.

I then embed the analysis in a model with a private sector which only offers monetary incentives but does not have any non-monetary incentives. It shows that when a negative shock happens on private sector salaries, selection of monetary motivated officers in the public sector causes a crowding out of intrinsic motivation due to overjustification effects on reputation-concerned agents. It concludes that if the proportion of reputation-concerned officers is large enough, higher public sector wages may lead to a higher level of corruption. These results imply in particular that policies to fight corruption should focus more on increasing the collective reputation of the public sector rather than using monetary incentives which have perverse effects on some agents.

Part Two of this thesis consists of three essays that add a new dimension to the discussion of corruption, namely, the 'depth' of corruption. An organization with few corrupt officers who deviate significantly from their duty is not more desirable than one with many corrupt officers who deviate slightly from their duty. Motivated by this observation, I propose that the study of corruption besides its spread should include its depth, i.e., the level of distortion of the duties of corrupt officers. In the existing literature the discussion of corruption focuses only on its spread, i.e., numbers or proportions of corrupt individuals, and fails to address its depth, i.e., the level of distortion of duties by corrupt individuals, so I develop an approach which highlights this dimension of corruption. I also propose anti corruption remedies that can be developed around the idea of exploiting market failures. Specifically, I demonstrate how uncertainty can be 'engineered' in order to trigger severe adverse selection effects which unravel the bribery market and thus have a profound effect on corruption.

Chapter 2 develops a microeconomic context of corruption decisions of an individual, notably decisions to accept bribes, when the individual is endowed with a range of alternative actions over which he may be bribed. This paper models individuals' variable distortion of their duties which captures the variable degree of corruption of individuals. Through a formal analysis of this model, I derive the level of bribe that represents the 'reservation' monetary payoff for various degrees of corruption of an individual.

Compared to the setting in which the officers are distinguished by whether they are

corrupt or not and they are homogenous inside these two groups, I introduce heterogeneous individuals in both groups. In this model the concept of alternative 'types' of individuals takes on the meaning that they have variable attitudes towards the performance of their duties. In other words I suggest that officers who are not corrupt do not perform their duties with the same diligence. The alternative attitudes with respect to performance of duty may be due to various motives (skill, motivation etc). Rather than dwelling into the cause of the different attitudes I focus on the consequence which is a varying success in performing a task. On the other hand, because there is a multitude of possible deviations from duty, corrupt officers may distort a duty in different ways. In other words I allow the possibility that there are multiple ways that a duty may be distorted. This allows the possibility that two individuals who perform that same task may be bribed to deviate from it in different degrees. Notice that when officers differ in their diligence in the performance of their duties, the distortion of their duties due to the bribe is not the same. Similarly officers who perform their duty with the same diligence may be bribed to deviate in different degrees.

Chapter 3 uses the context of the degree of corruption to evaluate the effectiveness of alternative anti corruption policies, e.g., salary increases and competition among officers. I use the tools developed in the previous section in order to represent the root of corruption: when the minimum bribe required by an officer to deviate from his task is less than the benefit that his deviation creates for the donor of the bribe, then there is room for a mutually beneficial deal between the two parties. In this way, I formalize the standard argument in the literature that salary increases may be effective in reducing the surplus from corruption. At the same time, my analysis highlights the drawbacks of this argument. For instance, reducing the surplus is not enough to eliminate a corrupt exchange. In fact, if the surplus is not eliminated, salary increases merely put more money in the pocket of a corrupt individual. My approach adds one more possible source of failure of this policy: salary increases may leave the surplus intact due to the substitution effect between salary and the distortion of duty of the officer. Following this lead, my approach evaluates this policy from an entirely new angle. I conclude that even though they may fail to extinguish corruption opportunities, salary increases may succeed in reducing the distortion of duty of corrupt officers.

In addition, this chapter examines the effect of competition among officers to fight corruption. If officers distorting their duties face no utility loss and the risk of detection is zero, the analysis is in line with the argument that Bertrand competition can reduce the level of bribes to zero and thus eliminate corruption. By contrast, following chapter

2, the model assumes that corrupt officers do face utility loss and the risk of detection when they accept the bribes to distort their duties. I show that the equilibrium level of bribe will equal the lowest reservation bribe but that is not zero so corruption will persist and concentrate on the type of officers requiring the minimum bribe across all types. In addition, I argue that if the degree of corruption across types of officers varies, the net benefit from corrupting them is heterogeneous. This heterogeneity inhibits competition across officers. In this case, the argument of introducing competition among officers to eliminate corruption through Bertrand competition fails.

Chapter 4 is a first attempt at proposing the development of indirect anti corruption policies inspired by the idea of triggering bribery market failures. Based on the varying degree of corruption among officers, knowledge of the type of officers is crucial for a corrupt exchange to occur. The uncertainty about the types of officers would be a powerful tool to inhibit corruption through adverse selection. Therefore, 'managing' this uncertainty provides fertile ground for anti corruption measures. To illustrate this point, I present a game setup that leads to complete unravelling of the bribery market due to adverse selection.

Literature Review

1. The definition and the magnitude of corruption

A common definition of corruption is the abuse or misuse of a position of trust or authority for personal gain rather than for the benefit of the party that bestowed that position (see, e.g., Svensson, 2005; and Nichlos and Robertson, 2016)[2]. Shleifer and Vishny (1993) define corruption "as the sale by government officials of government property for personal gain." They define property quite loosely to include both physical assets (e.g., land) and assets that have an option value (e.g., a business license). Furthermore, corruption also involves breaking rules, not just doing something that is unethical or against the collective interest (Banerjee, Mullainathan, and Hanna, 2012). In this sense, the rules define what is corrupt. As a result, the same action can be classified as corruption in one setting but not in another.

In line with Banerjee, et. al.(2012), I define corruption as the market exchange situation where monetary payoff (e.g., bribe) is paid for a specified action that is required by the donor and must be executed by the individual who accepts the bribe. Under this definition, an individual's distortion of the duty due to the bribe defines corruption. In the existing literature, bribes are associated with a specific action (which is assumed to be unique and hence is left largely undefined). Certainly, bribes must be associated with an objective, a purpose, but I contend that there can be multiple such objectives, each one potentially associated with a bribe and so the analysis of decisions to become involved in corrupt activity is more complex than the binary decision of accepting a bribe or not. What is required in return for a bribe becomes meaningful, because whereas a bribe might be acceptable for a certain deviation from duty, it might not be so for other deviations of duty. In addition to distinguishing individuals by whether they accept a bribe or not, this definition captures the depth of corruption by taking into account the individual's distortion of the duty due to the bribe.

[2]Svensson (2005) define corruption as the misuse of public office for private gain

On the empirical level, one thorny issue is the measurement of corruption. Current measures, e.g., the number of convictions for corruption-related crime (Glaeser, and Saks, 2006), corruption perceptions index, do not necessarily point to the same phenomenon, and similarly measured corruption does not necessarily have similar implications because the observed corruption is usually confounded with many different things (e.g., measures of prosecuted/convicted corruption also reflect political decisions to fight against corruption, see Gordon, 2009.). Therefore, the rankings of countries as more or less corrupt are based on subjective judgments and as such cannot be used to quantify the magnitude of corruption (Svensson, 2005).

Until now, the magnitude of corruption has to be evaluated by anecdotal or case-study evidence. Svensson (2003) provides the firm-survey evidence on the magnitude of corruption. He shows that in sub-Saharan Africa, over 80 percent of Ugandan firms reported needing to pay bribes. Researchers also compare the flows disbursed from the central government to the public goods, such as schools (Reinika and Svensson, 2004a) and road building projects (Olken, 2003, 2004) in order to infer the magnitude of corruption. The research shows that most of the money in the government projects were stolen. In addition, price comparisons serve as another fruitful method to estimate the magnitude of corruption. Di Tella and Schargrodsky (2003) find out that prices paid for basic homogeneous inputs in Buenos Aires public hospitals reduced by 15 percent during 1996-1997 when the government implemented the anti corruption activities. Hsieh and Moretti (2005) find the evidence that underpricing was a way for the Iraq regime to obtain illegal kickbacks from oil buyers. They estimate that Iraq collected $1 to $4 billion in bribes from 1997 to 2001.

However, the study on quantifying and identifying corruption is still at its infancy. The magnitude of corruption requires very careful discussion. This thesis advocates that in order to have a complete picture of corruption, the measurement of corruption besides the volume (i.e., numbers or proportions of corrupt individuals), should capture the issue of degree of corruption (i.e., the magnitude of distortion of their duties). The second part provides a theoretical foundation how the degree of corruption of an individual can be defined and which policies are effective in reducing the distortion of duties of corrupt individuals.

2. The debatable effectiveness of anti corruption policies

Classic incentive literature argues that pure income maximisation is a core source of corruption (see e.g., Andvig and Moene, 1990; Acemoglu, 1995; Aidt, 2003; Sah, 2007)

and the key to reducing corruption is to increase the minimum salary above what they can be got elsewhere (Becker and Stigler, 1974; Chand and Moene, 1999), thereby increasing the opportunity cost of taking bribes.

However, recent research suggests that wage increases may be an expensive and inefficient way to fight corruption (Mookherjee and Png, 1995; Van Rijckeghem and Weder, 2001, Bardhan, 2015) and may even encourage it (Foltz and Opoku-Agyemang, 2015). Mookherjee and Png (1995) argue that higher salaries increase the bribe required and so reduce the surplus in the exchange between the donor and the officer, but as long as this surplus is not eliminated corruption persists. Foltz and Opoku-Agyemang (2015) discuss a political experiment where the Ghana government doubled its police officer salaries in 2010 in part to mitigate petty corruption on its roads. The article demonstrates that the raised salaries caused the police to increase the effort they put forth to get bribes by 19%, the value of bribes taken at each individual stop by between $25-28\%$ and increased the total amount taken on the road. Van Rijckeghem and Weder (2001) study a sample of thirty-one developing countries and conclude that a rather large increase in wages is required to eradicate corruption solely by raising wages.

Another major anti corruption tool is the monitoring of activity. Of course, the mode and technology available for effective monitoring is a debated issue, as it is often unclear how illicit transactions can be detected or inferred from some activities. Nevertheless, to the extent that close monitoring increases the probability of corrupt officers getting caught red-handed, it certainly helps reduce corruption, as Becker (1968) points out. In practice, anti corruption legislation and strong punishment for corruption have been proved to be inefficient in combating corruption in some countries/organisations (e.g., Olken and Pande 2012, Ogus 2004), mainly because corruption also occurs in law enforcement and monitoring system, and corrupt officers can get away with it by bribing the inspectors (Damania 2004). I point out that monitoring, useful as it is against corruption, is not without drawbacks because it may make it easier to corrupt the more conscientious officers. The comparative statics of my model suggest that there is a range of actions that depend on the probability of detection, for which the minimum bribe required becomes lower for the more conscientious individuals. This range of actions expands as the probability of detection becomes closer to one.

Chapter 3 also address the effects of competition among corrupt officers on the level of corruption. Shleifer and Vishny (1993) and also Allen et al. (2015) model bribing situations inspired by Bertrand competition. In such a context at equilibrium the bribe requested by any individual is driven to zero and the individuals perform their duty. They

argue that competition among officers can eliminate corruption. Unlike these papers, my approach incorporates two tradeoffs in the decision to accept the bribe: a probability of detection and the disutility from moving away from the fallback action of the individual in absence of a bribe. These two aspects of the decision give rise to a positive minimum bribe required by individuals for any action (other than their fallback one). As long as the benefit to the donor is greater than this minimum bribe, corruption will persist. My context suggests that competition among officers may drive the bribe required for taking a certain action down to a minimum level, but that cannot be zero and the level of corruption at that minimum level needs not be zero either. Furthermore, the introduction of heterogeneity in distortion of duties of corrupt individuals inhibits the competition among individuals.

3. Intrinsic motivation and Reputation

The first part of this thesis also ties into the large psychology literature on intrinsic motivation and crowding out. The definition of intrinsic motivation focuses on doing something with the purpose of self-satisfaction rather than rewards. John Mill (1909) articulates in his account of the neglect of motivation in economics analysis :"Political economy does not treat the whole of man's nature... it is concerned with him solely as a being who desires to possess wealth,...it predicts only such...phenomena...as take place in consequence of the pursuit of wealth. It makes entire abstraction of every other human passion or motive." These arguments are advanced by behavioral economists (see e.g., Kreps, 1997). The recent definition of intrinsic motivation is given by psychologist Deci and Ryan (2000) that: "the doing of an activity for its inherent satisfactions rather than for some separable consequence. When intrinsically motivated a person is moved to act for the fun or challenge entailed rather than because of external prods, pressures, or rewards." I use the psychological definition of intrinsic motivation, i.e., commencing an activity because it is absorbing and gratifying in itself, as opposed to initiating an activity for external prods, pressures, or rewards (Deci and Ryan, 1985).

There is also substantial evidence from psychologists and sociologists that expected explicit rewards and punishments to perform a task sometimes may undermine a person's intrinsic motivation (e.g., Frey and Oberholzer-Gee, 1997; Deci, Koestner and Ryan, 1999). The crowding out effect has been used to explain the failure of incentive schemes in some principal-agent settings both theoretically (Bénabou and Tirole, 2003, Ellingsen and Johannesson, 2008) and empirically (Frey, 1997; Fehr and Gächter, 2001; Pokorny, 2008). Schulze and Frank (2003) show that the net effect of deterrence on overall corruption is *a priori* undetermined because deterrence increases the risk of being corrupt but

erodes individual's intrinsic motivation for honesty. My paper is similar to using crowding out effects but my focus is on image concerns or reputation concerns- I explicitly allow individuals to lose their desire to act pro-socially when their intentions are misattributed. Secondly, the presence of "greedy" agents in the pool, implies that higher monetary incentives crowd out intrinsic motivation. The negative externality imposed by extrinsically motivated agents in the pool causes crowding out in my model. This is similar to Tirole (1996) who argues that agents' incentives are not only determined by their own reputation, but also by that of the groups they belong to. However, Tirole (1996) does not investigate the crowding out of honest behaviour due to the overjustification effect.

In line with an emerging literature that extents the intrinsic motivation in standard market model to the analysis of incentive scheme in non-profit (Sheehan, 1996; Holmstrom and Milgrom, 1991) and public organizations (Wilson, 1989; Tirole, 1994; Dewatripont, 1999), this thesis investigates a setting where individuals applying for a job in public sectors are motivated by both monetary and non-monetary incentives. Daron, Acemoglu, and Mian (2003) provide a unified analysis of workers with career concerns in markets, firms and governments. Besley and Ghatak (2005) define agents serving in the mission-oriented organizations as motivated agents who pursue the mission for they obtain intrinsic benefits from actions and design a system of matching incentives that increase organizational efficiency by matching the mission preference of principals and agents.

This work is also closely related to the literature on the motivation of reputation. There are several psychologists arguing that individuals have a strong desire for social esteem and good reputation (Maslow, 1943). The problem of how social reputation concerns should be taken into consideration to analyze individual preference and consumption behavior has been extensively studied. Economists argue that individual's preference for social status leads to discrimination and luxury consumption (Becker, 1971; 1974). And status plays a significant role in the allocation of resources and the development of a society (Robson, 1992; Fershtman, Murphy, and Weiss, 1993). Becker, Murphy and Werning (2005) propose that as status is significant, agents would be willing to sacrifice time, effort and fortune for sufficiently high status.

Behavioral contract studies confirm that people's desire for self-images such as reputation and social esteem may explain prosocial behavior (Rabin, 1994; Benabou and Tirole, 2006; 2011). Society endows adherence and good deed with image rewards such as honor and many people care about the opinion others have of them. That is, adherence and good deeds with short-term cost give rise to better treatment by others and potential

bonus in the long run (See Katz and Shapiro, 1986; Banerjee and Besley, 1990; Batson, 1998; Freeman, 1997). Ellingsen and Johannesson (2008) suggest that providing monetary incentives and enhancing control systems corrode morale by impairing the agent's esteem for the principal, however, the principal who sets unconditionally high pay and signals a prosocial attitude could arouse prosocial agents to provide higher effort for providing them social esteem. Dal Bo and Tervio (2012) develop a theory of moral standards that mix desires for moral capital (good reputation), consumption value and self-esteem. They found that individuals' utility stems from the trade-off between receiving temptations that lead to consumption value and rejecting wrongdoing to build confidence and self-esteem.

Part 1

Chapter 1

Corruption, Intrinsic Motivation and the Love of Praise

Abstract: Do higher wages prevent corruption (bribe taking)? I investigate a setting where individuals who apply for public sector jobs are motivated not just by monetary incentives but also by intrinsic motivation and concern for the collective reputation of their profession. I show that an increase in monetary compensation may cause reputation concerned individuals to be more prone to participate in corruption due to an "overjustification" effect. The overall effect of monetary incentives on fighting corruption crucially depends on the composition of the pool of public sector workers for two reasons: first, different types of workers react differently to the same policy; second, the composition of the pool of workers affects individual behaviour through its effect on collective reputation. These results imply in particular that policies to fight corruption should focus more on increasing the collective reputation of the public sector rather than using monetary incentives which have perverse effects on some agents.

Keywords: Corruption, Collective Reputation, Intrinsic and Extrinsic Motivation.

JEL Classification Number: A13, D73, H10, Z13

1.1 Introduction

" Corresponding to the three types in the city, the soul also is tripartite, [...] I speak of this [the first] part of the soul, and justify my calling it the money-loving and gain-loving part? And [the second part] it is wholly set on predominance and victory and good repute [...] But surely it is obvious to everyone that all the endeavour of the [third] part by which I learn is ever towards knowledge of the truth of things, and that it least of the three is concerned for wealth and reputation [...] And that is why I say that the primary classes of men also are three, the philosopher or lover of wisdom, the lover of victory and the lover of gain."

—Plato in the Republic book 9, sections 580d-581c

Low wages are often cited as a cause of bureaucratic corruption (see Becker and Stigler, 1974; Chand and Moene, 1999; Amir and Burr, 2015) and the use of "efficiency" wages to fight bribery has been proposed as a solution (see Van Rijckeghem and Weder, 2001; Mahmood, 2005). However, evidence for the effect of monetary incentives as an anti-corruption measure is still quite mixed (see e.g., Treisman, 2000 and Swamy et al. 2001). A large body of field and experimental evidence indicates that monetary incentives and punishment may actually serve as "negative reinforcers" for the desired behaviour because they sometimes conflict with non-pecuniary motivation (see, e.g., Titmuss, 1970; Deci and Ryan, 1985).

As in Plato's description of the different motivations that drive the human soul (see quotation above), recent research has also been highlighting the different possible motivations that drive man-not just love of money, but also moral values, and the love of praise.[1] Policies that aim to affect agents' behaviour may have very different outcomes, depending on which types of agents this policy addresses (see Tirole, 1994; Mishra and Samuel, 2017).

In this chapter, I study how heterogeneity in individuals' motivations affects policies targeting corruption. Corruption is defined as bribe-taking behaviour while in public office. I assume that individuals not only have monetary incentives but also intrinsic motivation and reputation concerns to be honest. Simply put, reputation concerns stem from

[1] Mill (1909) first pointed out the limitation of the economic approach in focusing exclusively on material incentives without concerns for every other human passion or motive. Fehr and Falk (2002) introduced individuals' motivation to reciprocate, the desire for social approval and the intrinsic enjoyment to work on interesting tasks to shape agents' behaviour. Caselli and Morelli (2003) developed a model of the elective office rewarded by 'ego rents', i.e., social status and power.

the inference drawn by the general public about an individual's motivations for performing an action. When monetary incentives increase, this inference is negatively affected and may lead to a crowding out of intrinsic motivation that is driven by image concerns. Titmuss, 1970 and Bénabou and Tirole, 2006 discuss the case of blood donation- when the monetary rewards for donating blood increase, those individuals who care about the perception of intentions may stop donating blood. This is referred to as the "overjustification effect" (Lepper, Greene, and Nisbett, 1973): extrinsic incentives destroy the reputational value of good deeds.[2]

I build on Bénabou and Tirole (2006) in formalising the "overjustification effect" and provide a simple theoretical foundation of the crowding out effect on reputational concerns for honesty that monetary incentives may induce. In the psychological literature, Lepper, Greene and Nisbett (1973) e.g. observed that "when an individual observes another person engaging in some activity, he infers that the other is intrinsically motivated to engage in that activity to the extent that he does not perceive salient, unambiguous, and sufficient extrinsic contingencies to which to attribute the other's behaviour". In line with this idea, I model collective reputation as the expected level of intrinsic motivation of honest agents. Professional reputation is high when honest behaviour is driven by intrinsic motivations and not by extrinsic incentives, like the fear of losing a well-paid job. Agents care about public perception of their degree of *intrinsic motivation to be honest relative to their own internal moral standard*, rather than by perception of honesty itself. In the words of Adam Smith (1759) : "Nature, ... she taught him to feel pleasure in their favourable, and pain in their unfavourable regard. She rendered their approbation most flattering and most agreeable to him for its own sake, and their disapprobation most mortifying and most offensive." While it is hard to measure professional reputation defined in this way, public perception of the degree of intrinsic motivation for the job is plausibly positively correlated with occupational prestige: thus while firefighters figure high on occupational prestige, accountants, bankers, real estate agents have low prestige. I claim that this is at least partly because firefighters are paid less and thus it is more convincing that they are truly intrinsically motivated.[3]

[2]Rewards create doubt about the true motive for which prosocial behaviour is performed (Bénabou and Tirole, 2006).

[3]Further indirect evidence can be found in the survey made by Harris Interactive in 2014 looking at occupational prestige in the US the occupations with the highest prestige are: doctors (88% adults considering it to have either a great deal of prestige or prestige), military officers (78%), firefighters (76%), scientists (76%), and nurses (70%). At the other end of the spectrum, real estate broker/agent is the profession with the highest percentage of adults considering it to have less prestige (73%), jointly with stockbrokers, bankers (62%), and accountants (60%).

Our first main result is to show conditions under which higher salaries may have a perverse effect on total corruption, even when there are no selection issues. The intuition behind this result is as follows. On the one hand, as is typical in standard models of corruption, a wage increase lowers "greedy" (i.e. extrinsically motivated) agents' incentives to accept bribes, because it raises the opportunity cost of being corrupt. This raises the level of honesty in the profession. On the other hand, outsiders' perception of the level of intrinsic motivation to be honest in the profession is *negatively* affected when salaries increase, because outsiders no longer attribute honesty to intrinsic motivations but rather to the fear of losing a well-paid job. This reduction of the professional reputation implies that reputation concerned agents have lower incentives to be honest as the opportunity cost of being corrupt goes down. The overall effect, therefore, depends on the relative weights that monetary and non-monetary motivations have in the reputation-concerned officers' utility function, as well as on their internal moral standards.

Our second main result is about selection: Suppose there is a private sector which only offers wage incentives but does not have any mission orientation so that intrinsic motivation plays no role. I then analyse the selection effects of a negative shock on private sector salaries. I show conditions under which selection of extrinsically motivated officers in the public sector causes a crowding out of intrinsic motivation due to overjustification effects on reputation concerned agents. When the fraction of such agents is large enough, higher public sector wages may lead to higher corruption.

Overall, the paper highlights a mechanism which may explain why there is such conflicting evidence on the effect of higher wages to prevent bribe-taking in the public sector. It also suggests that rather than focusing on wages which can backfire, optimal policies to reduce corruption should take account of the competing motivations for public sector work and the importance of maintaining a high status in the public sector as opposed to private sector work. Even though each individual is motivated by monetary incentives, the net effect of non-monetary incentives is more straightforward than the use of monetary motivations.

This paper contributes to the related strands of literature on the signaling approach to social interactions. It is most closely related to Bénabou and Tirole (2006) (BT) in that agents value being perceived as having a high level of intrinsic motivation and gain negative reputation as being "greedy" or money-motivated and a higher incentive rate reduces the informativeness of actions about intrinsic motivation, while increasing it about monetary motivation. In other words, rewards create doubt about the true motive for prosocial behavior, and this "overjustification effect" can induce a crowding out of good behavior.

In line with BT, I define the reputation payoff as others' belief as to whether the action was taken due to pecuniary or intrinsic motivations (intention-based reputation payoffs). Building on BT, I assume that reputational benefit depends linearly on observers' posterior expectations of the agent's type and there is heterogeneity in individuals' level of reputation concerns which creates the "signal extraction" problem. However, my paper differs from BT in an important aspect. In my model, the individual payoff of prosocial behaviour does not depend on the public perception alone, but on the *difference* between the public perception and own intrinsic motivation as well. As discussed earlier, the model recognises that it is not a collective reputation for honest *behaviour* that matters but the motives that the public attributes to the behaviour. Moreover, it is the collective reputation relative to the individual's internal moral standard that matters.

Finally, Macchiavello's (2008) model assumes that workers are heterogeneous in terms of public sector motivation so that low public sector wage premia helps screen workers with intrinsic motivation, while a high wage helps motivate workers to be honest. In his model, private sector wages are endogenous and depend on the quality of governance in the public sector. His model yields a non monotonic relationship between wages and corruption: at low wages intrinsically motivated individuals are attracted to the public sector, as a result governance is good and private sector salaries are high- positive assortative matching takes place in equilibrium. If however, wages are too low then all agents are corrupt and private sector wages are also low. When wages increase in the public sector, it attracts some extrinsically motivated agents who cannot get high enough wages in the private sector, but will behave opportunistically in the public sector. At a basic level, the paper discusses how heterogeneous motivations imply that higher wages do not necessarily help to reduce corruption (increase the public sector motivation). However the mechanism he highlights is different from ours: In his model wages affect the level of corruption through an adverse selection problem, determining which type of agents are attracted into the public service. My main result shows that high wages can induce a crowding out effect on individual intrinsic motivation, that is wages affect not only which types of agents are attracted in the public sector but also how (motivated) agents behave.

Valasek (2016) follows Tirole's (1996) definition of collective reputation and shows that a non-monotonic wage path may be optimal to reform an institutional culture, attracting motivated agents. In Valasek's model, the level of collective reputation equals the fraction of honest agents, and therefore only depends on their behaviour and not on their motivation. Differently, in my model, collective reputation depends both on heterogeneity in agents' motives and behaviour.

The rest of the paper is organised as follows: Section 1.2 describes the model, Section 1.3 summarizes the main findings on how increasing salaries in the public sector affect total corruption. Section 1.4 adds the private sector to the model. Finally Section 1.5 concludes.

1.2 The Model

1.2.1 Basic setup

Below I use the words individuals, agents and officers interchangeably. There is a mass 1 of risk neutral individuals. I consider a standard model of corruption in which an officer, who receives a salary $w \geq 0$ for her job, decides whether or not to accept a bribe $B > 0$. If she accepts the bribe, then he is caught with a probability $q \in (0, \bar{q})$ with $\bar{q} < 1$.

There are three types of officers $t \in \{G, R, S\}$: For simplicity of notation I refer to the three types as "greedy" officers (G), in proportion β, "reputation-concerned" officers (R) , in proportion α and "saints" (S), in proportion γ, where $\beta + \gamma + \alpha = 1$. All types care about the salary they get. Greedy officers care *only* about monetary incentives. Saints are highly intrinsically motivated, such that even with zero wage they would not accept a bribe. Reputation-concerned officers have a positive level of intrinsic motivation and are also motivated by the desire for praise (reputation).

Let $v_t \geq 0$ denote type t officers' intrinsic valuation for being honest and $\theta_t \geq 0$ the weight on their concern for reputation. I assume $(v_G, \theta_G) = (0,0)$, $(v_S, \theta_S) = (v^S, 0)$, with $v^S \geq (1-q)B - qw \equiv \bar{v}$, which guarantees that saints never participate in corruption, and, finally, $(v_R, \theta_R) = (v^R, \theta^R)$ with $v^R \in (0, v^S)$ and $\theta^R > 0$. Officers' type is private information, while the proportion of each type in the population, as the levels of v, and θ for each type, are common knowledge.

The utility function of an honest officer of type t is

$$U_t^{honest} = w + v_t + \theta_t(qc(\delta) - v_t), \tag{1.1}$$

where the term $c(\delta)$ measures officer's collective reputation (more below) and depends on the behavior of each type because $\delta = (\delta_G, \delta_R, \delta_S)$ and δ_t with $t \in \{G, R, S\}$ is the fraction of honest officers of type t.

If a corrupt officer is charged, he gets zero utility; while if he is not, he gets

$$U_t^{corrupt} = (w + B + \theta_t qc(\delta)).$$

I define the collective reputation $c(\delta)$ as the expected level of an honest officer's intrinsic motivation:[4]

$$c(\delta) \equiv \frac{\delta_R \alpha v_R + \delta_S \gamma v_S + \delta_G \beta v_G}{\delta_G \beta + \delta_R \alpha + \delta_S \gamma}.$$

As in Lepper, Greene and Nisbett (1973) and Bénabou and Tirole (2006), collective reputation is high when officers' honest behaviour is driven by intrinsic motivations and not by extrinsic incentives, like the fear of losing a well-paid job. I assume that the reputational payoff of an individual is the difference between the collective reputation discounted by q and her own intrinsic motivation.[5] By assumption, this is different from zero only for reputation-concerned officers.

Whether a certain level of praise is a reputational loss or gain for an *R-type* officer depends on her own behaviour and the level of intrinsic motivation: an honest *R-type* officer considers any level of praise lower than her intrinsic motivation as a reputational loss, $qc < v^R$, while for a corrupt officer any positive level of praise is a reputational gain. Thus an *R-type* officer is motivated to be honest when the public rewards her for a higher level of honesty than her own intrinsic motivation to be honest (undeserved praise). On the other hand, the *R-type* officer gets disutility from being honest when the public credits her with a lower level of intrinsic motivation than her actual level and is therefore encouraged to be corrupt (undeserved shame).[6] When honour or shame is felt it is only with regard to an internal moral compass in our model. This is important because individuals with high moral values may be systematically attracted to some types of jobs. There can be both crowding in and crowding out of intrinsic motivation in my model- the initial level of intrinsic motivation of R types in the population is key. This implies that it is in precisely those jobs which attract highly motivated individuals and have high occupational prestige (firefighters, nurses, scientists), that increases in salary have a deleterious effect.

[4]Notice that, for any given equilibrium strategy profile, collective reputation is uniquely determined.

[5]When q is low (high), then the probability that an officer who is not caught is actually honest are low (high). Therefore, when the probability of detecting corruption is low in a country, the perceived collective reputation $qc(\delta)$ will be low.

[6]If $v^R = 0$, i.e., R-type officials don't have intrinsic motivation, the analysis would correspond to the case in which they only care about the collective reputation. I discuss this case in the conclusion.

1.2.2 Officers' behaviour

I want to analyse how a change in the salary offered to officers affect their propensity to accept a bribe, depending on their type. I restrict our analysis to symmetric equilibria, and therefore $\delta_t \in [0,1]$ will denote the probability that an officer of type t refuses the bribe. By assumption, $S-type$ officers never accept any bribe, and therefore in equilibrium $\delta_S = 1$. $G-type$ officers only care about monetary incentives and therefore their behaviour depends exclusively on the salary offered to them. A $G-type$ officer chooses to be honest if and only if

$$w \geq (1-q)(w+B), \tag{1.2}$$

defining a cutoff rule on the wage:

$$w \geq \frac{(1-q)}{q}B \equiv w_H^*. \tag{1.3}$$

Observe that as $q \to 0$, $w_H^* \to +\infty$, i.e, if the probability of being charged becomes negligible, the minimum salary necessary to keep a $G-type$ officer honest becomes arbitrarily large. The bribe is exchanged as long as the penalty, i.e., the probability of detection, is small enough (as shown in Basu et al., 2016). The following simple proposition directly follows from the above analysis.[7]

Proposition 1. *A $G-type$ officer is honest if and only if $w \geq w_H^*$.*

R-type officers' behaviour depends on their individual characteristics, the level of intrinsic motivation and their love of praise, as also on collective reputation. I need, then, to understand the relation between the salary paid to officers and their esteem in public eyes.

Consider first the case $w \geq w_H^*$, when, by Proposition 1, *G-type* officers are honest. The following proposition characterizes $R-type$ officers' behavior in equilibrium. This proposition contains one of my main results on the overjustification effect: there is non-empty set of parameter values in which *R-type* accepts a bribe ($\delta_R = 0$) even when material incentives are large enough to keep greedy officers honest. Let $v_H^1 \equiv \frac{q^2\gamma v^S}{1-q^2\alpha}$, $v_H^0 \equiv \frac{q^2\gamma v^S}{\beta+\gamma}$, $\theta_H^1 \equiv \frac{v^R+qw-(1-q)B}{v^R-q^2(\alpha v^R+\gamma v^S)}$ and $\theta_H^0 \equiv \frac{v^R+qw-(1-q)B}{v^R-\frac{q^2\gamma v^S}{\beta+\gamma}}$.

[7] The analysis could be extended to the case where $v^G > 0$. I prefer to keep the assumption that greedy officers are not intrinsically motivated to have a standard selfish type in my model. If $v^G > 0$ the main difference is that the threshold of the salary to keep greedy officers honest reduces, but my main results still hold.

Proposition 2. *Suppose* $w \geq w_H^*$. *If* $v^R \in (0, \frac{\gamma v^S}{1-\alpha})$,[8] *then*
(1) $\delta_R = 1$ *if* $\theta^R \in (0, \theta_H^1]$ *or* $v^R \in (0, v_H^1]$;
(2) $\delta_R = 0$ *if* $\theta^R \geq \theta_H^0$ *and* $v^R \in (v_H^0, \frac{\gamma v^S}{1-\alpha})$;
(3) $\delta_R = \delta_H^{mix}$, *where* $\delta_H^{mix} \in (0,1)$, *if* $v^R \in (v_H^1, v_H^0)$, *and* $\theta^R > \theta_H^1$, *or if* $v^R \in (v_H^0, \frac{\gamma v^S}{1-\alpha})$ *and* $\theta^R \in (\theta_H^1, \theta_H^0)$.
If $v^R \in [\frac{\gamma v^S}{1-\alpha}, v^S)$, *then*
(4) $\delta_R = 1$ *if* $\theta^R \in (0, \theta_H^0]$;
(5) $\delta_R = 0$ *if* $\theta^R \geq \theta_H^1$.

Proof: *see the Appendix.*

The intuitive explanation of these results is the following: high salaries crowd out *R-type* officers' individual intrinsic motivations, because an external observer cannot unambiguously attribute a high level of intrinsic motivation to honest behaviour. High salaries, therefore, negatively affect collective reputation. It follows that *R-type* officers refuse the bribe if either (i) they have a small love of praise, $\theta^R \leq \min\{\theta_H^0, \theta_H^1\}$ and therefore they do not care about collective reputation even when it represents a reputation loss for them, or (ii) they have a low level of intrinsic motivation, $v^R \leq v_H^1$, so that they are similar to greedy officers; in this case collective reputation is still higher than their intrinsic motivation due to the presence of *S-type* officers in the population. Therefore, there is a reputation gain in being honest- low intrinsic motivation agents benefit from undeserved praise.

On the other hand, if *R-type* officers have a high reputation concern, $\theta^R \geq \max\{\theta_H^0, \theta_H^1\}$ and are sufficiently intrinsically motivated: $v^R \in [v_H^0, v^S)$, they will accept the bribe because the fact that an external observer assigns a high probability that an honest officer is the greedy type, crowds out their intrinsic motivation, making it costly for them to be honest: this is the effect of undeserved shame and the over justification effect.

Figure 1 shows these results. When the salary is high, *G-type* officers choose to be honest, decreasing the level of collective reputation. An *R-type* officer with a high level of intrinsic motivation feels a reputation loss and then has an incentive to be corrupt. An *R-type* officer with a low level of intrinsic motivation feels a reputation gain and chooses to be honest no matter how much he cares about being praised. Image concerns make an

[8] If $R-type$ officers' level of intrinsic motivation is high $v^R \in [\frac{\gamma v^S}{1-\alpha}, v^S)$, the collective reputation when $R-type$ officers choose to be honest is higher than the collective reputation when they choose to be corrupt; on the contrary, if their level of intrinsic motivation is low $v^R \in (0, \frac{\gamma v^S}{1-\alpha})$, the collective reputation is lower when $R-type$ officers choose to be honest.

officer with a high level of intrinsic motivation (high internal moral standard) more prone to be corrupt than an officer with the low level of intrinsic motivation.

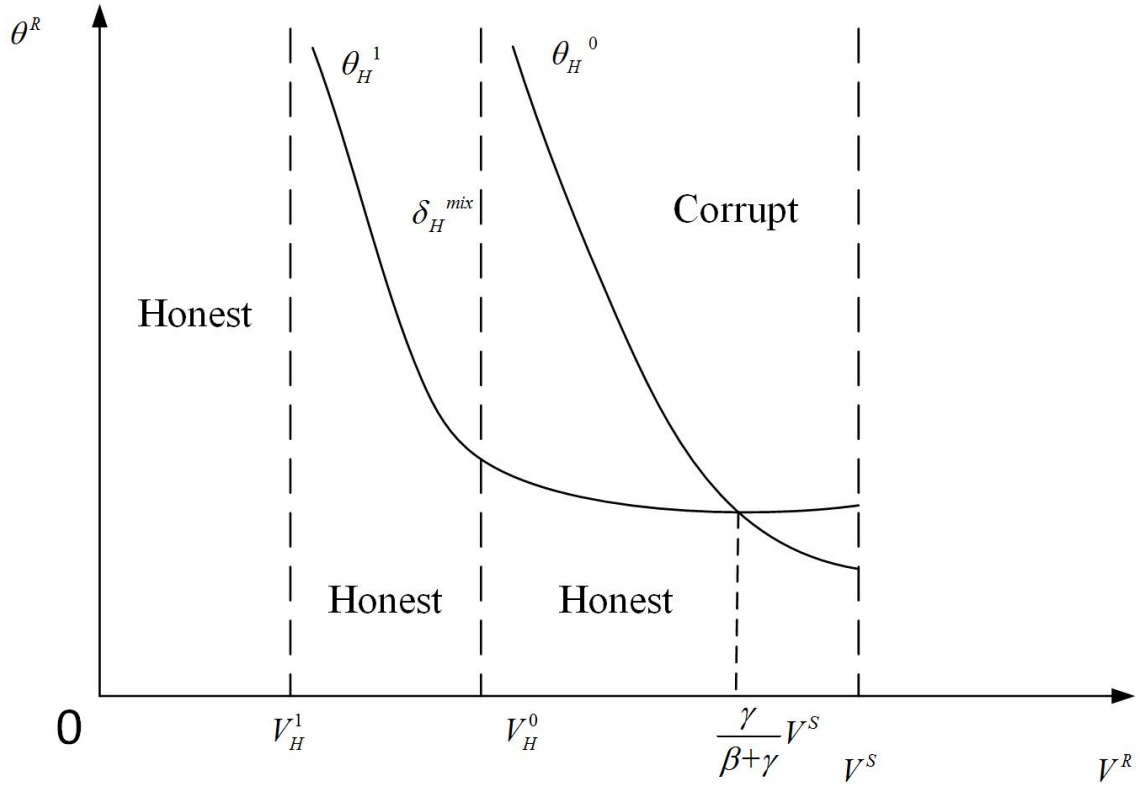

Figure 1.1: An illustration of $R-type$ officers' behavior when $G-type$ officers are honest $(w \geq w_H^*)$.

The next proposition shows that the effect of undeserved shame persists even when wages are lower so that greedy types are no longer honest. The first such case is when wages are still high enough to keep $R-type$ officers honest when they do not care about reputation at all ($w \geq w_L^* \equiv \frac{(1-q)B}{q} - \frac{v^R}{q}$,). As wages decrease, the negative externality from *G-types* dissappears. What determines $R-type$ officers' corrupt behavior is the effect of undeserved shame. The range of parameters over which the effect of undeserved shame and overjustification occurs is smaller than before as wages are lower. This can be seen in Figures 2 and 3. Let $v_M^0 \equiv q^2 v^S$, $v_M^1 \equiv \frac{q^2\gamma v^S}{1-q^2\alpha-\beta}$, $\theta_M^1 \equiv \frac{v^R+qw-(1-q)B}{v^R-\frac{q^2(\alpha v^R+\gamma v^S)}{\alpha+\gamma}}$, and $\theta_M^0 \equiv \frac{v^R+qw-(1-q)B}{v^R-q^2v^S}$.

Proposition 3. *Suppose* $w \in [w_L^*, w_H^*)$*; then*

(1) $\delta_R = 1$ *if* $\theta^R \in (0, \theta_M^1]$ *or* $v^R \in (0, v_M^1]$*;*

(2) $\delta_R = 0$ *if* $\theta^R \geq \theta_M^0$ *and* $v^R \in (v_M^0, v^S)$*;*

(3) $\delta_R = \delta_M^{mix}$*, where* $\delta_M^{mix} \in (0,1)$*, if* $v^R \in (v_M^1, v_M^0)$ *and* $\theta^R > \theta_M^1$ *or if* $v^R \in (v_M^0, v^S)$ *and* $\theta^R \in (\theta_M^1, \theta_M^0)$.

Proof: see Appendix.

Finally, when $w < w_L^*$, then *R-type* officers are honest only if they are less intrinsically motivated and have a strong love of praise: a large reputation gain is the only reward that can push them to be honest. When $R-type$ officers' intrinsic motivation is higher than collective reputation, honest officers would suffer from underserved shame and this effect crowds out their intrinsic motivation. The detailed description of the equilibrium in this range of parameters is contained in the following proposition. Let $\theta_L^1 \equiv \frac{(1-q)B-qw-v^R}{\frac{q^2(\alpha v^R+\gamma v^S)}{\alpha+\gamma}-v^R}$ and $\theta_L^0 \equiv \frac{(1-q)B-qw-v^R}{q^2v^S-v^R}$.

Proposition 4. *Suppose* $w \in (0, w_L^*)$*; then*

(1) $\delta_R = 1$ *if* $\theta^R \geq \theta_L^1$ *and* $v^R \in (0, v_M^1)$*;*

(2) $\delta_R = 0$ *if* $\theta^R \in (0, \theta_L^0]$ *or* $v^R \in [v_M^0, v^S)$*;*

(3) $\delta_R = \delta_L^{mix}$*, where* $\delta_L^{mix} \in (0,1)$*, if* $v^R \in (0, v_M^1)$ *and* $\theta^R \in (\theta_L^0, \theta_L^1)$*, or if* $v^R \in (v_M^1, v_M^0)$ *and* $\theta^R > \theta_L^0$.

Proof: see Appendix.

Overall, this section showed that when officers are motivated both intrinsically and by image/reputation concerns, then higher wages are not necessarily associated with higher probity in public life. If there is a large correlation between the level of intrinsic motivation and image concerns then the overjustification effect implies that even though greedy types are honest, many of the reputation concerned officers will not be as they suffer undeserved shame at being pooled with greedy types. The intuition behind this is that higher salaries lower the signal precision about intrinsic motivation (as in BT). Unlike BT, this effect persists even at lower salaries albeit the range of parameters for which it occurs is smaller. Unlike BT, jobs which attract individuals with low intrinsic motivation do not suffer the over-justification effect, because they benefit from undeserved praise from being pooled with saints. When wages are low, such individuals will be more motivated to work than those who are highly intrinsically motivated. Higher salaries help to make greedy types honest but have ambiguous effects on others depending on the level of intrinsic motivation and reputation concerns. The main driving force in my model is that image concerns are always relative to a personal moral standard: the overjustification effect arises from being misunderstood in the public perception of one's intentions-sometimes it has a positive effect and sometimes a negative one.

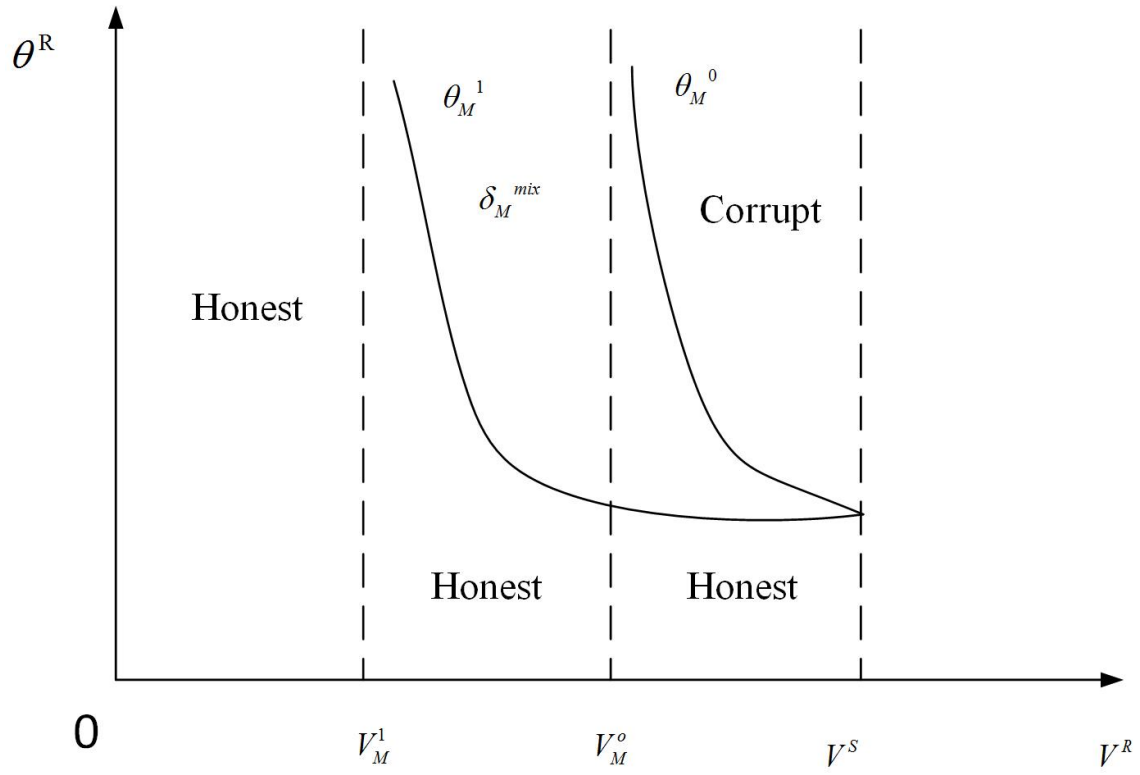

Figure 1.2: An illustration of $R-type$ officers' behavior when $G-type$ officers are dishonest and $w \in [w_L^*, w_H^*)$.

1.3 The impact of increasing officers' salary on the level of corruption

So far I have described how equilibrium varies at different intervals of salary. I am interested in the overall effect of increasing officers' salary on the level of corruption but this is not easily predicted. While *G-type* officers' propensity to accept a bribe unambiguously decreases when the salary increases, the way that *R-type* officers react to a salary increase depends on the levels of their intrinsic motivation and the love of praise. Thus, whether officers will be more or less prone to accept a bribe after a pay rise depends on their type, and the overall impact will depend on the proportion of each type among officers' population. The following two propositions illustrate the different effects that increasing salary may have on the level of corruption, measured as the fraction of officers who accept a bribe. Increasing salaries weakly reduces *G-type* officers' propensity of being corrupt. Therefore, anytime a pay rise lowers *R-type* officers' propensity to corruption, it reduces the level of corruption. This happens when *R-type* officers have

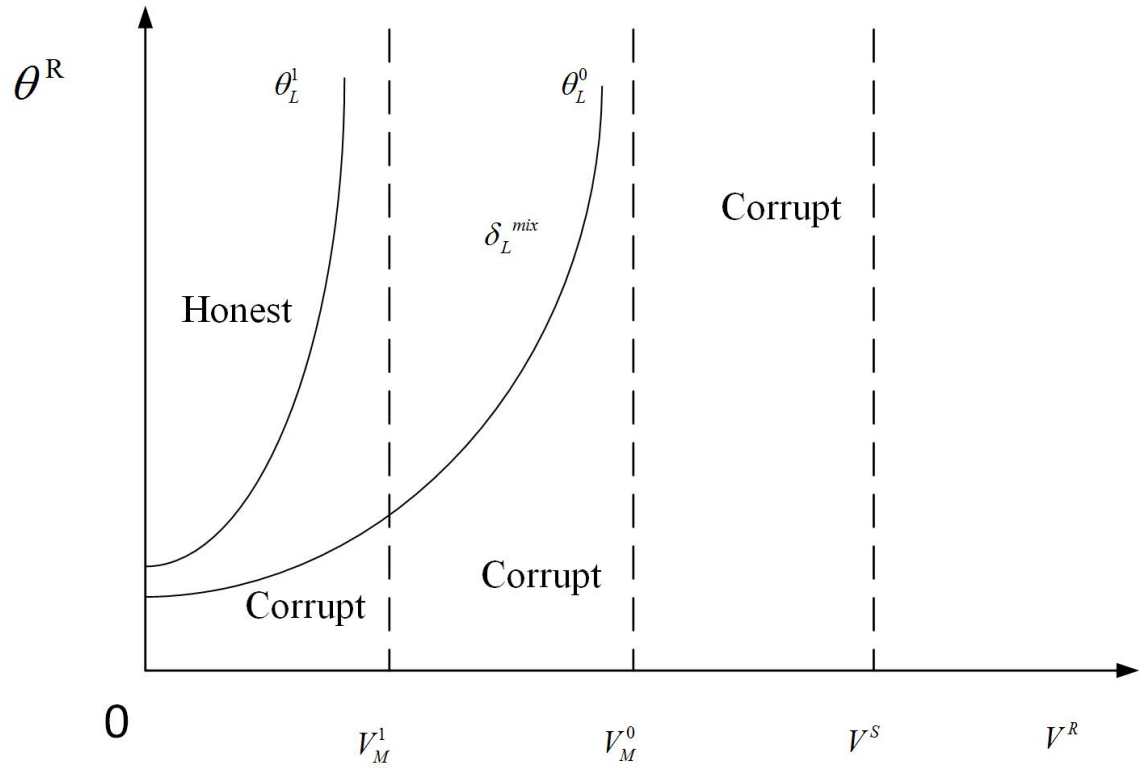

Figure 1.3: An illustration of $R-type$ officers' behavior when $G-type$ officers are dishonest and $w \in (0, w_L^*)$.

sufficiently low moral standards or sufficiently low weight on reputation concerns.

Proposition 5. *Suppose that either*

(i) $v^R \in (0, v_H^1]$ *and* $\theta^R < \theta_L^1$*; or*

(ii) $v^R \in (\max\left\{v_M^0, \frac{\gamma v^s}{1-\alpha}\right\}, v^S)$ *and* $\theta^R < \min\left\{\theta_M^0, \theta_H^0\right\}$*. If the salary increases from any* $w \leq w_L^*$ *to any* $w \geq w_L^*$,[9] *then the level of corruption decreases.*

Proof: see Appendix.

In case (i) *R-type* officers have a low level of intrinsic motivation as well as low reputation concerns. A pay rise from $w \in (0, w_L^*)$ to $w \in [w_L^*, w_H^*)$ does not affect *G-type* officers' behaviour because they are corrupt when the salary is below the threshold w_H^*. However, the rising salary modifies the behaviour of *R-type* officers who, after the pay rise, stop accepting bribes, as described in Proposition 3. When *R-type* officers have a low level of intrinsic motivation, an increase in salary works in the same direction as an increase in reputation. This is because *R-type* officers with low moral standards are motivated by a reputational gain (undeserved praise). A further pay rise turns the *G-type* officers honest and therefore reduces the propensity of being corrupt of every officer to zero. In case (ii), *R-type* officers are sufficiently intrinsically motivated and care very little about reputation. Not surprisingly, given our previous discussion, this is the case in which the crowding out effect of a pay rise is very limited and therefore the direct positive effect of a pay rise prevails.

Next, I present my main result showing how an increase in salary that makes greedy agents honest may lead to higher corruption among the *R-types*, because it crowds out their motivation by reducing the collective reputation of their profession and thereby reducing the precision of the signal.

The following proposition highlights the trade-off that a policy to fight corruption may have to confront: a pay rise may reduce *G-type* officers' propensity to be corrupt, while increasing *R-type* officers' propensity of being corrupt because it crowds out their motivation by reducing the collective reputation of their profession.

Proposition 6. *Suppose that either*

(i) $v^R \in [v_H^1, v_M^1]$, $\theta^R > \theta_H^1$, *and* $\alpha > \frac{\beta}{1-\delta_H^{mix}}$*; or*

(ii) $v^R \in [v_H^0, \min\{v_M^0, \frac{\gamma v^S}{1-\alpha}\}]$, $\theta^R > \max\{\theta_M^1, \theta_H^0\}$, *and* $\alpha > \frac{\beta}{\delta_M^{mix}}$.

[9] I focus on comparison of two public salary intervals but not on incremental increases in salary levels because most policies of salary increases to fight corruption are not marginal increases. Empirical research (e.g., Rijckeghem and Weder, 2001; Foltz and Opoku-Agyemang, 2015) also focuses on the effectiveness of considerable increases in salary to reduce corruption rather than incremental increases.

In both cases, if the salary increases from the interval $w \in [w_L^*, w_H^*)$ to $w \geq w_H^*$, the level of corruption increases.

Proof: see Appendix.

In case (i) above, an increase in salary that reduces officers' collective reputation turns $R-type$ officers, who have an intermediate level of intrinsic motivation and strong reputational concerns, from being corrupt with probability zero to being corrupt with positive probability δ_H^{mix}. In case (ii), an increase in salary that reduces officers' collective reputation turns *R-type* officers from being honest with positive probability, δ_M^{mix} to being honest with probability zero. In both cases, a pay rise increases *R-type* officers' propensity of being corrupt. If there are sufficiently many agents of this type, even if a pay-rise reduces *G-type* officers' propensity of being corrupt, the overall effect of a pay rise is counter-productive, and the level of corruption increases.

The above propositions highlight how difficult is to predict the effect of a pay rise on the level of corruption. Still, my analysis offers some guidelines to policymakers, about the cases when a salary increase may have a paradoxical effect on the level of corruption.

Remark 1. *The higher is the fraction of officers who are highly reputation-concerned and have high moral standards, the more likely a pay rise may have the perverse effect of increasing corruption among officers.*

1.4 The choice of working in the public sector: Selection

Until now I have assumed that all types of agents work in the public sector. I now focus on selection into the public sector as a function of relative salary. My goal in this section is to show that selection issues may be an additional reason which causes crowding out of motivation of *R-types*. When the salary in the public sector increases relative to the private sector, it will attract greedy types who will be corrupt unless the public sector salary is high enough. This lowers the reputation payoff for *R-types* who are highly intrinsically motivated and the overjustification effect kicks in. I see that starting from a low wage, low corruption scenario when the public sector wage relative to the private sector wage goes up then corruption increases due to selection effects. Policies to prevent this from happening are either to increase salaries in the public sector until greedy types are no longer corrupt, however, this will cause *R-types* to become corrupt and this policy will cause a big burden on the public exchequer. Alternatively, salaries can be reduced such that greedy types do not enter the public sector so that both criteria can be fulfilled

at the same time. I show that this conclusion depends crucially on the composition of *R-types* in the pool- if they do not care about reputation or have low intrinsic motivation then an increase in salary may be the optimal policy to reduce corruption. Either way, even if corruption reduces due to an increase in salary, it may crowd out the intrinsic motivation of the *R-types*. I show this in the cases below with some simplifying assumptions.

There are two sectors in the economy. A public sector job provides intrinsic motivation, as before but a job in the private sector does not provide any intrinsic motivation[10]. Thus, the only motivation to work in the private sector is the monetary compensation. Each worker decides whether to work in the public sector, of size $z < 1$, or in the private sector of size $1-z$. I consider a large stationary economy ($-\infty < T < +\infty$) in which at each time T the public sector re-recruits z officers. If there are more applicants to the public sector, candidates are randomly selected and those who are not selected end up working in the private sector.

I assume that the large majority of agents are greedy so β tends to one, $\gamma < z$, that is the number of incorruptible agents (saints) is not enough for the needs of the public sector, but $\alpha + \gamma > z$, which implies that the number of reputation-concerned agents and saints is larger than the size of the public sector. In the private sector, firms pay an exogenous competitive salary w^P. The salary in the public sector is chosen in order to minimise (i) the cost of hiring z officers (ii) the amount of corruption. A benevolent planner chooses the optimal policy that meets these two criteria, according to a social welfare function. Let w^G denote the salary paid in the public sector (government).

This simple model allows an analysis of the agents' choice of which sector they want to be employed in, to design the optimal wage offered in the public sector. Furthermore, it makes simple predictions of the effects that a negative shock on the private sector will have on the level of corruption in the public sector. I first consider an ideal situation in which a planner manages to attract only motivated agents in the public sector and takes advantage of this matching to have low salaries and no corruption.

A greedy agent who works in the public sector behaves honestly only if $w^G \geq \frac{(1-q)}{q}B$. Let w^H be the minimum salary that keeps reputation-concerned officers honest when saints and reputation-concerned officers apply to the public sector and greedy agents do not apply to the public sector:

$$w^H + v^R + \theta^R \left[\frac{q(\gamma v^S + \alpha v^R)}{\alpha + \gamma} - v^R \right] = (1-q) \left[w^H + B + \frac{q\theta^R(\gamma v^S + \alpha v^R)}{\alpha + \gamma} \right]. \qquad (1.4)$$

[10] See i.e., Wilson (1989), Tirole (1994), Sheehan (1996) and Besley and Ghatak (2005).

Rearranging (1.4), I get

$$w^H = \frac{(1-q)}{q}B - \frac{q\theta^R(\gamma v^S + \alpha v^R)}{\alpha+\gamma} - \frac{v^R(1-\theta^R)}{q}. \tag{1.5}$$

The salary w^H is lower than the salary that is needed to keep a greedy officer honest ($w^H \leq \frac{(1-q)}{q}B$). If (i) $v^R \leq \frac{q^2\gamma v^S}{\alpha+\gamma-q^2\alpha} \equiv v^{CR}$;[11] or (ii) $v^R > v^{CR}$ and $\theta^R \leq \frac{v^R}{v^R - \frac{q^2(\gamma v^S+\alpha v^R)}{\gamma+\alpha}} \equiv \theta^{CR}$ then R-type officers are honest. In the first case, reputation-concerned officers have a low level of intrinsic motivation and they get a reputation gain from the collective reputation of the public sector. In the second case, they are motivated by a high level of intrinsic motivation and do not have a strong love of praise. In the case that only saints and reputation-concerned officers work in the public sector, these officers have an additional motive to behave honestly rather than only being motivated by monetary incentives, which allows a planner to offer low salaries. Let

$$w_1^P \equiv \frac{(1-q)}{q}B - \frac{v^R(1-q)(1-\theta^R)}{q}$$

and

$$w_0^P \equiv w_1^P - \frac{q\theta^R(1-q)(\gamma v^S + \alpha v^R)}{\alpha+\gamma}$$

Proposition 7. *If $w_0^P \leq w^P \leq w_1^P$, $v^S \geq \max\{\bar{v}^{HS}, \hat{v}^S(w^p)\}$ and either of the following conditions holds: (i) $v^R \leq v^{CR}$, or; (ii) $v^R > v^{CR}$ and $\theta^R \leq \theta^{CR}$, the optimal compensation policy to minimise corruption in the public sector is to offer a salary equal to w^H identified by (1.5). In equilibrium all greedy workers work in the private sector and motivated workers work in the public sector. The level of corruption is zero.*

Proof: *see the Appendix.*

Consider now the consequences of an economic shock that produces a fall in the competitive salary offered in the private sector. Namely, suppose that the salary in the private sector reduces to $\tilde{w}^p < (1-q)(w^H + B)$: now working in the public sector is attractive for greedy officers.

If the salary in the public sector does not change, then corruption arises directly because greedy agents apply for a job in the public sector and choose to be corrupt. The fraction of corrupt officers is equal to β, which by assumption tends to one. Since corruption is widespread, a benevolent planner has two policies to fight corruption. The first

[11] This threshold is the same as $\underline{v}_{H^-}^R$ identified by (41) in Appendix to prove Proposition 3.

policy aims to increase the salary in the public sector to raise the opportunity costs of corruption for greedy officers. The minimum salary that induces greedy officers to be honest is $w^G = \frac{1-q}{q}B$. In this case, the collective reputation of a job in the public sector tends to zero because citizens assign probability near to one that an honest officer is a greedy type. A reputation-concerned officer prefers to accept a bribe if

$$\frac{(1-q)}{q}B + v^R(1-\theta^R) \leq (1-q)[\frac{(1-q)}{q}B + B]$$

which clearly holds if and only if $\theta^R \geq 1$.[12]

In this case, the overall level of corruption tends to zero (because by assumption β tends to one), but reputation-concerned officers' motivations are crowded out.

Lemma 8. *Suppose that $\theta^R \geq 1$ and (i) the salary in the public sector is equal to $w^G = \frac{1-q}{q}B$ and (ii) the salary in the private sector is $w^P \leq \frac{(1-q)}{q}B + v^R(1-q\theta^R)$. Hence, all types of agents apply to the public sector. Greedy officers and saints behave honestly, while reputation-concerned officers are corrupt.*

A policy that implies an increase in the remuneration of public officers during a recession may be hard to implement. An alternative policy is to reduce the salary in the public sector in order to discourage greedy agents to apply to the public sector. Let $\tilde{w}^p$ denote the salary paid in the private sector satisfying condition (ii) in Lemma 8. If the planner decides to lower the salary in the public sector, then reputation-concerned officers will be corrupt and the level of corruption will be $\frac{\alpha}{\alpha+\gamma}$. This discussion can be summarised by the following remark.

Remark 2. *Economic recession attracts non-motivated agents into the public sector. A benevolent planner can either react by increasing salaries in the public sector that incentivise non-motivated agents to be honest. If most of the agents are greedy, the planner restores a negligible level of corruption, even if motivations for reputation-concerned agents are crowded out. Alternatively, the planner can lower the salary in the public sector, to discourage greedy agents to apply, but it induces a positive level of corruption among reputation-concerned officers.*

A shock on the private sector has a similar effect as a pay rise in the public sector because it makes it more attractive to work in the public sector for greedy officers. For

[12]Note that $\theta^{CR} > 1$. Therefore, this condition $\theta^R \geq 1$ is compatible with the condition previously imposed that $\theta^R \leq \theta^{CR}$.

simplicity, I start from a situation in which only motivated agents work in the public sector and the (technical) assumptions in Proposition 7 guarantee that this is the case. If it is possible to only attract motivated workers, the optimal salary is the minimum that keeps motivated (reputation-concerned) officers honest. There is a shock which causes the salary in the private sector to drop and therefore greedy officers are attracted by the public sector. Policies that the planner may implement to fight corruption can make motivated officers dishonest.

This simple extension of my model with two sectors shows, as pointed out in the previous section, that there may exist situations in which greedy officers are honest while reputation-concerned officers are corrupt. More importantly, it points out that the remuneration policy in the public sector is not only relevant to design incentives to fight corruption, but also to determine the composition of the workforce. Corruption is not only a problem of moral hazard but also of adverse selection, and this latter consideration has not received the same attention than the former one.

1.5 Conclusion

Why does corruption take place in the public sector? I introduce a model based on the key premise that public officers' behaviour is driven by a mix of motivations: monetary incentives, intrinsic value for honesty and the love of praise. This mix varies across individuals, and importantly, the distributions of types among the population affects individual behaviour through its effect on collective reputation. A pay rise that lowers greedy officers' propensity to be corrupt may have an opposite effect on reputation-concerned officers, because it crowds out officers' collective reputation by questioning their true motive to be honest.

It is important to point out that it is the presence of image concerns about *intentions* and the internal moral standards that are important for the result- in an alternative interpretation, suppose prestige is defined differently and is higher when fewer officers are caught being corrupt.[13] Then, there is no trade off- higher salaries imply lower corruption for everyone absent any selection issues. Assume now that prestige is defined as the collective reputation about the level of intrinsic motivation to be honest, but that all R types are positively affected by reputation regardless of initial levels of intrinsic motivation (the analysis would correspond to the case in which $v^R = 0$)- higher salaries will still lead to

[13]This definition of course has some problems about conflating lower enforcement with lower perceived corruption, but let us ignore that for the argument.

crowding out as collective reputation goes down due to pooling with G types, however, salary increases always reduce corruption.

I summarise the main message of this paper in the following way: policies that aim to undermine the benefits of corruption have to be coupled with those that make working for the public good more prestigious, as Paul Collier lucidly states in a recent policy paper (2016): *"Until well into the 19th century, the British public sector was very corrupt. [...]. By the late 19th century, the British Civil Service had become honest and competent. This transformation was largely fortuitous rather than the result of a properly thought-through strategy. But its success reveals the key components of how change can be brought about. [....]In Britain, two key things – closing off the major opportunities for corruption and making working for the public good more prestigious and satisfying than abusing office for private gain – happened together. These two approaches are jointly critical in breaking cultures of corruption."*

1.6 Appendix

Proof of Proposition 2:

By assumption greedy officers behave honestly because $w \geq w_H^*$. Suppose $R-type$ officers also refuse to accept a bribe. In this case, the level of collective reputation is equal to

$$\frac{\alpha v^R + \gamma v^S}{\alpha + \beta + \gamma} = \alpha v^R + \gamma v^S \equiv c_H^1 \tag{1.6}$$

This is a Nash equilibrium if to refuse a bribe is $R-type$ officers' best response when collective reputation is equal to c_H^1; hence the following inequality must hold:

$$w + v^R + \theta^R(qc_H^1 - v^R) \geq (1-q)(w + B + q\theta^R c_H^1) \tag{1.7}$$

Substituting (1.6) into (1.7), leads to the following expression

$$\theta^R[q^2(\alpha v^R + \gamma v^S) - v^R] \geq (1-q)B - qw - v^R. \tag{1.8}$$

Since by hypothesis $w \geq w_H^*$, from (1.3), I get

$$(1-q)B - qw - v^R < 0. \tag{1.9}$$

The right side of equation (1.8) is negative and, since $\theta^R > 0$ by assumption, it follows

that (1.7) is valid whenever

$$q^2(\alpha v^R + \gamma v^S) - v^R \geq 0, \tag{1.10}$$

Condition (1.10) defines a cutoff v_H^1,

$$0 < v^R \leq \frac{q^2 \gamma v^S}{1 - q^2 \alpha} \equiv v_H^1, \tag{1.11}$$

such that for any level of intrinsic motivation $v^R \in (0, v_H^1]$, an $R-type$ officer chooses to be honest with probability one no matter how much he cares about being praised. If $v \in (v_H^1, v^S)$, I get

$$q^2(\alpha v^R + \gamma v^S) - v^R < 0, \tag{1.12}$$

then an $R-type$ officer chooses to be honest if and only if $\theta^R \in (0, \theta_H^1]$, where

$$\theta_H^1 \equiv \frac{-(1-q)B + qw + v^R}{v^R - q^2(\alpha v^R + \gamma v^S)}. \tag{1.13}$$

An $R-type$ public officer whose intrinsic motivation is $v^R \in (v_H^1, v^S)$ chooses to be honest with probability one if and only if $\theta^R \in (0, \theta_H^1]$.

When $w \geq w_H^*$, an $R-type$ officer chooses to be corrupt if and only if

$$w + v^R + \theta^R(qc_H^0 - v^R) \leq (1-q)(w + B + q\theta^R c_H^0) \tag{1.14}$$

where $c_H^0 \equiv \frac{\gamma v^S}{\beta+\gamma}$ is collective reputation when saints and greedy officers are honest; substituting c_H^0 into (1.14), leads to the following expression

$$\theta^R \left(\frac{q^2 \gamma v^S}{\beta + \gamma} - v^R \right) \leq (1-q)B - qw - v^R, \tag{1.15}$$

from (1.9) and given that $\theta^R > 0$, (1.15) is satisfied when

$$\frac{q^2 \gamma v^S}{\beta + \gamma} - v^R < 0. \tag{1.16}$$

I obtain a cutoff value

$$v^R > \frac{q^2 \gamma v^S}{\beta + \gamma} \equiv v_H^0 \tag{1.17}$$

Therefore, if $v^R \in (v_H^0, v^S)$, an $R-type$ officer chooses to be corrupt if and only if $\theta^R \in$

$[\theta_H^0, +\infty)$, where

$$\theta_H^0 \equiv \frac{-(1-q)B + qw + v^R}{v^R - \frac{q^2\gamma v^S}{\beta+\gamma}}. \tag{1.18}$$

When $w \geq w_H^*$, an $R-type$ officer whose intrinsic motivation $v^R \in (0, \frac{\gamma v^S}{1-\alpha})$ is indifferent between being honest and corrupt if and only if there is a $\delta_H^{mix} \in (0,1)$ such that

$$w + v^R + \theta^R(qc_H^{mix} - v^R) = (1-q)(w + B + q\theta^R c_H^{mix}), \tag{1.19}$$

where

$$c_H^{mix} \equiv \frac{\delta_H^{mix}\alpha v^R + \gamma v^S}{\delta_H^{mix}\alpha + \beta + \gamma}. \tag{1.20}$$

Substituting (1.20) into (1.19), I obtain

$$\delta_H^{mix} = \frac{(\beta+\gamma)[(1-q)B - qw - (1-\theta^R)v^R] - q^2\theta^R\gamma v^S}{\alpha\{q^2\theta^R v^R - [(1-q)B - qw - (1-\theta^R)v^R]\}}. \tag{1.21}$$

For any $v^R \in (v_H^0, \frac{\gamma v^S}{1-\alpha})$, if

$$(1-q)B - qw - (1-\theta^R)v^R < q^2\theta^R v^R, \tag{1.22}$$

then

$$\begin{aligned}(\beta+\gamma)[(1-q)B - qw - (1-\theta^R)v^R] - q^2\theta^R\gamma v^S < \\ (\beta+\gamma)q^2\theta^R v^R - q^2\theta^R\gamma v^S.\end{aligned} \tag{1.23}$$

By the assumption $0 < v^R < \frac{\gamma v^S}{\beta+\gamma}$, I obtain

$$\theta^R q^2[(\beta+\gamma)v^R - \gamma v^S] < 0, \tag{1.24}$$

and by (1.22) and (1.23), $\delta_H^{mix} < 0$, which implies that the solution to (19) does not belong to $(0,1)$. $\delta_H^{mix} > 0$ holding requires

$$q^2\theta^R v^R - [(1-q)B - qw - (1-\theta^R)v^R] < 0, \tag{1.25}$$

which implies

$$\theta^R > \frac{v^R + qw - (1-q)B}{v^R(1-q^2)} \equiv \hat{\theta}_H. \tag{1.26}$$

For all $\theta^R > \hat{\theta}_H$, $\delta_H^{mix} > 0$ if and only if

$$(\beta+\gamma)[(1-q)B-qw-(1-\theta^R)v^R]-q^2\theta^R\gamma v^S<0. \tag{1.27}$$

If $v^R \in (v_H^1, v_H^0)$, I get $v^R - \frac{q^2\gamma v^S}{\beta+\gamma} < 0$, and (1.27) holds for all $\theta^R > \hat{\theta}_H$.

For all $\theta^R > \hat{\theta}_H$, suppose $v^R \in (v_H^1, \frac{\gamma v^S}{1-\alpha})$, by (1.25), $\delta_{H^+}^* < 1$ if and only if

$$(\beta+\gamma)[(1-q)B-qw-(1-\theta^R)v^R]-q^2\theta^R\gamma v^S>\alpha\{q^2\theta^R v^R-[(1-q)B-qw-(1-\theta^R)v^R]\}, \tag{1.28}$$

which equals to

$$\theta^R[q^2(\alpha v^R+\gamma v^S)-v^R]<(1-q)B-qw-(1-\theta^R)v^R<0. \tag{1.29}$$

(1.29) defines a cutoff value

$$\theta^R > \frac{-(1-q)B+qw+v^R}{v^R-q^2(\alpha v^R+\gamma v^S)} \equiv \theta_H^1 > \hat{\theta}_H. \tag{1.30}$$

Therefore, if $v^R \in (v_H^1, v_H^0)$, there exists a $\delta_H^{mix} \in (0,1)$ if and only if $\theta^R > \theta_H^1$.

Suppose $v^R \in [v_H^0, \frac{\gamma v^S}{1-\alpha})$, we get $v^R - \frac{q^2\gamma v^S}{\beta+\gamma} > 0$, (1.27) defines a cutoff value

$$\theta^R < \frac{-(1-q)B+qw+v^R}{v^R-\frac{q^2\gamma v^S}{\beta+\gamma}} \equiv \theta_H^0. \tag{1.31}$$

Suppose $\theta^R > \hat{\theta}_H$ and $v^R \in (v_H^0, \frac{\gamma v^S}{1-\alpha}]$, (1.29) holds if and only if

$$(\beta+\gamma)[(1-q)B-qw-(1-\theta^R)v^R]-q^2\theta^R\gamma v^S>\alpha\{q^2\theta^R v^R-[(1-q)B-qw-(1-\theta^R)v^R]\}, \tag{1.32}$$

which defines a cutoff value

$$\theta^R > \frac{-(1-q)B+qw+v^R}{v^R-q^2(\alpha v^R+\gamma v^S)} \equiv \theta_H^1 > \hat{\theta}_H. \tag{1.33}$$

To conclude, if $v^R \in (v_H^0, \frac{\gamma v^S}{1-\alpha})$, an $R-type$ officer chooses to be honest with probability $\delta_H^{mix} \in (0,1)$ if and only if $\theta^R \in (\theta_H^1, \theta_H^0)$.

Furthermore, I analyze the case in which $v^R \in [\frac{\gamma v^S}{1-\alpha}, v^S)$. Suppose $v^R \in [\frac{\gamma v^S}{1-\alpha}, v^S)$, I have $c_H^1 \geq c_H^0$. Then, I get $0 < \theta_H^0 \leq \theta_H^1$. The above analysis implies that in this case, an

$R-type$ officer chooses to be honest if and only if

$$0 < \theta^R \leq \theta_H^0, \tag{1.34}$$

and chooses to be dishonest if and only if

$$\theta^R \geq \theta_H^1. \tag{1.35}$$

When $\theta^R \in (\theta_H^0, \theta_H^1)$, there is no equilibrium. □

Proof of Proposition 3:

Define $w_L^* \equiv \frac{(1-q)B}{q} - \frac{v^R}{q}$; when $w \in [w_L^*, w_H^*)$, an $R-type$ officer chooses to be honest ($\delta_R = 1$) if and only if

$$w + v^R + \theta^R(qc_M^1 - v^R) \geq (1-q)(w + B + q\theta^R c_M^1), \tag{1.36}$$

where

$$c_M^1 = \frac{\alpha v^R + \gamma v^S}{\alpha + \gamma}, \tag{1.37}$$

is the level of collective reuptation when $S-type$ and $R-type$ are honest, while $G-type$ are corrupt. Substituting (1.37) into (1.36), leads to the following expression

$$\theta^R[\frac{q^2(\alpha v^R + \gamma v^S)}{\alpha + \gamma} - v^R] \geq (1-q)B - qw - v^R. \tag{1.38}$$

Since by hypothesis $w \geq w_L^*$, from the definition of w_L^*, I get

$$(1-q)B - qw - v^R \leq 0. \tag{1.39}$$

The right side of equation (1.38) is non-positive and, since $\theta^R > 0$ by assumption, it follows that (1.36) is valid whenever

$$\frac{q^2(\alpha v^R + \gamma v^S)}{\alpha + \gamma} - v^R \geq 0, \tag{1.40}$$

Condition (1.40) defines a cutoff v_M^1,

$$0 < v^R \leq \frac{q^2 \gamma v^S}{1 - q^2\alpha - \beta} \equiv v_M^1, \tag{1.41}$$

such that for any level of intrinsic motivation $v^R \in (0, v_M^1]$, an $R-type$ officer chooses to be honest with probability one no matter how much he cares about being praised.

If $v^R \in (v_M^1, v^S]$, I get

$$\frac{q^2(\alpha v^R + \gamma v^S)}{\alpha+\gamma} - v^R < 0, \tag{1.42}$$

then an $R-type$ officer chooses to be honest if and only if $\theta^R \in (0, \theta_M^1]$, where

$$\theta_M^1 \equiv \frac{-(1-q)B + qw + v^R}{v^R - \frac{q^2(\alpha v^R + \gamma v^S)}{\alpha+\gamma}}. \tag{1.43}$$

An $R-type$ officer whose intrinsic motivation is $v^R \in (v_M^1, v^S)$ chooses to be honest if and only if $\theta^R \in (0, \theta_M^1]$.

When $w \in [w_L^*, w_H^*)$, an $R-type$ chooses to be dishonest ($\delta_R = 0$) if and only if

$$w + v^R + \theta^R(qc_M^0 - v^R) \leq (1-q)(w + B + q\theta^R c_M^0), \tag{1.44}$$

where

$$c_M^0 = v^S, \tag{1.45}$$

is collective reputation when only saints are honest; substituting (1.45) into (1.44), leads to the following expression which leads to

$$\theta^R(q^2 v^S - v^R) \leq (1-q)B - qw - v^R, \tag{1.46}$$

from (1.39) and given that $\theta^R > 0$, (1.46) is satisfied when

$$v^R \geq q^2 v^S \equiv v_M^0. \tag{1.47}$$

Therefore, if $v^R \in (v_M^0, v^S)$, an $R-type$ officer chooses to be corrupt if and only if $\theta^R \in [\theta_M^0, +\infty)$, where

$$\theta_M^0 \equiv \frac{-(1-q)B + qw + v^R}{v^R - q^2 v^S}. \tag{1.48}$$

Therefore, an $R-type$ officer whose intrinsic motivation $v^R \in (v_M^0, v^S)$ chooses to be dishonest if and only if $\theta^R \in [\theta_M^0 + \infty)$ where $\theta_M^0 > \theta_M^1 > 0$.

When $w \in [w_L^*, w_H^*)$, an $R-type$ public officer is indifferent between honest and

dishonest if and only if there is a $\delta_M^{mix} \in (0,1)$ such that

$$w + v^R + \theta^R(qc_M^{mix} - v^R) = (1-q)(w + B + q\theta^R c_M^{mix}), \tag{1.49}$$

where

$$c_M^{mix} \equiv \frac{\delta_M^{mix}\alpha v^R + \gamma v^S}{\delta_M^{mix}\alpha + \gamma}. \tag{1.50}$$

Substitute (1.50) into (1.49), get

$$\delta_M^{mix} = \frac{\gamma\{q^2\theta^R v^S - [(1-q)B - qw - (1-\theta^R)v^R]\}}{\alpha\{[(1-q)B - qw - (1-\theta^R)v^R] - q^2\theta^R v^R\}}. \tag{1.51}$$

If

$$(1-q)B - qw - (1-\theta^R)v^R < q^2\theta^R v^R, \tag{1.52}$$

by $0 < v^R < v^S$, I get

$$(1-q)B - qw - (1-\theta^R)v^R < q^2\theta^R v^R < q^2\theta^R v^S. \tag{1.53}$$

$\delta_M^{mix} < 0$ violates the assumption that $\delta_M^{mix} \in (0,1)$. Therefore, $\delta_M^{mix} > 0$ if and only if

$$q^2\theta^R v^R < (1-q)B - qw - (1-\theta^R)v^R < q^2\theta^R v^S. \tag{1.54}$$

Define $\hat{\theta}_M \equiv \frac{v^R + qw - (1-q)B}{(1-q^2)v^R} > 0$, if $v^R \in (v_M^1, v_M^0)$, $\delta_M^{mix} > 0$ holds for all $\theta^R > \hat{\theta}_M$. If $v^R \in (v_M^0, v^S)$, (1.54) defines a cutoff

$$\hat{\theta}_M < \theta^R < \frac{v^R + qw - (1-q)B}{v^R - q^2 v^S} \equiv \theta_M^0. \tag{1.55}$$

For all $\theta^R > \hat{\theta}_M$, $\delta_M^{mix} < 1$ if and only if

$$\gamma\{q^2\theta^R v^S - [(1-q)B - qw - (1-\theta^R)v^R]\} < \alpha\{[(1-q)B - qw - (1-\theta^R)v^R] - q^2\theta^R v^R\}, \tag{1.56}$$

so I get

$$\theta^R[\frac{q^2(\alpha v^R + \gamma v^S)}{\alpha + \gamma} - v^R] < (1-q)B - qw - v^R. \tag{1.57}$$

If $v^R \in (v_M^1, v^S)$, (1.57) defines a cutoff

$$\theta^R > \frac{-(1-q)B + qw + v^R}{v^R - \frac{q^2(\alpha v^R + \gamma v^S)}{\alpha+\gamma}} \equiv \theta_M^1, \tag{1.58}$$

and $\theta_M^1 > \hat{\theta}_M$.

Therefore, suppose $v^R \in (v_M^1, v_M^0)$, there exists a $\delta_M^{mix} \in (0,1)$ if and only if $\theta^R > \theta_M^1$. If $v^R \in (v_M^0, v^S)$, $\delta_M^{mix} \in (0,1)$ exists if and only if $\theta^R \in (\theta_M^1, \theta_M^0)$. □

Proof of Proposition 4:

When $w \in (0, w_L^*)$, an $R-type$ officer chooses to be dishonest ($\delta_R = 0$) if and only if

$$w + v^R + \theta^R(qc_M^0 - v^R) \leq (1-q)(w + B + q\theta^R c_M^0), \tag{1.59}$$

where

$$c_M^0 = v^S, \tag{1.60}$$

is the level of collective reputation when only $S-type$ officers are honest. Substituting (1.60) into (1.59), leads to the following expression

$$\theta^R(q^2 v^S - v^R) \leq (1-q)B - qw - v^R. \tag{1.61}$$

By the hypothesis $0 < w < w_L^*$, I get

$$(1-q)B - qw - v^R > 0. \tag{1.62}$$

The right side of equation (1.61) is positive and since $\theta^R > 0$ by the assumption, it follows that (1.59) is valid whenever

$$v^R \geq q^2 v^S \equiv v_M^0 \tag{1.63}$$

For any level of intrinsic motivation $v^R \in [v_M^0, v^S)$, an $R-type$ officer chooses to be dishonest with probability one no matter how much he cares about being praised.

If $v^R \in (0, v_M^0)$, I get

$$q^2 v^S - v^R > 0, \tag{1.64}$$

then an $R-type$ officer chooses to be dishonest if and only if $\theta^R \in (0, \theta_L^0]$ where

$$\theta_L^0 \equiv \frac{(1-q)B - qw - v^R}{q^2 v^S - v^R}. \tag{1.65}$$

An $R-type$ officer whose intrinsic motivation $v^R \in (0, v_M^0)$ chooses to be dishonest if and only if $\theta^R \in (0, \theta_L^0]$.

When $w \in (0, w_L^*)$, an $R-type$ officer chooses to be honest ($\delta_R = 1$) if and only if

$$w + v^R + \theta^R(qc_M^1 - v^R) \geq (1-q)(w + B + q\theta^R c_M^1), \tag{1.66}$$

where

$$c_M^1 = \frac{\alpha v^R + \gamma v^S}{\alpha + \gamma}. \tag{1.67}$$

Substituting (1.67) into (1.66), I get

$$\theta^R \left[\frac{q^2(\alpha v^R + \gamma v^S)}{\alpha + \gamma} - v^R \right] \geq (1-q)B - qw - v^R. \tag{1.68}$$

From (1.62) and given that $\theta^R > 0$, (1.68) is satisfied when

$$v^R < \frac{q^2 \gamma v^S}{1 - \beta - q^2 \alpha} \equiv v_M^1. \tag{1.69}$$

Therefore, if $v^R \in (0, v_M^1)$, an $R-type$ officer chooses to be honest if and if $\theta^R \in [\theta_L^1, \infty)$ where

$$\theta_L^1 \equiv \frac{(1-q)B - qw - v^R}{\frac{q^2(\alpha v^R + \gamma v^S)}{\alpha + \gamma} - v^R}. \tag{1.70}$$

When $w \in (0, w_L^*)$, an $R-type$ officer is indifferent between honest and dishonest if and only if there is a $\delta_L^{mix} \in (0,1)$ such that

$$w + v^R + \theta^R(qc_M^{mix} - v^R) = (1-q)(w + B + q\theta^R c_M^{mix}), \tag{1.71}$$

where

$$c_M^{mix} \equiv \frac{\delta_L^{mix} \alpha v^R + \gamma v^S}{\delta_L^{mix} \alpha + \gamma}. \tag{1.72}$$

Substituting (1.72) into (1.71), I get

$$\delta_L^{mix} = \frac{\gamma\{q^2 \theta v^S - [(1-q)B - qw - (1-\theta^R)v^R]]\}}{\alpha\{[(1-q)B - qw - (1-\theta^R)v^R] - q^2 \theta^R v^R\}}. \tag{1.73}$$

For any $w \in (0, w_L^*)$, from (1.62), I get $(1-q)B - qw - v^R + \theta^R(1-q^2)v^R > 0$ holds for

all $\theta^R > 0$. Therefore, $\delta_L^{mix} > 0$ if and only if

$$(1-q)B - qw - (1-\theta^R)v^R < q^2\theta^R v^S. \tag{1.74}$$

If $v^R \in (0, v_M^0)$, then (1.74) defines a cutoff

$$\theta^R > \frac{(1-q)B - qw - v^R}{q^2 v^S - v^R} \equiv \theta_L^0. \tag{1.75}$$

And $\delta_L^{mix} < 1$ if and only if

$$\gamma\{q^2\theta^R v^S - [(1-q)B - qw - (1-\theta^R)v^R]\} < \alpha\{[(1-q)B - qw - (1-\theta^R)v^R] - q^2\theta^R v^R\}, \tag{1.76}$$

which leads to

$$\theta[\frac{q^2(\alpha v^R + \gamma v^S)}{\alpha+\gamma} - v^R] < (1-q)B - qw - v^R. \tag{1.77}$$

If $v^R \in (v_M^1, v_M^0)$, (1.77) holds for any $\theta^R > 0$. If $v^R \in (0, v_M^1)$, then (1.77) defines a cutoff

$$\theta^R < \frac{(1-q)B - qw + v^R}{\frac{q^2(\alpha v^R + \gamma v^S)}{\alpha+\gamma} - v^R} \equiv \theta_L^1. \tag{1.78}$$

When $w \in (0, w_L^*)$, suppose $v^R \in (0, v_M^0)$, there exists a $\delta_L^{mix} \in (0,1)$ if and only if $\theta^R \in (\theta_L^0, \theta_L^1)$. If $v^R \in (v_M^1, v_M^0)$, there exists a $\delta_L^{mix} \in (0,1)$ if and only if $\theta^R > \theta_L^0$. □

Proof of Proposition 5: (i) Suppose $v^R \in (0, v_H^1]$, $\theta^R < \theta_L^1$, and $w \in (0, w_L^*)$, $R-type$ officers choose to be corrupt with positive probability. By Proposition 1, $G-type$ officers are corrupt. When the salary increases to $w \in [w_L^*, w_H^*)$, $G-type$ officers are still corrupt. By Proposition 3, $R-type$ officers with $v^R \in (0, v_H^1]$ and $\theta^R < \theta_L^1$ choose to be corrupt with probability zero. Therefore, the level of corruption decreases to β. When the salary further increases to $w \geq w_H^*$, $G-type$ officers become honest. $R-type$ officers with $v^R \in (0, v_H^1]$ and $\theta^R < \theta_L^1$ still choose to be honest with probability 1. The level of corruption is zero.

(ii) Suppose $v^R \in (\max\left\{v_M^0, \frac{\gamma v^s}{1-\alpha}\right\}, v^S)$, and $\theta^R < \min\left\{\theta_M^0, \theta_H^0\right\}$; by Proposition 4, when the salary is $w \in (0, w_L^*)$, $R-type$ officers choose to be dishonest with probability one. By Proposition 1, $G-type$ officers are corrupt. Therefore, the proportion of corrupt public officer is $\alpha+\beta$. When the salary increases to $w \in [w_L^*, w_H^*)$, $G-type$ officers are still corrupt. $R-type$ officers with $v^R \in (\max\left\{v_M^0, \frac{\gamma v^s}{1-\alpha}\right\}, v^S)$ and love of praise

$\theta^R < \min\left\{\theta_M^0, \theta_H^0\right\}$ choose to be honest with positive probability. The level of corruption decreases. When the salary further increases to $w \geq w_H^*$, $G-type$ officers become honest. $R-type$ officers with $v^R \in (\max\left\{v_M^0, \frac{\gamma v^s}{1-\alpha}\right\}, v^S)$ and $\theta^R < \min\left\{\theta_M^0, \theta_H^0\right\}$ chooses to be honest with probability one so that all three types are honest. The level of corruption further decreases. □

Proof of Proposition 6:

(i) When the salary is $w \in [w_L^*, w_H^*)$, $G-type$ officers are dishonest. $R-type$ officers whose intrinsic motivation $v^R \in [v_M^1, v_H^1]$ and love of praise $\theta^R > \theta_H^1$ choose to be honest with probability one. The proportion of corrupt public officers is β. When the salary increases to $w \geq w_H^*$, $G-type$ officers choose to be honest. $R-type$ officers whose intrinsic motivation $v^R \in [v_M^1, v_H^1]$ and love of praise $\theta^R > \theta_H^1$ choose to be corrupt with a positive probability δ_H^*. The proportion of corrupt public officer is $(1-\delta_H^{mix})\alpha$. Furthermore, if $\beta < (1-\delta_H^{mix})\alpha$, the level of corruption increases.

(ii) When the salary is $w \in [w_L^*, w_H^*)$, $G-type$ officers are dishonest. $R-type$ officers whose intrinsic motivation $v^R \in [v_H^0, \min\{v_M^0, \frac{\gamma v^S}{1-\alpha}\}]$ and $\theta^R > \max\{\theta_M^1, \theta_H^0\}$ choose to be honest with probability δ_M^{mix}. The level of corruption is $\beta + \alpha(1-\delta_M^{mix})$. When the salary increases to $w \geq w_H^*$, $G-type$ officers choose to be honest. $R-type$ officers with $v^R \in [v_H^0, \min\{v_M^0, \frac{\gamma v^S}{1-\alpha}\}]$ and $\theta^R > \max\{\theta_M^1, \theta_H^0\}$ choose to be honest with probability zero. The level of corruption is α. If $\alpha > \frac{\beta}{\delta_M^{mix}}$, the level of corruption increases. □

Proof of Proposition 7: A greedy officer does not apply to the public sector if

$$w^p \geq \max\left\{w^G, (1-q)(w^G+B)\right\}. \tag{1.79}$$

An $S-type$ officer applies to the public sector if

$$w^G + v^S \geq w^P, \tag{1.80}$$

and chooses to be honest if

$$w^G + v^S \geq (1-q)(w^G+B). \tag{1.81}$$

An $R-type$ officer applies to the public sector and behaves honestly if

$$w^G + v^R + \theta^R\left[\frac{q(\gamma v^S + \alpha v^R)}{\alpha+\gamma} - v^R\right] \geq w^P. \tag{1.82}$$

If the salary offered in the public sector is $w^H \leq \frac{(1-q)}{q}B$, $G-type$ officers prefer to work in the private sector if $w^P \geq (1-q)(w^H+B)$, or

$$w^P \geq \frac{(1-q)}{q}B - \frac{q\theta^R(1-q)(\gamma v^S + \alpha v^R)}{\alpha+\gamma} - \frac{v^R(1-\theta^R)(1-q)}{q} \equiv w_0^P.$$

Suppose $w^P \geq (1-q)(w^H+B)$, I have $w^P \geq w^H$. Conditions (80) and (81) require that, given w^P, there exists a $\hat{v}^S(w^P)$ such that for all $v^S \geq \hat{v}^S(w^P)$, $w^H + v^S - w^P \geq 0$ and a $\bar{v}^{HS}$ such that for all $v^S \geq \bar{v}^{HS}$, I have $qw^H + v^S - (1-q)B \geq 0$.

The fourth condition holds if

$$w^P \leq \frac{(1-q)}{q}B - \frac{v^R(1-q)(1-\theta^R)}{q} \equiv w_1^P$$

When the salary in the public sector is fixed at $w = w^H$, all officers behave honestly and collective reputation of the public sector is equal to $\frac{\gamma v^S + \alpha v^R}{\alpha+\gamma}$. At a lower salary reputation-concerned officers will be corrupt, therefore w^H is the minimum salary that allows a corruption free public sector. □

Part 2

Chapter 2

The Depth of Corruption

Abstract: I propose that the study of corruption besides its spread, i.e., the numbers of corrupt individuals, should include its depth (or degree), i.e., the level of distortion of the duties of corrupt individuals. A system where few corrupt officers who deviate significantly from their duties is not more desirable than one where many corrupt officers deviate slightly from their duties. Motivated by this observation, I develop a formal framework of decisions to accept the bribe, when an individual is endowed with a range of alternative actions over which he may be bribed. This approach introduces two sources of heterogeneity. Individuals who are not corrupt do not perform the duties with the same diligence and there is a multitude of possible deviations from duties for corrupt individuals. Therefore, individuals' distortions of their duties due to the bribe are not the same, which captures the variable depth of corruption of individuals and the ensuing distortion of their duties. Finally, I derive the 'list' of the level of bribe that represents the 'reservation' monetary payoff for various degrees of corruption of an officer.

Keywords: Corruption, the distortion of duty, the depth of corruption, bribe.

JEL Classification Number: D50, C71, C72, D73

2.1 Introduction

The International Monetary Fund research estimated that public sector corruption siphons $1.5 trillion to $2 trillion annually from the global economy in bribes and costs far more in stunted economic growth, lost tax revenues and sustained poverty. In addition to the well-known direct economic costs of corruption, its indirect costs may be even more substantial and debilitating. Corruption has a broader corrosive impact on society. It erodes trust in governance of institutions and undermines the ethical standards of private citizens. Thus tackling corruption is a critical component of development strategies.

Since 1996, the World Bank alone has supported more than 600 anti corruption projects. Unfortunately, the scholars and practitioners working on the topic are facing the increasing awareness of the failure of most anti corruption policies. It is widely accepted that anti corruption is one where research has lagged policy. The theoretical research on corruption faces an important obstacle - the lack of conceptual precision. Pushing the discussion further and refining the conceptualisation of corruption, and its various forms, is important from the perspective of both academic researchers for whom concepts are the basic units for thought and analysis, and practitioners who need definitions that are precise and operational. Indeed, many scholars have identified theoretical mischaracterization of the problem of corruption (Persson, Rothstein and Teorell, 2013) and the gap between design and reality as the main sources of policy failure. The prevalence and perniciousness of corruption require effort to conceptualise specific occurrences of corruption and fresh anti corruption mechanisms based on identifying its root causes.

The purpose of this paper is to introduce a new dimension, namely the depth (or degree) of corruption, into the discussion of the conceptualisation of corruption. This is a dimension of corruption which has been overlooked in the literature, which only focuses on the spread of corruption (i.e., the number or proportion of corrupt individuals). Of course, that approach has served well the study of corruption, but I believe that the depth of corruption of individuals (i.e., the distortion of duties of corrupt individuals due to bribe) must be an integral part of the debate about corruption in a system and the development of effective policies against it.

Of course, corruption takes so many forms that it is unrealistic to propose that a single model can capture all of them. Here I focus on a specific and arguably the most usual form of corruption: bribing. In line with Banerjee, Mullainathan, and Hanna (2012), I model bribing as a monetary payoff for a specified action that is required by the donor and must be executed by the officer who accepts the bribe. Once it is acknowledged

that the root of corruption lies in the self-interest of individuals, the articulation of a decision-making framework which highlights the temptation and tradeoffs of individuals to accept a bribe, is a necessary step for the development of ways that such temptations can be tamed. The need for research that studies the way in which an individual person decides whether or not to pay or accept a bribe, from the viewpoint of neuroscience, moral cognition and psychology, is highlighted in Nichlos and Robertson (2016). This research agenda necessitates the specification of a decision-making framework such as the one I propose here.

In order to capture the concept of the depth of corruption, this chapter develops a formal framework to analyze individual decisions to accept a bribe in return for taking a specific action among a menu of alternatives and investigate how such a decision is related to parameters in the environment. This approach is based on two sources of heterogeneity. First, individuals who are not corrupt do not perform their duties with the same diligence and second, there is a multitude of possible deviations from duties for corrupt individuals. Thus individuals' distortions of their duties due to the bribe are not the same, which captures the variable depth of corruption of individuals and the ensuing distortion of their duties. The analysis culminates in the computation of the reservation level of bribe for alternative distortion of duties, representing variable degrees of corruption.

The economic approach to the analysis of corruption can be traced to Becker (1968), who designs the optimal amount of enforcement and its determinants.[1] The existing literature on corruption views the tradeoff faced by individuals as one between the direct economic benefits of corruption, which is understood in terms of income maximization, and the cost of detection (see e.g., Andvig and Moene, 1990; Acemoglu, 1995; Aidt, 2003; Sah, 2007). Bribes are represented by simple monetary payoffs with no reference to what they are associated with, i.e., the objective of a bribe is left unspecified, assumed to be some fixed action to be taken. In this way the literature focuses on the individuals who require different levels of bribes in order to take that action. If we view a bribe as a 'contract', the modelling of bribes in the standard literature can be understood as contracts which all refer to a specific action (or distortion of duty) and differ only on the monetary payoff they promise in return. This way of viewing corruption decisions is based on the underlying principle that for a suitable bribe any individual can be tempted into taking a given action. However, this approach fails to account for the complementary principle that for a given bribe individuals might be tempted to take different actions.

Certainly, bribes are associated with an objective, a purpose. However, I contend that

[1] See also Rose-Ackerman, 1978; Cadot, 1987; Tirole, 1996; Benjamin, 2007.

there can be multiple possible objectives, each one potentially associated with a possible bribe and so the analysis of decisions to involve in corrupt activity is more complex than the binary decision of accepting a bribe to take an action or not. In my view corruption decisions should also incorporate the principle that individuals are tempted to do different things for a given bribe, i.e., they can be more or less corrupt. In the model I develop, I allow individuals to have a menu of alternative actions available to them, which may have a variable effect on the welfare of potential donors of bribes. First of all, the action of an individual in lack of a bribe (the fallback situation) is not immaterial neither for the decisions of a donor to offer nor for the individual to accept a bribe in order to take a specific action. After all, corruption occurs whenever a monetary payoff induces an individual to *deviate* from the action that they would take in absence of a monetary payoff. Thus in such a context, bribes can be associated with each of several alternative actions. In terms of viewing bribes as contracts, the extension that I propose, is that in addition to the monetary payoff they promise, contacts are now allowed to vary also with respect to the action they refer to. In short, my model allows for a much richer class of contracts in this sense I add a new dimension to the conceptualization of corruption. Following this idea, I derive formally the minimum bribe necessary to induce a certain action by an individual, which represents the 'reservation' monetary payoff in order to corrupt an officer to take alternative actions. This is a very interesting tool for the study of corruption decisions because the difference between a donor's benefit from paying for a specific action and the minimum bribe acceptable by the officer in order to take this action defines a surplus which forms the cornerstone of corruption.

I believe that this approach adds a new and meaningful dimension to the discussion of corruption. My model is inspired by the intuition that bribing an individual to do something close to what he would do anyway, is likely to be easier than bribing him to do something radically different. This issue is not given sufficient attention in the literature but is extremely important because it leads the discussion towards the direction of the intensity or degree of corruption. The discussion of (anti)corruption in the literature, focuses on the proportion of corrupt individuals but has nothing to say about their degree of corruption. Nevertheless, a few corrupt individuals who deviate grossly from their task is not necessarily a preferable situation than many individuals who deviate from their task only slightly. Therefore, both the spread and the depth of corrupt individuals are relevant in evaluating corruption in a system. As my model accounts for the depth of corruption, it paves the way for the discussion of corruption in that direction.

I start with a model of the individual's decision to take the action without bribe in

section 2. The key point is that the individuals are endowed a menu of alternative actions over which he may be bribed. This leads us naturally to think of corruption as a monetary payoff offered to change the individual's action. This is the subject of section 3, where I develop a simple theoretical framework for thinking about corruption as the distortion of duties due to bribe and find out a 'price list' for bribery. Section 4 is the conclusion.

2.2 Non corrupt behavior

Let $i = 1, 2, \ldots, n$ be an index of different types of actions available to an individual, where each action can be taken with variable degree of intensity measured by real numbers. I let $\Re^n_+$ denote the space of actions possible. My individual is associated (endowed) with a 'task' which is defined by some $a \in \Re^n_+$ and chooses an action vector $x \in \Re^n_+$. This task is nothing other than a specification of actions which correspond to some job or position description, for instance, actions that an officer in an organization would be expected to take.

I assume that the individual is intrinsically motivated to attain as much as possible the allocated task so the proximity of the individual's actions to the task increase their utility. On the other hand I assume that the execution of each action in increasing intensity results in some dis-utility for the individual (e.g. more intense action requiring more effort). My individual faces a tradeoff: more intense actions approximate better the task and increase utility but require more effort which has an opposite effect.

Besides the actions of the individual another utility relevant variable that I consider is monetary payoff which includes the salary and/or other monetary rewards (bonuses, bribes etc). In conclusion I assume that the individual has preferences which are expressed by a utility function $u : \Re_+ \times \Re^n_+ \to \Re$. In particular I adopt the utility function:

$$u(I, x; a) = \phi(I, x) - \frac{1}{2}\sum_{i=1}^{n} c_i (x_i - a_i)^2 \tag{2.1}$$

where $I > 0$ is individual income which is fixed and $\lim_{I \to +\infty} \phi = +\infty$ and $c \gg 0$ measures individual non-monetary value to attain as much as possible the task a, $D_x \phi \ll 0$, and $\frac{\partial \phi}{\partial I} > 0$. I assume that $u(I, x; a)$ is strictly concave so $D^2_x u$ is negative definite throughout the domain.

It will be very helpful in the sequel to perform a suitable shift of $\Re^n_+$ so that the variable $x \in \Re^n$ represents distance from the 'task' a and the utility function in (2.1) can be written as $u(I, x) = \phi(I, x + a) - \frac{1}{2}\sum_{i=1}^{n} c_i x_i^2$.

I assume that the individual is choosing actions in order to maximize utility, i.e., solves the problem

$$\max_{x\in\Re^n} \phi(I,x+a) - \frac{1}{2}\sum_{i=1}^{n} c_i x_i^2 \tag{2.2}$$

The first order conditions for maximization of utility require that $\frac{\partial u}{\partial x_i} = 0$ for $i = 1,2,\ldots,n$. Therefore, $\frac{\partial \phi}{\partial x_i} - c_i x_i = 0$. Let $\bar{x}(I,c) \in \Re^n$ denote the maximizing solution[2] to the above system of equations and observe that since $\frac{\partial \phi}{\partial x_i} < 0$ at the utility maximizing point it must be $\bar{x}(I,c) \ll 0$, i.e. the individual will never overshoot the task specification (recall my transformation). On the other hand notice that $\bar{x}(I,c) \neq 0$ does not mean that the individual is corrupt. It simply represents the performance of an individual for a given income I and level of 'conscientiousness' $c \in \Re^n_+$.

Let $\bar{x}(I,c)$ denote the solution to the above problem and define the function

$$v_1(I,c) \equiv u(I,\bar{x}(I,c))$$

I have the following Lemma:

Lemma 9. $\bar{x}_i(I,c) = -\left(2\left|\frac{\partial v_1}{\partial c_i}(I,c)\right|\right)^{\frac{1}{2}}$

Proof: see the Appendix.

The Lemma 9 shows how the optimal action can be computed. The quantity $\|\bar{x}(I,c)\|$ and its behavior with respect to the corresponding variables is of particular interest because it represents the contentiousness of the individual in performing their task, which is driven by their monetary reward and intrinsic motivation. It shows that honest individuals do not perform their duty with the same diligence, i.e., two individuals may perform their duty with varying ability or devotion, which introduces the heterogeneity among honest officers. From lemma (9) above I have $\|\bar{x}(I,c)\| = \left(2\sum_{i=1}^{n}\left|\frac{\partial v_1}{\partial c_i}(I,c)\right|\right)^{\frac{1}{2}}$.

Example 1. *Consider an individual with a predefined task $a = 1$, intrinsic motivation $c > 0$ and preferences $u(I,a) = 1 + \frac{1}{a-1} - (c-I)(a-1)^2$, where $c > I+1$. By setting $x = a-1$ this function can be written as $u(I,x) = 1 + \frac{1}{x} - (c-I)x^2$. If this individual does not receive a bribe, i.e., $I = w$ (the salary), then the optimal level of activity is determined by the solution to*

[2] I assume an interior solution only for reasons of simplicity. Alternatively there are assumptions on the utility function that can guarantee this.

$$\max_{x>-1} 1 + \frac{1}{x} - \frac{1}{2}(c-I)(x)^2 \tag{2.3}$$

The first order condition for the solution to this problem requires $-\frac{1}{x^2} - cx = 0$*, which yields* $\bar{x} = -(c-I)^{-\frac{1}{3}}$*. Furthermore, the second order condition is* $\frac{2}{(\bar{x})^3} - (c-I) = -3(c-I) < 0$ *as desired for a maximum*[3]. □

Comparative statics

Considering that officers are endowed with a menu of alternative actions to choose, it can be verified that different types of officers perform their tasks at different diligence. Before moving the discussion on to the analysis of corruption, it would be a good opportunity to discuss if increases in salary or in intrinsic motivation would lead to a better performance in individual's tasks. Intuitively, we would expect that salary increases or increases in motivation would induce better performance in individuals' tasks. However, it turns out that this is not generally true. As we show in the Appendix, an increase in the motivation to perform an action i will increase performance in that action, but will have ambiguous effects on the other actions j. Therefore, the overall effect of motivation on individual performance is unclear.

Example 2. *For* $n = 2$ *I have*

$$\begin{pmatrix} \frac{\partial^2\phi}{\partial x_1^2} - c_1 & \frac{\partial^2\phi}{\partial x_1 \partial x_2} \\ \frac{\partial^2\phi}{\partial x_2 \partial x_1} & \frac{\partial^2\phi}{\partial x_2^2} - c_2 \end{pmatrix} \cdot \begin{pmatrix} \frac{\partial \bar{x}_1}{\partial c_1} \\ \frac{\partial \bar{x}_2}{\partial c_1} \end{pmatrix} = \begin{pmatrix} \bar{x}_1(I,c) \\ 0 \end{pmatrix} \tag{2.4}$$

$$so \begin{pmatrix} \frac{\partial \bar{x}_1}{\partial c_1} \\ \frac{\partial \bar{x}_2}{\partial c_1} \end{pmatrix} = \begin{pmatrix} \bar{x}_1(I,c)\frac{\frac{\partial^2\phi}{\partial x_1^2} - 2c_1}{|H|} \\ \bar{x}_2(I,c)\frac{\frac{\partial^2\phi}{\partial x_2 \partial x_1}}{|H|} \end{pmatrix}$$

□

Clearly $\frac{\partial \bar{x}_1}{\partial c_1} > 0$ because $\bar{x}_1(I,c) < 0$ and from the second order conditions $\frac{\partial^2\phi}{\partial x_1^2} - 2c_1 < 0$ and $|H| > 0$ are required. However, the sign of $\frac{\partial \bar{x}_2}{\partial c_1}$ is unclear so the effect on the overall performance of the individual cannot be determined in general.

Comparative statics are not clear either with respect to the intuition that higher monetary reward leads to better task performance. An increase in the salary is not clear to

[3]Notice that since $c > I + 1$, $\bar{x} > -1$

induce better performance in individual's tasks because of potential substitution effects between activities.

Example 3. *For $n = 2$ I have*

$$\begin{pmatrix} \frac{\partial^2\phi}{\partial x_1^2} - c_1 & \frac{\partial^2\phi}{\partial x_1 \partial x_2} \\ \frac{\partial^2\phi}{\partial x_2 \partial x_1} & \frac{\partial^2\phi}{\partial x_2^2} - c_2 \end{pmatrix} \cdot \begin{pmatrix} \frac{\partial \bar{x}_1}{\partial I} \\ \frac{\partial \bar{x}_2}{\partial I} \end{pmatrix} = \begin{pmatrix} -\frac{\partial^2\phi}{\partial x_1 \partial I} \\ -\frac{\partial^2\phi}{\partial x_2 \partial I} \end{pmatrix} \tag{2.5}$$

$$so \begin{pmatrix} \frac{\partial \bar{x}_1}{\partial I} \\ \frac{\partial \bar{x}_2}{\partial I} \end{pmatrix} = \begin{pmatrix} \frac{\frac{\partial^2\phi}{\partial x_2 \partial I} \cdot \frac{\partial^2\phi}{\partial x_1 \partial x_2} - \frac{\partial^2\phi}{\partial x_1 \partial I} \cdot \frac{\partial^2\phi}{\partial x_2^2}}{|H|} \\ \frac{\frac{\partial^2\phi}{\partial x_1 \partial I} \cdot \frac{\partial^2\phi}{\partial x_2 \partial x_1} - \frac{\partial^2\phi}{\partial x_2 \partial I} \cdot \frac{\partial^2\phi}{\partial x_1^2}}{|H|} \end{pmatrix}$$

□

Example 4. *In the one dimensional numerical example (1) above* $\frac{\partial \bar{x}}{\partial I} < 0$, $\frac{\partial \bar{x}}{\partial c} > 0$

A fact that will be useful to us in the sequel is that $v_1(I,c)$ is monotonically increasing in I.

Lemma 10. $\frac{\partial v_1}{\partial I}(I,c) > 0$

Proof: see the Appendix.

Given that the individual chooses the optimal action $\bar{x}$, her maximum utility is increasing in income.

Example 5. *In the numerical example (1) above I have*

$$\begin{aligned} v_1(I,c) &= 1 - (c-I)^{\frac{1}{3}} - (c-I)(c-I)^{-\frac{2}{3}} \\ &= 1 - \frac{3}{2}(c-I)^{\frac{1}{3}} \end{aligned} \tag{2.6}$$

I now turn to discuss the behavior of corrupt individuals.

2.3 Corrupt behavior

A bribe is understood here as a monetary payoff which is awarded to an individual in order to influence their action in a prescribed way (which presumably benefits the donor). Since my model allows for a multitude of possible bribes these must be represented as

functions relating monetary payoffs to actions, i.e., it is a *contract* rather than merely a variable as many papers in this literature represent it.

It cannot be denied that there are important moral, social and legal issues involved in decisions to accept a bribe. However, I assume that these are encompassed by some objective function that represents the attitude of the individual with respect to such issues and I will focus on the materialistic part of such decisions.[4] I postulate that an individual decides whether to accept or reject a bribe based on individualistic considerations.

A microeconomic model of bribing

Let us consider now an officer as in the previous section, who in addition to the salary $w > 0$ he is presented with the opportunity to receive an (extra-institutional) additional monetary payoff $B > 0$ in exchange for taking a prescribed action z_j. In line with the literature on corruption I can introduce here a probability that the individual is caught 'hand in the cookie-jar', i.e., a probability $q \in (0,1)$. In this case the individual loses all monetary rewards and performs no action at all. Otherwise with the residual probability there is no scandal and the individual receives in addition to the monetary reward w an amount B and performs the promised action z_j. In view of the uncertainty introduced I assume that the individual is interested in maximizing expected utility so is faced with the problem

$$\begin{aligned} \max_{x\in\Re^n} \quad & q\left[\phi(0,-x^\star)-\frac{1}{2}\sum_{i=1}^{n}c_i x_i^{\star 2}\right]+(1-q)\left[\phi(I,x)-\frac{1}{2}\sum_{i=1}^{n}c_i x_i^2\right] \\ s.t. \quad & x_j = z_j \end{aligned} \tag{2.7}$$

where $I = w+B$. Since the first term in the summation is constant, without loss of essence I can normalize the utility function so that $\phi(0,-x^\star)-\frac{1}{2}\sum_{i=1}^{n}c_i x_i^{\star 2}=0$, in which case the above problem simplifies to

$$\begin{aligned} \max_{x\in\Re^n} \quad & (1-q)\left[\phi(I,x)-\frac{1}{2}\sum_{i=1}^{n}c_i x_i^2\right] \\ s.t. \quad & x_j = z_j \end{aligned} \tag{2.8}$$

[4] I should emphasize that I do not overlook the importance of moral, social and political issues. However, these are beyond the microeconomic framework that I pursue at the moment.

Furthermore by eliminating the constraint the problem can be written as

$$\max_{x\in\Re^{n-1}}(1-q)\left[\phi(I,(x,z_j))-\frac{1}{2}(\sum_{i\neq j}c_ix_i^2+c_jz_j^2)\right] \tag{2.9}$$

Let $\hat{x}(I,c;z_j)\in\Re^{n-1}$ denote the solution to this problem. A few remarks are in order.

Remark 3. *For simplicity of the exposition of my ideas, I have associated bribes with actions along only one dimension, as this is sufficient for the arguments in this paper. Nevertheless, my setup can capture bribes which refer to actions along several dimensions, i.e., bribes associated with pre specified combinations of actions. A richer analysis can be pursued in that case as complementarity or substitution effects between actions can be considered.*

Remark 4. *The effect of a bribe on the overall performance of an individual could be in either direction depending on the parameters of the model. In particular, it is conceivable that a bribe might induce a better overall performance of the individual, i.e.,* $\|\left(\hat{x}(I,c;z_j),z_j\right)\|<\|\bar{x}(w,c)\|$.

Let us define the function

$$v_2(I,c;z_j)\equiv(1-q)\left[\phi(I,(\hat{x}(I,c;z_j),z_j))-\frac{1}{2}(\sum_{i\neq j}c_i\hat{x}_i(I,c;z_j)^2-c_jz_j^2)\right]$$

.

there exists some $B>0$ so that

$$v_1(w,c)=v_2(w+B,c;z_j) \tag{2.10}$$

Proof: see the Appendix.

Equation (2.10) defines an implicit function $B(w,c;z_j)$ so that

$$v_1(w,c)\equiv v_2(w+B(w,c;z_j),c;z_j) \tag{2.11}$$

The quantity $B(w,c;z)$ represents the minimum bribe necessary in order to 'corrupt' an individual with salary w and intrinsic motivation c, in order to elicit the action z_j. By varying z_j one obtains a sort of 'price list' for bribery. It represents the 'reservation' monetary payoff in order to corrupt an individual to distort their duty at any level. This

minimum bribe function is a very useful tool because it characterizes the individual in the sense that it summarizes everything we need to know about the attitudes of this individual towards corruption.

Indeed, for a given population of officers one can even make comparisons of their respective tendencies to be corrupt, on the basis of their corresponding minimum bribe functions. For instance, it would be reasonable to define that the type c_1 individual is 'more corruptible' than type c_2, when $B(w,c_1;z_j) < B(w,c_2;z_j)$ for every z_j, i.e., when it is easier to corrupt for any level of distortion of duty. Of course, this definition might be overly demanding and it might be more reasonable to apply definitions based on (first or second) order of stochastic dominance. Characterizing stochastic dominance in this context and associating it with particular characteristics of an individual is a very interesting exercise. However, we will not pursue this here because our preoccupation is to substantiate the importance of this tool and further the value of our approach.

Lemma 11. $\frac{\partial B}{\partial z_j}(w,c;z_j) < 0$

Proof: see the Appendix.

Intuitively, the minimum bribe necessary in order to corrupt an individual with salary w and intrinsic motivation c is monotonically strictly decreasing in the action.

Comparative statics

The study of $B(w,c;z)$ can help us understand how salary increases and monitoring influence individual's minimum bribe acceptable to take a certain distortion of the duty. Intuitively, a better salary makes it more difficult to bribe an individual because it works as a substitute for a bribe and also it increases the stakes for the individual in case there is a scandal. This intuition can be expressed in terms of my model as $\frac{\partial B}{\partial w}(w,c;z) > 0$, i.e., that salary improvement increases the minimum bribe necessary to make corruption interesting. However, this condition can be developed as following.

Differentiating the identity (2.11) I obtain

$$\frac{\partial v_1}{\partial I}(w,c) = \frac{\partial v_2}{\partial I}(w+B(w,c;z)),c;z) \cdot (1+\frac{\partial B}{\partial w}(w,c;z))$$

By the envelope theorem

$$\frac{\partial v_1(w,c)}{\partial I} = \frac{\partial \phi}{\partial I}(w,\overline{x}(w,c))$$

$$\frac{\partial v_2}{\partial I}(w+B(w,c;z),c;z) = (1-q)\frac{\partial \phi}{\partial I}(w+B(w,c;z),\hat{x}(w+B(w,c;z),c;z);z)$$

Therefore,

$$\begin{aligned}\frac{\partial B}{\partial w}(w,c;z) &= \frac{\frac{\partial v_1}{\partial I}(w,c)}{\frac{\partial v_2}{\partial I}(w+B(w,c;z),c;z)} - 1 \\ &= \frac{\frac{\partial \phi}{\partial I}(w,\bar{x}(w,c))}{(1-q)\frac{\partial \phi}{\partial I}(w+B(w,c;z),\hat{x}(w+B(w,c;z),c;z);z)} - 1 \qquad (2.12)\end{aligned}$$

The last equality reveals that that the impact of salary increases depends crucially on the relative marginal utilities of income with or without corruption. In particular, the intuition of the effectiveness of this tool against corruption is verified, i.e., $\frac{\partial B}{\partial w}(w,c;z) > 0$, *only if* $\frac{\partial \phi}{\partial I}(w,\bar{x}(w,c)) > (1-q)\frac{\partial \phi}{\partial I}(w+B(w,c;z),\hat{x}(w+B(w,c;z),c;z);z)$. Otherwise salary improvements are counter productive in increasing the minimum bribe acceptable for the individual to participate in corruption. It is crucial therefore to verify the above condition before one argues in favor of the use of such a tool.

Example 6. *Continuing my numerical example (1) by setting* $v_1(w,c) = v_2(w+B,c;z)$ *I can calculate*

$$B(w,c;z) = \frac{1}{(1-q)z^2}[1 - \frac{3}{2}(c-w)^{\frac{1}{3}} - (1-q)[1+\frac{1}{2} - \frac{1}{2}(c-w)z^2]]$$

Differentiation with respect to w results in:

$$\frac{\partial B}{\partial w} = \frac{\bar{x}^2}{(1-q)z^2} - 1$$

For all $z < \frac{\bar{x}^2}{(1-q)}$ *I have*[5] *that* $\frac{\partial B}{\partial w} < 0$ □

It is fairly intuitive that the probability of uncovering corruption, which represents how closely individuals are monitored, is the most basic and effective tool against corruption. For instance it is immediate from the analysis above that higher values of q increase the minimum bribe $B(w,c,z)$ necessary to induce any action z. Besides the (unspecified)

[5] $\frac{\bar{x}^2}{(1-q)} > -1$ for all $q < 1-\bar{x}^2$

costs related to the monitoring technology that an increase in q may imply, there is another drawback in the use of this tool which is not directly obvious. This is highlighted by the following lemma where I let c vary in an open set in $\Re_+$.

Lemma 12. *For all* $z \in [\bar{x}(1-q)^{-\frac{1}{2}}, -\bar{x}(1-q)^{-\frac{1}{2}}]$, $\frac{\partial B(w,c,z)}{\partial c} < 0$.

Proof: see the Appendix.

The above lemma demonstrates an important drawback of monitoring. It creates a neighborhood around $\bar{x}$, where the reservation bribe declines for the more conscientious individuals for each action in that neighborhood, i.e., it becomes easier to corrupt the more conscientious individuals. That neighborhood expands as the probability of being charged gets closer to one, including more actions for which the more conscientious individuals would be easier to corrupt. The explanation for this is that it is easier to corrupt more conscientious individuals because the utility of such an individual being honest is decreasing in the variable c. It would take an action z far from their optimal one in order for the conscientiousness of individuals to kick in and require a higher bribe.

Bribe and bonus

Another aspect that distinguishes a bribe from other monetary payoffs is its source. A monetary payoff that originates from the institution responsible for the actions of an individual as a bonus may be legitimate whereas the same payoff originating from extra-institutional centers is not. However, the fact that a bonus, unlike a bribe, is a risk-less monetary payment makes bonuses a 'cheaper' way to induce certain actions. Finally, I emphasize that a bribe should not always be thought as 'offered' to an individual. On many occasions the instigator of corruption (the party which offers the contract) may be the individuals themselves.[6]

An officer who is promised a bonus in order to take a specific action is faced with the problem:

$$\begin{aligned} \max_{x \in \Re^n} \quad & \phi(I,x) - \frac{1}{2}\sum_{i=1}^{n} c_i x_i^2 \\ s.t. \quad & x_j = z_j \end{aligned} \tag{2.13}$$

where $I = w + b$.

[6] Strictly speaking that would constitute abuse of power, but it still constitutes corrupt behavior.

As with the case of a bribe let $\tilde{x}(I,c;z_j) \in \Re^{n-1}$ denote the solution to this problem and define

$$v_3(I,c;z_j) \equiv \left[\phi(I,(\tilde{x}(I,c;z_j),z_j)) - \frac{1}{2}(\sum_{i \neq j} c_i(\tilde{x}_i(I,c;z_j))^2 - c_j z_j^2) \right]$$

Since $v_1(w,c) \geq v_3(w,c;z_j)$ and by the envelope theorem $v_3(\cdot,c;z_j)$ is monotonically increasing in I, there is $b(w,c;z_j) \geq 0$ so that $v_1(w,c) \equiv v_3(w+b(w,c;z_j),c;z_j)$, defining the boundary of the acceptable region for a bonus. The following proposition establishes that for each $z_j \in \Re$, the minimum bribe required is always higher than the minimum bonus required precisely because the first entails a risk.

Proposition 13. *$B(w,c;z_j) > b(w,c;z_j)$. Furthermore, $\hat{x}(I,c;z_j) = \tilde{x}(I,c;z_j)$, i.e., the solutions to problems (2.7) and (2.15) are identical.*

Proof: see the Appendix.

Hence, I conclude that $v_3(w+B(w,c;z_j),c;z_j) > v_3(w+b(w,c;z_j),c;z_j)$, which implies that $B(w,c;z_j) > b(w,c;z_j)$. Of course, this conclusion does not come as a surprise but I think it is important to establish this inequality for the following reason. In a hierarchical organization the difference $B(w,c;z_j) - b(w,c;z_j) > 0$ defines a 'bribing' list for the superiors of the individual, who would be willing to accept the bribe $B(w,c;z_j)$ and kick forward the bonus $b(w,c;z_j)$ to the individual. From the view point of the other party this makes no difference. Let us not forget that such corrupt situations can be instigated by the individuals themselves, i.e., an administrator can elicit a bribe by threatening to give a bonus to their employee in order to take a specific action. Of course, strictly speaking such a situation constitutes abuse of power which is another facet of corrupt behavior.

2.4 Conclusion

I have attempted an approach to corruption which is based on the idea that officers are heterogeneous, whether corrupt or not. My motivation for doing so is that I would like to introduce the dimension of the degree in the discussion of corruption and related policies. My model incorporates the idea that corrupt individuals can in principle be bribed to do anything among a menu of alternatives, a possibility which is absent so far in the study of corruption decisions. Thus the novelty of my model is the introduction of multiple possible actions over which an individual has a choice and can be bribed to undertake. I also incorporate the fallback behavior of individuals which is also an

important parameter in bribing decisions, an aspect that is also absent in the discussion of corrupt behavior.

This approach embeds two sources of heterogeneity into the analytical framework of an individual's decision to be corrupt or not. First, that non corrupt officers do not execute their duties with the same diligence. Second, that corrupt individuals can in principle be bribed to do anything among a menu of alternatives, i.e., exhibit variable degrees of corruption. I believe that this is a reasonable and meaningful way of looking at corruption because it incorporates the consideration of the depth of corruption of an individual, which in my view is a necessary ingredient in the discussion of corruption issues. The minimum bribe acceptable for an individual to distort the duties can be used as a tool in order to evaluate alternative remedies to corruption. More importantly, this tool opens the door to contract theory because it relates bribes to corresponding actions.

The model I presented here is a bare-bones one because my purpose is to look at the basic parameters involved. I do recognize however that there are many more issues likely to be involved in corruption decisions (pressure, prestige, career prospect etc.). I do not pretend that the utilitarian nature of a decision model is the only driving force of such decisions, nor that motives are purely materialistic, but I do argue that these aspects are crucial. Other variables that affect such decisions (e.g. social issues) can be potentially taken into consideration in future extensions of the model, once the mechanism via which they propagate in decisions becomes tangible. I plan to further explore this line with a view to identifying other tools based on the parameters which characterize equilibria, that would work for us in order to minimize corruption.

2.5 Appendix

Proof of Lemma 9:

By definition I have

$$v_1(I,c) \equiv \phi(I,\bar{x}(I,c)) - \frac{1}{2}\sum_{i=1}^{n} c_i(\bar{x}_i(I,c))^2$$

Differentiating this identity I have:

$$\begin{aligned}\frac{\partial v_1}{\partial c_i}(I,c) &= \sum_{j=1}^{n}\frac{\partial \phi}{\partial x_j}\phi(I,\bar{x}(I,c))\frac{\partial x_j}{\partial c_i} - \frac{1}{2}\left((\bar{x}_i(I,c))^2 + \sum_{i=1}^{n} 2c_j\bar{x}_j(I,c)\frac{\partial x_j}{\partial c_i}\right)\\ &= \sum_{j=1}^{n}\left(\frac{\partial \phi}{\partial x_j}(I,\bar{x}(I,c)) - c_j\bar{x}_j(I,c)\right)\frac{\partial x_j}{\partial c_i} - \frac{1}{2}(\bar{x}_i(I,c))^2\end{aligned}$$

However, $\frac{\partial \phi}{\partial x_j}(I,\bar{x}(I,c)) - c_j\bar{x}_j(I,c) \equiv 0$ for all $j = 1,2,\ldots,n$. Therefore, I can further conclude that $\frac{\partial v_1}{\partial c_i}(I,c) = -\frac{1}{2}(\bar{x}_i(I,c))^2$ from which the conclusion follows □

Intrinsic motivation and performance:

Substitute $\bar{x}(I,c) \in \Re^n$ into the first order conditions to obtain:

$$\frac{\partial \phi}{\partial x_i}(I,\bar{x}(I,c)) - c_i\bar{x}_i(I,c) \equiv 0 \tag{2.14}$$

Differentiating these identities with respect to c_i for $i = 1,2,\ldots,n$, I obtain

$$D_{c_i}\bar{x} = H^{-1}\begin{pmatrix} 0 \\ \cdot \\ \bar{x}_i(I,c) \\ \cdot \\ 0 \end{pmatrix} \tag{2.15}$$

where H is the Hessian matrix of the utility function, i.e.,

$$H = \begin{pmatrix} \frac{\partial^2 \phi}{\partial x_1^2} - c_1 & \cdots & \cdots & \frac{\partial^2 \phi}{\partial x_1 \partial x_n} \\ \cdot & \cdots & \cdots & \cdot \\ \cdot & \cdots & \cdots & \cdot \\ \frac{\partial^2 \phi}{\partial x_n \partial x_1} & \cdots & \cdots & \frac{\partial^2 \phi}{\partial x_n^2} - c_n \end{pmatrix} \tag{2.16}$$

and

$$D_{c_i}\bar{x} = \begin{pmatrix} \frac{\partial \bar{x}_1}{\partial c_i} \\ \cdot \\ \cdot \\ \frac{\partial \bar{x}_n}{\partial c_i} \end{pmatrix} \tag{2.17}$$

□

Higher monetary reward and performance:

Differentiating the identities in (1.1) with respect to the variable I I obtain for $i = 1,2,\ldots,n$:

$$\frac{\partial^2\phi}{\partial x_i \partial I}(I,\bar{x}(I,c)) + \sum_{j=1}^{n} \frac{\partial^2\phi}{\partial x_i \partial x_j}(I,\bar{x}(I,c)) \frac{\partial \bar{x}_j(I,c)}{\partial I} - \sum_{j=1}^{n} c_j \frac{\partial \bar{x}_j(I,c)}{\partial I} = 0$$

which has a solution

$$D_I \bar{x} = -H^{-1} \cdot D^2_{x,I}\phi \tag{2.18}$$

where H is as before, and

$$D_I \bar{x} = \begin{pmatrix} \frac{\partial \bar{x}_1}{\partial I} \\ \cdot \\ \cdot \\ \frac{\partial \bar{x}_n}{\partial I} \end{pmatrix}, D^2_{x,I}\phi = \begin{pmatrix} \frac{\partial^2 \phi}{\partial x_1 \partial I} \\ \cdot \\ \cdot \\ \frac{\partial \phi}{\partial x_n \partial I} \end{pmatrix} \tag{2.19}$$

□

Proof of equation 2.10:

It can be verified that $v_2(\cdot,c;z_j)$ is also monotonically increasing: $\frac{v_2(I,c;z_j)}{\partial I} > 0$.

Example 7. *In the numerical example (1) above, since x is one dimensional I have* $v_2(I,c) = (1-q)[1+\frac{1}{z}-\frac{1}{2}(c-I)z^2]$

Observe that

$$\begin{aligned} v_1(w,c) &\geq \phi(w,\hat{x}(w,c;z_j);z_j) - \frac{1}{2}\sum_{i=j} c_i \hat{x}_i(w,c;z_j)^2 - \frac{1}{2}c_j z_j^2 \\ &> (1-q)\left[\phi(w,\hat{x}(w,c;z_j);z_j) - \frac{1}{2}\sum_{i=j} c_i \hat{x}_i(w,c;z_j)^2 - \frac{1}{2}c_j z_j^2\right] \\ &= v_2(w,c;z_j) \end{aligned} \tag{2.20}$$

Since $\frac{v_2(I,c;z_j)}{\partial I} > 0$, there exists some $B > 0$ so that

$$v_1(w,c) = v_2(w+B,c;z_j) \tag{2.21}$$

□

Proof of Lemma 10:

$$\begin{aligned}
\frac{\partial v_1}{\partial I}(I,c) &= \frac{\partial u(I,\bar{x}(I,c))}{\partial I} \\
&= \frac{\partial \phi(I,\bar{x}(I,c))}{\partial I} + \sum_{i=1}^{n} \frac{\partial \phi(I,\bar{x}(I,c))}{\partial x_i}\frac{\partial x_i}{\partial I} - \sum_{i=1}^{n} c_i \bar{x}_i(I,c)\frac{\partial x_i}{\partial I} \\
&= \frac{\partial \phi(I,\bar{x}(I,c))}{\partial I} + \sum_{i=1}^{n} \left(\frac{\partial \phi(I,\bar{x}(I,c))}{\partial x_i} - c_i \bar{x}_i(I,c) \right)\frac{\partial x_i}{\partial I} \\
&= \frac{\partial \phi(I,\bar{x}(I,c))}{\partial I} \\
&> 0
\end{aligned} \tag{2.22}$$

where the third equality follows from (1.1) and the inequality by hypothesis □

Proof of Lemma 11:

By differentiation of the identity $v_1(w,c) \equiv v_2(w+B(w,c;z_j),c;z_j)$ I obtain (I suppress the variables w,c).

$$\frac{\partial v_2}{\partial I}(w+B(z_j),c;z_j)\frac{\partial B}{\partial z_j}(z_j) + \frac{dv_2}{dz_j}(w+B(z_j),c;z_j) = 0$$

By the envelope theorem $\frac{\partial v_2}{\partial I}(w+B(z_j),c;z_j) = \frac{\partial \phi}{\partial I}(w+B(z_j),\hat{x};z_j)$ and also $\frac{dv_2}{dz_j}(w+B(z_j),c;z_j) = -\frac{1}{2}c_j z_j$. Hence, I conclude

$$\frac{\partial B}{\partial z_j}(z_j) = -\frac{\frac{dv_2}{dz_j}(w+B(z_j),c;z_j)}{\frac{\partial \phi}{\partial I}(w+B(z_j),\hat{x};z_j)} = \frac{1}{2}\frac{c_j z_j}{\frac{\partial \phi}{\partial I}(w+B(z_j),\hat{x};z_j)} < 0$$

□

Proof of Lemma 12:

Differentiating the identity (2.11) I obtain:

$$-\frac{1}{2}\bar{x}_j^2 = (1-q)\left[\frac{\partial \phi}{\partial I}\frac{\partial B(w,c,z_j)}{\partial c_j} - \frac{1}{2}z_j^2\right]$$

Re arranging this equation I obtain

$$\frac{\partial B(w,c,z_j)}{\partial c_j} = \frac{1}{2}\frac{z_j^2 - \bar{x}_j^2(1-q)^{-1}}{\frac{\partial \phi}{\partial I}}$$

□

Proof of Proposition 13:

For ease of notation I suppress the arguments (I,c). Observe that for any given $I>0$ if $\hat{x}(z_j)$ is a solution to (2.15) it maximizes the expression $\phi(I,(x_{-j},z_j)) - \frac{1}{2}\sum_{i\neq j} c_i x_i^2 - \frac{1}{2}c_j z_j^2$. Hence,

$$\begin{aligned}
v_3(I,c;z_j) &= \phi(I,(\tilde{x}(z_j),z_j) - \frac{1}{2}(\sum_{i\neq j}^{n} c_i(\tilde{x}_i(z_j))^2 - c_j z_j^2) \\
&\geq \phi(I,(\hat{x}(z_j),z_j)) - \frac{1}{2}(\sum_{i\neq j} c_i(\hat{x}_i(z_j))^2 - c_j z_j^2) \\
&\geq \phi(I,(\tilde{x}(z_j),z_j) - \frac{1}{2}(\sum_{i\neq j}^{n} c_i(\tilde{x}_i(z_j))^2 - c_j z_j^2) \\
&= v_3(I,c;z_j)
\end{aligned}$$

It follows that

$$\phi(I,(\tilde{x}(z_j),z_j)) - \frac{1}{2}(\sum_{i\neq j}^{n} c_i(\tilde{x}_i(z_j))^2 - c_j z_j^2) = \phi(I,(\hat{x}(z_j),z_j)) - \frac{1}{2}(\sum_{i\neq j} c_i(\hat{x}_i(z_j))^2 - c_j z_j^2)$$

By strict concavity of the utility function it follows that

$$\hat{x}(I,c;z_j) = \tilde{x}(I,c;z_j)$$

I conclude that for each $I>0$

$$\begin{aligned} v_3(I,c;z_j) &= \phi(I,(\hat{x}(z_j),z_j)) - \frac{1}{2}(\sum_{i\neq j} c_i \hat{x}_i(z_j)^2 - c_j z_j^2) \\ &= \frac{1}{1-q} v_2(I,c;z_j) \\ &> v_2(I,c;z_j) \end{aligned}$$

Therefore, by definition of $B(I,c;z_j)$ I have for $I = w + B(w,c;z_j)$:

$$v_3(w+B(w,c;z_j),c;z_j) > v_2(w+B(w,c;z_j),c;z_j) \equiv v_1(w,c)$$

Also from the definition of $b(w,c;z_j)$ I further have that:

$$v_1(w,c) \equiv v_3(w+b(w,c;z_j),c;z_j)$$

□

Chapter 3

The Evaluation of Anti Corruption Policies with the Viewpoint of the Depth of Corruption

Abstract: Using the context of the depth of corruption which has been discussed in the second chapter, I evaluate the effect of alternative anti corruption policies, e.g, salary increases and the competition among officers, on both the level of corruption and the distortion of duties of corrupt officers. It shows that salary increases may fail to extinguish corruption opportunities without the rigorous monitoring. However, salary increases may succeed in reducing the equilibrium distortion of duties of corrupt individuals. Finally, contrary to the argument that competition among officers can inhibit corruption by Bertrand competition, this paper shows that when the officers are endowed with a range of alternative actions over which they may be bribed, heterogeneity in the distortion of duties of corrupt officers inhibits competition across officers.

Keywords: Anti corruption policies, bribe-taking, salary increases, competition.

JEL Classification Number: D50, C71, C72, D73

3.1 Introduction

I pose the following rhetorical question: Is a system where few corrupt officers deviate significantly from their task more desirable than one where many corrupt officers deviate slightly from their task? Whatever side one wishes to take in this question, the point is to highlight the relevance of the *depth* of corruption in terms of *distortion of duty*. This is a dimension of corruption where the literature has been silent because it focuses on the *spread* of corruption (i.e., the number or proportion of corrupt individuals[1]). Certainly, that approach has served well the study of corruption, but I believe that the consideration of corruption with respect to its depth, will enrich this discussion and the debate of alternative anti corruption policies.

The purpose of this paper is to substantiate the interest in this dimension of corruption and to attempt an initial approach to anti corruption policy from this viewpoint. This paper conveys the main message that a proper evaluation of the level of corruption in a system, besides a 'head count' of individuals who receive kickbacks, must also take into account how seriously they distort their tasks. I believe that highlighting this aspect of corruption is important because it shapes the way I devise and evaluate the success of alternative anti corruption policies. For instance, a policy may fail to reduce the number of corrupt individuals, but succeed to curb substantially the distortion of their tasks. Also, a policy may be effective for some levels of corruption but not for all.

Let us motivate and discuss these contributions. In the existing literature it is understood that individuals may accept bribes in order to deviate from their duty and perform some (largely unspecified) alternative action.[2] In this way individuals are distinguished between corrupt (who do not perform their duty) or not (who perform their duty) and inside these two groups they are homogenous with respect to their performance (or not) of their duty. I would like to introduce heterogeneity among individuals in both groups with respect to their actions, not merely as a matter of appeal to reality but because it bears on the discussion of anti corruption policy, as I will demonstrate in the sequel. I introduce two sources of heterogeneity. I propose that individuals who are not corrupt do not perform their duty with the same diligence, i.e., two individuals may perform their duty with varying ability or devotion. For corrupt individuals I assume that there is a multitude of possible deviations from duty, i.e., that they may distort their duty in a number of different ways. In this way, whereas an individual may decline a bribe for a certain deviation from

[1] In this paper, I use interchangeably the term 'officer' and 'individual'.

[2] See e.g., Andvig and Moene, 1990; Acemoglu, 1995; Aidt, 2003; Sah, 2007.

her duty, it is possible that he might accept it for a different one. Observe that in this case two individuals who differ in their diligence in the performance of their tasks, when they accept a bribe to distort their duty in the same way provide a differentiated 'service' to the donor, in the sense that the distortion of their task due to the bribe is not the same. This is a crucial point of my approach.

Following this lead, I develop a framework where there is a menu of actions available and individuals may accept varying bribes in return for taking alternative actions. My analysis culminates in the computation of the reservation level of bribe for alternative degrees of corruption. Then I use my analytical tool to evaluate alternative anti corruption policies that have been proposed in the literature. In particular, I point out some drawbacks of monetary incentives in reducing the spread of corruption, but at the same time their beneficial effect in reducing the degree of corruption. I also point out some important limitations of the effects of competition among officers on the spread of corruption.

I start in the next section with a study of the decision of an officer to accept a bribe in exchange for alternative deviations from their task. Section 3 reviews the effectiveness of salary increases on the spread but also on the depth of corruption, i.e., the distortion of duties. In Section 4 I review the arguments about competition among officers serving as anti corruption tool. The last section summarizes my conclusions.

3.2 A standard model of bribery

In the existing literature individuals are understood as performing some duty and bribes as 'contracts' involving monetary payoffs associated with some action, presumed to be different from the duty of individuals, i.e., the objective of a bribe is left unspecified, assumed to be some fixed action to be taken. This serves well the discussion of the spread of corruption in terms of proportions of corrupt individuals, but fails to account for their degree of corruption in terms of the level of distortion of duties.

In order to capture the possibility of variable distortion of duty, I assume that each individual (also referred to as officer) has available a menu of possible actions, represented by $a \in \Re_+$. The *duty* (or *task*) of each individual is represented by a specific action $a^\star \in \Re_{++}$. This task is nothing other than a specification of the action which corresponds to some job or position specification. For instance the action that an officer in an organization is expected to take. Nevertheless, an individual is free to choose any action $a \in [0, a^\star]$. With a suitable change of variable $x = a - a^\star$ I may identify the task as $x^\star = 0$ so that any action $x \in [-a^\star, 0]$ identifies a distortion of duty.

Besides the actions of the individual another utility relevant variable that I consider is a monetary payoff which includes the salary and/or other monetary rewards (bonuses, bribes etc). In conclusion I assume that the individual has preferences which are expressed by a utility function $u(I,x)$, where $I > 0$ is individual income and x is an action level in terms of distance from the duty $x^\star$ (recall my transformation). I assume that $u(I,x)$ is twice continuously differentiable, strictly concave in x so $\frac{d^2u}{dx^2} < 0$ and also $\frac{du}{dI} > 0$, $\frac{d^2u}{dI^2} \leq 0$ (non increasing marginal utility of income) throughout the domain and $\lim_{I\to+\infty} u = +\infty$.[3]

Non corrupt behavior

A crucial point is the action of an individual in lack of a bribe (the fallback situation) because this is not immaterial neither for the decisions of a donor to offer, nor for the individual to accept a bribe in order to take a specific action. After all corruption occurs whenever a monetary payoff induces individuals to *deviate* from the action that they would take in absence of this monetary payoff. The literature implicitly assumes that in lack of a bribe officers would simply perform their task $x^\star$, which in turn renders all non corrupt officials homogenous in this regard. By contrast, in order to introduce some heterogeneity, I assume that the individual is choosing actions in order to maximize utility, i.e., solves the problem

$$\max_{x\in\Re} u(I,x) \tag{3.1}$$

Let $\bar{x}(I) \in [-a^\star, 0]$, denote the solution to this problem. Notice that $\bar{x}(I) \neq 0$ does not mean that the individual is corrupt. It simply represents the performance of an individual for a given income I. Given the solution $\bar{x}(I)$ I can define the function

$$v_1(I) \equiv u(I,\bar{x}(I))$$

Corrupt behavior

Svensson, 2005 and Nichlos and Robertson 2013 refer to bribery as a corrupt transaction that involves quid pro quo; an exchange of a payoff for the abuse or misuse of office. Similarly Banerjee, Mullainathan, and Hanna (2012), define bribery as the breaking of a rule by a bureaucrat in order to provide service to someone that he was not supposed to,

[3] Other assumptions on u, will be added as needed in the sequel.

in return for a covert monetary bribe. Following these leads a bribe is understood here as a monetary payoff which is awarded to individuals in order to influence their action in a prescribed way.[4]

It cannot be denied that there are important moral, social and legal issues involved in decisions to accept a bribe. However, I assume that these are encompassed by the utility function that encompasses the attitude of the individual with respect to such issues and I focus on the materialistic part of such decisions. I postulate that an individual decides whether to accept or reject a bribe based on individualistic considerations.

Let us consider an individual as in the previous section, who in addition to the monetary reward $w > 0$ is presented with the opportunity to receive an (extra-institutional) additional monetary payoff B in exchange for taking a prescribed action z.

In line with the literature on corruption I introduce here a probability that the individual is caught 'hand in the cookie-jar', i.e., a probability assessment $q \in (0,1)$. In this case the individual loses all monetary rewards and performs no action at all (e.g. is obliged to take an unpaid leave). Otherwise with the residual probability there is no scandal and the individual receives in addition to the monetary reward w an amount B and performs the action z. In view of the uncertainty introduced the individual obtains expected utility

$$qu(0,-x^\star)+(1-q)u(w+B,z) \tag{3.2}$$

Since the first term in the summation is constant, without loss of essence I can normalize the utility function so that $u(0,-x^\star)=0$, in which case the above expression simplifies to

$$v_2(I;z) \equiv (1-q)u(w+B,z) \tag{3.3}$$

It can be verified that $v_2(\cdot;z)$ is monotonically increasing in I, i.e., $\frac{v_2(I;z)}{\partial I} > 0$.

Observe that

[4]The aspect that distinguishes a bribe from other monetary payoffs is its source. A monetary payoff that originates from the institution responsible for the actions of an officer as a bonus may be legitimate whereas the same payoff originating from extra-institutional centers is not. From this point of view a bonus awarded to an official can be viewed as a sort of 'bribe' on behalf of the institution and often institutions use such mechanisms as a tool against corruption.

$$\begin{aligned} v_1(w) &\geq u(w,z) \\ &> (1-q)u(w,z) \\ &= v_2(w;z) \end{aligned} \tag{3.4}$$

Since $\frac{v_2(I;z)}{\partial I} > 0$ and $\lim_{I\to+\infty} u = +\infty$, there exists some $B > 0$ so that

$$v_1(w) = v_2(w+B;z) \tag{3.5}$$

Since $v_1(w)$ is bounded, equation (3.5) defines an implicit function $B(w;z)$ so that

$$v_1(w) \equiv v_2(w+B(w;z);z) \tag{3.6}$$

The quantity $B(w;z)$ represents the minimum bribe necessary in order to 'corrupt' an individual with salary w, in order to elicit the action z. By varying z one obtains a 'price list' for bribery. It represents the 'reservation' monetary payoff for various levels of distortion the duty of an individual.

The representation of cost-benefit from corruption

In order to fix ideas, suppose that the action x of an individual affects adversely the payoff of another (say the profit of a firm) which is denoted as $\pi(x)$. If there is no corruption this payoff would be $\pi(\bar{x}(w))$. If on the other hand the individual was corrupt to the level $z < 0$ instead then, given the probability of detection, the expected payoff would be $\pi^e(z)$. In order to provide a motive for distortion of duty I assume that $\frac{d\pi^e}{dz}(z) < 0$, i.e., the expected profit is directly related to the distortion of duty. Hence, influencing the action of the individual at a level $z < \bar{x}(w)$ would create the benefit $\pi^e(z) - \pi(\bar{x}(w))$ and it would cost $B(w;z)$ to the donor from corrupting the officer. So the surplus from corrupting the individual at a level z is given by

$$S(w;z) = \pi^e(z) - \pi(\bar{x}(w)) - B(w;z) \tag{3.7}$$

This surplus represents the cost-benefit considerations of corruption. Here lies the root of corruption: if there is some distortion of duty $\bar{z}$ so that $S(w;\bar{z}) > 0$ then there is room for a mutually beneficial deal between the two parties, i.e., corruption will occur. Notice that

$S(w;\bar{z}) > 0$ implies that $\bar{z} < \bar{x}(w)$.

The problem facing anti corruption authorities is to find ways to inhibit such deals by affecting directly or indirectly this surplus.

3.3 The impact of salary increases on corruption

It has been proposed in the literature that salary increases can be used as a tool against corruption (see e.g., Becker and Stigler, 1974; Cadot, 1987; Chand and Moene, 1999; Cracau and Franz, 2013). Intuitively, salary increases work against corruption through 'inflating' the cost of corrupting individuals. This of course eliminates opportunities of corruption by raising the cost and making it uninteresting for the potential donor of a bribe. Other authors (for instance Besley and Mclaren (1993), Van Rijckeghem and Weder (2001), Sosa (2004), Mookherjee and Png (1995)) have expressed reservations as to the effectiveness of this policy. Let us discuss these issues from my viewpoint.

Salary increases with a fixed distortion of duty.

Salary increases are understood to have an effect on corruption by distorting the surplus from corruption. Differentiating (3.7) I obtain:

$$dS(\bar{z}) = -\left(\frac{\partial \pi}{\partial x}\frac{\partial \bar{x}}{\partial I} + \frac{\partial B}{\partial I}(w,\bar{z})\right) dI$$

CONCLUSION 1. *Salary increases are effective in reducing the surplus from corruption, i.e.,* $\frac{dS}{dI} < 0$ *when* $\frac{\partial B}{\partial I}(\bar{z}) > -\frac{\partial \pi}{\partial x}\frac{\partial \bar{x}}{\partial I}$.

For comparison, in the literature $\bar{x}(w) = x^\star$ so $dS(\bar{z})$ is inversely proportionate to $\frac{\partial B}{\partial I}(\bar{z})$. Hence, the effectiveness of this policy hinges on the sign of $\frac{\partial B}{\partial I}(\bar{z})$. Differentiating the identity (3.6) and using the envelope theorem I obtain

$$\begin{aligned} \frac{\partial B}{\partial I}(w;z) &= \frac{\frac{\partial v_1}{\partial I}(w)}{\frac{\partial v_2}{\partial I}(w+B(w;z);z)} - 1 \\ &= \frac{\frac{\partial u}{\partial I}(w,\bar{x}(w))}{(1-q)\frac{\partial u}{\partial I}(w+B(w;z),z)} - 1 \end{aligned} \tag{3.8}$$

Therefore, the effectiveness of salary increases depends crucially on the relative marginal utilities of income with or without corruption. If the marginal utility of income is constant and independent of the action x, as it is often assumed in the literature, then $\frac{\partial B}{\partial I}(w;z) = \frac{1}{1-q} - 1 > 0$. However, my model suggests that this need not be the case generally. The following proposition, where for simplicity I have taken $q = 0$, shows how a situation where salary increases are counter productive can arise.

Proposition 14. *Suppose that $u(\cdot,\cdot)$ is such that marginal utility of income is constant in I and decreasing in x, i.e., $\frac{\partial u}{\partial I}(\cdot,x)$ is constant and $\frac{\partial u}{\partial I}(I,\cdot)$ is decreasing. Then for any $z < \bar{x}(w)$ I have $\frac{\partial B}{\partial I}(w;z) < 0$.*

Proof: see the Appendix.

Intuitively, a salary increase may decrease the minimum bribe acceptable to be corrupt because an individual whose marginal utility of income increases when she is corrupt to a level z, puts more value to her monetary payoff than the achievement of her task. So with a salary increase he would be willing to accept a lower bribe.

Finally, a couple of comments are worthwhile here. First, reducing the surplus is not enough to eliminate a corrupt exchange. In fact, if the surplus is not eliminated the salary increase merely puts more money in the pocket of a corrupt individual whose salary increases and in addition her reservation bribe is elevated and thus has an improved bargaining position for the remaining surplus. Second, eliminating the surplus does not require substantial salary increases if $\left|\frac{\partial \pi}{\partial x}\frac{\partial \bar{x}}{\partial I} + \frac{\partial B}{\partial I}(\bar{z})\right|$ takes a sufficiently high value. This is possible for instance when q is sufficiently close to 1 (monitoring is tight) in which case from (2.12) it can be seen that $\frac{\partial B}{\partial I}(\bar{z})$ becomes very high.

Alternative approach: variable distortion of duty.

When the distortion of duty is allowed to vary, there is a new angle in the assessment of the effects of salary increases on corruption, because salary increases can have substitution effects on the distortion of duty. In other words there is a rate of *substitution* between salary and the distortion of duty of the individual which retains intact the surplus from corruption. As a result the effect of salary increases on corruption will be in terms of degree and not of incidence, i.e., the salary increase may fail to reduce the number of corrupt individuals but nevertheless succeed in reducing the distortion of their duty. To see this consider the total differential of the surplus $S(w;\bar{z})$ defined before:

$$dS(w;\bar{z}) = \left(\frac{d\pi^e}{dz}(\bar{z}) - \frac{\partial B}{\partial z}(w;\bar{z})\right)dz - \left(\frac{d\pi}{dx}(\bar{x})\frac{\partial \bar{x}}{dI}(w) + \frac{\partial B}{\partial I}(w;\bar{z})\right)dI$$

It follows that there is a marginal rate of substitution between the variables w and z so that the surplus remains intact provided that $\frac{d\pi^e}{dz}(\bar{z}) - \frac{\partial B}{\partial z} \neq 0$:

$$dS(w;\bar{z}) = 0 \Leftrightarrow \frac{dz}{dI}(w;\bar{z}) = \frac{\frac{d\pi}{dx}(\bar{x})\frac{\partial \bar{x}}{dI}(w) + \frac{\partial B}{\partial I}(w;\bar{z})}{\frac{d\pi^e}{dz}(\bar{z}) - \frac{\partial B}{\partial z}(w;\bar{z})} \tag{3.9}$$

CONCLUSION 2. *Salary increases may fail to extinguish corruption opportunities (the surplus of corruption), but succeed in influencing the level of distortion of duties.*

Effects on the equilibrium distortion of task.

In order to make my point about the effect of salary increases on the degree of corruption, let us consider a simple situation where one donor is faced with a group of (homogenous) officers. For my purposes here it will suffice to represent the donor by a payoff function $\pi^e(z) - \pi(\bar{x}(w)) - b$ and the officers by their reservation bribe. The corruption procedure evolves sequentially with the donor signalling a distortion of duty z required and the officers signalling back the bribe they would require to that effect. An equilibrium (in terms of moves) in this situation consists of a pair $(\bar{z}, \overline{b}) \in \Re_- \times \Re_+$ which forms a subgame perfect Nash equilibrium. A Bertrand type argument establishes that at such an equilibrium in the second stage $\overline{b}(\bar{z}) = B(w;\bar{z})$ (the bribe equals the reservation bribe of the officers), whereas in the first stage the donor chooses $\bar{z}$, that solves:

$$\max_{x \in \Re} \pi^e(z) - \pi(\bar{x}(w)) - B(w;z) \tag{3.10}$$

Assuming the objective function satisfies the appropriate conditions for the existence of the solution. The solution to this problem $\bar{z}(w)$ represents the degree of corruption at equilibrium, i.e., the distortion of duty that will be optimally requested by the donor and will be provided by the officer. Recall that it must be that $\bar{z}(w) < \bar{x}(w)$ (otherwise the net benefit would be negative). Finally, the corresponding $\overline{b}(w) = B(w;\bar{z}(w))$ represents the equilibrium level of bribe.

I am interested in assessing the effect of salary increases on the equilibrium degree of corruption $\bar{z}(w)$. In this regard I have the following proposition

Proposition 15. *When* $\frac{\partial^2 u}{\partial I \partial x} > 0$ *we have that* $\frac{d\bar{z}}{dI}(w) > 0$*, i.e., salary increases are effective in reducing the equilibrium degree of corruption.*

Proof: see the Appendix.

The above conclusion substantiates my point about the relevance of the degree of corruption in evaluating the efficacy of anti corruption policies. Whether or not the policy of salary increases is successful in reducing the spread of corruption may remain questionable. On the other hand this policy is effective in reducing the degree of corruption (the distortion of duties by corrupt individuals) and from this point of view it is a successful policy against corruption.

3.4 Competition among corrupt individuals

It has been argued that the competition among corrupt officers can reduce the level of bribes to zero and thus eliminate corruption. Shleifer and Vishny (1993) and also Allen et al. (2015) model bribing situations inspired by Bertrand competition. The Bertrand paradox applies in such a context so at equilibrium the bribe requested by any individual is driven to zero and the individuals perform their duty.

My context suggests that this argument may fail in several ways when there is heterogeneity across corrupt officers. To see this suppose that there is a set T of possible 'types' of officers and the utility functions of officers depend on their type $c \in T$, i.e., the utility function of an officer of type c is $u(c,I,x)$. The type of an officer may reflect for instance different attitudes with respect to income vs diligence in the performance of duty. For simplicity I assume a finite number of types each populated by a large number of individuals. The analysis of the section 2 can be recast *mutatis mutandis* and I can derive $B(c,w.z)$ representing the reservation bribe required by an officer who is of type c and receives a salary w in order to distort task to a level z. Taking into account the different types of officers the surplus from a given distortion of duty $\bar{z}$ is expressed as $S(c,w;\bar{z}) = \pi^e(\bar{z}) - \pi(\bar{x}(c,w)) - B(c,w;\bar{z})$.

Competition with a fixed distortion of duty.

The literature assumes that $\bar{x}(c,w) = x^\star$, i.e, for given $\bar{z}$ the degree of corruption across types is uniform. In this case maximizing the surplus is equivalent to minimizing $B(c,w;\bar{z})$, i.e., bribing officers of type(s) $\bar{c}$ with the minimum reservation bribe $B(\bar{c},w;\bar{z}) =$

$\min\{B(c,w;\overline{z}) : c \in C\}$. If there are sufficient numbers of officers of these types it can be argued along a Bertranean line, that the only level of bribe $\overline{B}$ compatible with equilibrium is where $\overline{B} = B(\overline{c},w;\overline{z})$, i.e., the minimum bribe requested. If I further assume that officers distorting their task from $x^\star$ face no utility loss or risk of detection this minimum bribe $B(\overline{c},w;\overline{z})$ is zero, which is in line with Shleifer and Vishny (1993) and also Allen et al. (2015).

By contrast my approach assumes that corrupt officers do face utility loss and a risk of detection when they deviate from $\overline{x}(c,w)$ (or $x^\star$). Therefore, $B(c,w;\overline{z}) > 0$ for any $\overline{z} \neq x^\star$. Hence, it will be $\overline{B} = B(\overline{c},w;\overline{z}) > 0$ and corruption will persist at equilibrium.[5]

CONCLUSION 3. *When the degree of corruption across types of officers is uniform, the equilibrium level of bribe will equal the minimum bribe required across all types of officers $B(\overline{c},w;\overline{z})$ and corruption concentrates on the type(s) $\overline{c}$ of officers with the lowest reservation bribe.*

Another line of argument stemming from my approach is that corrupt officials of different types are differentiated with respect to $\overline{x}(c,w)$. This differentiates the service (benefit) provided to the donor of a bribe $\pi^e(z) - \pi(\overline{x}(c,w))$. In short, the Bertrand competition is now over a 'differentiated service'. Hence, maximizing surplus is no longer equivalent to approaching officers with a view of minimizing the bribe paid out, but rather approaching officers of type(s) $\overline{c}$ such that $\pi(\overline{x}(\overline{c},w)) + B(\overline{c},w;\overline{z}) = \min\{\pi(\overline{x}(c,w)) + B(c,w;\overline{z}) : c \in C\}$. In this case it is possible to have types c_1, c_2 where the benefit from corrupting a c_2-type officer is higher $\pi^e(z) - \pi(\overline{x}(c_2,w)) > \pi^e(z) - \pi(\overline{x}(c_1,w))$ while the cost of bribing a c_2-type officer is higher so that $S(c_1,w;\overline{z}) = S(c_2,w;\overline{z})$.

CONCLUSION 4. *When the degree of corruption across types of officers varies, the competition among corrupt officers is over a differentiated benefit and the Betrand paradox does not apply in order to eliminate corrption. At equilibrium corruption is concentrated on the type(s) of officers $\overline{c}$ where $\pi(\overline{x}(\overline{c},w)) + B(\overline{c},w;\overline{z}) = \min\{\pi(\overline{x}(c,w)) + B(c,w;\overline{z}) : c \in C\}$ and bribes are exchanged at the level $\overline{B} = B(\overline{c},w;\overline{z}) > 0$.*

Competition with variable distortion of duty.

When the distortion of duty is also variable, the differentiation of the donor's benefit across types of officers,i.e., $\pi^e(z) - \pi(\overline{x}(c,w))$, is exacerbated so competition is further

[5] If there is an infinite number of types it is possible that $\inf\{B(c,w;\overline{z}) : c \in C\} = 0$, but this is not ensured without assumptions.

inhibited and hence less likely to eradicate corruption. In this case donors would choose the level of distortion of duty requested from each type of officer seeking to maximize surplus.

$$\max_{z \in \Re \times C} \pi^e(z) - \pi(\overline{x}(c,w)) - B(c,w;z) \tag{3.11}$$

The solution to this problem is a *pair* $(\overline{c}(w), \overline{z}(w))$, i.e., at equilibrium the level of distortion of duty and the bribes exchanged is variable across types.

CONCLUSION 5. *At equilibrium corruption extends to type(s)* $\overline{c}$ *where* $S(\overline{c},w,\overline{z}(\overline{c},w)) = S(\overline{c}(w),w,\overline{z}(w))$ *and the distortion of duties and bribes exchanged varies across types of officers.*

3.5 Conclusions

I review from the viewpoint of the depth of corruption some anti corruption arguments that have been debated in the literature. The analysis examines the effectiveness of salary increases on corruption from two perspectives. I find that when the distortion of duty, i.e., the degree of corruption, is allowed to vary, there are substitution effects between the cost and the degree of corruption, which inhibit (or even extinguish) the effect of salary increases on the donor's cost benefit analysis of corruption. Even when the degree of corruption is fixed, as in the existing literature, salary increases do not change only the cost of but also the benefit from corruption for the donor. Therefore, the cost benefit analysis of engaging in corruption becomes ambivalent. These arguments cast doubts as to the effectiveness of salary increases on the *spread* of corruption. On the other hand I find that salary increases are effective in the reduction of the *degree* of corruption, in the sense of reduction of the level of distortion of duty that occurs at equilibrium. I believe that these conclusions substantiate my point that the degree of corruption is a meaningful and essential ingredient in the discussion of (anti)corruption.

Our approach also casts doubts on the arguments in the literature that competition among corrupt individuals is in itself an effective anti corruption tool. I find that due to the heterogeneity I introduced, the benefit that a donor buys with a bribe is differentiated, which inhibits competition across officers. As a result, the Bertrand paradox does not apply to eradicate corruption. Furthermore, corruption no longer concentrates on types of officers who are 'easier to corrupt', in the sense that their reservation bribe is minimal, but

extends possibly to a more complex configuration of types, especially when the degree of corruption is allowed to vary.

3.6 Appendix

Proof of Proposition 14:

$$\begin{aligned} \frac{\partial u}{\partial I}(w,\bar{x}) &= \frac{\partial u}{\partial I}(w+B(w),\bar{x}) \\ &< \frac{\partial u}{\partial I}(w+B(w),z) \end{aligned} \tag{3.12}$$

In this case $\frac{\partial B}{\partial I}(w) = \frac{\frac{\partial u}{\partial I}(w,\bar{x})}{\frac{\partial u}{\partial I}(w+B(w),z)} - 1 < 0$ □

Proof of Proposition 15:

$\bar{z}(w)$ must satisfy the first order conditions of (3.10) identically:

$$\frac{d\pi^e}{dz}(\bar{z}(w)) - \frac{\partial B}{\partial z}(w;\bar{z}(w)) \equiv 0 \tag{3.13}$$

Differentiating this expression with respect to I I obtain

$$\frac{d^2\pi^e}{dz^2}(\bar{z}(w))\frac{d\bar{z}}{dI}(w) - \left(\frac{\partial^2 B}{\partial z \partial I}(w;\bar{z}(w)) + \frac{\partial^2 B}{\partial z^2}(w;\bar{z}(w))\frac{d\bar{z}}{dI}(w)\right) = 0$$

so the effect of salary increases on the *equilibrium* degree of corruption can be computed as

$$\frac{d\bar{z}}{dI}(w) = \frac{\frac{\partial^2 B}{\partial z \partial I}(w;\bar{z}(w))}{\frac{d^2\pi^e}{dz^2}(\bar{z}(w)) - \frac{\partial^2 B}{\partial z^2}(w;\bar{z}(w))} \tag{3.14}$$

I would like to establish the sign of the above expression. This can be done along the following steps:

Step I: From (3.13) I have $\frac{\partial B}{\partial z}(w;\bar{z}(w)) = \frac{d\pi^e}{dz}(\bar{z}(w)) < 0$.
Step II: By differentiating (2.12) I have

$$\frac{\partial^2 B}{\partial z \partial I} = -\frac{\frac{\partial u}{\partial I}(w,\overline{x}(w))\left[\frac{\partial^2 u}{\partial I \partial x} + \frac{\partial^2 u}{\partial I^2}\frac{\partial B}{\partial z}\right]}{(1-q)\left(\frac{\partial u}{\partial I}(w+B(w),\overline{z}(w))\right)^2}$$

Since $\frac{\partial^2 u}{\partial I \partial x} > 0$ (by hypothesis), $\frac{\partial u}{\partial I} > 0$, $\frac{\partial^2 u}{\partial I^2} < 0$ (by assumption), and $\frac{\partial B}{\partial z} < 0$ by step I, it follows that $\frac{\partial^2 B}{\partial z \partial I}(w;\overline{z}(w)) < 0$.

Step III: From the second order conditions of (3.10) I have $\frac{d^2\pi^e}{dz^2}(\overline{z}(w)) - \frac{\partial^2 B}{\partial z^2} < 0$.

Therefore, by steps II and III, I can conclude from (3.14) that $\frac{d\overline{z}}{dI}(w) > 0$, i.e., an increase in salaries reduces (recall $z(w) < 0$) the equilibrium degree of corruption. □

Chapter 4

The Failures of Bribery Market

Abstract: The analysis of the distortion of duties due to bribe paves the way to understanding bribing as a 'market' exchange situation where monetary payoffs are traded for some actions. Based on the varying degree of corruption among officers I propose the development of indirect anti corruption policies inspired by the idea of *triggering* bribery market failures. Uncertainty of officers' type could be 'managed' by inducing adverse selection in order to serve as an anti corruption tool. To illustrate this point, I present a game setup that leads to complete unraveling of the bribery market, akin to Akerlof's market for lemons.

Keywords: Anti corruption policies, uncertainty, adverse selection, committee.

JEL Classification Number: D50, C71, C72, D73

4.1 Introduction

The bribe is associated with a certain objective. In my view, corruption decisions are more complex than the binary decision of accepting a bribe or not. In addition, corruption decisions should also incorporate the principle that for a given bribe individuals are tempted to do different things among several possibilities. Chapter 2 introduces two sources of heterogeneity. It proposes that individuals who are not corrupt do not perform their duty with the same diligence, i.e., two individuals may perform their duty with varying ability or devotion. For corrupt individuals, it assumes that there is a multitude of possible deviations from duty, i.e., that they may distort their duty in a number of different ways. Observe that in this case two individuals who differ in their diligence in the performance of their tasks, when they accept a bribe to distort their duty in the same way provide a differentiated 'service' to the donor, in the sense that the distortion of their task due to the bribe is not the same. Intuitively, bribing an officer to do something close to what he would do anyway, is likely to be easier than bribing him to do something radically different.

Building on the uncertainty about the varying degree of distortion of the tasks of individuals, I present a result that shows how the market for bribes can be conditioned in a way so that it completely unravels due to adverse selection, similarly as the Akerloff market for lemons. In other words, I propose that the management of uncertainty in a way that exacerbates adverse selection effects can be a very effective anti corruption tools.

As economists, we are called to find ways to sustain situations which are against the private interests of individuals (e.g. minimize trade in 'markets' for corruption, which is the opposite of my usual task), but I am well placed to know what it takes to do so. I view the corruption as a trade relationship between donors of bribes and individuals whose actions affect the interest of donors, which sets in view the prospect of developing an equilibrium model of corruption transactions. The motivation for doing so is that the investigation of the fundamentals and parameters, which characterize equilibrium situations, would help us develop tools to fight corruption. The central message of this chapter is that the variable degree of corruption of individuals gives the opportunity for the development of anti corruption policies which can make use of what I have learned in economics about market failures. The key idea is to view corruption as arising through a 'market' situation where bribes (monetary or other) are exchanged for distortions of duties (apparently involving breaking rules) and to devise anti corruption tools which operate through triggering failures of such markets.

I start with an example in order to explain the idea of indirect corruption policies based on adverse selection in Section 2. Following it, I offer a general analysis of corruption and uncertainty in a strategic game. Section 3 summarises the conclusions.

4.2 Adverse Selection as an Anti Corruption tool

In the previous section I saw that potential donors of bribes will be interested in approaching specific types of officers and offer bribes for variable distortions of duty. Hence, knowledge of the types of officers is crucial for a corrupt exchange to occur. This intuition naturally leads to the idea that uncertainty about the types of officers would inhibit corruption. Ryvkin and Serra (2012) suggest that uncertainty about the counter party in a corrupt transaction, inhibits corruption through its influence on the perception of the probability of getting caught. I believe that uncertainty has a more profound impact on corruption through adverse selection effects, so I follow a different lead inspired by the lessons I have learned from market failures. My main message here is this: as economists we have identified situations where markets fail and these can be exploited to work for us against corruption.[1] Indirect anti corruption measures can be developed around the idea of 'managing' uncertainty in order to *trigger* severe adverse selection effects which will unravel the bribery market. In what follows I present a simple model of a bribery game which illustrates my point.

An example of adverse selection in a market for corruption

I consider a set of such individuals who are characterized by their 'type', represented by the variable c in their utility function. I let the interval $[\underline{c},\bar{c}] \subset \Re_+$ summarize the possible types of individuals, who are distributed in this interval according to a distribution function $F(c)$, which is assumed to be non-degenerate so there are at least two types present in nonzero proportions and salary w as above. The total number (more precisely measure) of individuals is N.

Let $\bar{x}(w,c) \in \Re$ be the level of activity that an individual of type c, receiving a salary w, would normally choose (I have dropped the dependence on w from the notation).

The party would ideally prefer the activity level to be at level z. Let $\pi(\bar{x}(c)-z)$ represent the (monetary) value[2] of the individual taking the activity z instead of $\bar{x}(c)$. In

[1] or any other market I would like to eliminate.

[2] This specification results from an objective function $-\frac{1}{2}\pi\int(z-\bar{x}(c))^2\,dc$, which is the spread of the

order to achieve this the donor would be willing to offer a bribe, in the form of a contract, $b(z) \in \Re+$. According to my analysis in the previous sections the individual would accept this contract if $b(z) \geq B(c,z)$, i.e., his reservation price is the minimum bribe required to induce him to take the action z. Obviously a mutually interesting transaction between the two parties is possible when $\pi(\bar{x}(c)-z) \geq B(c,z)$. Let us assume that $\pi(\bar{x}(c)-z) \geq B(c,z)$ for every $c \in [\underline{c},\bar{c}]$ so that the donor would be interested to bribe any type. If the type c of the individual is observable the donor could offer a bribe $b(c,z) = B(c,z)$ depending on c and this would induce the desired action z by the individual.

This situation becomes more interesting (and realistic) when the type of the individual is unobservable. An interesting interpretation of this situation is that the donor will be assigned randomly to an individual who will take an action affecting their interest. In that case a bribe can no longer be type dependent and the donor has to consider the 'expected' benefit of a bribe among the types who will accept it.

In this situation a bribe $b(z) \in \Re+$ will be accepted by all individuals with a smaller reservation bribe to perform the action z, i.e., individuals $S = \{c : b(z) \geq B(c,z)\}$ will be available to corrupt. On the other hand if μ denotes the belief of the donor about the average benefit from the actions of individuals who would accept a bribe $b(z)$, he would offer the bribe as long as $b(z) = \mu$. But the belief μ would correctly reflect the average benefit from individuals in S when $\mu = E[\pi(\bar{x}(c)-z)|c \in S]$. Hence, at the equilibrium level of corruption it must be $b(z) = E[\pi(\bar{x}(c)-z)|c \in S]$. The following definition of equilibrium corresponds to the classical definition of Akerlof (1970).

DEFINITION 1. *An equilibrium corruption is a bribe $b^*(z)$ and $S^* \subseteq [\underline{c},\bar{c}]$ such that $S^* = \{c : b^*(z) \geq B(w,c,z)\}$ and $b^*(z) = E[\pi(\bar{x}(c)-z)|c \in S^*]$.*

As we know from the literature on asymmetric information, this equilibrium is characterized by the phenomenon of adverse selection: for some levels of bribe, the most valuable individuals do not corrupt, which reduces the average value of the action of corrupt individuals. This reduces the level of bribe that the donor would be willing to offer, which in turn further alienates the more valuable individuals and so on. Here I have a classic case of adverse selection because $\pi(\bar{x}(c)-z) \geq B(c,z)$ (so it is profitable to bribe every type) and most crucially that $B(\cdot,z)$ is increasing[3] in the variable c. The last fact is what guarantees adverse selection: the most valuable individuals are more expensive to corrupt in order to take the action z.

random variable $\bar{x}(c)$ relative to the target activity z, i.e., the profit of the donor decreases the further $\bar{x}(c)$ is spread away from z.

[3]See previous section and recall that $z < \bar{x}(c)(1-q)^{-\frac{1}{2}}$

The adverse selection can be a very useful tool in order to guarantee that this 'market' for bribes collapses completely. To see how this can be achieved let $\varepsilon > 0$ represent an arbitrarily small shock (note that it does not need to be type dependent) so that $\pi(\bar{x}(c) - z) \geq B(c,z) + \varepsilon$, i.e., a reduction to $B(c,z)$. For instance, this can be achieved by a reduction to the parameter q which reduces $B(c,z)$ but does not affect $\bar{x}(c)$. In that case the corruption unravels completely as the following proposition shows.

Proposition 16. *Suppose that $\pi(\bar{x}(c) - z) \geq B(c,z) + \varepsilon$, where $(\bar{x}(c) - z)$ is uniformly distributed with measure N, where N is sufficiently large so that $B(\underline{c},z) > \frac{1}{N}\pi(\bar{x}(\bar{c}) - z)$. Then there can be no equilibrium $b(z) > 0$, i.e., $E[\pi(\bar{x}(\bar{c}) - z) | b(z) \geq B(c,z)] < b(z)$ for every $b(z) > 0$.*

Proof: see the Appendix.

Corruption and adverse selection in a strategic game

I apply the idea of adverse selection in a somewhat different context of a game. Besides being appealing to the realism for the particular context considered, the setup captures better the idea that the equilibrium level of bribe is determined via a process which is sensitive to individuals' decisions to accept the bribe. This is different the competitive process in the approach adopted in the previous analysis where the individuals' decisions to be corrupt or not had a negligible effect on the equilibrium level of the bribe. Let us consider a game involving a donor (or a group of coordinating donors) and officers in a large set O, partitioned into types in a finite set T, i.e., $c_h \in T$ for each $h \in O$.

Let us consider the following situation. An action to be taken will be decided collectively by a committee $H \subset O$ consisting of N officers, each of whom proposes an action and the decision will be the average of the proposed actions.[4] Suppose that the action decided by this committee affects adversely the welfare of another party, referred to as 'donor', who prefers actions in the direction of a certain $z \in \Re_-$ which for simplicity I assume so that $z < \bar{x}(c_h)$ for each $h \in I$, i.e., an action further away from the task of each officer. Hence, the donor is interested in bribing as many officers as possible to propose the action z, so that the decision (the average) is as close to z as possible. In order to accomplish this the donor may offer to pay bribes. We assume that the donor cannot distinguish the types of individuals, so he has to offer to each individual a bribe which is independent of the type. Hence, the donor offers a total bribe bill $b \geq 0$ to those officers who propose the action z, so his strategy set can be taken to be $S_d = \Re_+$.

[4] Recall that in our setup an 'action' is identified with a certain 'distortion of task'.

Officers on the other hand receive a salary w and may either accept or reject the contract on offer. It is convenient to represent the decision to accept or reject a contract with the strategy set $\{0,1\}$, where $t_h = 1$ ($t_h = 0$) corresponds to 'accept' ('reject'). Those who accept, i.e., $t_h = 1$ propose the action z and those who don't, i.e., $t_h = 0$, propose the action $\bar{x}(c_h)$ (we have dropped the variable w from the notation), i.e., the solution to (2.2). In turn those officers who accept the contract will split the bribe amongst themselves and those who reject it simply receive their salary w. In other words, given a profile of strategies $t_h \in \{0,1\}$ for each $h \in H$, each officer receives a kickback $\frac{t_h}{\sum_{h\in H} t_h} b$, where $0/0$ is defined to equal zero. This equal split represents the intuition that individuals recognize that the donor is oblivious to their type, so he offers the same bribe to each of them. Hence, he only specifies the total bribe bill to be distributed among all those who agree to take the action z required.

The game proceeds sequentially in two stages where the donor moves first setting the bribe bill, followed by the individuals signing up (or not) to it. A behavioral strategy for individuals is then a mapping $s_h : S_d \to \{0,1\}$. Let S_h denote the collection of behavioral strategies of individual h and $S = \prod_{h\in H} S_h$. Once strategies are executed the payoffs to the donor and individuals respectively are as follows:

$$\pi_d(b,t) = -\frac{1}{N}\sum_{h\in H}[t_h z + (1-t_h)\bar{x}(c_h)] - b \tag{4.1}$$

$$\pi_h(b,t) = t_h v_2(c_h, w + \frac{1}{\sum_{h\in H} t_h} b; z) + (1-t_h) v_1(c_h, w) \tag{4.2}$$

The intuition for these payoff functions is as follows. Notice that in expression (4.1) when $t_h = 1$ ($t_h = 0$) the corresponding individual has (not) signed up to the bribe and proposes the action z ($\bar{x}(c_h)$). The interpretation is that the payoff to the donor depends on the average of the actions proposed by all officers.[5] Correspondingly, in expression (4.2) when $t_h = 1$ ($t_h = 0$) the corresponding individual has (not) signed up to the bribe and receives the corrupt (honest) payoff $v_2(c_h, w + \frac{1}{\sum_{h\in H} t_h} b; z)$ ($v_1(c_h, w)$).[6]

Remark 5. *This setup resembles Shapley Shubik type of strategic market game so we can import some of the intuition from these games in order to enrich our insight of this situation and relate it to the previous section. When* $\sum_{h\in H} t_h \neq 0$, *the ratio* $\frac{b}{\sum_{h\in H} t_h} \equiv p$

[5] For simplicity, I assumed that the donor's value of the action equals one, but as it will be evident in the sequel our analysis is valid for any affine transformation of (4.1).

[6] The story behind this game can be recast in several other ways. For instance, one donor attempting to bribe one officer with many 'potential' selves.

can be thought as the average 'price' for $\sum_{h\in H} t_h$ the level of distortion of duty z, so that $b = p\sum_{h\in H} t_h$. This gives the opportunity to interpret the situation as follows. The choice of a bribe b can be thought of as the choice of a 'demand' function $D(p) = \frac{b}{p}$ for the level of distortion of duty z. Similarly the choice of a strategy $t_h \in \{0,1\}$ can be thought of as supply of one unit of the distortion of duty z, so total supply is $S(p) = \sum_{h\in H} t_h$. Market clearing requires a price p so that $D(p) = S(p)$, i.e., $b = p\sum_{h\in H} t_h$. However, it should be emphasized that in the above interpretation the market is not competitive: p is price 'on average' rather than 'on the margin' and is always market clearing but not necessarily 'equilibrium' in some sense.

An equilibrium is a collection of strategies $(b,s) \in S_b \times S$, which form a subgame perfect Nash equilibrium (SPNE) of this two stage game. Such an equilibrium is characterized by a set of individuals[7] $C = \{h \in H : s_h(b) = 1\}$. The corresponding payoffs to the donor and individuals are respectively:

$$\pi_d(b,s) = -\frac{1}{N}\left[\#Cz + \sum_{h\in H\setminus C} \bar{x}(c_h)\right] - b \tag{4.3}$$

$$\pi_h(b,s) = v_2(c_h, w + \frac{1}{\#C}b; z),\ h \in C \tag{4.4}$$

$$\pi_h(b,s) = v_1(c_h, w),\ h \in H \setminus C \tag{4.5}$$

Equation (4.3) shows that the profit of the donor increases the more individuals take the action z instead of their fallback action $\bar{x}(c_h)$. Therefore, the donor would be interested in bribing as many officers as possible.

I proceed to explore a few facts about SPNE in this game, which for expositional purposes I state as elementary lemmas.

Proposition 17. *For any $b \in S_b$ there is $\bar{s}(b) \in S$ which is a Nash equilibrium in the second stage of the game.*

Proof: see the Appendix.

Lemma 18. *At a SPNE the following must hold:*

$$\pi_d(b, s(b)) \geq -\frac{1}{N}\sum_{h\in H} \bar{x}(c_h) \tag{4.6}$$

[7] We assume that when $v_2(c_h, w + \frac{1}{\sum_{h\in H} t_h}b; z) = v_1(c_h, w)$, then $s_h(b) = 1$.

Proof

This follows from the fact that $0 \in S_b$ and $s \in S$ such that $s_h(0) = 0$, $\forall h \in H$ is a Nash equilibrium in the second stage game □

Lemma 19. *At a SPNE where $b > 0$ the following must hold:*

$$\frac{1}{\#C} b \geq B(c_h, z), \ \forall h \in C \tag{4.7}$$

Proof: see the Appendix.

Lemma 20. *Define $B_C = \max\{B(c_h, z) : h \in C\}$. At a SPNE where $b > 0$ the following must hold:*

$$b = (\#C) B_C \tag{4.8}$$

Proof: see the Appendix.

Corollary 21. *At a SPNE the payoffs for the donor and individuals are respectively*

$$\pi_d(b, s) = -\frac{1}{N} \left[\#C z + \sum_{h \in H \setminus C} \bar{x}(c_h) \right] - (\#C) B_C \tag{4.9}$$

$$\pi_h(b, s) = v_2(c_h, w + B_C; z), \ h \in C \tag{4.10}$$

$$\pi_h(b, s) = v_1(c_h, w), \ h \in H \setminus C \tag{4.11}$$

From the view point of anti corruption policy, the objective is to form a committee in a way that restricts corruption. The advantage of the policy maker relative to a potential donor of a bribe is that the former is aware of the type of each individual whereas the latter is oblivious to it. Building on this premise I explain how the choice of a committee can be done in a way so that the desired restriction of corruption can be achieved by exploiting adverse selection effects. The idea is to select the individuals H who participate in the game, in a way that mimics the conditions of the 'market for lemons', in order to trigger the desired unraveling effects.

By renaming types if necessary I may sort the types of individuals according to their diligence $\bar{x}(c)$ in descending order, i.e., $\bar{x}(1) > \bar{x}(2) > \ldots > \bar{x}(T)$. Starting from the top let us select a subset $T' = 1, 2, \ldots, t$, where $t > 1$. For each $A \subseteq T'$ denote $\bar{x}(A) = \max\{\bar{x}(t) : t \in A\}$ and $B_A = \max\{B(t, z) : t \in A\}$ and associate the smallest natural number N_A so that

$$\frac{\overline{x}(A)-z}{B_A} < N_A$$

Finally, let us select a set of individuals $H \subseteq c^{-1}(T')$ such that $\#H \geq N = \max\{N_A : A \subseteq T'\}$. The following proposition verifies that this procedure results in a set of individuals for whom bribery collapses.

Proposition 22. *(Complete unraveling) The unique SPNE is where $b = 0$ and for all $h \in H$,*

$$s_h(b) = \begin{cases} 0 & b = 0 \\ \overline{s}_h(b) & b > 0 \end{cases} \tag{4.12}$$

where $\overline{s}(b)$ is as in the proof of (17).

Proof: see the Appendix.

Consider $H' \subseteq c^{-1}(T)$ where $\#H' \geq N = \max\{N_A : A \subseteq T'\}$. The following proposition can be proved along the same lines.

Proposition 23. *(Partial unraveling) For any SPNE $(b,s) \in S_b \times S$ where $b > 0$, I have that $\{h \in H' : s_h(b) = 1\} \cap T' = \emptyset$, i.e., only individuals of types $T \setminus T'$ can be bribed at any equilibrium.*

Proposition (22) is akin to Akerlof's unraveling of the 'lemons market', albeit in a strategic framework. Intuitively, the uncertainty of donors as to what individuals they will have to deal with can be exploited by the authorities to fine tune the situation so that the market for corruption collapses.[8] This is the meaning of requiring N, the number of (types of) individuals to be chosen appropriately so that the average contribution of each group of (types of) individuals becomes smaller than the bribe necessary to corrupt it.

For comparison, the particular example of the 'lemons market' obtains when: (a) $c^{-1}(t)$ is singleton for each $t \in T'$. (b) The sorting of types with respect to $B(c,z)$ in descending order is the same as the sorting with respect to $\overline{x}(c)$. In this way for each $A \subseteq T'$, $\frac{\overline{x}(A)}{B_A} = \frac{\overline{x}(\bar{t}_A)}{B_{\bar{t}_A}}$ for the 'top' type $\bar{t}_A \in A$. Therefore, one needs to consider only nested subsets $A(r) = T' \cap \{r, r+1, \ldots, t\}$, where $r = 1, 2, \ldots, t$, i.e., each time excluding

[8] As economists we are faced here with the pervasive task of making adverse selection happen rather than looking for a way to correct it.

the 'top' type. Once N is chosen[9] so that $\frac{\bar{x}(\bar{t}_{A(r)})}{B_{\bar{t}_{A(r)}}} < N$ I have that

$$\frac{1}{N}\sum_{t\in A(r)}(\bar{x}(t)-z) < \frac{1}{N}(\bar{x}(\bar{t}_{A(r)})-z) < (\#C)B_{\bar{t}_{A(r)}} = (\#C)B_{A(r)}$$

for each $r = 1,2,\ldots,t$ and our proof applies.

4.3 Conclusions

In conclusion, in both of the above discussions in chapter 2 and chapter 3 the key effect of the heterogeneity of officers, is the differentiation that it introduces to the corresponding cost benefit analysis of corrupting them. This leads naturally to the idea that the uncertainty about the differentiated cost benefit considerations of corrupting alternative (types of) officers, can be 'managed' in order to serve as anti corruption tool. The lessons I have learned from adverse selection come in handy in this respect. As I demonstrated it may be possible to condition the market for bribes in a way so that the adverse selection effects take a severe form that completely unravels the market.

I believe that other known market failures lend themselves to such ideas, so this is a line worthwhile pursuing further. This paper is by no means exhaustive but rather a step in pursuing this line of studying anti corruption. As economists we are called to find ways to sustain situations which are against the private interests of individuals (e.g. minimize trade in markets, which is the opposite of my usual task), but I am well placed to know what it takes to achieve this.

4.4 Appendix

Proof of Proposition 16:

From the definition of equilibrium I must have $E[\pi(\bar{x}(\bar{c})-z)|b(z) \geq B(c,z)] = b(z)$. Notice that by (2.15) $\bar{x}(c)-z$ is increasing in c. By hypothesis I have that for $c \in [\underline{c},\bar{c}]$, $B(\cdot,z)$ is increasing and $\pi(\bar{x}(c)-z) > B(c,z)$. Finally, I have that

$$B(c,z) \geq B(\underline{c},z) > \frac{1}{N}\pi(\bar{x}(\bar{c})-z) \geq \frac{1}{N}\pi(\bar{x}(c)-z)$$

[9] In this case N refers to number of types.

It follows that

$$\begin{aligned} E[\pi(\bar{x}(\bar{c})-z)|b(z)\geq B(c,z)] &\leq E[\pi(\bar{x}(\bar{c})-z)|b(z)>\frac{1}{N}\pi(\bar{x}(c)-z)] \\ &\leq E[\pi(\bar{x}(\bar{c})-z)|Nb(z)\geq \pi(\bar{x}(c)-z)] \\ &= \frac{1}{N}[Nb(z)-\pi(\bar{x}(\underline{c})-z)] \\ &= b(z)-\frac{1}{N}\pi(\bar{x}(\underline{c})-z) \\ &< b(z) \end{aligned}$$

□

Proof of Proposition 17:

Given b we construct a group of individuals as follows. Sort individuals in descending order according to $B(c_h,z)$ and let $B_1=\max_{h\in H}\{B(c_h,z):B(c_h,z)\leq b\}$. Select a subset $C_1\subseteq\{h\in H:B(c_h,z)=B_1\}$ so that $\#C_1B_1<b<(\#C_1+1)B_1$ (i.e., a subset including the maximum number of individuals of this type who would be willing to sign up to the bribe b). Next, move to the next tier i.e., $B_2=\max_{h\in H}\{B(c_h,z):B(c_h,z)<B_1\}$ and select a set of individuals $C_2\subseteq\{h\in H:B(c_h,z)=B_2\}$ so that $(\#C_1+\#C_2)B_1<b<(\#C_1+\#C_2+1)B_1$. Continue in the same way until all $t\in c^{-1}(H)$ down the order are exhausted.

Consider now the set $C=\bigcup_{t\in c^{-1}(H)}C_t$ (recall that there is a finite number of types) and define $s(b)\in S$ as follows:

$$s_h(b)=\begin{cases}1 & h\in C\\ 0 & h\notin C\end{cases} \tag{4.13}$$

It is easy to verify that the strategy profile so constructed is a Nash equilibrium in the second stage □

Proof of Lemma 19:

This is immediate from the definition of $B_h(c_h,z)$ in the previous section. By definition of the set C I have that $\forall h\in C$, $s_h(b)=1$, so it must be

$$v_2(c_h,w+\frac{1}{\#C}b;z)\geq v_1(c_h,w)\equiv v_2(c_h,w+B_h(c_h,z);z)$$

It follows that $\frac{1}{\#C} b \geq B_h(c_h, z)$ □

Proof of Lemma 20:

By lemma (19) I have $b \geq (\#C)B_C$. Suppose that $b > (\#C)B_C$.

Then by choosing $(\#C)B_C \leq b' < b$, I would still have $B_h(c_h,z) \leq B_C \leq \frac{b'}{(\#C)}$ for $h \in C$. Also, $\frac{b'}{(\#C+1)} < \frac{b}{(\#C+1)} < B_h(c_h,z)$ for $h \notin C$. Therefore $\{h \in H : s_h(b') = 1\} = C$. However, in this case $\pi_d(b',s) > \pi_d(b,s)$, contradicting the SPNE □

Proof of Proposition 22:

Let $(b,s) \in S_b \times S$ be a SPNE where $b > 0$ and denote $C = \{h \in H : s_h(b) = 1\}$. By lemma (20) it must be $b = (\#C)B_C$. Since

$$\begin{aligned} \frac{\frac{1}{\#C}\sum_{h\in C}(\bar{x}(c_h) - z)}{B_C} &= \frac{\frac{1}{\#C}\sum_{t\in c^{-1}(C)} \#\{h \in C : c_h = t\}(\bar{x}(t) - z)}{B_C} \\ &< \frac{\bar{x}(C) - z}{B_C} \\ &< N \end{aligned} \tag{4.14}$$

I have that

$$\frac{1}{N}\sum_{h\in C}(\bar{x}(c_h) - z) < (\#C)B_C$$

It follows that

$$-\frac{1}{N}\sum_{h\in H\setminus C}\bar{x}(c_h) + \frac{1}{N}\sum_{h\in C}(\bar{x}(c_h) - z) < (\#C)B_C - \frac{1}{N}\sum_{h\in H\setminus C}\bar{x}(c_h)$$

This inequality can be rearranged as

$$-\frac{1}{N}\sum_{h\in H\setminus C}\bar{x}(c_h) - \frac{1}{N}\sum_{h\in C} z - (\#C)B_C < -\frac{1}{N}\sum_{h\in H\setminus C}\bar{x}(c_h) - \frac{1}{N}\sum_{h\in C}\bar{x}(c_h)$$

Hence, I conclude that

$$-\frac{1}{N}\left[(\#C)z+\sum_{h\in H\setminus C}\bar{x}(c_h)\right]-(\#C)B_C<-\frac{1}{N}\sum_{h\in H}\bar{x}(c_h)$$

By corollary (21) the left hand side is the equilibrium payoff for the donor, Therefore, the above inequality implies that

$\pi_d(b,s)<-\frac{1}{N}\sum_{h\in H}\bar{x}(c_h)$, which contradicts lemma (18) □

Discussion and Conclusion

This thesis has been focusing on the economics research of corruption to ask the following questions. Why corruption arises in the first place? What motivates an individual to participate in corrupt activities? How can the degree of corruption of an individual be defined? How to explain the failure of most anti corruption policies? Which policies are effective in reducing the distortion of duties of corrupt individuals?

I answer these questions by embedding them into a microeconomic model of decision making to analyze the decision of an individual to accept a bribe or not and investigate how such a decision is related to parameters in the environment. In the first part, the individual decides whether to accept the bribe or not combined a mix of motivations: monetary incentives, intrinsic motivation and the love of praise. Higher salary keeps greedy officers honest, thus reduces the reputation of the profession because it creates doubts about individual's true motive to be honest. Such 'overjustification' effect induces individuals who care about collective reputation to be more prone to accept the bribe. Furthermore, a shock on the private sector has a similar effect as a pay rise in the public sector because it attracts greedy officers, which may increase the level of corruption in the public sector. Importantly, it points out that the numeration policy in the public sector is not only relevant to design incentives to fight corruption, but also to determine the composition of the workforce. The overall effect of monetary incentives on fighting corruption crucially depends on the composition of the pool of public sector workers.

In the second part, I have attempted a new approach to corruption through the development of a basic microeconomic framework of individual decision to become corrupt. The approach combines two resources of heterogeneity. For non corrupt individuals, they perform their duties with the different diligence. On the other hand, corrupt individuals can in principle be bribed to do anything among a menu of alternatives, a possibility which is absent so far in the study of corruption decisions. Thus the original aspect of this thesis is the introduction of the dimension of degree of corruption of individuals, i.e., the magnitude of distortion of duty for a given bribe. I believe that the degree of corruption

of its members must be an integral part of the debate about corruption in a system and the development of effective policies against it.

In order to demonstrate the value of my approach I use it to take an alternative view to some anti corruption policies that have been debated in the literature. My analysis casts doubts on the effectiveness of salary increases to reduce the spread of corruption from two directions. First, I find that salary increases may actually decrease the minimum bribe required by an officer in order to take a specific action. Second, I argue that marginal salary increases which increase the minimum bribe required to corrupt an officer can be countered by a shift in the action required by the officer in a way so that the actual surplus to be shared between the donor and the officer remains intact. Hence, the salary increases may fail to reduce the spread of corruption and put more money in the pocket of the corrupt officer. However, I find out that salary increases may succeed to reduce the distortion of duties of corrupt officers. This conclusion shows that whereas the success of this policy with respect to the spread of corruption may be debatable, it is not so with respect to the depth of corruption. This confirms my point that it is worthwhile and indeed necessary to include the 'depth' dimension into the discussion of corruption and the evaluation of anti corruption policy.

This point is further corroborated by my analysis of the effects of competition among officers serving as anticorruption tool, as the literature has suggested. I point out that competition among officers may fail to reduce the level of corruption due to the heterogeneity I introduced. The heterogeneity in officers' distortion of their duties due to the bribe differentiates a donor's benefit to bribe the officer, which inhibits competition across officers. Furthermore, when the degree of corruption is allowed to vary, the differentiation of the donor's benefit across types of officers is exacerbated so competition is further inhibited and hence less likely to eradicate corruption.

The novelty of my approach is to design anti corruption policies with a view of creating the conditions to trigger such failures. My approach sets in view the prospect of developing an equilibrium model, where corruption is viewed as a trade relationship between donors of bribes and individuals whose actions affect the interest of donors. The motivation for doing so is that the investigation of the fundamentals and parameters, which characterize equilibrium situations, would help us develop tools to fight corruption. As economists we are called on to find ways to sustain situations which are against the private interests of individuals (e.g. minimize trade in 'markets' for corruption, which is the opposite of our usual task), but we are well placed to know what it takes to do so. In this paper, I provide an example of this philosophy in approaching corruption. For

example policies which, based on the varying degrees of corruption, would manage the uncertainty of officer's type to create adverse selection that would, in turn, unravel the bribery exchange.This study is by no means exhaustive but rather a first step in pursuing this line of studying corruption. I believe that there are many results in the mechanism design and in contract theory literature which lend themselves to my purpose.

The model I presented here is a barebones one because my purpose is to look at the basic economic parameters involved. I do recognize however that there are many more issues likely to be involved in corruption decisions (pressure, prestige, career prospect etc.). Other variables that affect such decisions (e.g. social issues) can be potentially taken into consideration in future extensions of the model, once the mechanism via which they propagate in decisions becomes tangible. I plan to further explore this line with a view to identifying other tools based on the parameters which characterize equilibria, that would work for us in order to minimize corruption.

Another notable direction that warrants extension is the inclusion of the anti corruption authority itself, e.g. a government sector or the internal affairs of an organization, in a full equilibrium model. This thesis only focused on the two parties that are involved in a corrupt transaction and assumed that the authorities only care to minimize corruption, either in terms of spread or depth. This was done because my purpose here has been to establish the significance of the depth dimension of corruption, both conceptually and policy wise. The inclusion of an anti corruption authority, would indeed highlight the cost-benefit considerations it faces in fighting corruption. In this way the evaluation of anti corruption policies can be done more systematically taking into account their cost as well instead of just their prospect of effectiveness. Such an extension is perfectly possible I believe, by use of the main tool developed in this thesis, the function representing the minimum bribe required for various degrees of corruption. Nevertheless I hope the reader recognizes that this is a formidable exercise that is beyond the scope of this thesis.

The empirical evaluation of the depth of corruption is a challenging direction as well. I believe that besides estimates of the spread, including the depth in the way we measure corruption is warranted because it will provide a more rounded understanding of this phenomenon. I recognize that the measurement of the depth of corruption (e.g., in terms of distortion of duty) poses difficult empirical challenges, but worthwhile to address Hopefully this thesis can serve as inspiration to attempts in that direction.

In conclusion, I hope to have succeeded in convincing the reader that the dimension of degree is an essential facet of corruption and worthwhile pursuing both from the theoretical but also from the empirical point of view.

Bibliography

[1] Acemoglu, D. (1995) Reward Structures and the Allocation of Talent, *European Economic Review* 39 (1), 17-33.

[2] Aidt, T. (2003) Economic Analysis of Corruption: a Survey, *The Economics Journal* 113 (491), 632-652.

[3] Allen F., J. Qian, and S., Lin (2015) Corruption and Competition. Working paper.

[4] Amir, R., and C. Burr (2015) Corruption and Socially Optimal Entry, *Journal of Public Economics* 123, 30-41.

[5] Andvig, J., and K. Moene (1990) How Corruption May Corrupt, *Journal of Economic Behavior & Organization* 13 (1), 63-76.

[6] Banerjee, A., S., Mullainathan, and R., Hanna (2012) Corruption. Working paper No 17968.

[7] Banerjee, A. and T. Besley (1990) Peer Group Externalities and Learning Incentives: a Theory of Nerd Behavior. Working paper: Princeton.

[8] Bardhan, P. (2015). Corruption and Development Policy (Drawing Upon the Recent Indian Debate), *Journal of Public Economic Theory* 17(4), 472-479.

[9] Batson, D. (1998) Altruism and Prosocial Behavior. In Handbook of Social Psychology. New York: McGraw Hill.

[10] Becker, G. (1968) Crime and Punishment: An economic approach. *Journal of Political Economy* 76 (2), 169-217.

[11] Becker, G. (1971) The Economics of Discrimination. University of Chicago Press: Chicago.

[12] Becker, G. (1974) A Theory of Social Interactions. *Journal of Political Economy* 82(6): 1063-1093

[13] Becker, G., and G. Stigler (1974) Law Enforcement, Malfeasance, and Compensation of Enforcers *The Journal of Legal Studies* 3, 1-18.

[14] Bénabou, R., and J. Tirole (2003) Intrinsic and Extrinsic Motivation. *Review of Economic Studies* 70, 489-520.

[15] Bénabou, R., and J. Tirole (2006) Incentives and Prosocial Behavior. *The American Economic Review* 96(5): 1652-1678.

[16] Bénabou, R., and J. Tirole (2011) Identity, Morals and Taboos: Beliefs as Assets. *Quarterly Journal of Economics* 126(2): 805-855.

[17] Benjamin A. O., 2007. Monitoring Corruption: Evidence from a Field Experiment in Indonesia. *Journal of Political Economy* 115(2), 200-249.

[18] Besley, T., and M. Ghatak (2005) Competition and Incentives with Motivated Agents, *American Economic Review* 95 (3), 616-636.

[19] Besley, T., and J., Mclaren. 1993. Taxes and Bribery: the Role of Wage Incentives. *The Economic Journal* 103: 119-141.

[20] Cadot, O., 1987. Corruption As A Gamble. *Journal of Public Economics* 33: 223-244.

[21] Caselli, F., and M. Morelli (2003) Bad Politicians, *Journal of Public Economics* 88, 759-782.

[22] Chand, S., and K. Moene (1999) Controlling Fiscal Corruption, *World Development* 27 (7), 1129-1140.

[23] Cracau, D., and B., Franz. 2013. Bonus Payments as an Anti corruption Instrument: A Theoretical Approach. *Economics letters* 120 (1): 1-4.

[24] Dal Bo, E., and M. Tervio (2013) Self-esteem, Moral Capital and Wrongdong. *Journal of the European Economic Association* 11(3): 599-663.

[25] Damania, R., P. G. Fredriksson, and M. Mani (2004) The Persistence of Corruption and Regulatory Compliance Failures: Theory and Evidence. *Public Choice* 121: 3-4, 363-390.

[26] Daron, K., M. Acemoglu, and A. Mian (2007) Incentives in markets, Firms, and Government. *The Journal of Law, Economics and Organization* 24(2): 273-306.

[27] Deci, E., R. Koestner, and R. Ryan (1999) A Meta-Analytic Review of Experiments Examining the Effects of Extrinsic rewards on Intrinsic Motivation, *Psychological Bulletin* 125 (6), 627-668.

[28] Deci, E., and R. Ryan (1985). *Intrinsic Motivation and Self-determination in Human Behavior*. New York: Plenum.

[29] Deci, E., and R. Ryan (2000) Intrinsic and Extrinsic Motivations: Classic Definitions and New Directions. *Contemporary Educational Psychology* 25: 54-67

[30] Dewatripont, M. (1999) The Economics of Career Concerns, Part ii: Application to Missions and Accountability of Government Agencies. *Review of Economic Studies* 66(1): 199-217.

[31] Di Tella, R., and E. Schargrodsky (2003) The New Comparative Economics. *Journal of Comparative Economics* 46 (1): 595-619.

[32] Ellingsen, T., and M. Johannesson (2008) Pride and Prejudice: The Human Side of Incentive Theory, *American Economic Review* 98 (3), 990-1008.

[33] Fershtman, C., K. M.Murphy, and Y. Weiss (1996) Social Status, Education, and Growth. *Journal of Political Economy* 104(1): 108-132.

[34] Foltz, J., and K., Opoku-Agyemang (2015) "Do Higher Salaries Lower Petty Corruption? A Policy Experiment on West Africa's Highways. Working paper.

[35] Fehr, E., and A. Falk (2002). Psychological Foundations of Incentives, *European Economic Review* 46, 4-5, 687-724.

[36] Fehr, E., and S. Gächter (2001) Do Incentive Contracts Crowd Out Voluntary Cooperation? Discussion Paper, No. 3017, CEPR.

[37] Freeman, R. (1997) Working for Nothing: The Supply of Volunteer Labor. *Journal of Labor Economics* 15(1): 140-166.

[38] Frey, B. (1997) Not just for the Money: An Economic Theory of Motivation. Edward Elgar Pub: Cheltenham.

[39] Frey, B., and F. Oberholzer-Gee (1997) The Cost of Price Incentives: An Empirical Analysis of Motivation Crowding-Out, *American Economics Review* 87 (4): 746-755.

[40] Glaeser, E. and R. Saks (2006) Corruption in America. *Journal of Public Economics* 90: 1053-72

[41] Gordon, S. (2009) Assessing Partisan Bias in Federal Public Corruption Prosecutions. *American Political Science Review* 103(4): 534-554.

[42] Holmstrom B., and P. Milgrom. (1991) Multitask Principal-agent Analyses: Incentive Contracts, Asset Ownership and Job Design. *Journal of Law, Economics and Organization* 7: 24-52.

[43] Hsieh, C. T., and E. Moretti (2005) Did Iraq Cheat the United Nations? Underpricing, Bribes, and the Oil for Food Program. NBER Working Paper NO. 11202.

[44] Katz M. L., and C. Shapiro (1986) Technology Adoption in the Presence of Network Externalities. *Journal of Political Economy* 94: 822-841.

[45] Kreps, D. (1997) Intrinsic Motivation and Extrinsic, *American Economic Review* 87 (2), 359-364.

[46] Lepper, M., D. Greene, and R. Nisbett (1973) Undermining Children's Interest with Extrinsic Rewards: A Test of the "Overjustification Hypothesis", *Journal of Personality and Social Psychology* 28 (1), 129-137.

[47] Macchiavello, R. (2008) Public Sector Motivation and Development Failures, *Journal of Development Economics* 86 (1), 201-213.

[48] Mahmood, M. (2005) Corruption in Civil Administration: Causes and Cures, *Humanomics* 21(3/4), 62-84.

[49] Maslow, A. H. (1943) A Theory of Human Motivation. *Psychological Review* 50(4): 370-396.

[50] Mill, J. (1909) Principles of Political Economy with some of their Applications to Social Philosophy. London: Longmans, Green and Co.

[51] Mishra, A., and A., Samuel (2017) Preemptive Bribery and Incomplete Information: Does Prior Knowledge Matter? *Journal of Public Economic Theory* 19, 658-673.

[52] Mookherjee, D., and I.P.L. Png (1995) Corruptible Law Enforcers: How Should They Be Compensated? *The Economic Journal* 105: 145-159.

[53] Murphy K., G. Becker, and I. Werning (2005) The Equilibrium Distribution of Income and the Market for Status. *Journal of Political Economy* 113(2): 282-310.

[54] Nichols, P., and D. C. Robertson (2016) Thinking about Bribery: Neuroscience, Moral Cognition and the Psychology of Bribery. *Cambridge University Press*.

[55] Ogus, A. (2004) Corruption and Regulatory Structures. *Law and Policy* 26: 3-4, 329-346.

[56] Olken, B. A. (2006) Corruption and the Costs of Redistribution: Micro Evidence from Indonesia. *Journal of Public Economics* 90: 853-870

[57] Olken, B. A. (2007) Monitoring Corruption: Evidence from a Field Experiment in Indonesia. *Journal of Political Economy* 115 (2): 200-249.

[58] Olken, B. A., and R. Pande. (2012) Corruption in Developing Countries. *Annual Review of Economics* 4(1): 479-509.

[59] Persson, A., B. Rothstein, and J. Teorell (2012) Why Anticorruption Reforms Fail - Systemic Corruption as A Collective Action Problem. *Governance*. 26(3): 449-471.

[60] Plato, 1985. *The Republic*, Translated by Jowett, B., First Avenue Editions: New York.

[61] Pokorny, K. (2008) Pay-But Do Not Pay Too Much: An Experimental Study on the Impact of Incentives, *Journal of Economic Behavior and Organization* 66 (2), 251-264.

[62] Rabin, M. (1994) Cognitive Dissonance and Social Change. *Journal of Economic Behavior and Organization* 23: 177-194.

[63] Reinikka, R. and J. Svensson (2005) Fighting Corruption to Improve Schooling: Evidence from a Newspaper Campaign in Uganda. *Journal of European Economic Association* 3 (2): 259-67.

[64] Robson, A. (1992) Status, the Distribution of Wealth, Private and Social Attitudes to Risk. *Econometrica*: 837-857.

[65] Rose-Ackerman, S. (1978) Corruption: A Study in Political Economy. Academic Press: New York.

[66] Ryvkin, D., and D. Serra (2012) How corruptible are you? Bribery under uncertainty. *Journal of Economics Behavior and Organization* 81: 466-477, 307-331.

[67] Sah, R. (2007) Corruption Across Countries and Regions: Some Consequences of Local Osmosis, *Journal of Economic Dynamics and Control* 31 (8), 2573-2598.

[68] Schulze, G., and B. Frank (2003) Deterrence Versus Intrinsic Motivation: Experimental evidence on the Determinants of Corruptibility, *Economics of Governance* 4, 143-160.

[69] Shapley, L and M. Shubik (1975) Trade using one commodity as a means of payment, *Journal of Political Economy* 85: 937-968.

[70] Sheehan, R. (1996) Mission Accomplishment as Philanthropic Effectiveness: Key Findings from the Excellence in Philanthropy Project. *Non-profit and Voluntary Sector Quarterly* 25(1): 110-123.

[71] Shleifer, A., and R. W. Vishny (1993) Corruption. *Quarterly Journal of Economics* 108: 599-617.

[72] Smith, A. (1759) *The Theory of Moral Sentiments*, Amherst, New York: Prometheus Books.

[73] Sosa, L. (2004) Wages and Other Determinants of Corruption. *Review of Development Economics* 8 (4): 597-605.

[74] Svensson, J. (2003) Who Must Pay Bribes and How Much? *Quarterly Journal of Economics* 118 (1): 207-230.

[75] Svensson, J. (2005) Eight Questions about Corruption. *Journal of Economic Perspectives* 19 (3): 19-42.

[76] Swamy, A., S. Knack, and Y. Lee, and O. Azfar (2001) Gender and Corruption *Journal of Development Economics* 64 (1), 25-55.

[77] Tirole, J. (1994) The Internal Organization of Government, *Oxford Economic Papers* 46 (1), 1-29.

[78] Tirole, J. (1996) A Theory of Collective Reputations (with Applications to the Persistence of Corruption and to Firm Quality, *Review of Economic Studies* 63 (1), 1-22.

[79] Titmuss, R. (1970) *The Gift Relationship: From Human Blood to Social Policy* London: Allen and Unwin.

[80] Treisman, D. (2000). The Causes of Corruption: A Cross-National Study, *Journal of Public Economics* 76 (3), 399-457.

[81] Valasek, J. (2016) Reforming an Institutional Culture: A Model of Motivated Agents and Collective Reputation, Working Paper No. 5599, CESifo.

[82] Van Rijckeghem, C., and B. Weder (2001) Bureaucratic Corruption and the Rate of Temptation: Do Wages in the Civil Service Affect Corruption, and by How Much? *Journal of Development Economics* 65 (2), 307-331.

[83] Wilson, J. (1989) Bureaucracy: What Government Agencies Do and Why They Do It? Basic Books, 2nd ed. edition: New York.