Corruption, Regulation Compliance, and The Shadow Economy

Fabio Méndez
University of Arkansas
Department of Economics
Business Building Room 402
Fayetteville, AR, 72701
fmendez@uark.edu

Facundo Sepúlveda
Depto. de Gestión y Políticas Públicas.
Universidad de Santiago de Chile

April 3, 2007

Abstract

In this paper we study the effects of different types of corrupt behavior on the level of regulation compliance and the extent of the unofficial economy. We find that while decreasing corruption at any level of government always augments regulation compliance, decreasing corruption at high levels of government might also produce an unforeseen expansion of the shadow economy. We also find that extortion always magnifies the negative effects of corruption. Furthermore, with respect to the question of whether it is best to combat corruption at high or low levels of government, we find that under certain conditions, the most effective policy is that which reduces corruption at the level of government where it is most prevalent to begin with.

1 Introduction

The presence of corruption alters the individual's decisions on whether to join the unofficial economy[1] and whether to comply with government mandated regulations (see Mookherjee and Png (1995), Friedman et al. (2000), Johnson et al. (2000), and Choi and Thum (2005), for theoretical and empirical support of this claim). Thus, in this manner, corruption has an indirect influence on a variety of issues of public interest regarding immigration, tax evasion, health codes, carbon emissions, and natural resource conservation, to name a few examples.

The actual mechanisms through which corruption operates, however, are difficult to understand because corruption may take different forms and it may surface at different stages of the individual's decision process. When imposing regulations on economic activities, governments may require a *permit* from those who wish to legally engage in production and they may also impose *punishments* on infractors. Thus, corruption may occur at a "high-level" of government (which is given the task of issuing permits); or at a "low-level" of government (which is given the task of punishing infractors).

Moreover, when extortion and bribery coexist, the effects of corruption change. For an "underground" business who has not followed the regulations, having to pay an "absolutory bribe" to a corrupt official (who agrees to oversee the violation in exchange of the payment) is a cost imposed by his illegal status and a reason to flee the underground economy. For a legal business, in contrast, having to pay an "extortionary bribe" to a corrupt official (who

[1] The terms "unofficial" or "shadow" economy are defined here as those economic activities, whether legal or illegal, that escape detection in the official estimates of GDP (see Schneider and Enste (2000), or Schneider (2005) for similar and alternative definitions).

threatens to shut down the business unless he is paid such bribe) represents an additional burden and an incentive to hide into the shadow economy. As put by Johnson et al (2000), agents may want to go underground in order to avoid bribes, or they may have to pay bribes in order to be able to go underground.

The purpose of this paper is to present a theoretical model that formally describes the relationship between unofficial economic activity, regulation compliance and corruption in its different forms. The specific questions addressed in this paper are: First, how does corruption affect the level of regulation compliance and the size of the shadow economy? Second, are the effects of corruption at high levels of government different than its effects at low levels of government? Third, how are the answers to these questions modified when extortion is also present?

The results of the model are compatible with those of previous studies in the literature, but additional results are obtained. We find that while a decrease in corruption at any level of government always brings about an increase in regulation compliance, a decrease in corruption at high levels of government might also produce an expansion of unofficial economic activity. We also find that extortion always magnifies the negative effects of corruption and increases the impact of public policies intended to reduce corruption. Furthermore, with respect to the question of whether it is best to combat corruption at high or low levels of government, we find that under certain conditions, the most effective policy is that which reduces corruption at the level of government where it is most prevalent to begin with.

Our theoretical model serves as a complement to a growing body of literature that includes Choi and Thum (2005) and Mookherjee and Png (1995)[2]. The paper by Choi and Thum (2005) focuses on the links between corruption and the *shadow economy*. In their model, individuals must pay a bribe *before* they engage in production and in order to obtain a license and join the official economy. In turn, the paper by Mookherjee and Png (1995) focuses on the links between corruption and *regulation enforcement*. They present a model in which individuals pay a bribe *after* they have engaged in production and in order to reduce the penalties associated with the mandated regulations.

In this paper we allow for bribery to occur *before and after* production has taken place, and study the effects of corruption at early stages of the production process separately from the effects of corruption at late stages. In addition, we also study the effects of corruption when it is used for *extortionary motives*. Furthermore, in our paper the relationship between the level of regulation compliance and the extent of the shadow economy is modeled explicitly, so that we can study the changes in *both of these variables simultaneously.* Interestingly, although the extent of the shadow economy and the level of regulation compliance are related, they do not necessarily go hand in hand.

The remainder of the paper is organized as follows: Section 2 presents the main theoretical model and describes the decisions of the individual entrepreneurs who must choose whether to follow the mandated regulations and whether to join the unofficial economy. Section 3 expands the analysis to consider the effects of extortion and Section 4 concludes.

[2]Other related papers that look at the interaction between tax payers and auditors in an evironment where some corruption exists include Chander and Wilde (1992) and Çule and Fulton (2005).

2 An economy with corruption

We study an economy with a continuum of agents endowed with a level of entrepreneurial ability R_i, drawn from a uniform distribution with c.d.f. $G(R)$. The government in this economy imposes a set of regulations on productive activities and requires a permit from individual investors in order for them to operate legally. Following these regulations and obtaining the permit imposes a cost α on investors.

When the time comes to obtain the permit for their projects, investors get a random draw of a government official. We refer to these officials as "high-level" officials. High-level officials are of two types. A proportion $1-p$ is honest and verifies that regulations have been followed. If they have not, the permit is simply not given and the business is not allowed to operate legally. The remaining p officials are corrupt, and they are willing to grant the permit to investors who have not followed the regulations in exchange for a bribe β.

In addition, there are a number of "low-level" public officials who monitor economic activities under way and check that no business operates without a permit, as required by law. The monitoring capabilities of the government are limited and only a fraction d of all business projects gets detected. Officials at this lower level are also of two types: a proportion $1-\widetilde{p}$ is honest and does not allow businesses to continue operations unless they own a permit. The remaining fraction $\widetilde{p}$ of low-level officials are corrupt and they allow businesses to operate without a permit in exchange for a bribe $\widetilde{\beta}$. Noticeably, a corrupt official at the low level of government cannot issue a permit; he can only save illegal businesses from the punishment they are supposed to receive.

By taking the levels of corruption p and $\widetilde{p}$ as exogenous, we are abstracting from all those elements that influence the public servant's decision on whether to be honest or corrupt. Such elements include the public servant's compensation, his level of risk aversion, the penalties imposed on those found to accept a bribe, the penalties imposed on those found to pay a bribe, the moral disposition of public servants, and others (see Treisman (2000) and Mookherjee and Png (1995) for two studies that look at the determinants of corrupt behavior). Thus, instead of looking at the determinants of corruption, we concentrate on the consequences.

Given the government policies, agents who engage in economic activities have three possible courses of action that we call "strategies": **1.** They may follow the regulations, obtain a permit that certifies their legal status, and join the official economy. **2.** They may not follow the regulations, hide into the shadow economy, and face a positive probability of detection. If detected by an honest official, the business is closed down. If detected by a corrupt official, the business can continue its operations by paying a bribe. **3.** They may try to obtain the permit through a corrupt official at the high level of government and join the official economy without having complied with the regulations. If an agent is not able to find a corrupt official that sells him the permit, he still has the option to operate without the permit by hiding into the shadow economy.

Throughout the paper, the agent's net expected value of following strategies 1, 2, and 3 is denoted by $v(1)$, $v(2)$, and $v(3)$ respectively. In choosing whether to comply with the regulations and whether to join the official economy, individuals maximize the net benefits perceived from the economic activity. That is, individuals choose

$$v = \max\{v(1), v(2), v(3)\}. \tag{1}$$

Where, according to the most simple production function, ability (R_i) is transferred one to one into earnings; and the functions $v(1), v(2)$ and $v(3)$ are defined as follows:

$$\begin{aligned} v(1) &= R_i - \alpha \\ v(2) &= (1-d)R_i + d\widetilde{p}(R_i - \widetilde{\beta}) \\ v(3) &= p[R_i - \beta] + (1-p)[(1-d)R_i + d\widetilde{p}(R_i - \widetilde{\beta})] \end{aligned} \tag{2}$$

We briefly discuss the set of equations (2). The payoff $v(1)$ represents the earnings of the economic activity minus the costs of following the regulations. This payoff is riskless since there is no extortion in this economy. The payoff $v(2)$ represents the expected earnings derived from hiding into the shadow economy. With probability $(1-d)$ the individual goes undetected and all production (R_i) becomes earnings. With probability $d\widetilde{p}$ the individual is detected by a corrupt official and he must pay the bribe or be shut down. Similarly, with probability $d(1-\widetilde{p})$ the individual is detected by an honest official and the payoff becomes zero as the official does not allow the business to continue its operations.

Finally, the payoff $v(3)$ represents the expected earnings for an agent who decides not to follow the regulations and look for a corrupt official at the high level of government before he engages in production. With probability p, a corrupt official is found, a permit is obtained, and no other costs or risks are necessary for the business to proceed. With probability $(1-p)$, however, the agent will encounter an honest official who does not issue the permit, and the agent is then forced to hide into the shadow economy (and receive the respective payoff $v(2)$).

When an economic agent bribes a low level official, the amount of the bribe $(\widetilde{\beta})$ is determined by Nash bargaining, where the bargaining power of the official is represented by $\phi \in (0,1)$. Noticeably, the reservation value for the investor who bribes a low level official is zero, as she faces the threat of having her business closed down. Thus, assuming that the reservation value for the corrupt official is also zero, the bribe $\widetilde{\beta}$ can be determined by solving

$$\max_{\widetilde{\beta}}(\widetilde{\beta})^{\phi}(R_i - \widetilde{\beta})^{1-\phi}. \tag{3}$$

The solution for the bribe follows a simple rule of surplus sharing between corrupt officials and investors. The solution to (3) is the solution for the bribe at low levels of government: $\widetilde{\beta} = \phi R_i$.

In similar fashion, when an economic agent bribes a high level official, the size of the bribe β is also determined by Nash bargaining. In this case, however, the reservation value for the investor is not zero, since he still has the option of hiding into the shadow economy were he to choose not to pay the bribe. Substituting for the bribe $\widetilde{\beta}$ into $v(2)$ and simplifying the expressions, the Nash bargaining problem can be written as follows:

$$\max_{\beta}(\beta)^{\theta}[(R_i - \beta) - R_i(1-d) - R_i\widetilde{p}d(1-\phi)]^{1-\theta}. \tag{4}$$

Where the bargaining power of the high level official is represented by θ. The solution to (4) is the solution for the bribe at high levels of government: $\beta = \theta d R_i$. This result is similar to that of Choi and Thum (2005), who also find that the threat of hiding into the unofficial sector effectively reduces the size of the bribe when bargaining for a permit.

2.1 Individual decisions and comparative statics

By comparing the values $v(1), v(2)$ and $v(3)$ as described in (2), one can verify that strategy 2 dominates strategy 1 only for low levels of R_i; but that strategy 2 is always dominated by strategy 3. Similarly, it can be verified that strategy 1 dominates strategy 3 as long as the individual's value of R_i is greater than the constant $R^* = \frac{\alpha}{d(1-p+p\theta)(1-\widetilde{p}+\widetilde{p}\phi)}$. The proof is in the appendix.

The implication of these results is that those individuals endowed with ability $R_i > R^*$ will always follow the regulations and join the official economy. In turn, individuals endowed with ability $R_i < R^*$ will not follow the regulations and look for a corrupt official to get their permit. A fraction p of these individuals find a corrupt official and join the official economy, while the remaining $(1-p)$ do not find one and hide into the shadow economy. The distribution and scope of all economic activity is illustrated in Figure 1.

Intuitively, as long as it is possible to search for a corrupt official who might provide a safe passage to the official economy without the costs of following the regulations, that option is preferred over hiding into the shadow economy directly and strategy 2 is dominated by strategy 3. In turn, strategy 1 dominates strategy 3 only at higher levels of R_i because agents choose to follow the regulations only when the cost of following these regulations is smaller than the cost of not following them (in terms of potential bribes and punishments).

Since the cost of complying with the regulations (α) is independent from R_i, and the bribes at both the first and the second levels of government are increasing functions of R_i, the result follows logically.

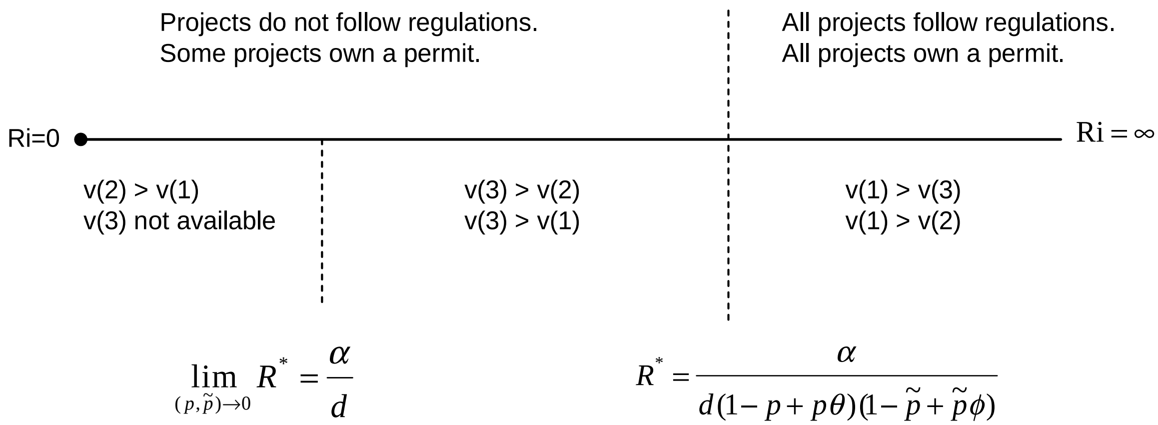


Figure 1: Equilibrium Strategies

Before we can make any assertions regarding the level of regulation compliance or the size of the shadow economy, however, we need to be precise about how do we measure them. In what follows, the degree of regulation compliance is measured by the fraction of all investment projects that comply with the regulations. Thus, the level of regulation compliance is measured by

$$C = [1 - G(R^*)]. \tag{5}$$

In turn, the unofficial economy is measured as the fraction of all investment projects that operate undetected by the government (and without a permit); that is, the size of the shadow economy is measured as

$$S = (1 - p)(1 - d)G(R^*) + (1 - p)d\widetilde{p}G(R^*). \tag{6}$$

The first component of this measure captures those individuals who hid and remained undetected. The second component captures those individuals who hid and were detected by a corrupt official, who did not report them.

With this in mind, one can verify that in this model, ceteris paribus, an increase in the cost of regulations (α) reduces the level of regulation compliance and increases the size of the shadow economy. That is, one can show that $\frac{\partial C}{\partial \alpha} < 0$ and $\frac{\partial S}{\partial \alpha} > 0$. These results are consistent with the empirical evidence presented by Friedman et al. (2000) and Schneider (2005). Friedman et al. (2000), for example, report that "every available measure of overregulation is significantly correlated with the share of the unofficial economy", with more regulations been associated with larger unofficial activity. Similarly, Schneider (2005) lists "state regulatory activities" as a "major driving force underlying the size and growth of the shadow economy".

In the same manner, it can be verified that, ceteris paribus, an increase in the detection probability (d) increases the level of regulation compliance and reduces the size of the shadow economy. That is, one can show that $\frac{\partial C}{\partial d} > 0$ and that $\frac{\partial S}{\partial d} < 0$. These results mimic the standard result regarding crime and punishment (see Becker (1968)); where an increase in the probability of detection makes it less attractive to violate the regulations and hide; regardless of the level of corruption that exists.

With respect to the effects of corruption, the results of the model can be summarized as follows:

1. In the absence of corruption, neither full regulation compliance is attained, nor the unofficial economy disappears.
2. An increase in corruption at low levels of government causes a decrease in the level of regulation compliance and an expansion of unofficial economic activity, ceteris paribus.
3. An increase in corruption at high levels of government causes a decrease in the level of regulation compliance, but may cause a reduction or an expansion of unofficial economic activity, ceteris paribus.

We now turn to the discussion of these results. Algebraically, changes in the level of regulation compliance with respect to changes in corruption at either level can be calculated as $\frac{\partial C}{\partial p} = -G'(R^*)\frac{\partial R^*}{\partial p}$ and $\frac{\partial C}{\partial \widetilde{p}} = -G'(R^*)\frac{\partial R^*}{\partial \widetilde{p}}$, respectively. Where the corresponding expressions for the changes in R^* with respect to changes in p and $\widetilde{p}$ can be obtained as $\frac{\partial R^*}{\partial p} = \frac{\alpha d(1-\theta)(1-\widetilde{p}(1-\phi))}{[d(1-p+p\theta)(1-\widetilde{p}+\widetilde{p}\phi)]^2} > 0$ and $\frac{\partial R^*}{\partial \widetilde{p}} = \frac{\alpha d(1-\phi)(1-p(1-\theta))}{[d(1-p+p\theta)(1-\widetilde{p}+\widetilde{p}\phi)]^2} > 0$. Thus, when corruption at either level of government increases, the level of regulation compliance falls. This result is compatible with that of Mookherjee and Png (1995).

The intuition behind this result is simple: As the value of p increases, it becomes easier to buy a permit without having to follow regulations, because there are more officials willing to accept a bribe. Similarly, as the value of $\widetilde{p}$ increases, it becomes less likely that any business will be shut down if detected in violation of the rules. For either reason, less agents choose to follow the regulations.

Noticeably, however, when the levels of p and $\widetilde{p}$ go to zero (and corruption disappears from the economy), the size of the shadow economy becomes smaller but remains positive, and the level of regulation compliance remains below the maximum attainable. Such an outcome seems to be fitting with empirical estimates of unofficial economic activities in countries where corruption is perceived to be small, such as Sweden, Netherlands, Finland or Canada[3]. In his empirical estimations, Schneider (2005) reports the size of the shadow economy for any of these countries to be at least 12% of GDP. The corresponding values of C and S for an economy without corruption, are given in the model by $\lim_{(p,\widetilde{p})\to 0} C$ and $\lim_{(p,\widetilde{p})\to 0} S$, respectively.

Furthermore, the results of the model also show that changes in corruption at high levels of government affect the scope of the shadow economy differently than changes in corruption at low levels of government. Analyzing the change in S with respect to changes in $\widetilde{p}$, we obtain the positive expression $\frac{\partial S}{\partial \widetilde{p}} = d(1-p)G(R^*) + G'(R^*)\frac{\partial R^*}{\partial \widetilde{p}}[d\widetilde{p}(1-p) + (1-d)(1-p)] > 0$. That is to say, we obtain that an increase in corruption at low levels of government always increases the size of the shadow economy.

Intuitively, as corruption in low levels of government ($\widetilde{p}$) increases two reinforcing effects take place. First, the fraction of illegal businesses that gets closed down diminishes and

[3]See the International Country Risk Guide (ICRG) for a ranking of international corruption perceptions. Sweeden, Netherlands, Finland and Canada have consistently ranked among the countries with least corruption. ICRG indexes are publicly available since the 1980s.

more businesses are allowed to operate in the shadow economy. Second, as the expected punishment associated with detection becomes smaller, the total amount of businesses that choose not to comply with the regulations and hide into the shadow economy to begin with grows larger.

In contrast, when calculating the change in S with respect to changes in p, we obtain a expression of indefinite sign. That is to say, we obtain that an increase in corruption at high levels of government may increase or decrease the size of the shadow economy. In specific, we find the expression $\frac{\partial S}{\partial p} = G'(R^*)\frac{\partial R^*}{\partial p}[d\widetilde{p}(1-p) + (1-d)(1-p)] - G(R^*)[1-d(1-p)]$; where an increase in corruption at high levels of government causes an increase in the size of the shadow economy only for low enough values of $G(R^*)$.

The intuition behind this result is simple. When corruption at high levels of government (p) increases, two opposing effects take place: On the one hand, a portion of the individuals who used to follow the regulations now find it more attractive not to follow the regulations and look for a corrupt official, as it is now easier to find one. As a result, more people end up joining the shadow economy. On the other hand, as there are more corrupt officials at the high level of government, more permits are issued and less people go unregistered into the unofficial economy. In economies that have low regulation compliance to begin with (high $G(R^*)$), it is possible for the second effect to dominate the first, and for a decrease in the level of corruption p to cause an expansion of the shadow economy.

Thus, the model suggests that in developing countries (that typically exhibit low regulation compliance), the reaction of shadow economies to policies that reduce corruption at high levels of government would be different than the reaction observed in developed countries (that typically exhibit high regulation compliance). In this regard, Schneider (2005) finds significant differences on the dynamics of unofficial economic activities between rich and poor countries. Unfortunately, however, Schneider (2005) does not include measures of corruption in his list of explanatory variables

Finally, it must be pointed out that the results of the model are not in conflict with other recent studies (see Choi and Thum (2005) and Schneider (2005)), for example) that suggest the existence of a positive correlation between the size of the unofficial economy and the size of the official economy under certain circumstances. In the model presented here, an increase in the overall amount of economic activity would result in a simultaneous expansion of both the official and the unofficial sectors[4]. Such a simultaneous increase, of course, would require an expansion of the overall economy.

2.2 Implications for Anti-Corruption Policies

If a policy maker had to choose between combating corruption at low levels of government and combating corruption at high levels of government, which option should he choose? Are the expected benefits of diminishing corruption at high levels of government greater than the expected benefits of diminishing corruption at low levels of government? In this section, we turn our attention to this type of questions. For simplicity, we assume that the costs associated with decreasing corruption are the same for both levels of government; so that we

[4] This can be formally demonstrated by including an initial "set-up" cost i for businesses. One can show that a change in i would either increase or decrease the size of both the official and the unofficial sectors simultaneously.

can concentrate only on the expected benefits.

From our previous analysis of the model, we concluded that policies intended to decrease corruption at low levels of government are sure ways to attain both policy goals of increasing regulation compliance and reducing the size of the unofficial economy. In contrast, policies that reduce corruption at high levels of government might have the undesired consequence of expanding the unofficial economy, specially in undeveloped countries. Thus, from the point of view of a policy maker who wants to be sure that his policies will generate only positive outcomes, combating corruption at low levels of government would always be preferred.

In turn, from the point of view of a policy maker whose goal is to attain higher levels of regulation compliance, the preferred policy would be that which increases compliance the most. In the model, the benefits of diminishing corruption at high and low levels of government can be directly compared by taking the derivative of C with respect to both p and $\widetilde{p}$. After obtaining the respective derivatives and simplifying the expressions, it can be shown that $\left|\frac{\partial C}{\partial p}\right| > \left|\frac{\partial C}{\partial \widetilde{p}}\right|$ if and only if $p > \widetilde{p} + \frac{\theta - \phi}{1 - \theta - \phi}$.

For economies in which all public officials are fairly similar ($\theta \backsimeq \phi$) or for economies in which bribes do not take away a big share of firms profits (θ and ϕ are small), the results of the model have a clear policy implication: that it is most efficient to increase regulation compliance by combating corruption at the level where it is most prevalent. That is to say that, for example, if corruption is more widespread in low levels of government than in high levels (and $\widetilde{p} > p$), then policies that reduce corruption at low levels of government ($\widetilde{p}$) would generate a greater increase in regulation compliance than policies that reduce corruption at high levels of government (p).

In general, however, the constant $\frac{\theta-\phi}{1-\theta-\phi}$ can take on a wide range of values and one can not make any statements about which types of policies are best suited to increase regulation compliance. Actual estimations about the values of the parameters θ and ϕ are not readily available and one can only rely on anecdotal evidence; which is also mixed.

Finally, from the point of view of a policy maker whose goal is to reduce the size of the unofficial economy, two alternative scenarios are possible. The first scenario corresponds to those economies in which reducing corruption at high levels of government (p) results in an expansion of the shadow economy. In these cases, policies that reduce corruption at low levels of government are clearly preferred.

The second scenario corresponds to those situations in which reducing corruption at any level leads to a reduction of the shadow economy. In these cases the preferred policy would be that which reduces the shadow economy the most. To this effect, one can calculate the corresponding derivatives and show that $\left|\frac{\partial S}{\partial p}\right| > \left|\frac{\partial S}{\partial \widetilde{p}}\right|$ if and only if $p > \widetilde{p} + \frac{\theta-\phi}{1-\theta-\phi}$. Thus, as before, for economies in which all public officials are fairly similar ($\theta \backsimeq \phi$) and for economies in which bribes do not constitute a big share of profits (θ and ϕ are small), it would be most efficient to reduce unofficial activity by combating corruption at the level where it is most prevalent. But in general, the relative benefits of the two alternative policies cannot be determined.

3 An economy with corruption and extortion

Corruption may also incentive economic agents to join the unofficial economy if it takes the form of extortion. That is, if corrupt agents use their power to threat those businesses who have followed all the regulations with closing them down anyway (unless they pay a bribe). In this section, we add extortion to our model and study its consequences beyond those of the more typical varieties of corruption. Although, as reported by Johnson et al. (2000) and by Friedman et al. (2000), such cases of extortion are common in transition economies.

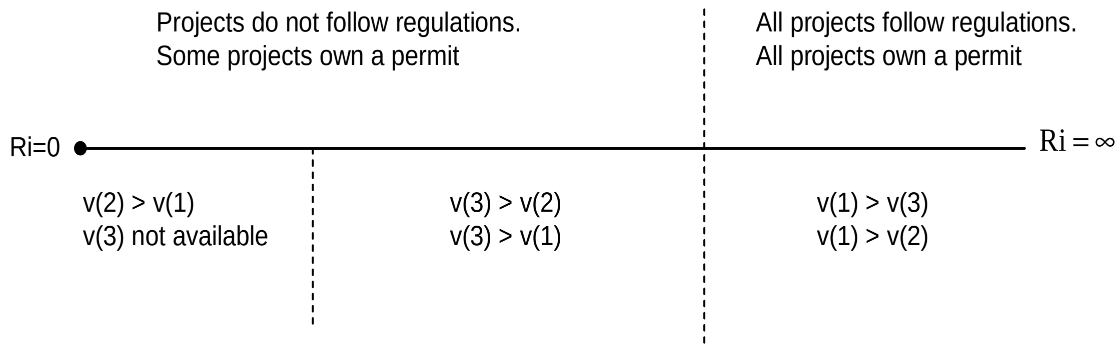
All assumptions and modelling choices from the previous section are preserved. The only difference in this section is that, when a corrupt official comes in contact with legal, law-abiding businesses, he will also demand a bribe from them. Including extortion in the model modifies the payoffs for the strategies. The respective payoffs are now described by the following set of equations, where, in order to differentiate extortionary bribes with other types of bribes, we labeled the extortionary bribe as β_e:

$$v(1) = R_i - \alpha - \beta_e d\widetilde{p}$$
$$v(2) = (1-d)R_i + d\widetilde{p}(R_i - \widetilde{\beta})$$
$$v(3) = p[(R_i - \beta)(1 - d + d(1-\widetilde{p})) + (R_i - \beta - \beta_e)d\widetilde{p}] + (1-p)[(1-d)R_i + d\widetilde{p}(R_i - \widetilde{\beta})]$$

The expression for $v(1)$ is similar than before, except that now it includes an extra term representing the expected costs of extortion; which amounts to the extortionary bribe β_e times the probability of being detected by a corrupt official ($d\widetilde{p}$). Because of this possibility, the payoff $v(1)$ is smaller than before. The expression for the payoff $v(3)$ has also changed. Now, when an agent obtains a permit by dealing with a corrupt official, he may still have to pay an additional extortionary bribe if detected by a corrupt official at the low level of government. Finally, the expression for the payoff $v(2)$ remains unaltered from the previous section because, by definition, extortionary bribes are charged only to those who operate legally.

Noticeably, when an agent is faced with a corrupt official who threatens to shut down her business, it does not matter whether the business is legal or whether it has followed the regulations. Since the threat is the same, the bribe is also the same. It follows that $\beta_e = \widetilde{\beta} = \phi R_i$. Substituting for the values of the bribes β_e and $\widetilde{\beta}$ into the payoffs, and proceeding as before, one can obtain the value of the bribe that solves the bargaining problem between the agent and the corrupt official at the high level of government as $\beta = R_i d(1-\widetilde{p})\theta$. This value is lower than the one obtained in the previous section. Thus, in this model, the emergence of extortion reduces the size of the bribe when bargaining for a permit.

Given these values, the individuals decisions on whether to comply with the regulations and whether to join the official economy are similar than before. More specifically, there is a unique value $R^{**} = \frac{\alpha}{d(1-\widetilde{p})(1-p(1-\theta))}$ such that individuals endowed with ability $R_i > R^{**}$ will always follow the regulations and join the official economy; and individuals endowed with ability $R_i < R^{**}$ will look for a corrupt official to get their permit. A fraction p of these individuals find a corrupt official and join the official economy, while the remaining $(1-p)$ do not find one and hide into the shadow economy. The distribution and scope of all productive activities in an economy with corruption and extortion is presented in Figure 2.



$$\lim_{(p,\tilde{p})\to 0} R^{**} = \frac{\alpha}{d} \qquad R^{**} = \frac{\alpha}{d(1-\tilde{p})(1-p+p\theta))}$$

Figure 2: Equilibrium Strategies under Extorsion

The results of the model regarding the effects of changes in corruption at the different levels (p and $\tilde{p}$), changes in the costs of the regulations (α), and changes in the probability of detection (d), are similar to the ones obtained in the previous section. The policy implications also remain unchanged. Thus, we concentrate our attention on the changes that occur when extortion is present in the model. These results can be summarized as follows:

1. An economy with extortion exhibits less regulation compliance than an economy without extortion, ceteris paribus.

2. An economy with extortion experiences more unofficial economic activity than an economy without extortion, ceteris paribus.

3. For any given initial level of regulation compliance, policies that reduce corruption

have greater success in increasing regulation compliance in an economy with extortion than in an economy without extortion.

4. For any given initial level of regulation compliance, policies that reduce corruption have greater success in reducing unofficial economic activities (and are more likely to actually reduce it) in an economy with extortion than in an economy without extortion.

We now turn to the discussion of these results. Algebraically, it is easy to show that $R^{**} > R^*$ and, therefore, that in an economy with extortion there is less regulation compliance and more unofficial economic activity than in an economy without extortion. Similarly, by calculating the respective derivatives one can verify that, for any given initial level of regulation compliance $C(R^{**}) = C(R^*)$, the changes in S and C with respect to changes in either p or $\widetilde{p}$, are always greater in an economy with extortion than in an economy without extortion. We present the actual calculations in the appendix and concentrate in the intuition of these results in what follows.

Intuitively, in an economy with extortion, the net expected value of following the regulations and joining the official economy ($v(1)$) falls relatively more than the net expected value of not following the regulations ($v(3)$ or $v(2)$). This is so because the emergence of extortion affects only those businesses that operate under the approval of the government to begin with. Thus, as extortion emerges, it becomes less attractive to join the official economy; and as less businesses join the official economy, less businesses choose to follow the regulations. It is for this same reason that policies that reduce corruption now become more effective as well, because by reducing corruption they reduce the negative effects of extortion.

4 Conclusions

In this paper we present a model that studies the effects of corruption in its different forms and manifestations on both, regulation compliance and unofficial economic activity. We show that the effects of corruption at low levels of government are different than the effects of corruption at high levels of government. We also show that the emergence of extortion is always detrimental. In an economy with extortion, there is less regulation compliance and more unofficial economic activity than in an economy without extortion.

In our model, the level of regulation compliance and the extent of the shadow economy were defined explicitly, so that one can study the changes in both of these variables simultaneously. Interestingly, although the extent of the shadow economy and the level of regulation compliance are related, they do not necessarily go hand in hand.

5 References

Becker, G. (1968). Crime and punishment: an economic approach. Journal of Political Economy, vol. 76, no. 2, pp. 169-217.

Chander Parkash and Louis Wilde (1992). Corruption in tax administration. Journal of Public Economics, vol. 49, pp. 333-349.

Choi, Jay Pil and Marcel Thum (2005). Corruption and the shadow economy. International Economic Review, vol. 46, no. 3, pp.817-36

Çule, Monika and Murray Fulton (2005). Some implications of the unofficial economy-bureaucratic corruption relationship in transition countries. Economics Letters, vol. 89, pp. 207-21.

Damania, Richard, Per G. Fredriksson and Muthukumara Mani (2004). The persistence of corruption and regulatory compliance failures: Theory and evidence. Public Choice, vol. 121, pp. 363-90.

Friedman, Eric, Simon Johnson, Daniel Kaufmann and Pablo Zoido-Lobaton (2000). Dodging the grabbing hand: the determinants of unofficial activity in 69 countries. Journal of Public Economics, vol. 76, pp. 459-93.

Johnson, Simon, Daniel Kaufmann, John McMillan, and Christopher Woodruff (2000). Why do firms hide? Bribes and unofficial activity after communism. Journal of Public Economics, vol. 76, pp. 495-520.

Mishra, Ajit (2006). Persistence of corruption: some theoretical perspectives. World Development, vol. 34, pp.349-58.

Mookherjee, Dilip and I.P.L. Png (1995). Corruptible law enforcers: how should they be compensated? The Economic Journal, vol. 105, no. 428, pp. 145-159.

Schneider, Friedrich and Dominik H. Enste (2000). Shadow economies: size, causes, and consequences. Journal of Economic Literature, vol. 38 (march), pp. 77-114.

Schneider, Friedrich (2005). Shadow economies around the world: what do we really know? European Journal of Political Economy, vol. 21, pp. 598-642.

Treisman, Daniel (2000). The causes of corruption: a cross national study. Journal of Public Economics, vol. 76, pp. 399-457

6 Appendix

6.1 Individual decisions in an economy without extortion

In an economy without extortion, the individual choices $v(1), v(2)$ and $v(3)$ are defined as follows:

$$\begin{array}{l} v(1) = R_i - \alpha \\ v(2) = (1-d)R_i + d\widetilde{p}(R_i - \widetilde{\beta}) \\ v(3) = p[R_i - \beta] + (1-p)[(1-d)R_i + d\widetilde{p}(R_i - \widetilde{\beta})] \end{array} \tag{7}$$

- $v(2) > v(1)$ if and only if $(1-d)R_i + d\widetilde{p}(R_i - \widetilde{\beta}) > R_i - \alpha$. Substituting for the value of the bribes, this condition becomes $(1-d)R_i + d\widetilde{p}R_i(1-\phi) > R_i - \alpha$; which is true if and only if $R_i < \frac{\alpha}{d(1-\widetilde{p}(1-\phi))}$.

- $v(3) > v(1)$ if and only if $p[R_i-\beta]+(1-p)[(1-d)R_i+d\widetilde{p}(R_i-\widetilde{\beta})] > R_i-\alpha$. Substituting for the value of the bribes, this condition becomes $R_i - R_i d(1-p) - R_i dp\theta + R_i d\widetilde{p}(1-\phi)(1-p+p\theta) > R_i - \alpha$; which is true if and only if $R_i < \frac{\alpha}{d(1-\widetilde{p}+\widetilde{p}\phi)((1-p+p\theta)}$.

- $v(3) > v(2)$ always. This can be verified by substituting $\beta = \theta d R_i$ and $\widetilde{\beta} = \phi R_i$ into $v(3)$ and $v(2)$. The value of $v(3)$ is always greater than the value of $v(2)$ because the individual would not choose to pay the bribe otherwise and the corrupt public official would lower his demand until a mutually beneficial bribe amount is negotiated.

In turn, the respective derivatives of C with respect to p and $\widetilde{p}$ are: $\frac{\partial C}{\partial p} = -G'(R^*)\frac{\alpha d(1-\theta)(1-\widetilde{p}(1-\phi))}{[d(1-p+p\theta)(1-\widetilde{p}+\widetilde{p}\phi)]^2}$ and $\frac{\partial C}{\partial \widetilde{p}} = -G'(R^*)\frac{\alpha d(1-\phi)(1-p(1-\theta))}{[d(1-p+p\theta)(1-\widetilde{p}+\widetilde{p}\phi)]^2}$, respectively. Comparing these values one obtains that

$\left|\frac{\partial C}{\partial p}\right| > \left|\frac{\partial C}{\partial \widetilde{p}}\right|$ if and only if $p > \widetilde{p} + \frac{\theta-\phi}{1-\theta-\phi}$. A similar procedure can be followed to obtain that $\left|\frac{\partial S}{\partial p}\right| > \left|\frac{\partial S}{\partial \widetilde{p}}\right|$ if and only if $p > \widetilde{p} + \frac{\theta-\phi}{1-\theta-\phi}$.

6.2 Results with and without extortion

The resulting level of regulation compliance in an economy without extortion is $C = 1 - G(R^*)$, with $R^* = \frac{\alpha}{d(1-\widetilde{p}+\widetilde{p}\phi)((1-p+p\theta)}$. In turn, the resulting level of regulation compliance in an economy with extortion is $C = 1 - G(R^{**})$, with $R^{**} = \frac{\alpha}{d(1-\widetilde{p})(1-p(1-\theta))}$. By comparing R^* with R^{**}, one obtains $R^* < R^{**}$ if and only if $\frac{\alpha}{d(1-\widetilde{p}+\widetilde{p}\phi)((1-p+p\theta)} < \frac{\alpha}{d(1-\widetilde{p})(1-p(1-\theta))}$; which is always true given the assumptions about the parameter values.

In an economy without extortion, the values for $\frac{\partial C}{\partial p}$ and $\frac{\partial C}{\partial \widetilde{p}}$ were given above. For an economy with extortion, the derivatives of C with respect to p and $\widetilde{p}$ are: $\frac{\partial C}{\partial p} = -G'(R^{**})\frac{\alpha d(1-\theta)(1-\widetilde{p})}{[d(1-p+p\theta)(1-\widetilde{p})]^2}$ and $\frac{\partial C}{\partial \widetilde{p}} = -G'(R^{**})\frac{\alpha d((1-p+p\theta))}{[d(1-p+p\theta)(1-\widetilde{p})]^2}$. Because the distribution function is uniform $G'(R^{**}) = G'(R^*)$ for any values of R^{**} and R^*. Thus, assuming two alternative economies with an identical initial level of regulation compliance $C = C(R^*) = C(R^{**})$ and comparing the respective derivatives, one obtains $\frac{\partial C(R^*)}{\partial p} < \frac{\partial C(R^{**})}{\partial p}$ and $\frac{\partial C(R^*)}{\partial \widetilde{p}} < \frac{\partial C(R^{**})}{\partial \widetilde{p}}$. That is, one obtains that for any given initial level of regulation compliance, policies that reduce corruption have greater success in increasing regulation compliance in an economy with extortion than in an economy without extortion. A similar procedure can be followed to show the same is true for the value of S.