WHEN CORRUPTION BEGETS CORRUPTION: WELFARE ANALYSIS & THE ROLE OF BUREAUCRATIC WAGES UNDER MULTIPLE EQUILIBRIA*

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Abstract

The paper presents some empirical puzzles in the relationship between bureaucratic wages and corruption levels, and attempts to reconcile them within a general equilibrium framework that leads to multiple equilibria in the incidence of corruption. In the presence of such multiple equilibria, the relationship between bureaucratic wages and corruption is no longer monotonic, and much more complex than detailed by previous theoretical and empirical research. Further, a welfare analysis shows that social welfare is decreasing in the incidence of corruption, across such equilibria.

Key Words: Corruption, Bureaucratic Wages, Welfare, Multiple Equilibria
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1 Introduction

In recent years economists have increasingly focused upon the phenomenon of bureaucratic corruption.[1] The research on corruption has identified two important concerns - (a) the welfare consequences of corruption; and (b) the importance of bureaucratic wages for reducing corruption. This paper contributes an understanding to both of these issues. First, the paper shows that when there are multiple equilibria in the incidence of corruption, these equilibria can be ranked in terms of social welfare and that equilibria with higher levels of corruption are characterized by lower levels of welfare. Second, and more importantly, in the presence of multiple equilibria the relationship between corruption and bureaucratic wages is more complex and not monotonic - where higher wages always imply lesser corruption - as suggested by prior research.

In the context of the first issue, a strand in the corruption literature suggests that in the presence of a cumbersome regulatory framework, corruption may actually enhance welfare and efficiency. As early as 1714, Bernard Mandeville wrote:

> "Private vice by the dextrous management of a skillful politician may be turned into public benefits"

Arguments for the positive effects of corruption have been made in terms of "the much-needed grease for squeaking the wheels of a rigid administration",[2] speed money which reduces delay in moving files in governmental offices and in getting ahead in slow moving queues for public services.[3] Corruption has also been looked upon as a Coasean bargaining process between a bureaucrat and a private agent for a permit or license, where the highest briber obtains the contract or license. Since the contract goes to the highest bidder and since it is the lowest cost firm which can afford the highest bribe, allocative efficiency is maintained.

This paper shows how corruption reduces rather than increases welfare when there are multiple

[1] See the seminal articles by Becker and Stigler (1974), Rose-Ackerman, (1975) and a recent survey by Bardhan (1997).

[2] Economists have shown that in a second-best world with pre-exisiting distortions, additional distortions in the form of black markets and smuggling may actually improve welfare. Corruption can be thought to do the same. See Bhagwati and Hansen (1973), Bhagwati and Srinivasan (1973).

[3] See Lui (1985) for a queuing model that shows that bribing strategies form a Nash equilibrium minimizes waiting time, thus reducing the inefficiency in public adminstration.

equilibria in the incidence of corruption.[4] In particular, we are able to show that social welfare declines in a monotonic fashion as we move from an equilibrium with zero corruption to one with full corruption. While in a first-best world absent of regulations, social welfare is the highest; in a second-best world in the presence of regulations, social welfare is diminishing in the incidence of bureaucratic corruption. Corruption, in this model is equivalent to an increase in overhead costs for firms and by inducing exit of the marginal firms (who would have entered either in the absence of licensing or in the absence of bribes being demanded), it imposes welfare costs.[5]

In terms of the relationship between corruption and bureaucratic wages, a general consensus amongst policy makers is that to combat corruption one has to increase the wages of the bureaucracy. Such an idea is theoretically appealing since bureaucrats are likely to trade off the temptation of a bribe against the risks of losing a high paying job. This belief is also consistent with the experience of countries like Singapore and Israel where a reputation for honesty is accompanied by generous bureaucratic wages. Unfortunately, the hypothesis that high wages are associated with low corruption levels has largely failed to find empirical support in studies that use data across countries. For instance, Rauch and Evans (2000) find that controlling for country income, level of education, and ethnolinguistic diversity, the importance of competitive salaries for corruption could not be clearly established. Section 2 of this paper presents some empirical anomalies in the relationship between corruption and wages. Subsequently, we show theoretically that in the presence of multiple equilibria, one may expect such puzzling results. In other words, once we allow for multiple equilibria in corruption levels the empirical failure to confirm a monotonic relationship between bureaucratic wages and corruption is no longer surprising.

We present a two sector (one characterized by constant returns and the other by increasing returns), small open economy where firms in the IRS sector require a license from a bureaucrat to commence production. This discretionary power granted to the bureaucrats provides them with an opportunity to demand a bribe for issuing the license. Bureaucrats are assumed to

[4] Cadot (1987) and Andvig and Moene (1990) present models of multiple equilibria in corruption. However, the focus of this paper is on the welfare comparisons of these multiple equilibria.

[5] Bliss and Di Tella (1997) question such a reasoning on the grounds that a free entry equilibrium with a single homogenous good, and overhead costs involves an excessive number of firms. Corruption, by inducing exit may then enhance welfare. However, with 'love-of-variety' utility function used in this paper, exit does diminish welfare.

allocate their time between "dishonest activities", where they may either choose to engage in malfeasance or shirk, and "honest activities", where they grant permits to applicants without demanding any bribes. Firms, conditional on choosing to apply for a license may face either an honest or a corrupt bureaucrat. The former simply issues the license but the latter demands a price for issuing the license. Firms then have the option of either paying or complaining. The complaint is addressed by another bureaucrat chosen at random, who in turn, may be corrupt or honest. If the second bureaucrat is corrupt as well, nothing comes of the complaint and the firm is denied a license. However, if the second bureaucrat is honest, the firm obtains the license and the original bureaucrat is fired.We therefore endogenize the probability of detection and punishment of corrupt bureaucrats. This structure gives rise to frequency dependence, with both the bribe levels demanded and the probability of being fired dependent on the existing incidence of corruption. The three subgame perfect equilibria of this game are analyzed and compared in terms of welfare. Next, comparative static results are presented showing how corruption levels change with respect to bureaucratic wages in each of the three equilibria.

Finally, a notion that has gained popularity recently is that centralization of corruption dominates decentralized bribery. This idea has its origin in Olson's (1993) idea of smaller distortions imposed by "stationary bandits" as opposed to "roving bandits". Shleifer and Vishny (1993) explain the increase in the inefficiency flowing from corruption in post-Communism Russia in comparison to Communist Russia in these terms.[6] This paper shows that such a conclusion is not warranted once we allow for the possibility if multiple equilibria and where the number of firms in an industry are endogenously determined. Only in the equilibria, where all bureaucrats choose to be corrupt, does centralized corruption dominate. In the interior equilibrium, where only a fraction of bureaucrats are corrupt, as well as in the equilibrium where all bureaucrats are honest, decentralized corruption dominates in terms of social welfare.

The structure of this paper is as follows: Section 2 briefly examines the empirical regularities

[6] Schleifer and Vishny (1993) analyze a bureaucracy issuing complementary permits to perform some economic activities in exchange for bribes. They show that if bureaucrats do not coordinate to extract bribes, they fail to internalize their the effect of their demand for bribes on other officials' income. A centralized bureaucracy that acts as a joint monopolist takes this externality into account. As a result, while the bribe price is higher so is the supply when compared to the decentralized case.

in the relationship between bureaucratic wages and corruption. Section 3 presents the basic setup of the model and characterizes the equilibrium in the absence of licensing requirements; Section 4 considers the equilibria in the presence of licensing and analyzes both centralized as well as decentralized corruption; Section 5 performs a welfare ranking of the various equilibria; Section 6 derives and discusses the comparative static results with respect to wages and ties them to the empirical observations in section 2; Section 7 concludes.

2 Bureaucratic Wages and Corruption - The Evidence

In this section, we explore the relationship between bureaucratic wages and the incidence of corruption. The major empirical work is that of Van Rijckeghem and Weder (1997) who find evidence for a negative relationship between corruption and civil sector wages in a sample of 25 developing countries. However, as mentioned earlier, other empirical research on corruption fails to find such a relationship. Perhaps one of the reasons why the empirical correlation between wages and corruption is not well established is the paucity of internationally comparable data on civil sector wages. This need has been recently addressed by Amit Mukhejee and Giulio de Tommaso of the World Bank, who have constructed a cross-country data set on civil sector wages. We use this data to construct a new measure of civil-sector compensations. First, we calculate real wages measured in constant 1997 dollars. Next we calculate the ratio of civil-sector to manufacturing sector wages by supplementing this data with the UNIDO dataset on manufacturing sector wages and employment.[7] For bureaucratic corruption, we use a survey based corruption measure from the International Country Risk Guide (ICRG). The ICRG measure is based on a six-point scale, available for 129 countries, and has been used previously and described in detail in Knack and Keefer (1995). We recode this measure so that higher numbers denote higher levels of corruption. We also control for per capita GDP, for ethnolinguistic fractionalization within a country, for civil rights, for financial sector depth, as well as for regional variations in corruption using three regional dummies (a dummy for oil producing countries, a East-Asia and a sub-Saharan Africa

[7] The standard models linking corruption to bureaucratic wages holds higher wages deter corruption by raising the cost of being fired. Any corrupt bureaucrat who is fired must seek a job outside and the manufacturing sector wage is used to capture this outside option.

dummy).[8]

First, a regression of corruption on relative civil-sector wages suggests that countries with higher civil sector (in relatives terms) wages exhibit lower levels of corruption but the coefficients are only marginally significant. This provides some support to the commonly held notion that high bureaucratic wages reduce corruption. The regression estimates are as follows with the standard errors in parentheses.

$$\begin{aligned} corruption_i &= \underset{(2.16)}{14.04} \underset{(0.115)}{-0.214} * wage\text{-}ratio_i - \underset{(0.248)}{1.236} * gdp_i + \ controls \\ N &= 54, R^2 = 0.59 \end{aligned}$$

Next we categorized countries along two dimensions - corruption and bureaucratic wages and divided them into high and low along each of the dimensions using the median for both corruption and the real wage variable (see table 1). If the hypothesis that higher wages lower corruption levels is true, most countries will be in the off-diagonal cells in table 1. But almost one-third of the countries in our sample are on the diagonal cells, where we either have either a combination of high civil sector wages and high levels of corruption, or low civil sector wages and low levels of corruption.[9] Therefore, the negative relation between bureaucratic wages and corruption may simply be driven by the extremes, i.e., by countries in the diagonal cells of table 1 - countries that are very corrupt and pay very low wages and countries with almost zero corruption who pay bureaucrats very high wages. So we ask the following question: what is the relationship between bureaucratic wages and corruption in countries that are only moderately corrupt? Is it the case that even in these countries higher bureaucratic wages lower corruption? To answer this question, we ranked the countries according to the corruption index, picked the middle one-third, and reran

[8] Graeff and Mehlkop (2003) find a strong role for per-capita GDP and show that financial sector depth is the only variable that affects corruption significantly for both rich and poor countries. We find this as well. We also reran the results using the corruption measure from Transparency International (TI) - the results remain qualitative the same given the high correlation (0.8) between the ICRG and TI measures.

[9] It may be argued that the oil-producing countries are the ones that have both high levels of corruption as well as those that can afford to pay higher bureaucratic wages. In the regression results, we control for per-capita GDP and include a dummy for oil producing countries.

the same regressions.[10] For these countries we obtain

$$\begin{aligned} corruption_i &= \underset{(1.93)}{4.95} + \underset{(0.18)}{0.33} * wage\text{-}ratio_i - \underset{(0.213)}{0.167} * gdp_i + \ controls \\ N &= 19; R^2 = 0.61 \end{aligned}$$

Here we obtain the striking result that in countries with intermediate levels of corruption, corruption seems to increase with civil sector wages. If we run the same regressions for countries that exhibit either very high or very low levels of corruption, our results indicate that bureaucratic wages play a strong and significant role in mitigating corruption. Therefore, the hypothesized model of low government wages leading to high corruption works only if we confine our attention to countries that have either very high or very low levels of corruption. For countries with intermediate levels of corruption, higher bureaucratic wages seem to increase corruption.

It may be argued that the survey-based corruption measures are simply a ranking and cannot be given a cardinal interpretation. So as a robustness check we also run ordered probit regressions. For the entire sample we obtain,

$$\begin{aligned} corruption_i &= \underset{(0.118)}{-0.142} * wage\text{-}ratio_i - \underset{(0.339)}{1.175} * gdp_i + \ controls \\ N &= 54;\ \text{Pseudo } R^2 = 0.18 \end{aligned}$$

Here the coefficient on relative bureaucratic wages has the right sign but is not significant at the 5% level. Moreover, the pseudo R^2 is quite low in the ordered probit regression However, if we recode the ICRG measure from the original 6 point ordinal measure to a 0-1 binary measure (using the median of the data to classify countries as high or low corruption) the fit improves dramatically. The ordered probit regression estimate (which coincides with a simple probit estimate) is

$$\begin{aligned} corruption_i &= \underset{(0.295)}{-0.69} * wage\text{-}ratio_i - \underset{(0.46)}{0.995} * gdp_i + \ controls \\ N &= 54;\ \text{Pseudo } R^2 = 0.5 \end{aligned}$$

The coefficient on bureaucratic wages is strongly significant and the pseudo R^2 almost quadruples. A likelihood ratio test suggests a significant improvement as well. Therefore, this finding suggests

[10] The summary statistics for this subset of countries shows an average corruption level of 2.33, and a standard deviation of 0.76.

that while real wages can predict well which country will be highly corrupt and which country will have very low corruption, it is not a good predictor at intermediate levels of corruption, where its explanatory power diminishes significantly.

Next we categorized countries into four quartiles according to their incidence of corruption. Here, we find that for countries in the fourth quartile ($ICRG \geq 4$), the correlation between corruption levels and wages is very low (0.008) and the regression coefficient on wages is not significant (not shown). This suggests that for countries with very high levels of corruption , there is little or no correlation between corruption and real wages. In other words, in these countries an increase in bureaucratic wages does not seem to affect corruption.

These results, while simplistic, suggest that the relationship between corruption and wages is much more complex than is widely regarded. In the model that follows, we will perform some comparative statics on corruption with respect to bureaucratic wages and find that some of the stylized facts established above are in accordance with the theoretical results.

3 The Model Without Licensing

Consider a small open economy where the representative individual lives for two periods and maximizes a utility function

$$U = u(c_{01}, C_1) + \delta u(c_{02}, C_2) \tag{1}$$

subject to the intertemporal budget constraint $Y_1 + \frac{Y_2}{1+r} = c_{01} + P_1 C_1 + \frac{1}{1+r}(c_{02} + P_2 C_2)$, where c_{ot} is a numeraire good (whose price is set to unity), C_t is an index of differentiated products. Y_t is the income in period $t = 1, 2$ respectively, and $\delta \in (0, 1)$ is the discount factor. i is the rate at which the individual can borrow and lend and it is assumed to equal the world interest rate. For simplicity we assume $\delta = \frac{1}{1+r}$. Utility in each period takes the following functional form[11]

$$u(c_{0t}, C_t) = (c_{0t})^{\gamma} (C_t)^{1-\gamma}, \gamma \in (0, 1)$$

and where,

[11] A monotonic transformation of the above utility function that we shall use for welfare comparisons is $W(u(c_{0t}, C_t)) = \gamma \log c_{0t} + (1-\gamma) \log C_t$

$$C_t = \left[\int_0^{n_t} x_{it}^{\frac{\sigma-1}{\sigma}} di\right]^{\frac{\sigma}{\sigma-1}} ;\ \sigma > 1 \tag{2}$$

x_i is the consumer's consumption of good of variety i, n_t is the total number of varieties in period t. From the Lagrangian first order conditions we can derive the demand functions as,

$$\begin{aligned} c_{01} &= c_{02} = \gamma \left(\frac{Y_1 + \delta Y_2}{1+\delta}\right) \\ C_t &= \left(\frac{1-\gamma}{P_i}\right)\left(\frac{Y_1 + \delta Y_2}{1+\delta}\right) \text{ for } t = 1, 2 \end{aligned}$$

As we shall soon see we have that $Y_1 = Y_2$ so that we can write for $t = 1, 2$

$$c_{0t} = \gamma Y_t;\ C_t = (1-\gamma)\frac{Y_t}{P_t} \tag{3}$$

Maximizing the subutility function C_t subject to the constraint that $C_t = (1-\gamma)\frac{Y_t}{P_t}$ gives the demand facing the producer of variety i is given by

$$x_{it} = (1-\gamma)\frac{Y_t}{P_t}\left(\frac{P_{it}}{P_t}\right)^{-\sigma} \quad i = 1, ...n_t \tag{4}$$

where

$$P_t = \left[\int_0^{n_t} P_{it}^{1-\sigma} di\right]^{\frac{1}{1-\sigma}} \tag{5}$$

is the price index for the consumer product varieties. Each of the varieties is produced by a monopolist who we assume for simplicity has unit marginal costs (Alternatively we may choose the units for measuring quantities of the $x's$ such that the marginal cost is unity for all goods). In particular, we assume that the production function for each product variety is of the form

$$l_{it} = x_{it} + \mu \tag{6}$$

where μ is the fixed cost of commencing operations assumed identical for all producers. The numeraire good is produced using a CRS technology characterized by perfect competition. Labor is the only input in the economy and each individual is endowed with a unit of labor that she supplies inelastically.

$$c_{0t} = l_{0t} \tag{7}$$

The CRS formulation implies that wages in this sector is unity. In addition, we assume perfect mobility of labor between the CRS and the IRS sector which in turn implies that wages are equalized in the two (private) sectors.

$$w_p = 1 \text{ for all } t \tag{8}$$

The monopolist for good i, therefore sets the price P_{it} to maximize the present value of profits

$$\max_{x_{i1}, x_{i2}} \pi = (P_{i1} - 1)\, x_{i1} + \delta \cdot (P_{i2} - 1)\, x_{i2} - \mu \tag{9}$$

where x_{it} is the demand facing the monopolist as given above. The usual optimization exercise yields

$$P_{it} = \frac{\sigma}{\sigma - 1} \text{ for all } i, t \tag{10}$$

and thus

$$x_{it} = x_t = (1 - \gamma)\frac{Y_t}{n_t}\left(\frac{\sigma - 1}{\sigma}\right) \tag{11}$$

Each monopolist discounts profits at the same rate δ so that the total profit of each monopolist is,

$$\pi = \pi_1 + \delta\pi_2 = (1 - \gamma)\left(\frac{Y_1}{n_1\sigma} + \delta\frac{Y_2}{n_2\sigma}\right) - \mu \text{ for all } i \tag{12}$$

The representative individual receives wages from supplying her unit of labor and we assume that profits are repatriated back to the consumers at the end of the second period along with interest on the profits. This implies that national income in each period is given by

$$Y_1 = L - T_1 + w \tag{13}$$

$$Y_2 = L + (1 + r)\, n_1\pi_1 + n_2\pi_2 - T_2 + w = L + \frac{1}{\delta}n_1\pi_1 + n_2\pi_2 - T_2 + w \text{ since } \delta = \frac{1}{1 + r} \tag{14}$$

T_1 and T_2 are lumpsum taxes imposed by the government to finance the wages (w) of the bureaucrat. In the absence of corruption and licensing $T_1 = T_2 = w$, and firms will enter the market as long as profits net of fixed costs are positive. The zero profit condition also implies that $Y_1 = Y_2 = L$. Ignoring integer constraints, we can therefore impose the zero profit condition to determine the total number of products in each period as[12]

$$n_1 = n_2 = n^* = (1 - \gamma)(1 + \delta)\frac{L}{\mu\sigma} \tag{15}$$

[12] With $T_1 = T_2 = w$ we have $Y_1 = Y_2 = L$.

Thus the number of firms in the market is increasing in national income and decreasing in the fixed outlay μ and the elasticity of substitution σ. The demand for the numeraire good in each period equals $\gamma Y_t = \gamma L$. Substituting these expressions into the utility function of the representative consumer we have following indirect utility (social welfare) function.

$$SW^{NL} = (1+\delta)\left[\begin{array}{c} \gamma\log\gamma + (1-\gamma)\log(1-\gamma) + \log L + \\ \frac{1-\gamma}{\sigma-1}\log n^* + (1-\gamma)\log\left(\frac{\sigma-1}{\sigma}\right) \end{array}\right] \quad (16)$$

where NL stands for "no licensing". Thus utility and social welfare is increasing in the number of product varieties n.

$$\frac{\partial SW}{\partial n^*} = \frac{1-\gamma}{(\sigma-1)\,n^*}(1+\delta) > 0 \quad (17)$$

since $\gamma < 1, \delta > 0$ and $\sigma > 1$.[13]

4 The Case with Licensing

The government now stipulates that if any of the firms is to commence production it needs to obtain a license[14] . There is an application fee of a for obtaining a license. Such a fee is equivalent to an increase in fixed costs for the firm. This implies that the number of firms, once licensing is introduced becomes

$$n^L = (1-\gamma)(1+\delta)\frac{L}{(\mu+a)\sigma} < n^* \quad (18)$$

From the above definition, of the welfare function we see that licensing imposes a welfare cost even in the absence of corruption by reducing the number of firms active in the IRS sector.

4.1 Decentralized Corruption

We now assume that licenses need to be approved and a bureaucratic mechanism is in place that grants such approval. Once a firm obtains such a license it can enter the market and there are no other bureaucratic impediments that it faces. There are a continuum of identical bureaucrats of

[13] Note that n^* itself is endogenous to the system of equations. This partial derivative simply implies that anything that raises the number of firms in equilibrium (for isntance, a lower fixed cost) will also raise economic welfare.

[14] We do not provide any rationale for the licensing requirement. However, such an assumption can be justified on the basis that every firm in the real world has to submit to various governmental regulations. Instances of these could include obtaining a license to commence production, registration of the firm, compliance with enviromental regulations etc. See Banerjee (1997) for a model that provides a theoretical rationale for such a regulatory process.

Lebesque measure 1 who award these licenses. Each bureaucrat is endowed with a unit of time which he must allocate between time spent being honest and 'dishonest' activities. Because of such a formulation, the proportion of time spent in honest activities in the aggregate can be interpreted as the proportion of honest bureaucrats at any instant, which is the interpretation that will be used henceforth. Dishonest activities take two forms - either taking bribes from prospective firms or simply shirking. Shirking yields a utility gain of d per unit time whereas taking bribes yields B per unit time - the bribe price prevailing in the market.[15]

The bureaucrat is risk neutral and simply maximizes the present value of his income. Bureaucrats are also assumed to discount the future at the rate δ. I assume an exogenous monitoring mechanism that can be succinctly summarized as "the guardians guard each other". This assumption can be justified on the grounds that there are no hierarchies of bureaucrats who are all identical and therefore, face the same choices. For every bureaucrat who engages in 'dishonest' activities there is a probability that he will be monitored. This probability is simply equal to the proportion of honest bureaucrats in the system.[16] [17] This follows from the fact that dishonest bureaucrats who spend time either shirking or taking bribes do not engage in monitoring during such time. Given that any bureaucrat is monitored, the conditional probability that he is caught is directly proportional to the amount of time he allocates to dishonest activities. For simplicity, we assume that this probability coincides with the proportion (and thus also the total time, since, he has a unit of time) of time spent being corrupt. Bureaucrats who are caught are simply fired and lose their wages (and any bribes they may have taken). Therefore, if a bureaucrat allocates $\beta_i \in [0, 1]$ to dishonest activities and β proportion of all bureaucrats are corrupt, the probability

[15] The introduction of shirking introduces certain elements that are in accordance with reality. First, corruption and laziness of bureaucrats are often treated as observationally and morally equivalent. Second, the introduction of shirking allows us to introduce a certain threshold in bureaucratic wages below which zero corruption/shirking can never be observed. Third, it allows us to more effectively distinguish between the zero and the full corruption equilibrium where the ex-post bribes turn out to be zero in both cases.

[16] More accurately the probability of being monitored will be $\int_0^1 \left(1 - \beta_j\right) dj$. In the symmetric equilibrium when $\beta_j = \beta \; \forall j$ this probability equals β which can be interpreted as the proportion of honest bureaucrats at any instant.

[17] A more general assumption would be that the probability of being monitored is a function of the proportion of honest bureacrats. Here, for simplicity, we assume that the two are identical. A general functional form will not affect any of the results.

that he gets fired is given by:[18]

$$P(\text{Fired}) = P\,(\text{Monitored})\,P\,(\text{Caught / Monitored}) = (1-\beta)\cdot\beta_i$$

Each bureaucrat faces a given fixed wage of $w_b = w$ in each period, which may be either institutionally fixed or may simply be the wages prevailing in the rest of the economy. Wages of bureaucrats are financed through lumpsum taxes imposed upon the representative agent. Here we abstract from the usual principal agent framework where the wages may be set by the government (the principal) to deter corruption amongst the bureaucrats (the agents) as in Becker and Stigler (1974). To make welfare comparisons easier,[19] we will assume that there is a constant administrative cost c' for licenses (this is an aggregate cost incurred by the government in period 1 when first enter the IRS sector and independent of the wages paid to bureaucrats) and the licensing fee a is set to cover this administrative cost. T_1 and T_2 are the lumpsum taxes in periods 1 and 2 respectively. The government balances its budget each period so that $T_1 + n_1 a = w + c' \longrightarrow T_1 = w; T_2 = w$. This implies that national income in each of the two periods is given by $Y_1 = Y_2 = L$.

Bureaucrats who are not caught retain their wages as well as the 'wages of sin'. If bureaucrats decide to be dishonest, they will choose to shirk if $d > B$ but choose to be corrupt if $d \leq B$. Therefore, each bureaucrat faces the following payoffs with the accompanying probabilities.

Payoff	**Description**	**Probability**
$[w + \delta w + \beta_i \max\{d, B\}]$	Not Monitored	β
$[w + \delta w + \beta_i \max\{d, B\}]$	Monitored But Not Caught	$(1-\beta)(1-\beta_i)$
0	Monitored and Caught	$(1-\beta)\,\beta_i$

The i^{th} bureaucrat therefore solves the following problem:

Choose β_i to maximize,

$$(1-\beta)\,\beta_i \cdot 0 + (1-\beta)(1-\beta_i)\,[w' + \beta_i \max\{d, B\}] + \beta\,[w' + \beta_i \max\{d, B\}]$$
$$= (1 - \beta_i + \beta\beta_i)\,[w' + \beta_i \max\{d, B\}] \text{ subject to } \beta_i \in [0, 1]$$

where $w' = w + \delta w$. Therefore his revenue from dishonesty is the total time devoted to such

[18] An equivalent interpretation would be that with probability β_i, the bureaucrat is caught, and he is fired only if the bureaucrat responsible for firing him, is honest. The latter happens with probability $1-\beta$.

[19] The same welfare comparisons may be made under $c' = 0$, provide a is small enough or L is large enough.

activities multiplied by the bribe B from each of the licensees or by the utility gain from shirking, whichever of the two is larger.

4.1.1 The Structure of the Game

The game is a two stage-game where the sequence of moves is as follows: In stage 1, bureaucrats choose the amount of time to devote to dishonest activities and firms simultaneously choose whether to enter the market or not by incurring the application fee of a. Licensing is abolished in period 2 and all who seek to enter the market in period 2 do so without any constraints. We may think of period 2 as some point in time in future where licensing is to be abolished and the time period in which this is done is common knowledge. Modelling this explicitly, would simply complicate the problem in hand without yielding additional insights.[20] In the second stage, firms are matched with bureaucrats. In case they meet an honest bureaucrat, they simply obtain their licenses and commence production. However, if they are matched with a dishonest bureaucrat who demands a bribe, the firm in question has two choices: it can either pay up, or it can lodge a complain.[21] A second bureaucrat investigates the complain. If the latter is honest, the firm attains its license in period 1 and the dishonest bureaucrat is fired. If the second bureaucrat is also dishonest, nothing comes of the complaint and the firm is denied a license in period1. The firm therefore, can commence production only in period 2. Further, it is assumed that if a firm is indifferent between paying and complaining, the firm pays the bribe demanded.

The second stage thus determines the bribe prevailing in the market. While each bureaucrat is small in relation to the entire bureaucracy, subsequent to being matched to the firm he is a monopolist. He therefore makes a take-it-or-leave-it offer such that the firm is indifferent between paying and complaining. The firms always pay and there is a zero probability of the bureaucrat being caught on account of the firm's complaint. This justifies the bureaucrat ignoring this risk of being caught from firm complaints. Figure 1 shows the game tree listing the sequence of moves

[20] In the presence of corruption, investment decisions, both domestic and foreign, are likely to be postponed. See Wei (2000) who finds empirical support for this. We capture this aspect by including a second period in our model. Note that as shown earlier, regulation per se in the absence of corruption, crowds out some firms but we always observe firms entering in period 1.

[21] We assume that the firm first pays the licensing fee and then is faced with a bribe demand, so that it cannot get its fee back even if it decides not to pay the bribe and its complaint is thrown off.

and payoffs to the firm.

4.1.2 The Determination of the Bribe

If the firm pays the bribe its payoff equals

$$(1-\gamma)\left(\frac{Y_1}{n_1\sigma}+\delta\frac{Y_2}{n_2\sigma}\right)-a-\mu-B \tag{19}$$

If the firm complains, with probability $(1-\beta)$ it gets the license without paying the bribe, and with probability β its complaint is not addressed and it gets $-a$ in period 1 (the application cost) and earns second period profits. It is assumed that production may be commenced and setup costs incurred only after a firm acquires a license. Its expected payoff is therefore

$$(1-\beta)\left((1-\gamma)\left(\frac{Y_1}{n_1\sigma}+\delta\frac{Y_2}{n_2\sigma}\right)-a-\mu\right)+\beta\left(\delta(1-\gamma)\frac{Y_2}{n_2\sigma}-a-\delta\mu\right) \tag{20}$$

The bureaucrat sets B to make the two equal. This yields the bribe price as

$$B=\beta\left((1-\gamma)\frac{Y_1}{n_1\sigma}-(1-\delta)\mu\right) \tag{21}$$

The bribe price is therefore increasing in first period profits and in the extent of corruption β prevailing in the economy.[22]

4.1.3 The Entry Decision of Firms

Assume that $\beta\in[0,1]$ is the incidence of corruption. If a firm enters in period 1, its expected profits equal

$$(1-\gamma)\left(\frac{Y_1}{n_1\sigma}+\delta\frac{Y_2}{n_2\sigma}\right)-a-\mu-\beta^2\left((1-\gamma)\frac{Y_1}{n_1\sigma}-(1-\delta)\mu\right)$$

If it waits till period 2 when there is no licensing (and therefore no bribe demands) it earns,

$$\delta(1-\gamma)\frac{Y_2}{n_2\sigma}-\delta\mu$$

It prefers to enter in period 1 as long as

$$a<\left(1-\beta^2\right)\left[(1-\gamma)\frac{Y_1}{n_1\sigma}-(1-\delta)\mu\right] \tag{22}$$

[22] The bribe is decreasing in n_1 and the maximum value of $n_1=(1-\gamma)(1+\delta)\frac{L}{(\mu+a)\sigma}$. For this value of n_1, the bribe $B=\beta\left[\frac{\delta^2\mu+a}{1+\delta}\right]>0$ as long as $\beta>0$

which we may rewrite as

$$\beta \leq \left[1 - \frac{a}{(1-\gamma)\frac{Y_1}{n_1\sigma} - (1-\delta)\mu}\right]^{0.5} = \bar{\beta}$$

As long as $\beta \leq \bar{\beta} < 1$ all firms enter in period 1 but if the incidence of corruption exceeds this threshold, they all prefer to enter in period 2.[23]

4.1.4 The Equilibria

We shall concentrate on symmetric subgame perfect equilibria. In our model we have multiple equilibria. There are two positive feedback mechanisms from the average level of corruption to the individual level. First, higher is β, lower is the probability of being monitored. Second, the higher is β, the higher is the bribe price, i.e., the higher are the payoffs from being corrupt. These feedback mechanisms create incentives for dishonest activities and give rise to the possibility of multiple equilibria.

Zero Corruption: $\beta = 0$. When $\beta = 0$, the bribe price B from equation 21 is also zero. The entry condition in equation 22 becomes

$$a < \delta\mu$$

which, ensures that all firms will enter in period 1. Intuitively, this requires that either the licensing fees are small, or that the fixed costs are large (so that each firm needs profits in two periods to recoup this cost) or the discount factor δ is large.

For bureaucrats, $\max\{d, B\} = \max\{d, 0\} = d$. The bureaucrat maximizes

$$(1-\beta_i)\,[w' + \beta_i d] \text{ subject to } \beta_i \in [0,1]$$

From the Kuhn- Tucker first order conditions we obtain

$$\beta_i\,(d - w' - 2\beta_i d) = 0,\ \beta_i \geq 0,\ (d - w' - 2\beta_i d) \leq 0 \tag{23}$$

For zero corruption to be an equilibrium we must have $\beta_i = \beta = 0$. This requires that $w \geq \frac{d}{1+\delta}$. This gives us the first proposition.

Proposition 1 *There is a threshold level of wages $\frac{d}{1+\delta}$ such that if wages were below this threshold zero corruption can never be part of a symmetric equilibrium. The threshold level is increasing in the utility gain from shirking and decreasing in the discount factor.*

[23] Note also that n_1 is determined endogenously and depends on β.

Proof: If wages were below this threshold then each bureaucrat would choose

$$\beta_i = \beta = \frac{1}{2} - \frac{w'}{2d} > 0$$

But then our initial assumption of $\beta = 0$ would not hold. Clearly, the threshold is increasing in d and decreasing in δ, the discount factor. ■

In this equilibrium all firms enter in period 1, the number of firms n^{ZC} can be derived from the zero-profit equation as

$$n_1^{ZC} = n_2^{ZC} = n^{ZC} = (1-\gamma)(1+\delta)\frac{L}{(\mu+a)\sigma} < n^* \tag{24}$$

Full Corruption: $\beta = 1$. We solve the game backwards. If firms were to enter then from equation 21, they would have to pay a bribe of

$$B = \left((1-\gamma)\frac{Y_1}{n_1\sigma} - (1-\delta)\mu\right)$$

Since all bureaucrats are corrupt they pay this bribe with probability one. The payoff from entering is now

$$(1-\gamma)\left(\frac{Y_1}{n\sigma} + \delta\frac{Y_2}{n\sigma}\right) - a - \mu - \left((1-\gamma)\frac{Y_1}{n_1\sigma} - (1-\delta)\mu\right) \tag{25}$$

$$= \delta(1-\gamma)\frac{Y_2}{n\sigma} - a - \delta\mu \tag{26}$$

However, if they were to wait and enter in period 2 then their payoff in present value terms would be

$$\delta(1-\gamma)\frac{Y_2}{n\sigma} - \delta\mu \tag{27}$$

Since the latter payoff is higher each firm would prefer to wait. Therefore

$$n_1^{FC} = 0, n_2^{FC} = (1-\gamma)\frac{L}{\sigma\mu} \tag{28}$$

where n_2^{FC} is determined by

$$(1-\gamma)\frac{L}{n\sigma} - \mu = 0 \tag{29}$$

Since no firms enter in period 1 the effective bribe that bureaucrats get equals 0. Therefore $d = \max\{d, B\}$. When $\beta = 1$, the objective function that the bureaucrat maximizes becomes

$$[w' + \beta_i \max\{d, B\}] \text{ subject to } \beta_i \in [0, 1]$$

Every bureaucrat sets $\beta_i = 1$ and their equilibrium payoff is $w' + d$. Therefore $\beta = \beta_i = 1$ is an equilibrium. This we term the dishonest equilibrium, where even though no bribes are explicitly paid, each bureaucrat devotes his entire time to dishonest activities. The full corruption equilibria also has the property that rational but corrupt agents inflate bribes to a level so as to deter entry and in the process extinguish their source of bribes.[24] Such seemingly irrational behavior arises because of the decentralized nature of decision-making by each bureaucrat. It is precisely in such a situation that we would expect a centralized version of corruption to perform better, both in terms of bribes actually received, and in terms of welfare as we shall see in the next section.

The Interior Equilibrium: $\beta_i \in (0,1)$. For n_1 firms that enter in the first stage of the game, $B = \beta\left((1-\gamma)\frac{Y_1}{n_1\sigma} - (1-\delta)\mu\right) = \beta k$. We assume that $d < \beta\left((1-\gamma)\frac{Y_1}{n_1\sigma} - (1-\delta)\mu\right)$ in the interior equilibrium, so that the bureaucrat prefers to take bribes rather than shirk. Therefore $B = \max\{d, B\}$. The bureaucrat's maximization exercise yields the following first order condition

$$\beta \geq \frac{(k-w') + \sqrt{k^2 + w'^2 + 6w'k}}{4k} \rightarrow \beta_i = 1 \tag{30}$$

$$\beta \leq \frac{k}{k+w'} \rightarrow \beta_i = 0 \tag{31}$$

$$\beta_i = \frac{1}{2}\left[\frac{1}{1-\beta} - \frac{w'}{\beta k}\right] \text{ otherwise} \tag{32}$$

i.e., we write β_i as a function of β. In the symmetric interior equilibrium we must have $\beta_i = \beta = \beta^*$. The equation above has only one positive real root, which we denote as $\beta^*(n)$. We may simplify the above equation using expression $\beta_i = \beta$ as

$$2\beta^2 + 1 + \frac{w'}{k} = \frac{1}{1-\beta}$$

When $\beta = 0$, the left hand side of the above equation equals $\frac{w'}{k} + 1 > 1 =$ right hand side, and when $\beta = 1$, left hand side equals $3 + \frac{w'}{k} < \lim_{\beta\to 1}\left(\frac{1}{1-\beta}\right)$. Moreover, both functions are monotonically increasing in β so that we have a unique interior solution. Plotting the two series $\beta_i = \beta$ and equations 30-32 yields figure 2.

Equilibrium is at the point where the two curves intersect. The number of firms, and the

[24] This is somewhat similar to the behavior of trade unions who inflate wages to the extent of inducing the exit of the very firms that provide them with employment.

proportion of corrupt bureaucrats is determined by the following equations

$$\beta = \beta^*(n)$$

$$(1-\gamma)\left(\frac{Y_1}{n\sigma} + \delta\frac{Y_2}{n\sigma}\right) - a - \mu - \beta^{*2}(n)\left((1-\gamma)\frac{Y_1}{n\sigma} - (1-\delta)\mu\right) = 0$$

which sets expected profits of entering firms to zero. Since all firms are identical they all enter in period 1. We label the number of firms as

$$n_1^{IE} = n_2^{IE} = n^{IE}$$

We assume again that a is small or δ is large enough such that the equation 22 holds

$$a < \left(1 - \beta^{*2}\right)\left[(1-\gamma)\frac{L}{n_1^{IE}\sigma} - (1-\delta)\mu\right]$$

This condition ensures, that all firms in the interior equilibrium prefer to enter in period 1. In the interior equilibrium, the bribe is simply an addition to the fixed cost of every firm. Since the number of firms is declining in fixed costs fewer firms enter and produce in the market in this interior equilibrium as compared to the zero corruption equilibrium.

To summarize we have the following equilibria:

(i) Zero Corruption Equilibrium: $\beta = 0$; $n_1^{ZC} = n_2^{ZC} = n^{ZC} = (1-\gamma)(1+\delta)\frac{L}{(\mu+a)\sigma}$

(ii)Full Corruption Equilibrium: $\beta = 1$; $n_1^{FC} = 0$; $n_2^{FC} = (1-\gamma)\frac{L}{\sigma\mu}$

(iii) Interior Equilibrium: $\beta = \beta^* \in (0,1)$; $n_1^{IE} = n_2^{IE} = n^{IE}$

4.2 Centralized Corruption

We now analyze the case where there is a single bureaucrat. The question that we seek to answer is whether decentralized corruption is better or worse in terms of welfare as compared to centralized corruption. In this case, every firm has no recourse to complaining since there is only a single bureaucrat.[25] There are also no monitoring issues. We retain the assumption that in period 2 everyone who applies for a license gets it without having to pay a bribe. The single bureaucrat simply sets the bribe price such that every firm is indifferent between entering in period 1 and waiting till period 2.

[25] Think of such a bureaucrat as an all-powerful dictator or oligarch. Marcos' Phillipines, Suharto's Indonesia are appropriate cases of centralized corruption - here it is clear who is to be bribed, how much; monitoring as a concept is meaningless and no further bribes are demanded once the licenses are issued.

The payoff from entering in period 1 and paying the bribe B is

$$(1-\gamma)\left(\frac{Y_1}{n_1\sigma}+\delta\frac{Y_2}{n_2\sigma}\right)-a-\mu-B$$

while the payoff from waiting till period 2 in present value terms is

$$\delta\left((1-\gamma)\frac{Y_2}{n_2\sigma}-\mu\right)$$

Equating the two yields the bribe price as

$$B=(1-\gamma)\frac{Y_1}{n_1\sigma}-(1-\delta)\mu-a \tag{33}$$

We assume that if firms are indifferent between entering and not entering, they choose to enter. The number of firms that enter in period 1 is therefore given by the zero profit condition

$$\left((1-\gamma)\frac{Y_2}{n\sigma}-\mu\right)=0$$

Therefore

$$n_1^{CC}=n_2^{CC}=n^{FC}=(1-\gamma)\frac{L}{\sigma\mu}$$

assuming that the single bureaucrat is paid the same wages w. Therefore, the number of firms are exactly the same as in the full corruption equilibrium - the only difference is that each of these firms enter in period 1 in case of the centralized corruption equilibrium whereas, they enter in period 2 in case of the decentralized full corruption equilibrium. However the number of firms are higher in case of the zero corruption decentralized equilibrium.

With centralized corruption as that of a dictator, the worst equilibrium of "full-corruption" is no longer a possibility. This is similar to the argument of Shleifer and Vishny (1993) who show that in the presence of complementary licenses, a centralized and corrupt public authority, when charging a bribe for a license, internalizes the effect this bribe has on the demand for complementary licenses. In our model, by recognizing that too high a bribe demand would lead to postponement of entry by firms to period 2, a centralized corrupt authority ensures that the bribe is bounded (and equal to) the amount that makes firm indifferent between entering now and postponing their entry to period 2. Decentralized bureaucrats may fail to take this into account leading to the "full-corruption" equilibrium where no entry takes place in period 2. However, under decentralized corruption, the probability of being monitored and caught is endogenous giving rise to multiple equilibria where zero-corruption and an interior equilibrium are a possibility. It is exactly here that decentralized corruption can dominate centralized corruption in terms of welfare as we show below.

5 Welfare Ranking

Having solved for each of the three equilibria, it is now possible to rank these equilibria. In doing welfare rankings, we consider the welfare only of the representative individual in the economy. The bureaucrats' welfare is not taken into account. The reason for doing so is that at least in the interior equilibrium, bureaucrats are better off than in the zero corruption equilibrium since their expected income consists of wages plus bribes which is higher than in the zero corruption equilibrium where they receive only wages. In the absence of an aggregation mechanism that aggregates the preferences of individuals and bureaucrats, the only criterion that we can use is the Pareto criterion. By this criterion, the equilibrium states cannot be ordered or ranked since whenever there are fewer varieties on the market, so that the representative individual is worse off, the bureaucrat is better off given that the choice that he makes is an optimal response to the average level of corruption prevailing.

The representative individual is however worse off since there are fewer firms in the market in each period.. Without a particular specification of a social welfare function, it is impossible to reconcile this trade-off. Therefore we will simply look at the welfare of the representative agent and argue that the bureaucratic sector is small in relation to the rest of the economy.

Proposition 2 *Economic welfare, as defined in terms of the welfare of the representative individual, is decreasing in the level of corruption.*

Proof: We first compare the interior equilibrium with the zero corruption equilibrium. In the former, $n_1 = n_2 = n^{IE}$ is the solution to

$$(1-\gamma)\left(\frac{L}{n\sigma} + \delta\frac{L}{n\sigma}\right) - a - \mu - \beta^{*^2}\left((1-\gamma)\frac{L}{n\sigma} - (1-\delta)\mu\right) = 0$$

where $\beta^* \in (0,1)$. In the zero corruption equilibrium, $n_1 = n_2 = n^{FC}$ is the solution to

$$(1-\gamma)\left(\frac{L}{n\sigma} + \delta\frac{L}{n\sigma}\right) - a - \mu = 0$$

Subtracting the two, we see that

$$\beta^{*^2}\left((1-\gamma)\frac{L}{n^{IE}\sigma}-(1-\delta)\mu\right)=(1-\gamma)\frac{L}{\sigma}(1+\delta)\left(\frac{1}{n^{IE}}-\frac{1}{n^{ZC}}\right)$$

Since the left hand side is strictly positive it must be the true that

$$n^{ZC}>n^{IE}$$

We can write social welfare as

$$SW=(1+\delta)\begin{bmatrix}\gamma\log\gamma+(1-\gamma)\log(1-\gamma)+\log L\\ +\frac{1-\gamma}{\sigma-1}\log n+(1-\gamma)\log\left(\frac{\sigma-1}{\sigma}\right)\end{bmatrix}$$

Since, $n^{ZC}>n^{IE}$, social welfare under zero corruption must be greater than that in the interior equilibrium, i.e.,

$$SW^{ZC}>SW^{IE}$$

We now compare the interior equilibrium to the full corruption equilibrium. Here, $n_1^{FC}=0$, n_2^{FC} is the solution to

$$(1-\gamma)\frac{L}{n\sigma}-\mu=0$$

Subtracting this equation from equation for the interior equilibrium, we have

$$\left(1-\beta^{*^2}\right)\left((1-\gamma)\frac{L}{n^{IE}\sigma}-\mu(1-\delta)\right)-a+\delta(1-\gamma)\frac{L}{\sigma}\left(\frac{1}{n^{IE}}-\frac{1}{n^{FC}}\right)=0$$

Since we have assumed a to be small so that equation 22 holds, a necessary condition for this equality to be satisfied is

$$\frac{1}{n^{IE}}<\frac{1}{n^{FC}}$$

or

$$n^{IE}>n^{FC}$$

We now write the welfare function as

$$SW=SW_1+\delta SW_2=\sum_{t=1,2}\delta^t\left(c_{0t}\right)^{\gamma}\left(C_t\ \right)^{1-\gamma}$$

When $n_1 = 0$, (as is the case in the interior equilibrium), the first period welfare is zero and the welfare function becomes,

$$SW = SW_2 = (c_{02})^{\gamma} (C_2)^{1-\gamma}$$
$$= (\gamma^{\gamma}(1-\gamma)^{\gamma}) L \left(\frac{1}{P_2}\right)^{1-\gamma}$$

where

$$P_2 = n_2^{\frac{1}{1-\sigma}} \left(\frac{\sigma}{\sigma-1}\right)$$

Since $n_2^{IE} > n_2^{FC}$, it must be true that $P_2^{IE} < P_2^{FC}$. This in turn, implies that

$$SW_2^{IE} > SW_2^{FC}$$

Therefore,

$$SW^{IE} = SW_1^{IE} + SW_2^{IE} > SW_2^{FC} = SW^{FC}$$

Combining these two results, we have that

$$SW^{ZC} > SW^{IE} > SW^{FC}$$

■

Proposition 3 *Under centralized corruption, welfare is higher than the full corruption case and lower than in the zero corruption and interior equilibrium cases.*

Proof: We have that $n_1^{FC} = 0$, $n_1^{CC} = n_2^{CC} = n_2^{FC} < n^{IE}$. From these it follows that

$$SW^{CC} > SW^{FC}$$

$$SW^{ZC} > SW^{IE} > SW^{CC}$$

Therefore, it is not true that centralized corruption is always more desirable than decentralized corruption, in the presence of multiple equilibria. In fact, in two out of the three multiple equilibria, under a decentralized bureaucracy, social welfare is higher. Only in the full corruption equilibria, is welfare lower with centralized corruption. Comparing this with the results of Shleifer and Vishny (1993), we can see that their results hinge critically on the assumption of complementarity in regulations and the absence of multiple equilibria. In the presence of multiple equilibria, where zero corruption is a possibility, even with complementary permits the zero corruption equilibrium will always dominate the equilibrium with a single corrupt regulatory authority.

6 Bureaucratic Wages and Corruption - Theoretical Results

Both extreme equilibria do not respond to changes in any of the parameters. In fact, the equilibrium where $\beta = 1$, is one where corruption is not affected by changes in civil sector wages. This points to the policy implication that in such situations, institutional reforms may be the only recourse out of such a high-level corruption trap. This also agrees with our findings in section2, where we saw that in highly corrupt countries, an increase in wages does not significantly alter corruption levels and that in these countries the correlation between bureaucratic wages and corruption is weak.

Next, we consider comparative statics for the interior equilibrium. We earlier established a threshold level of corruption $\bar{\beta}$ such that if β is higher than this level, no firm enters in period 1. We also assumed that a is small enough and that δ is large enough so that in the interior equilibrium $\beta^* \leq \bar{\beta}$. In this equilibrium, an increase in wages raises corruption, which again matches our findings in section 2. In figure 2, an increase in w shifts the curve $\beta_i(\beta)$ to the right so that it intersects the 45^o line at a higher level of corruption. Subsequent increases in wages continues to raise β till a point is reached where $\beta^* > \bar{\beta}$. At this point no firms enter the market and the level of corruption falls abruptly to zero. However, now all bureaucrats spend their time shirking.[26]

While it may argued that the interior equilibrium is unstable, given that we have a static model, stability is essentially a meaningless concept. Moreover, nothing precludes us from comparing corruption levels in two countries, both whom have intermediate levels of corruption, and one of whom has higher bureaucratic wages. In this case, we would expect that the country with the higher wage also has a higher level of corruption. This agrees with observation 1, where we found in a cross-sectional comparison of countries with intermediate corruption levels (who are in the interior equilibrium), evidence for a positive relationship between bureaucratic wages

[26] Even though effectively no bribes are paid at this point, firms perceive a high level of corruption and postpone entry. Since most corruption measures are perception-based survey measures the data would classify such a country as highly corrupt as well. This is a second advantage of adopting a broader definition of engaging in 'dishonest activities.'

and corruption. Therefore, in the presence of multiple equilibria, one can no longer theoretically expect a monotonic relationship between civil sector wages and corruption. Once this theoretical expectation is revised, the failure of previous researchers to empirically confirm such a monotonic relationship is no longer surprising.

7 Conclusion

This paper makes two contributions. First, it shows that corruption unambiguously reduces economic welfare. We see that multiple equilibria are possible in the levels of corruption, and that higher levels of corruption either crowd out firms or postpone their entry, leading to lower social welfare. Further, we find that centralized corruption may not always be preferred to decentralized corruption. In fact, we find the existence of two equilibria in a decentralized setting that dominate the equilibrium under a centrally corrupt authority.

Second, the paper presents some puzzling empirical evidence on the relationship between corruption and bureaucratic wages. It starts off by showing that a) in a set of countries with intermediate levels of corruption, there is a positive and significant relation between corruption and wages; b) in countries with very high levels of corruption, wages do not seem to affect corruption levels; and c) in countries with zero corruption, wages are higher than a threshold level. The paper finds that in the presence of multiple equilibria, one obtains theoretical results that are in concordance with such empirical evidence. Given that one may reasonably expect multiple equilibria, it would be naïve to expect a simple negative relationship between wages and corruption.

The presence of multiple equilibria also helps explain the differences in the incidence of corruption across countries, and the reason for their persistence, despite the best efforts of governments. The underlying frequency dependency may negate the use of incentive mechanisms to reduce corruption, such as increasing the remuneration of bureaucrats. In such situations, institutional reforms may be the only recourse out of such a high-level corruption trap.

References

Andvig, Jens C. and Moene, Karl O. 1990. 'How corruption may corrupt,' *Journal of Economic Behavior and Organization,* 13, pp. 63-76.

Banerjee, Abhijit 1997. 'A Theory of Misgovernance,' *Quarterly Journal of Economics*, 112, pp. 1289-1332.

Bardhan, Pranab 1997'Corruption and Development: A review of issues,' *Journal of Economic Literature,* Vol. XXXV September.

Becker, Gary and Stigler, George J. 1974. 'Law enforcement, malfeasance and the compensation of enforcers,' *Journal of Legal Studies,* 5, pp. 1-19.

Bhagwati, Jagdish and Hansen, Bent 1973. 'A theoretical analysis of smuggling,' *Quarterly Journal of Economics*, 87, pp. 172-187.

Bhagwati, Jagdish and Srinivasan, T.N. 1973. 'Smuggling and trade policy,' *Journal of Public Economics*, 2, pp. 377-389.

Bliss, Christopher and Di Tella, Rafael 1997. "Does Competition Kill Corruption?" *Journal of Political Economy*, 1055, pp. 1001-23.

Cadot, Olivier 1987. 'Corruption as a gamble,' *Journal of Public Economics,* 33, pp. 223-244.

Graeff, P. and Mehlkop, G. 2003. 'The impact of economic freedom on corruption:different patterns for rich and poor countries," *European Journal of Political Economy*, 19, pp. 605-620.

Klitgaard, Robert 1990. 'Gifts and bribes,' in Richard Zeckhauser, ed. *Strategy and Choice,* Cambridge, MA: MIT Press.

Knack, Stephen, and Philip Keefer, 1995, 'Institutions and Economic Performance: Cross-country tests using Alternative Institutional Measures,' *Economics and Politics*, Vol. 7, No. 3, 207-228.

Lui, Francis T 1986'A dynamic model of corruption deterrence,' *Journal of Public Economics,* 3, pp. 1-22.

Olson, Mancur 1993. "Dictatorship, Democracy, and Development", *American Political Science Review*, Vol. 87, No. 3, pp. 567-576.

Rauch, James and Evans, "Bureaucratic Structure and Bureaucratic Performance in Less Developed Countries", *Journal of Public Economics*, 75, 1, 49-71.

Rose-Ackerman, S 1975. 'The economics of corruption,' *Journal of Political Economy,* 4, pp. 187-203.

Shleifer, Andrei and Vishny, Robert W. 1993. 'Corruption,' *Quarterly Journal of Economics,* 108, pp. 599-617.

Van Rijckeghem and Weder, Beatrice (2001). 'Corruption and the rate of temptation: Do low wages in the civil service cause corruption?' *Journal of Development Economics,* 65(2), pp. 307-31.

Table 1: Corruption and Bureaucratic Wages

Corruption \ Wages	Low	High
Low	Algeria, Bulgaria, Burkina Faso, Cameroon, China, Ecuador, Hungary, Kenya, Madagascar, Mongolia, Mozambique, Nicaragua, Niger, Poland, Romania, South Africa, Sri Lanka	Argentina, Australia, Austria, Belgium, Botswana, Canada, Chile, Denmark, Finland, France, Germany, Israel, Italy, Malaysia, New Zealand, Singapore, Spain, Sweden, Switzerland, Thailand, UK, USA
High	Bangladesh, Bolivia, Colombia, Cote d'Ivoire, Egypt, El Salvador, Gabon, Ghana, Guatemala, Guinea-Bissau, Honduras, India, Indonesia, Jordan, Mali, Mexico, Morocco, Pakistan, Philippines, Saudi Arabia, Senegal, Syria, Tanzania, Togo, Tunisia, Turkey, Uganda, Yemen, Zambia, Zimbabwe	Bahrain, Iran, South Korea, Kuwait, Malta, Oman, Panama, Qatar

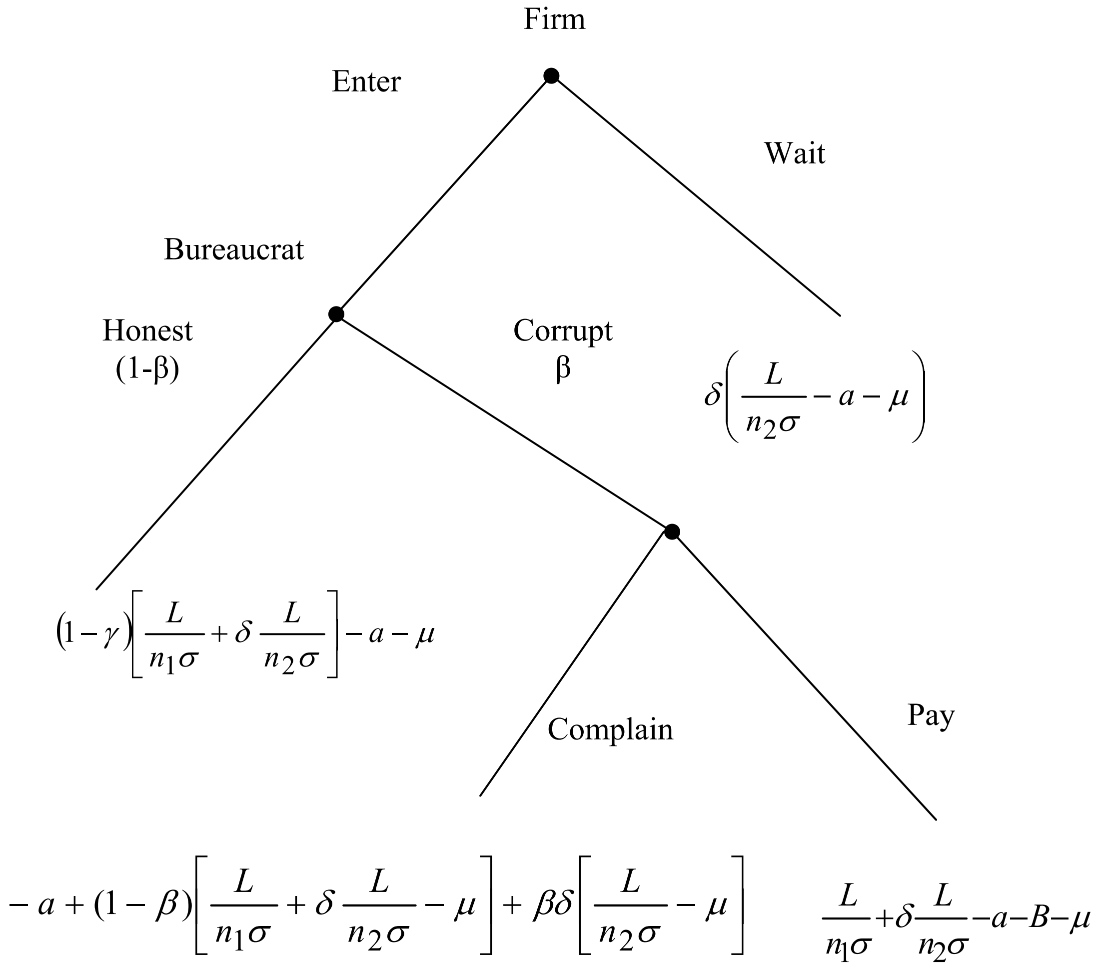

Figure 1: The Structure of the Game

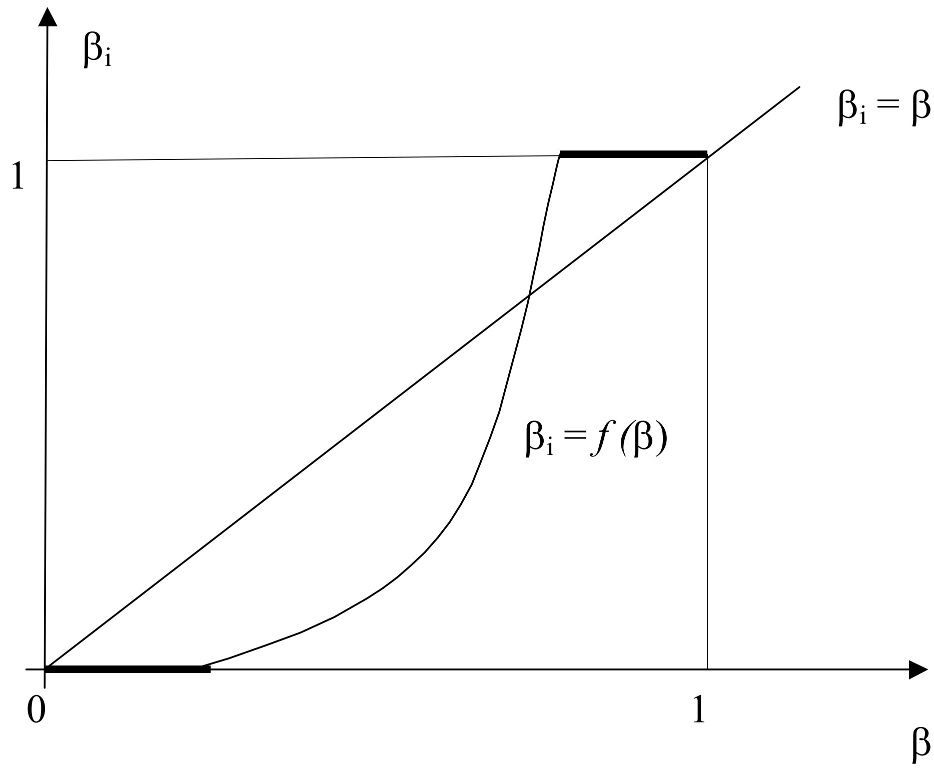

Figure 2: The Bureaucrat's Best Response