Corruption and regulatory burden

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5. May 2008

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Abstract

It is known that government has discretionary power in providing public goods and regulating the economy. Corrupt bureaucracy with discretionary power creates and extracts rents by manipulating with the public good supply and regulations: i) by attaching excessive red tape to the public good they are providing; ii) or by making the regulations difficult for the private agents to comply with. The former type of corruption results in less public input being provided at higher cost to the private agents. The latter increases non-compliance, which then breeds bribery. Consequently, the overall public sector burden is higher in the environment with corrupt bureaucracy. We show this outcome using a simple theoretical model, and then confront it with empirical evidence.

*I thank Prof. Yew-Kwang Ng for the valuable comments on the paper

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1 Introduction

Some researchers find that corruption can play a positive role for economic growth by decreasing red tape. However, this finding rests on the assumption that corruption and red tape are independent from each other. In reality, it is a strong assumption. Both corruption and red tape are created by the same bureaucracy and thus it is more reasonable to assume that they are dependent on the characteristics of the underlying institutions.

The idea that the inefficient government sector can lead to larger optimal size of government has been demonstrated by Ng (2000). The increase in government size implies a heavier public sector burden. In this work I set a task of relating the public sector burden with the inefficiencies stemming from corruption of bureaucracy running the public affairs.

The paper in particular aims to develop a simple model that enables to associate the quality of bureaucracy with the regulation burden. In other words, endogenous red tape or regulatory burden is modelled as depending on the quality of public institutions or conversely on the corruption level in them. Then the proposition stemming from of the model suggesting a positive relationship between corruption and regulatory burden is tested empirically.

Since we will be referring to the concept of red tape we need to define it first. In the current context red tape is defined as a set of procedures obligatory to fulfil by the private agents to obtain public goods and services to operate legally. In fact, red tape is a type of regulation set and enforced by the government. The other regulations can be lumped into one non-red-tape regulations group. Those regulations are different from red tape because they are not associated

with obtaining public good or service.

Corruption is defined as illegal use of public position for personal gain. The public position provides the power to introduce, implement and enforce regulations and rules. In corrupt environments the discretionary power of the public officials is strong and their activities are not transparent.

We know that in general the government is a monopolist in the provision of public goods and services. At the same time the purpose of government is not profit maximisation, therefore, a benevolent government should provide the goods and services at their marginal cost.

Corrupt bureaucracy uses its public position for creating and extracting rents from the private sector. In general, the bureaucracy does it by abusing their monopolistic power and manipulating with red tape and regulations. Therefore, the regulations are not independent of corruption, but is a mechanism used by corrupt bureaucracy to extract rents from private agents.

Shleifer and Vishny (1993) and Barreto (2000, 2003) indicate that corrupt bureaucrats take advantage of their monopolistic power and rent-seek. The monopolistic behaviour of the public agents leads to less public goods being offered to the private sector. As the act of corruption is illegal, the bureaucrats do not openly increase the price for the service they are providing as the private monopoly would do. Also any official increase in public good prices leads to an increase of government revenue, not the corrupt official‘s income. So rent-seeking is done by simple creation of hurdles or red tape on the way of the private agents trying to obtain public services and goods. In general, an optimal level of red tape can be positive as red tape may play an information creating function. There-

fore, we refer not to red tape in general, but only to its type, which is excessive and wasteful. For example, corrupt officials tend to create long queues or erect artificial barriers for the private agents by making up *ad-hoc* procedures and requirements.

The time of the bureaucrat is limited, thus engagement in creation of excessive red tape effectively decreases his useful output. Instead of the costly red tape the private agents might choose to pay a bribe to the bureaucrat on top of the statutory cost of the public service or good. That is what usually called "speed money" or "greasing the wheels". This is the main reason to see corruption as a phenomenon improving efficiency by speeding up rigid bureaucracy. However, in the first place, the bureaucracy become slow and rigid due to corrupt intentions, as it is how they invite for bribing.

From the corruption literature we know that corruption may happen *ex ante* or *ex post*. In the *ex ante* corruption or "corruption without theft" the bureaucracy increases the price of the public goods before the interaction with the private agent. As the bureaucracy has the monopolistic power it can charge monopolistic prices for the public goods it is providing. The other example of the *ex ante* corruption is framing and extortions exercised by public officials abusing the public power endorsed upon them.

It is apparent that the institutions of poor quality create opportunities for the public officials to engage in such corrupt behaviour. Since the higher cost of obtaining public good or extortions decrease private agents income, the *ex ante* corruption increases the burden of the public sector.

The *ex post* corruption or "corruption with theft" takes place when bureau-

cracy learns about the type of the private agent and can conceal socially valuable information for private gain. Usually it happens when the corrupt bureaucrat inspecting the private agent finds that the private agent has not fulfilled his liability required by regulation.

A regulation may be introduced in order to deal with externalities created by private production or other social reasons. In case of *ex post* corruption, both the inspector and the producer might gain at the expense of the society as a whole. This type of corruption may decrease the burden of regulations on the individual agents involved. However, if the enforcer also has the opportunity to set the regulation parameters then he will increase the effective burden of the regulation, so that the rent created is fully captured by the bureaucrat. The effective burden of regulations on the private agents, in this case, does not decrease, though lower compliance with the regulations increases negative externalities.

Due to increased negative externalities imposed on the other agents, corruption makes the society as whole worse-off. For example, in some countries traffic police is so corrupt that one can just buy a drivers' license and pay off his way in case of violating traffic rules. Seemingly it should make the individuals life easier, but as everybody on the road is doing the same, driving becomes a formidable experience. In fact, the indirect burden of such corruption is much higher than its direct burden.

Summing up, we can state that the driving force of corruption is the possible rents that may be captured by the bureaucracy. The rents can be created only through regulatory power of the government, thus regulatory burden is directly related to the corruption level in the public sector. Based on this rationale we

can conjecture that corruption and red tape (regulation burden) are correlated and both depend on the deeper parameters characterising the public sector.

This paper contributes to the literature by constructing a model that relates the quality of institutions to the burden of the regulations. The results leading to this conclusion are based on both a theoretical model and empirical tests on the validity of the hypothesis stemming out of the theoretical model.

In the theoretical model the government provides a single public good. We assume that this good is an essential input to private production. We relate the benevolence measure of the bureaucracy to its capacity to reap monopolistic rents in providing public goods. The bureaucracy also sets and enforces externality-related regulations. The bureaucracy increases statutory burden of the regulations by manipulating with the regulation parameters. The high burden of the artificially stringent statutory regulation decreases compliance rates among the private agents as they seek their way out by bribing the bureaucrats involved. We show that in such an environment under some conditions with the increase of corruption the equilibrium regulation burden becomes higher.

To test the prediction of the model we formulate a hypotheses stating that the corruption level and governance quality are associated and there is positive correlation between the measure of corruption and the effective cost of red tape. Using cross country data we find strong dependence between the corruption measure and the governance measures that reflect the quality of the public institutions. The second hypothesis postulating a positive association between the corruption level and the regulatory burden is tested, and the evidence supports the hypothesis.

The paper is organised as follows. First I set up a theoretical model and find its solution. Then I test the main hypothesis that whether the level of corruption is associated with the quality of underlying institutions; and whether the countries with higher corruption levels also have a higher red-tape burden? In the last section I draw conclusions about how corruption and regulatory burden are related.

2 A review of the literature

In the literature there are conflicting views about the effect of corruption on economic efficiency. Basically, there are findings that corruption can be efficiency enhancing in the over-regulated, rigid and inefficient environment. To the best of my knowledge, since Leff (1964) the idea that corruption contributes to efficiency improvements has find its proponents. Leff (1964) advocates corruption on the grounds that it helps to circumvent bad regulations and thus improves economic efficiency. A similar rationale is used in arguments presented by Huntington (1968), Tanzi (1998), Kaufmann and Wei (1999), Barreto (2000); Barreto and Alm (2003). They point out that corruption can help to overcome different regulatory obstacles and lessen the adverse effect of bad policies and governance.

Meon and Weill (2006) find some evidence supporting the hypothesis that corruption can be efficiency-enhancing. They claim that corruption is positively related to the efficiency in countries with malfunctioning institutions. Though, they find that in countries with effective institutions the relationship between corruption and efficiency is negative.

The other argument used to support the efficiency-enhancing nature of corruption is that it leads to better resource allocation. In other words, corruption functions similar to auctions that determine the most efficient allocation of the public goods, permits, and licenses. According to this argument corruption allows distributing permits to most efficient producers and lowers regulatory burden at the same time (Lui, 1985).

This argument is based on the implicit assumption that the public power is exogenously given to the public officials. The reality is much more complicated and public officials in corrupt environments are not independent agents but a members of some clans or groups. So they are not totally driven by their individual short-term interests, but to keep their own rent seeking position in the long-term they serve the clan's interest which they are a member of. In other words, corruption cronysm, nepotism and patronage go along with corruption in the public sector. Therefore, there is nothing like auctions in distribution of permits and licenses. It is rather a distribution of permits driven by the combination of short-term and long-term rent-seeking.

The other view is that corruption may improve professional quality of the public officials as it creates incentives to attract talents by increasing their effective incomes (Bailey, 1966; Leys, 1965). However, this only makes corruption schemes more sophisticated and harmful, as there is no guarantee that more talented people are less self-interested.

Nevertheless, the contemporary dominating view is that corruption is a significant impediment for economic growth. The main argument is that the regulatory burden or the rigidity of the bureaucratic procedures is not exogenous

to corruption. Corrupt bureaucrats create those regulatory barriers to extract bribes from the private agents (Myrdal, 1968). Corruption may increase number of transaction with the bureaucracy, which offsets any efficiency gains from corruption (Bardhan, 1997; Jain, 2000; Kaufmann and Wei, 1999). In addition, corrupt bureaucrats create distortions in the public and private sectors to create rents or just to maintain them (Kurer, 1993; Mauro, 1995; McChesney, 1997; Shleifer and Vishny, 1993; Tanzi, 1998). The empirical studies by Mauro (1995), Brunetti et al. (1998), Mo (2001), and Ali and Isse (2003) confirm the negative relationship between corruption and growth.

Barro (1990) and Keefer and Knack (2002) show that when government is rent seeking the overall public burden increases. Their result indirectly supports the idea that corrupt bureaucracy is positively correlated with a higher regulatory burden. Modelling the interaction between the corrupt bureaucracy and private agents, Guriev (2004) finds that in the corrupt environment the equilibrium burden of red tape is higher than in the absence of corruption. His model is based on the agency theory, and assumes heterogeneous private agents of two types. However, there is no quality measure for the bureaucracy in his model that can be related to the level of corruption in the economy.

The literature, with the exception of Guriev (2004), lacks studies of the dependence between corruption level and regulatory burden. To the best of our knowledge there has not been any empirical study testing the correlation between corruption and regulatory burden. The aim of the paper is to address this gap in the literature.

3 The model

3.1 Assumptions

Let us first lay out our assumptions about the agents operating in the economy, their preferences, and production technology.

3.1.1 The Agents

Suppose that the model economy is populated with identical household-producers and bureaucrats. Each private agent has an initial endowment of consumer goods of X. If the agent decides to produce, he has to obtain public input essential for production. This condition captures the public sector involvement in production through permits, licenses, certifications, and provision of infrastructure and other public inputs.

The agents preferences are defined by a utility function of the form:

$$u = u(y, e) \tag{1}$$

where y is income, e is the quality of the environment the agents living in. I use income as an argument of the utility function n as we are assuming away saving in our model. I also assume that the utility of the agent is increasing in both arguments, $u'_y, u'_e > 0$. The environment measure depends on the hazard or negative externality in general, h. From now I refer to this variable as the externality. Put it formally as $e = e(h)$, $e'(h) < 0$, where h is a measure of the externality stemming from production process.

I assume that generally the government represented by bureaucracy with qual-

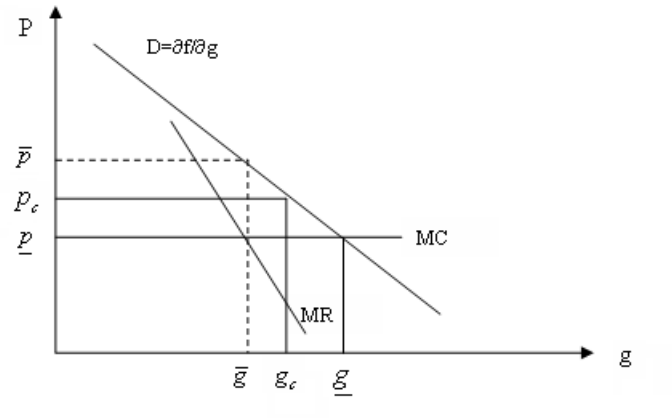


Figure 1: Public good provision in a corrupt environment

ity measured by an index $I \in [0, 1]$. Only if $I = 1$, the bureaucracy is completely honest and benevolent.

The government provides public goods that are essential input to private production. The fully benevolent bureaucracy provides the public good at its marginal cost, however, when the bureaucracy is not fully benevolent or when $I < 1$ the price of the public good is set with a mark-up.

$$p = MC + (1 - I)m \tag{2}$$

where MC is the marginal cost of public good production, m is the maximum mark-up. The second term in this equation is the cost of corruption imposed on the private agents.

This model is in fact, an extension of the model proposed by Shleifer and Vishny (1993), which is illustrated in Figure 1. The demand for the public input is de-

termined from the profit maximisation and given by curve D in Figure 1. The price for the public good is defined on $p \in [\underline{p}, \bar{p}]$, where $\underline{p} = MC$ is the legal[1] price set by the government, while $\bar{p} = MC + m$ is the higher price acceptable by producers. The price faced by the private agents is higher with higher corruption as $I < 1$ implies $p > \underline{p}$.

Note, in any case the bureaucrat reports the legal price $\underline{p}$, while any exceeding amount per unit of the public good equal to $p_c - \underline{p}$ is pocketed by him. We can treat the mark-up as a bribe paid by the private agent to obtain the public good. We assume that the bureaucracy is paid salary w equal to the sum of two components. Formally it is expressed as

$$w = \underline{p}g + \bar{w} \tag{3}$$

where g is the real amount of the public services provided, $\bar{w}$ is the salary of the bureaucrats independent of their efforts at work.

In reality, it is possible that the bureaucrats get only a fraction of the revenue $\underline{p}g$ as a salary. For simplicity we assume that they get all the revenue as their salaries. Thus with the bribes the bureaucrats‘ actual income equals

$$w_b = w + (1 - I)ms_1 \tag{4}$$

where s_1 is the productivity of the public official. To make our algebra simple we assume that $s_1 = 1$.

[1]We are assuming that at least at the political level government is instituted for promoting so called “ public interest” and therefore, its intentions are benevolent.

3.1.2 Private Production

The private agent might spend a portion of his endowment X to buy the public good and engage in production. His production technology is given by

$$y_a = f(g, \bar{l}, h). \tag{5}$$

where, g is the real amount of public inputs, $\bar{l}$ is the fixed amount of labour, and h is the hazard to environment created or generally the negative externality of production. That is to say that the quality of environment e is a function of this production externality h, or $e = e(h)$. Note, without obtaining the public good the production process does not take place. We assume the production function $f(g, \bar{l}, h)$ is continuous and monotonically increasing in g and h, or $\lim_{g,h\to 0} f'_g(\bullet), f'_h(\bullet) = \infty$ and $\lim_{g,h\to\infty} f'_g(\bullet), f'_h(\bullet) = 0$ and $f''_g(\bullet), f''_h(\bullet) < 0$. Here and further $\bullet$ denotes all other arguments of a function.

The producers maximise their profits treating the institutional structure and technology as given. This problem is formally stated as:

$$\max_{g,h} y = f(\bullet) - c_1(g) - c_2(h) \tag{6}$$

where $c_1(g) = pg$ is the cost of the public input,$c_2(h) = \psi(h - h_0)$ is the cost of the externality exceeding the allowed limit.

The first-order condition with regards to the public input for this problem leads to the optimality condition for the private agent:

$$p_c = \frac{\partial f(\bullet)}{\partial g}, \tag{7}$$

where p_c is the equilibrium price of the public input provide by the monopolist bureaucrat.

Recall that the rent seeking public officials charge higher prices for the public input they are providing, or $p_c > \underline{p}$. Denote by $\bar{g}$ the amount of public input obtained by the producer at the minimal price $\underline{p}$. Based on the condition in (7) and the properties of the production function ($f'_g(\bullet) > 0$, $f''_g(\bullet) < 0$), we infer that $g_c < \bar{g}$, where g_c is the amount of the public input. Since the production function is increasing in the public input g, the following condition $f(g_c, \bullet) < f(\bar{g}, \bullet)$ holds. Therefore,we conclude that in a corrupt environment private output is lower than in the absence of corruption, other inputs being the same.

3.1.3 Production Externality

The level of the negative externality created by production process, h, can be chosen by the producer based on his technology, $y_a = f(g, h, \bar{l})$. Suppose that the level of h that maximises $f(\bullet, h)$ is equal to h_m. However, this level of externality may not be acceptable for the society. In this case the government establishes a regulation that sets a ceiling to the permitted level of the externality as $h_0 < h_m$.

To maximise their profits the producers choose the externality level h given the probability of being caught and punished.

The FOC of (6) with regards to h yields us the following:

$$\frac{\partial f}{\partial h} - \psi = 0 \tag{8}$$

The solution of this equation gives us the optimal value of the effective externality,

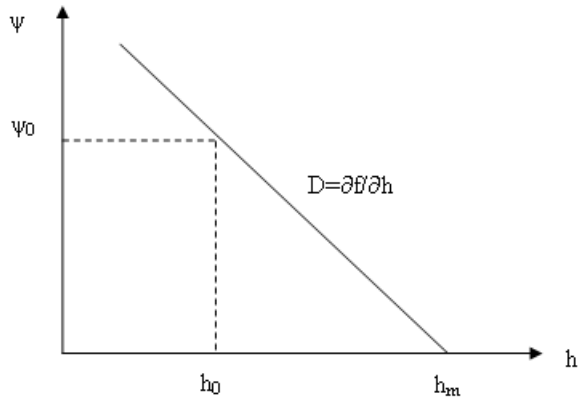


Figure 2: Full compliance in the absence of corruption

h^*.

The price of the excessive externality depends on the penalty rate of non-compliance, ϕ and the probability of detection, δ. Thus we can write, $\psi = \delta\phi$. The benevolent government chooses δ and ϕ in such a way that it would be optimal for the producer to comply, or

$$\psi_0 \geq \frac{\partial f}{\partial h}|_{h^*=h_0}$$

where h^* is the optimal amount chosen by the producer, h_0 is the officially allowed level of externality.

This outcome is illustrated in Figure 3. When the cost of the externality is equal to ψ_0 the producer will choose not to demand h in excess of the level permitted by the regulation. Therefore, in this case the producer complies with the regulation and demands only the free allowance equal to h_0.

The profit maximising producers would demand more externality at lower

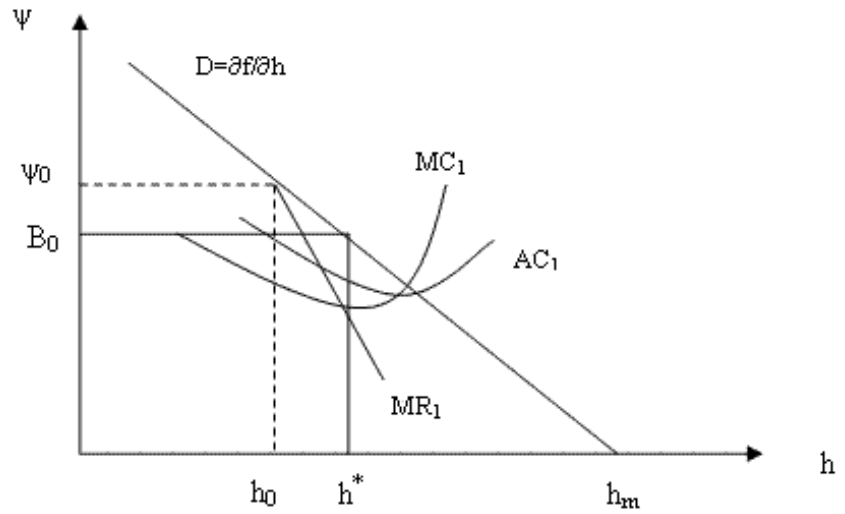


Figure 3: Corruption with theft

prices. The corrupt bureaucrats can sell the additional allowances for externality at lower price, B_0, which is just the bribe rate.

Usually, government regulations are enforced by a specific department or office depending on the nature of the regulation. Also the bureaucracy one has to deal with is also location specific, so that if one has a business in some location then the entrepreneur is attached to a certain local bureaucracy in terms of regulation compliance. Put in another way, the bureaucrats exercise monopolistic power in provision of public services and regulation enforcement.

As a monopolist the bureaucracy supplies the additional externality allowances in the amount that equalises its marginal revenue MR_1 and marginal cost MC_1. Note, that the effective demand by the producers for additional externality starts only after point h_0. Therefore, the marginal revenue curve MR_1 is effective only to the right of the vertical at point h_0.

The bureaucrats face some costs when they allow for excessive externality. The cost schedule faced by the corrupt bureaucrats can be non-linear in general as it is depicted in Figure 3. However, for simplicity we can assume that this cost is a function of the amount of the excessive externality being sold by the bureaucrat. So, this cost is given as as the following function:

$$c_b = \gamma_0(h - h_0) \tag{9}$$

where γ is a cost parameter. Given the cost function the bureaucrats then maximise their net bribes. In this setting the marginal cost then is given by:

$$MC_1 = c_b'(h) = \gamma_0$$

The result of such a corrupt interaction should be higher equilibrium externality equal to $h^* > h_0$, which is depicted in Figure 3.

Since only those who do not comply with the regulation are subject to bribe-paying, it is in the corrupt bureaucrats' interest to have more violators among the producers. The simple way to do that is to make the regulation more stringent by decreasing the allowed level of externality. In our context, it is equivalent to decreasing the allowed ceiling for externalities from h_0 to $h_c < h_0$.

The implications of such corruption is illustrated in Figure 4. Now the corrupt bureaucrats can sell more allowance of externality than before. Therefore, they now have a new marginal revenue curve given by MR_2. However, this type of corruption involves violation of more laws than just the corruption with theft, thus the cost of the corrupt bureaucrats should be different.

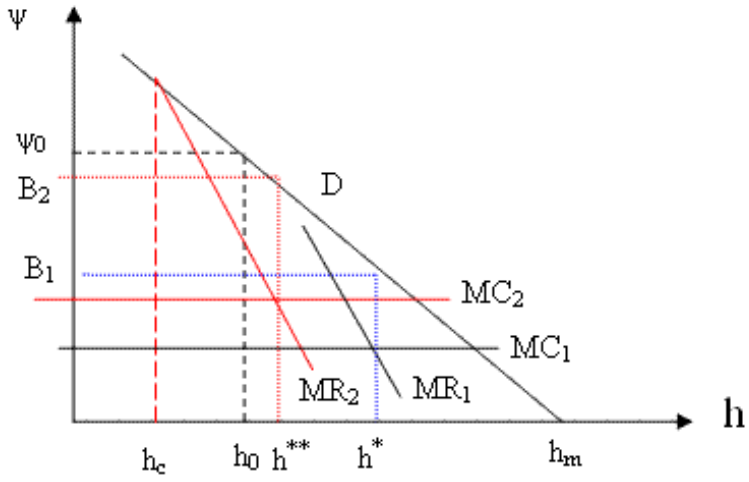


Figure 4: Combination of corruption with theft and without theft.

In the simplest setting the cost faced by the bureaucrats should have two components. The first component should capture the cost for taking bribes that is related to the amount of externality, whereas there should be cost related to the extortionary behaviour of the bureaucrats. Based on this rationale we assume that the cost of the corrupt bureaucrats is given by

$$c_b = [\gamma_0 + \gamma(h_0 - h_c)]\,(h - h_c) \tag{10}$$

Under this condition marginal cost curve is given by

$$MC_2 = c_b'(h) = \gamma_0 + \gamma(h_0 - h_c) \tag{11}$$

It is clear that the marginal cost of the corrupt bureaucrats is greater in these circumstances, as $MC_2 > MC_1 = \gamma_0$. The equilibrium externality level is then lower and found as equal to h^{**}, where $h_0 \leq h^{**} < h^*$; also the bribes are heavier

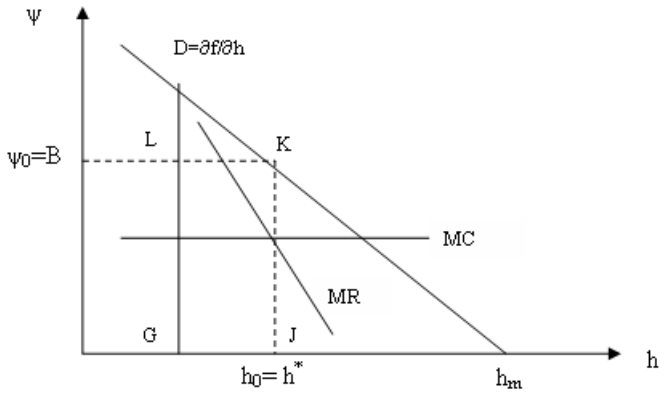


Figure 5: Extortionary corruption

than in the case without extortions, $B_2 > B_1$. The results of the analysis are illustrated in Figure 4.

Based on the logic of this model we can find that it is possible the bribe level is equal to the official cost of non-compliance, $B = \psi_0$, and the equilibrium externality allowed is equal to the officially allowed level, $h^* = h_0$. However, this allowed externality level is not obtained free of charge as in the case without corruption, but rather involves a burden of bribing the corrupt officials. This outcome is portrayed in Figure 5. The burden of corruption here is the cost of bribes measured by the area of rectangle $GLKJ$.

The other important question is: what is the equilibrium level of the allowed externality set by the corrupt bureaucracy, h_c? The corrupt bureaucrats maximise their bribes given the cost they face for being corrupt. As we supposed earlier, the higher extortions are made by deviating more from the legal benchmark h_0. However, the greater the deviation from the legal benchmark, the higher is the cost of being corrupt. Therefore, the corrupt official should maximize his

bribes, R, by taking account of the possible costs:

$$\max_{h_c} R = \int_{h_c}^{h} (B - AC)dh,$$

$$s.t. MR = MC$$

where B is the bribe rate, AC is the average cost of selling a permit for a unit of externality, h_0 is the legal benchmark for externality, h_c is the lower benchmark set by corrupt bureaucrats.

For illustration purposes we consider a specific case. Suppose that the bribe obtained per unit of excessive externality is given by

$$B = b_0 + b(h_0 - h_c).$$

This formulation captures the idea that the lower the benchmark set by the corrupt bureaucracy for free externality, h_c, relative to the legal benchmark, h_0, the higher the bribe rate.

Suppose, the average cost of corrupt bureaucrat is given by

$$AC = \frac{c_b}{h - h_c} = \gamma_0 + \gamma(h_0 - h_c).$$

From condition $MR = MC$ we get the optimal demand for h^*. Then taking it into account we can state the bureaucrats problem as

$$\max_{h_c} R = [b_0 - \gamma_0 + (b - \gamma)(h_0 - h_c)] (h^* - h_c)$$

The FOC with respect to h_c is then given by

$$(b_0 - \gamma_0 + (b - \gamma)(h_0 - h_c) - (b - \gamma)(h^* - h_c) = 0.$$

By solving for h_c we obtain its equilibrium value

$$h_c^* = \frac{(h^* - h_0)}{2} - \frac{b_0 - \gamma_0}{2(b - \gamma)} \tag{12}$$

From this result we can infer that an increase in rents from corruption with theft $(b_0 - \gamma_0)$ relative to the rents from predation $(b - \gamma)$ leads to higher predation, defined as a lower value for h_c^*. So policy-wise it is more effective to focus on curtailing the corruption with theft, which also decreases predatory behaviour of the bureaucracy.

We also infer that the corrupt bureaucrats set the allowed level of the externality h_c such that the condition given by $h^* > h_0$ holds. Put another way, in the environment with corrupt bureaucracy, the equilibrium level of the externality exceeds the legally permitted level.

3.2 Welfare implications

If there was no restriction on the externality then the producer would use h_m at no charge. However, the regulation sets the allowed externality equal to h_0, which is also free of charge. Then for the individual producer who does not take into account his contribution to the quality of environment, the effect of the regulation equals the foregone output.

In the absence of corruption the foregone output due to a lower level of per-

mitted hazard or externality can be found as a difference between the maximum output in case of no regulation, $y_m = f(\bullet, h_m)$, and the optimal output under the regulation, $y = f(\bullet, \bar{h_0})$. This condition is captured by

$$T_0 = f(\bullet, h_m) - f(\bullet, h_0) \tag{13}$$

The utility of the agent also depends on the quality of the environment, and due to regulation the environment is improved by $e(h_0) - e(h_m)$, where $e(h_0) > e(h_m)$. So, the overall effect of the regulation depends on whether utility decreases

$$U_a\left[f(\cdot, h_m), e(h_m)\right] > U_a\left[f(\cdot, h_0), e(h_0)\right]$$

or increases

$$U_a\left[f(\cdot, h_m), e(h_m)\right] < U_a\left[f(\cdot, h_0), e(h_0)\right]$$

is true. It is reasonable to assume that the benevolent government chooses the regulation in a manner that improves the overall welfare, so that the latter inequality holds.

In case of corruption with extortions the effect of the regulation on the producer is then given by

$$T_c = \left[f(\bullet, h_m) - f(\bar{l}, g_c, h^*)\right] + B(h^* - h_c) + (p_c - \bar{p})g_c \tag{14}$$

where the last terms stand for the amount of bribes and the surcharge for the public input correspondingly.

If the condition $h^* = h_0$ holds then the burden of the regulation on the

producer in the environment with corrupt bureaucracy is strictly higher,

$$T_c > T_0$$

Then we can ascertain that in this case the overall welfare effect of corruption is negative, and expressed as:

$$U_a\left[f(\bar{l},\bar{g},h_0),e(h_0)\right] > U_a\left[f(\bar{l},g_c,h_0) - B(h_0-h_c) - (p_c-\bar{p})g_c, e(h_0)\right]$$

Earlier, for the specific form of the cost function we found that the equilibrium externality is greater than the legal level $h^* > h_0$. However, with corruption the public input is lower, or $g_c < \bar{g}$. Then the burden of regulation can still be higher than the legal one. In other words, as soon as the condition

$$f(\bar{l},\bar{g},h_0) > f(\bar{l},g_c,h^*) - B(h^*-h_c) - (p_c-\bar{p})g_c$$

holds, $T_c > T_0$ is also true. Recall that $h^* > h_0$ implies $e(h^*) < e(h_0)$. Thus this outcome suggests that due to corruption the private agent may loses both in income and in the quality of the environment.

This is then the worst social outcome as the producers face higher costs in obtaining the public input and the negative externality is higher than the optimal level. Also note that the bribes paid by the private agents are not fully transferred to the bureaucracy as they waste resources while extorting bribes reflected by the cost of rent seeking, c_b. The overall effect then will be a loss incurred to social welfare.

The other implication we may consider is that the concept of environment can be considered from a wider perspective and by going beyond the natural environment. The wider concept of environment may also include the safety and property rights protection. So the increase in the externality level may also affect the efficiency of the production process. As in the example of the traffic rules being enforced by the corrupt officers mentioned earlier: the increase in externality due to corruption may lead to strong deterioration of the environment. In such a case the personal gain from non-compliance is offset entirely by the adverse effect of the negative externality imposed by others.

This logic can apply in general: as the government fails in its organising role and boosting cooperation, the private agents may find themselves in an uncertain environment with high levels of negative externality. This should imply higher cost for production, safety, property rights protection, which leads to lower output for any given level of inputs.

Summarising we draw the following conclusions:

1. Corruption increases the direct burden on the private agents

    - from the condition that the bureaucrat maximises his revenue we conclude that the condition $p_c > \underline{p}$ the cost of the public inputs is higher with corruption,
    - in addition to it, the corrupt bureaucracy increases red tape related to the externality standards thus making the cost of the regulation heavier. The effective burden of regulations, when the bureaucracy is corrupt, can exceed the burden, when bureaucrats are honest, or $T_c \geq T_0$.

2. Corruption creates inefficiencies that lead to lower aggregate income and poorer quality of the environment. This may result in overall welfare loss.

It is a standard approach to define the public sector burden as a ratio of the cost of the burden to the total income. In the absence of distortions caused by tax evasion and corruption, the public sector burden is given by

$$\tau = \frac{T_0}{Y},$$

where τ is also the statutory tax rate. In the presence of tax evasion and corruption, the public sector burden is different, as we see above. Applying the same logic, we can write the relative burden as

$$\tau_e = \frac{T_c}{Y},$$

where τ_e is different from the statutory tax rate, τ. In case, $T_c \geq T_0$ is true, then $\tau_e \geq \tau$ should hold. Importantly, this result also shows that corruption alters the effective public sector burden.

The analysis based on the theoretical model has shown that with broader corruption, that not only lets for lower compliance with the regulations, but also makes the regulations harder to comply with, can result in overall heavier public sector burden. Based on this rationale we formulate the following proposition, which will be tested empirically in the next section.

Proposition 1: *The burden of the public sector increases with the increase in the level of corruption.*

4 The empirical analysis

4.1 Hypotheses

Based on the theoretical model we state two hypotheses to test:

H1: *The level of corruption depends on the quality of the public institutions*

H2: *The regulatory burden in the economy is positively associated with the level of corruption.*

The first hypothesis captures the assumption of the theoretical model that relates the level of corruption to the quality of the institutions. That is, I am assuming some sort of functional relation between the corruption level and the quality of the public institutions given as

$$CPI = F(\textit{ quality of public institutions})$$

The empirical model that spells out this relation can be stated as

$$CPI_i = \alpha + \beta \mathbf{Z} + \varepsilon_i \tag{15}$$

where CPI_i is the measure of the corruption level, $\mathbf{Z}$ is a vector of measures of the quality of governance, ε_i is the disturbance term.

The second hypothesis is based on the idea that corruption changes the effective burden of the public sector. By comparing (14) $T_c = \big[f(\bullet, h_m) - f(\bar{l}, g_c, h^*)\big] + B(h^* - h_c) + (p_c - \bar{p})g_c$ and (13) $T_0 = f(\bullet, h_m) - f(\bullet, h_0)$ we can easily state that corruption captured by the values of the parameters such as the bribe rate, the externality threshold, and the price of the public input, in fact leads to different

levels of public sector burden. Therefore, the effective public sector burden can be represented as a function of corruption,

$$T_c = F\,(\textit{corruption measure}, Y, \tau), \tag{16}$$

where Y is the total income, τ is the statutory public sector burden. In other words, for given total income and regulation parameters, the effective public sector burden can differ depending on the corruption level in the economy. One may ask, if corruption causes high public burden? We do not know yet. However, corruption certainly changes the burden, and we have discussed the intuition.

To test the second hypothesis we write on the basis of (16) our empirical model as

$$\textit{burden}_i = \alpha + \beta CPI_i + \mathbf{bX} + \varepsilon_i \tag{17}$$

where $\textit{burden}_i$ is a measure of the effective regulatory burden for a given country, α is a constant term, β is the coefficient at the measure of corruption CPI_i for the country, $\mathbf{X}$ is a vector of other variables that may be included into the model, ε_i is the disturbance term. Note, empirically we cannot claim that corruption causes changes in the statutory burden, as we do not know the magnitudes of the statutory burden. Instead, we claim, that the corruption leads to changes in the effective or observed public sector burden. The theoretical model shows this relation.

To sum up, if we cannot reject the first hypothesis that will support the idea that corruption is endogenous to the institutional structure of the economy. If the second hypothesis is not rejected then we can maintain the conjecture that

corruption does not lead to efficiency improvements through reduction of red tape.

4.2 Data description

The data set constructed for the empirical analysis in order to find dependence between corruption and regulation burden consists of cross-country data for 140 countries (for 2005). The list of variables with description is given in the appendix.

There are three types of data we use in the analysis.

1. A measure of corruption,
2. Measures of institutional quality or governance,
3. Measures of regulation burden.

4.2.1 Corruption measure

The level of corruption is measured by an index, and in our case we employ the Corruption Perception Index (CPI) complied by the Transparency International. This measure of corruption is based on the surveys of the private agents perception of corruption related to their economic activities, hence is called the Corruption Perception Index. The CPI values are determined in the range of (0, 10), the higher value signifies the less corruption in the economy. We transform the original variable CPI to $CI = 10 - CPI$, so to associate higher values with higher corruption. For comparison reasons we also use a variable named "Corruption control" as a proxy for the corruption measure. The "Corruption

control" values are determined in the range of (-1.5, 2.5), again the higher values signify the better corruption control in the economy. The data for this variable is extracted from the Governance Indicators Dataset (Kaufmann et al., 2004).

4.2.2 Governance

The quality of institutions is represented by Governance Indicators Dataset complied by the World Bank. These measures include indexes (ranges are indicated after each index) on Government effectiveness ($GE \in (-2, 2.5)$) , Rule of Law ($ROL \in (-2, 2.5)$) , Regulatory quality ($REG \in (-2, 2.5)$) , Voice and Accountability ($VA \in (-2, 2)$) , Political stability ($PS \in (-3, 2.5)$) .

4.2.3 Regulation burden

The cross-country data on the burden of regulations were obtained from the database "Doing Business" compiled on the base of the World Business Environment Survey. The data from the Doing Business database includes the measures of costs related to different regulations and activities. The costs of regulations are pegged to the per capita income of the given country and also given as time spent on dealing with the regulation. In this analysis I use only comparable costs in real terms, that is the cost in terms of time spent on meeting the regulations. Specifically, the following cost measures are used: Starting a business cost (days), Dealing with licences cost (days), Property registration cost (days), Tax payment cost (days), Export operations cost (days). I actually use a sum of all these time costs as a regulation burden measure. The variable I am operating

with, $RTCOST$, is found as

$$\begin{aligned} RTCOST \ &= \text{Starting a business cost} + \\ &+ \text{Dealing with licences cost} + \\ &+ \text{ Property registration cost} \\ &+ \text{Tax payment cost} + \text{ Export operations cost} \end{aligned} \tag{18}$$

On the base of the different costs related to doing business, the countries are ranked and the aggregate index called the "Ease of Doing Business Rank" is constructed by the World Bank. The "Ease of Doing Business Rank" measures overall burden of regulations on the businesses and denoted as DBR. The easier is the burden the higher is the rank.

4.2.4 Macroeconomic data

In order to control for the income effect, the data on the GNI per capita in US dollars were obtained from the World Development Indicators database. The intuition behind the idea of using the income differences as a factor affecting the regulatory burden is as follows: It is quite intuitive to assume that higher income is associated with higher productivity, more complex technology and economic structure. The advanced technology and complex structure of the economy must involve greater regulation and therefore, the regulation burden should be relatively higher for the economies with higher per capita income.

4.3 Data Analysis

4.3.1 Hypothesis on corruption and the quality of the public institutions

To see if the corruption level of the country is associated with its governance indicators we explore the data for corruption level and governance. The simplest way to do is to determine the correlation coefficients between the Corruption Index (CI) and the other governance indicators.

The Jarque-Bera test statistics for corruption measures, CPI and CI, demonstrate a departure from normality. Therefore, to account for non-normality we find Spearman's rho between CI and the governance indicators. The results are given in Table 1. We see that all governance indicators manifesting the underlying institutional quality are negatively and strongly correlated with the level of corruption. It is also evident from the Kendall-plots given below in Figure 6.

Table 1: Correlation between corruption and governance measures

	Spearman's rho	Stat. significance
Corruption Control	-0.80481	**
Govern. Effectiveness	-0.79545	**
Political Stability	-0.60153	**
Regulatory Quality	-0.7751	**
Rule of Law	-0.75475	**
Voice and Accountability	-0.58454	**
**Correlation is significant at the 0.01 level (2-tailed).		

4.3.2 Kendal-plots

Kendall-plot (Genest and Boies, 2003) are based on the probability integral transformation of the variables. They have been developed as tools to assess the pos-

sible dependence between variables. We use these plots to identify the possible dependence between corruption and governance measures.

The Kendall-plot (K-plot) also depends on the ranks of the data. It is obtained in the similar fashion as a QQ-plot. Assume H is a bivariate (continuous) distribution function. The pairs (X_i, Y_i) are transformed to pairs $(W_{i:n}, H_{(i)})$ for *i=1,2,...n*, where $H_{(i)}$ values are ordered according to: $H_{(i)} < ... < H_{(n)}$. These values are order statistics related to the quantities $H_1, ..., H_n$ that are calculated as

$$H_i = \sum_{j \neq i} I(X_j \leq X_i, Y_j \leq Y_i)/(n-1) \tag{19}$$

The $W_{i:n}$ values are expectations of the i^{th} statistic from the random sample of the random variable $W = C(U, V) = H(X, Y)$ of size n. Under the null hypothesis U and V (or X and Y) are independent. The $W_{i:n}$ values can be calculated as follows:

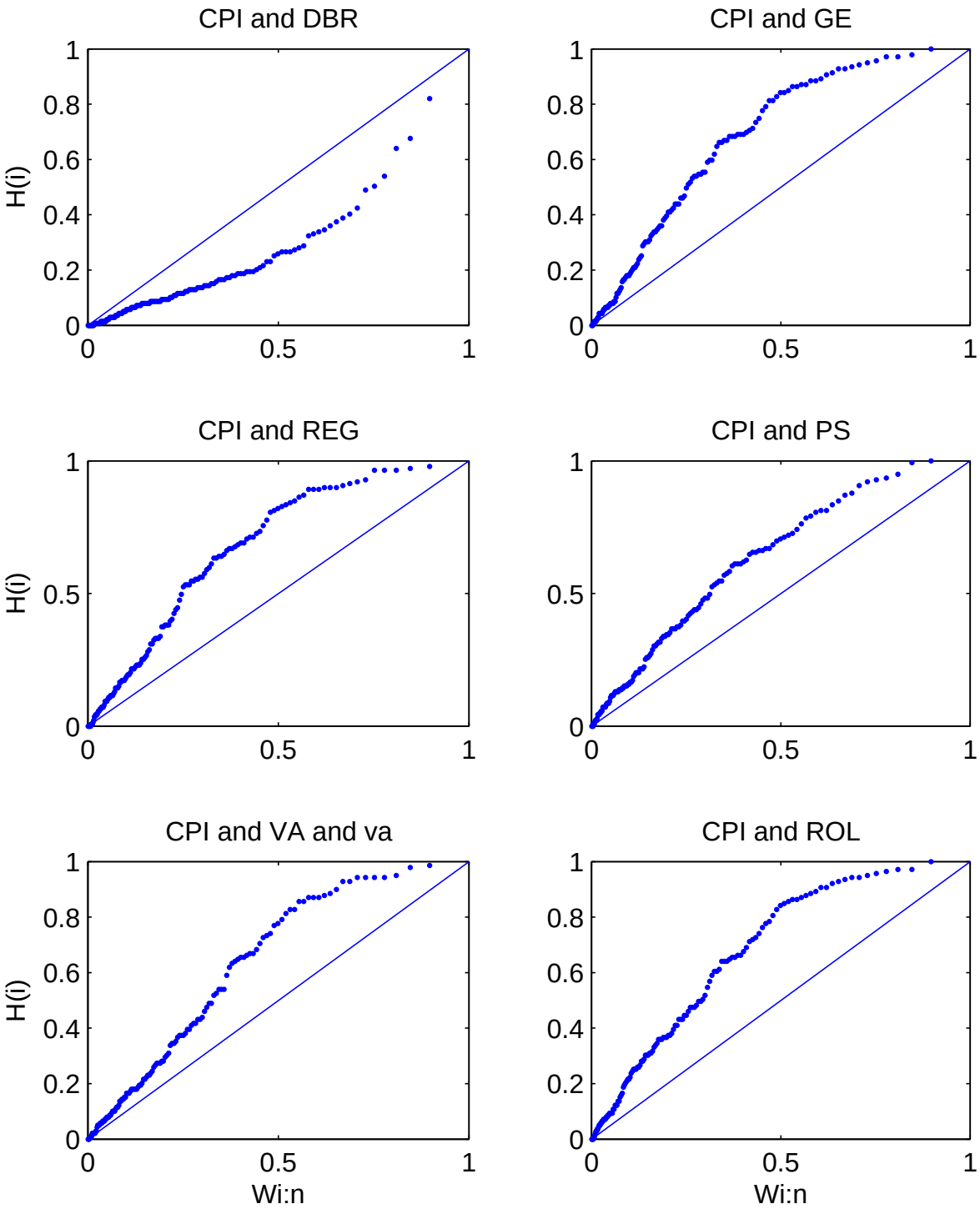
$$W_{i:n} = \omega k_o(\omega)\{K_o(\omega)\}^{i-1}\{1 - K_o(\omega)\}^{n-i} d\omega \tag{20}$$

where $K_o(\omega) = P(UV \leq \omega) = P(U \leq \frac{\omega}{v})dv = 1dv + \frac{\omega}{v}dv = \omega - \omega \log(\omega)$ and k_0 is the corresponding density.

I have constructed K-plots (Figure 6) for pairs that include corruption perception index (CPI) and governance indicators as governance effectiveness (GE), regulatory quality (REG), rule of law (ROL), voice and accountability (VA), political stability (PS), and overall measure of regulatory burden–Doing business rank (DBR).

Recall that if two variables are independent, then the K-plot will be a straight line being close to the 45-degree line shown in all graphs. The deviation from the

Figure 6: K-Plots for corruption and governance measures



45-degree lines indicates the dependence between the variable. We also can infer that the sign of the association between the variables are persistent. One can see that there is strong positive dependence between CPI and all other governance indicators, whereas, CPI and regulatory burden (DBR) have a negative dependence. The empirical evidence supports our conjecture about the association between the quality of institutions and corruption, and corruption and regulatory burden. Unfortunately, the lack of time series for the given variables does not allow us to consider causality issues between the levels of regulatory burden and corruption measures.

4.3.3 Regression results: Hypothesis I

The OLS estimation of the general equation relating the corruption index with governance indexes, $CI_i = \alpha + \beta Z + \varepsilon_i$, where $Z = \{$ Government effectiveness, Corruption control, Regulatory quality, Rule of law, Political stability, Voice and Accountability $\}$ is given as:

$$CI_i = C_1 + C_2 CC_i + C_3 \mathrm{GE_i} + C_4 \mathrm{REG_i} + C_5 \mathrm{ROL_i} + C_6 \mathrm{PS_i} + C_7 \mathrm{VA_i} + \varepsilon_i \qquad (21)$$

The model explains almost 81% of variation in the corruption measure across the countries. Although only the coefficient at CC and the constant term are significant. The diagnostic test for heteroscedasticity shows that the variance is constant. The RESET test indicates that the following types of specification errors as omitted variables and an incorrect functional form may have taken place.

Table 2: Regression results: CI vs. Governance measures with interactions

Dependent Variable: CI				
Method: Least Squares				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	6.29	0.11	56.21	0.00
CC	-1.45	0.11	-13.41	0.00
GE*REG	-0.46	0.18	-2.52	0.01
ROL*CC	-0.51	0.19	-2.73	0.01
PS*CC	0.51	0.17	3.05	0.00
R-squared	0.85	Mean dependent var	5.78	
Adjusted R-squared	0.84	S.D. dependent var	2.25	
S.E. of regression	0.89	Akaike info criterion	2.64	
Sum squared resid	106.32	Schwarz criterion	2.75	
Log likelihood	-178.60	F-statistic	186.90	
Durbin-Watson stat	1.92	Prob(F-statistic)	0.00	

By trying different functional forms we obtain the following model

$$\mathrm{CI_i} = \mathrm{C_1}+\mathrm{C_2CC_i}+\mathrm{C_3}(\mathrm{GE_i}\cdot\mathrm{REG_i}) + \mathrm{C_4}(\mathrm{ROL_i}\cdot\mathrm{CC_i}) + \mathrm{C_5}(\mathrm{PS_i}\cdot\mathrm{CC_i})+\varepsilon_\mathrm{i} \quad (22)$$

This model passes both heteroskedasticity and RESET tests, and is better in terms of Log likelihood, AIC and Schwarz criterion. The signes at *CC* (Corruption Control) , and the interaction terms *GE*REG* (Governance efficiency and Regulation quality), *ROL*CC* (Rule of Law and Corruption Control) is negative as expected (see Table 2). The interaction term *PS*CC* (Political Stability and Corruption Control) has a positive sign, which a bit surprising. A possible explanation as it is argued by Olson (1984) is that in stable societies the bureaucracy can be more rent-seeking.

Summarising, we can conclude that there is a strong correlation between the

Table 3: Correlation between corruption and regulatory burden

Spearman's rho				
	CI	CC	DBR	RTCOST
CI	1.00	-0.80	0.66	0.55
CC	-0.80	1.00	-0.73	-0.61
DBR	0.66	-0.73	1.00	0.76
RTCOST	0.55	-0.61	0.76	1.00
**Correlation is significant at the 0.01 level (2-tailed).				

governance indicators that measure quality of the underlying institutions and the corruption level represented by the corruption index *CI*. Much of the variation in corruption level can be explained by the differences in governance indicators. Therefore, our first hypothesis is not rejected.

4.3.4 Hypothesis on corruption and regulation burden

The next step is to test the second hypothesis. Again we start with a simple correlation analysis. The Spearman's rho between two regulation burden measures and corruption measures are given in Table 3. First we see that there is a strong correlation between the regulation burden measures given by "Ease of Doing Business Rank" or DBR, and our computed time burden indicator RTCOST. The corruption index CI is positively correlated with both regulatory burden measures. The higher corruption levels are associated with higher regulatory burden, or corruption does not really lead to efficiency improvements by decreasing red tape. The governance measure "Corruption Control", or CC is negatively correlated with both burden measures. A simple K-plot diagram between the proxies for the regulation cost and corruption measure (Figure 7) shows that decrease in *CI* is associated with the lower values of the time cost of regulation (RTCOST) and lower values of the ranking of the ease of doing business

(DBR). This signifies that there is dependence between the level of corruption in the country and the cost of regulations. Another important thing is that it is likely that with the increase of corruption the regulatory burden grows even faster. In other words, corruption elasticity of the regulatory burden is greater than one.

Table 4: Clusters matched by regulation burden and corruption level

	Clusters		
	1	2	3
RTCOST	438.7	232.4	642.1
CI	6.44	4.14	7.37

To see how the dependence between corruption, regulation cost and income level are interrelated we run a cluster analysis (K-means) using CI, RTCOST, and GNI per capita. We assume that the countries will form three clusters depending on corruption level, regulation cost, and income level.

The cluster centre values for the given variables are shown in Table 4. Again, we see that if we control for the income level, higher corruption (larger values for CI) corresponds to a greater time cost due to regulations.

4.3.5 Regression results: Hypothesis II

All preliminary data analysis indicate there is positive relationship between effective regulatory burden and the corruption level. I estimate the model

$$LOG(RTCOST_i) = C_1 + C_2 CI_i + C_3(CI_i)^2 + C_4(CI_i)^3 + \varepsilon_i \qquad (23)$$

Figure 7: K-Plots for regulatory burden and corruption

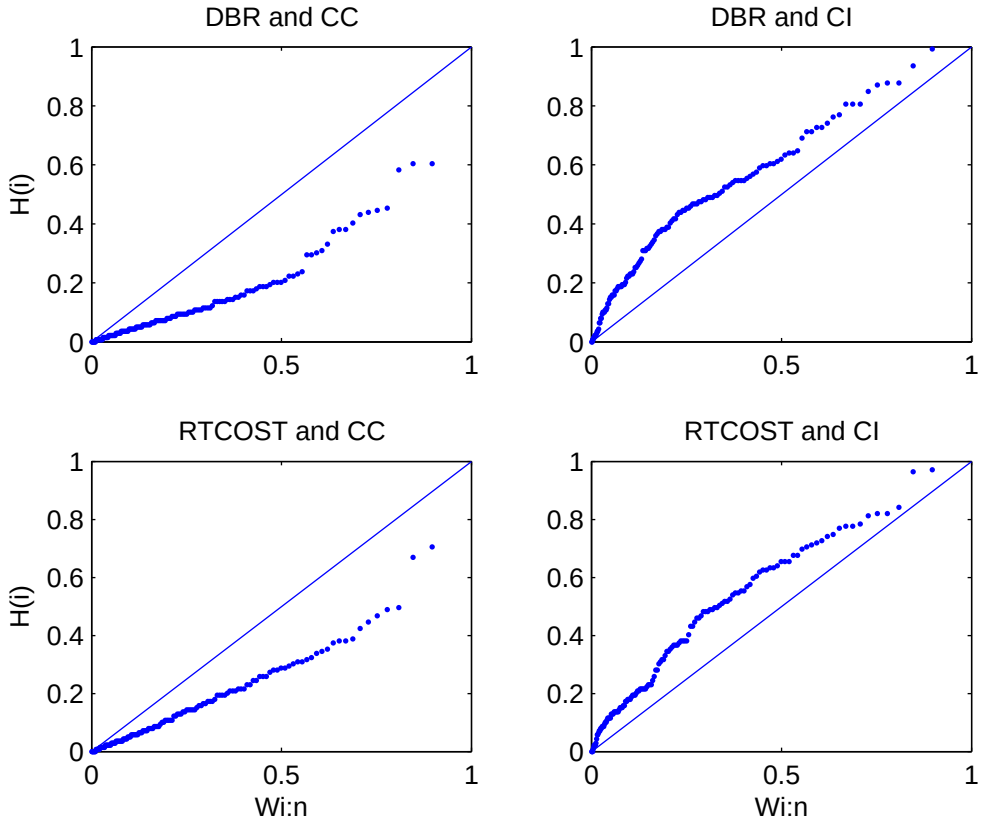


Table 5: Regression results: LOG(RTCOST) vs. corruption measure, CI

Method: Least Squares				
White Heteroskedasticity-Consistent Standard Errors & Covariance				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.66	0.13	34.89	0.00
CI	0.61	0.14	4.29	0.00
(CI)^2	-0.11	0.04	-2.79	0.01
(CI)^3	0.01	0.00	2.33	0.02
R-squared	0.48	Mean dependent var		5.90
Adjusted R-squared	0.46	S.D. dependent var		0.44
S.E. of regression	0.32	Akaike info criterion		0.62
Sum squared resid	14.13	Schwarz criterion		0.70
Log likelihood	-38.57	F-statistic		40.50
Durbin-Watson stat	1.80	Prob(F-statistic)		0.00

and find that almost a half of the variation in the log of the time cost of regulations is explained by the differences in the corruption level (Table 5).

I run a similar regression for the "Ease Doing Business rank" against the corruption index (Table 6).

$$LOG(DBR_i) = C_1 + C_2 LOG(CI_i) + C_3 LOG(CI_i)^2 + \varepsilon_i \qquad (24)$$

The results of the last regression (Table 6) confirm the non-linear relationship between the regulatory burden and corruption. For both specifications I run a RESET diagnostic test for stability and find that the model satisfies this test.

The simple data analysis demonstrates that based on the actual data we cannot reject both hypotheses formulated in the foregoing. Therefore, it is concluded that there is evidence supporting the assumption in the theoretical model that corruption level depends on the quality of institutions. The evidence also sup-

Table 6: Regression results: LOG(DBR) vs. LOG(CI)

Method: Least Squares				
Weighting series: LOG(CI)				
White Heteroskedasticity-Consistent Standard Errors & Covariance				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.23	0.24	9.46	0.00
LOG(CI)	0.68	0.24	2.77	0.01
LOG(CI)^2	0.26	0.11	2.46	0.02
Weighted Statistics				
R-squared	0.42	Mean dependent var		4.47
Adjusted R-squared	0.41	S.D. dependent var		2.06
S.E. of regression	0.55	Akaike info criterion		1.65
Sum squared resid	40.81	Schwarz criterion		1.71
Log likelihood	-112.36	F-statistic		50.25
Durbin-Watson stat	2.13	Prob(F-statistic)		0.00

ports the implication of the theoretical model, which states that with higher corruption we observe higher effective regulatory burden.

5 Conclusions

It is reported that corruption can play a positive role by decreasing excessive red tape. This paper questions it. I investigate the mechanics of the corrupt bureaucracy and propose that bureaucracy uses excessive red tape to stipulate bribing of the private agents trying to cut the excessive red tape down. In other words, corrupt bureaucracy can abuse its monopolistic position through erecting barriers by the means of excessive red tape. Therefore, *ex ante* corruption effectively increases red tape or regulatory burden, whereas the *ex post* corruption then decreases the artificial high burden for exchange of bribes.

Considering the *ex post* corruption only, one may conclude that corruption is efficiency improving. However, it is clear the state of the efficiency should be judged only on the base of the resulting outcome after taking into account both types of corruption. I has been shown that it possible that corruption results in heavy burden on the private sector and overall welfare losses.

As the equilibrium depends on the structure of the economy and institutions the theoretical model does not yield a concrete conclusion on the issue. To clarify the inference on the relation between corruption and the regulatory burden I test the hypothesis that the higher levels of corruption is associated with the higher levels of regulation burden. A data analysis fails to reject the hypothesis. Therefore, the overall conclusion we can draw is that corruption effectively does not reduce excessive red tape, and in the environment with higher corruption the effective red tape cost or regulatory burden is higher. The corrupt government imposes higher burden both by increasing red tape and providing less public inputs into private production.

6 Data sources

1. Worldwide Governance Indicators: 1996-2005,
   http://info.worldbank.org/governance/kkz2005/tables.asp;
2. The IFC of the WB, $http://www.doingbusiness.org/$;
3. World Development Indicators 2006, http://econ.worldbank.org.
4. Transparency International, $http://www.transparency.org/policy_research/surveys_indic$

7 Appendix

Table 7: List of Variables

Variable	**Comment**
SBT	Starting a business cost (days)
LCT	Dealing with licences cost (days)
PRT	Property registration cost (days)
TPT	Tax payment cost (days)
ECT	Export operations cost (days).
DBR	Doing Business Rank
GNIP	GNI per capita (US$)
CPI	Corruption Perception Index
CI	Corruption Iindex=10-CPI
RTCOST	Time cost Index=SBT+LCT+PRT+TRT+ECT
GE	Government Effectiveness index
REG	Regulatory Quality index
CC	Corruption Control Index
ROl	Rule of Law Index
PS	Political Stability
VA	Voice and Accountability

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