Liberalization and Corruption in Developing Countries: Is there a non-monotonic relationship? §

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Abstract

Liberalization increases the number of goods available for consumption within a country. Since consumers, including bureaucrats, value variety, this raises the marginal utility of accepting a bribe. This "benefit effect" is, however, counteracted by an increasing "cost effect" from corruption deterrence activities that arise due to greater international pressure to curb corruption. The interaction of these two effects can lead to the existence of a Kuznet's-type curve, where corruption initially increases with liberalization, and then decreases beyond a threshold. Moreover, credible pre-commitment to deterrence activities is shown to be more effective in deterring corruption. Empirical evidence from developing countries supports the existence of a non-monotonic relation between import to GDP ratio and corruption.

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1. Introduction

In an increasingly integrating world, the nexus between globalization and corruption is an important issue, especially for policy purposes.[1] The extant literature on corruption has generally found a negative relation between corruption on one hand, and trade, investment and growth on the other (see Rose-Ackerman, 1975, 1978; Mauro, 1995; and the survey by Bardhan, 1997).[2] The explanation offered is as follows: by introducing greater foreign competition, trade liberalization reduces monopolistic rents enjoyed by firms and decreases their ability to pay a bribe, thereby reducing bureaucratic corruption.[3] One exception to this general finding is Ades and Di Tella (1999), who show that if corruptible officials are paid an efficiency wage to induce honest behaviour, the effect of increasing competition on corruption is ambiguous. By reducing profits of oligopolistic firms, competition reduces the efficiency wage as it becomes less attractive to induce honesty, but, at the same time, any level of wage deters more corruption as the gains to corrupt officials fall with competition. As a result of these two contradictory effects, equilibrium corruption can either rise *or* fall with competition.

The empirical evidence on how openness affects corruption across countries has been mixed. In contrast to the ambiguous nature of their theoretical predictions, Ades and

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[1] Corruption – the misuse of public office for private gains (Bardhan, 1997) – can be "administrative" (misuse by law enforcers) or "grand" (misuse by lawmakers). This paper deals with the former type of corruption only.

[2] There is less unanimity on the effect of corruption on static efficiency. While Shleifer and Vishny (1993), Mauro (1998) and Ahlin and Bose (forthcoming) find corruption to be distortionary, Leff (1964) has argued that in a second best world, with pre-existing policy induced distortions, corruption may actually improve efficiency. The ability of the lowest cost firm to pay the highest bribe can ensure an efficient outcome in a bargain between a corrupt official and prospective firms, where the former tries to sell a permit to the latter. This argument, of course, presupposes that the lowest cost firm is able to meet the objectives of the permit-programme as well as the other firms.

[3] The causality between openness and *grand* corruption can run in the other direction as well. Corrupt lawmakers are more likely to create regulations involving licenses, permits, quotas, and tariffs so as to facilitate their rent-seeking activities. Such policies can be inimical to trade and business opportunities.

Di Tella's (1999) empirical results showed that foreign competition (as proxied by import to GDP ratio and other variables) negatively affects corruption. Similarly, Wei (2000a, 2000b) and Gatti (2004) found an inverse relation between openness and corruption. Treisman (2000), however, reported a "surprisingly small" negative relation between corruption and openness to trade (measured by import to GDP ratio).[4]

The ambiguity evident in the literature, notably in Ades and Di Tella (1999) and Treisman (2000), seems to suggest that the relation between openness and corruption is more complex and may even be non-monotonic in many countries due to the interplay of opposing factors that are inherent in globalization.[5] A positive relation between openness and corruption is borne out by the initial experience of the transitional economies of Eastern Europe and erstwhile USSR, "where essential steps to privatize the economy and rewrite the rules of commerce after the demise of socialism were often accompanied by widespread corruption" (Transparency International, 2005, p. 271). However, there is recent (1999-2002) evidence to support the view that "the prevalence and costs of some types of corruption are becoming more moderate in many countries in the region" (ibid).

The purpose of the present paper is three-fold. First, we explore a different (from those explored in the existing literature) channel through which economic openness can stimulate corruption among public officials. Second, we provide a possible explanation

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[4] In contrast, Williams and Beare (1999, p. 116) have noted "a conviction that corruption has increased to epidemic levels, and that globalization has provided much of the impetus and opportunity for this growth."

[5] The possibility of a non-monotonic relationship between economic growth and corruption has been suggested by Bardhan (1997). While reporting a negative relationship in general for most countries, Bardhan (p. 1329) observed that, "in some countries with the process of modernization and growth corruption may have got worse for some time before getting better." This, according to him, can arise due to counteracting forces generated by the growth process. On one hand, an expansion of the economy provides public officials with "more opportunities for making money from their decisions" (*ibid*). On the other hand, a prospering economy can afford to pay its civil servants better (thus reducing their motivation to be corrupt), and may be more likely to install institutions that check corruption. Bardhan (1997), however, does not formally model these forces or their interaction.

for the existence of a non-monotonic relation between economic openness and corruption in developing countries. Lastly, we use data to demonstrate the existence of such a relationship across developing countries. In this sense, our empirical analysis moves away from the existing literature which is preoccupied with estimating the linear relationship between openness and corruption.

The different channel, referred to above, is as follows: liberalization typically increases imports, and imports introduce new goods and services to consumers of liberalized economies.[6] This effect is likely to be stronger in developing countries, which lack the ability to produce many goods, and depend on imports to make them available. Availability of more products increases the marginal utility of consumers' income, given that they have a taste for variety. In particular, this would also increase the corruptible officials' marginal utility of bribe income, and increase their incentive to be corrupt.[7] Thus liberalization, by increasing the allure of consumerism, strengthens the propensity of officials to be corrupt (at least initially) in our model.

But there is a second, and countervailing, effect that results from greater openness. A commonly observed attribute of globalization is that it engenders additional pressures on developing countries to reduce corruption and improve governance. For one, greater openness makes domestic corruption more "internationally visible".[8] Second, international bodies have a greater incentive and ability to pressurize more open countries

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[6] This is in the spirit of international trade models with product differentiation (such as Krugman, 1979, 1980; and Lawrence and Spiller, 1983), and Romer (1994). Klenow and Rodriguez-Claire (1997) estimate that a 1% lower tariff was accompanied by a 0.5% increase in import variety for Costa Rica during 1986-1992.

[7] Anecdotal evidence from India suggests that the influx of new goods (such as consumer electronics and automobiles) and brands that followed the 1991 liberalization fueled greediness among many corrupt officials (and dowry seekers, among others).

[8] See, for examples, the following media articles: "The G8's African Challenge" (*The Economist*, July 7, 2005), and "Africa Tackles Graft, With Billions in Aid in Play" (*The New York Times*, July 6, 2005).

to crack down on corruption. For example, according to Williams and Beare (1999, p. 142), "both the IMF and World Bank have recently introduced reforms to their lending practices making the provision of funds conditional upon the successful implementation of a variety of macroeconomic and anti-corruption reforms." Similar anti-corruption initiatives have been launched by the United Nations (*UN Convention Against Corruption*, 2005), African Union (*Convention on Preventing and Combating Corruption*, 2003), OECD (*Convention on Combating Bribery of Foreign Public Officials in International Business Transactions*, 1997), and the Organization of American States (*Inter-American Convention against Corruption*, 1996). The OECD convention, for instance, seeks to criminalize bribe payments by OECD-country corporations to foreign government officials.

Our paper models a hierarchical public administrative structure consisting of many corruptible inspectors, and an honest regulator (an anti-corruption agency) who undertakes deterrence activities to reduce corruption among the inspectors. We find that an increase in the number of consumption goods increases the marginal utility of accepting a bribe, which, in the absence of deterrence activities, leads to greater corruption among the inspectors (Section 2). In the presence of monitoring by a regulator, however, corruption may not increase monotonically, especially if greater openness also leads to greater pressure on the regulator to tackle corruption. This is shown in section 3 of our paper, where we introduce the regulator. Our paper demonstrates that while greater openness initially leads to increased bureaucratic corruption, the accompanying increases in corruption-reducing activities can cause corruption to fall after some threshold of liberalization has been reached. Thus, our theoretical analysis supports the existence of a

"Kuznet's-type curve" in the relationship between corruption and economic liberalization. The role of pre-commitment by the regulator to her monitoring activity is also analyzed in section 3. By credibly pre-committing to a monitoring frequency, the regulator is not only able to detect violators (which she is able to do even if she cannot credibly pre-commit) but also able to influence the optimizing behaviour of the corruptible inspectors. Hence, we find corruption to be less under pre-commitment. Section 4 deals with the empirical analysis, where we find evidence of a non-monotonic relation between liberalization and corruption in developing countries. The last section concludes.

2. Corruption Without Deterrence

Consider a closed economy where many identical consumers derive utility by consuming n goods. Following Spence (1976) and Dixit and Stiglitz (1977), we assume that consumers have an innate preference for variety, and that each individual's utility is given by the CES utility function $U = \left[\sum_{i=1}^{n} x_i^{\rho}\right]^{1/\rho}$, where x_i is the representative individual's consumption of good $i \in [1, n]$, and $\rho \in (0,1)$ is a constant.

Suppose the government imposes a regulation on F firms in this economy, and c denotes each firm's cost of implementing this regulation.[9] For example, the regulation could be one that requires each of the F firms to install a new, more environmentally friendly, technology, which costs c. Further suppose there are M (with $M \geq F$)

[9] Although this not strictly necessary for our results to hold qualitatively, assume for expositional ease that these F domestic firms do not produce any of the n goods that are consumed in the economy. The goods produced by these regulated firms could be either exported or are capital goods. Furthermore, c is not so high that one or more of the F firms have to exit the market.

government inspectors to enforce the regulation. For analytical convenience, we assume that one inspector inspects and certifies only one firm.[10] The inspectors are corruptible, and the firms are willing to offer a bribe of an amount B to the inspectors for false certification. The maximum amount of bribe a firm will be willing to pay is c, the cost it can save by such bribing.[11,12] The inspectors will accept the bribe if utility from it exceeds their disutility (psychic cost or guilt) from being corrupt. The net utility of a corrupt inspector is then

$$U - \theta = \left[\sum_{i=1}^{n} x_i^{\rho} \right]^{1/\rho} - \theta , \qquad (1)$$

where θ is the psychic cost associated with being corrupt. The inspectors are heterogeneous in this cost, and θ is distributed uniformly over the interval $[0, \bar{\theta}]$. For an inspector who does not take a bribe, $\theta = 0$.

We assume that the inspectors earn zero salary income (so that their only income comes from accepting the bribe), and that the prices of all goods are equal to p, normalized to 1. For our purpose, these assumptions simplify the exposition without

[10] As in Ades and Di Tella (1999), and Acemoglu and Verdier (2000).

[11] The scenario that we analyze is one where firms offer bribes to attract officials. Each official has the authority to certify at most one firm. A firm cannot be worse off by choosing bribery over honesty, as the maximum bribe it pays equals the cost of complying with the regulation.

[12] The setting of our model is similar to what Sapru (1998, p. 172) notes for India, "The practice of large scale corruption and other forms of bribery among officials has stalled the implementation of pollution control laws to a significant extent. Industry owners commonly perceive that public servants can be bought by monetary incentives. Therefore, industrial polluters reason that they have recourse to cheaper ways than to comply with regulations that may entail significant cost."

reducing the robustness of our results.[13] Then the indirect utility of a corrupt inspector will be

$$V(n, B, \theta) = n^{\gamma}B - \theta, \tag{2}$$

where $\gamma \equiv (1-\rho)/\rho > 0$. Since by not accepting the bribe an inspector will earn zero utility, the inspector who is indifferent between accepting and rejecting the bribe will have a threshold psychic cost of

$$\theta^* = n^{\gamma}B. \tag{3}$$

Let $\tilde{M}(B) \equiv M\theta^*/\bar{\theta} = n^{\gamma}BM/\bar{\theta}$ denote the number of corrupt inspectors when the bribe amount is B. Keeping in mind that the bribe cannot exceed the cost of the green technology, c, we denote $\tilde{M}_{max} \equiv \tilde{M}(c) = n^{\gamma}cM/\bar{\theta}$. With one inspector per firm, let the equilibrium number of corrupt officials (also bribe-paying firms) be denoted by $\tilde{M}^*$. Then, it is easy to see that:

(i) If $\tilde{M}_{max} < F$, then $B^* = c$, and $\tilde{M}^* = \tilde{M}_{max}$. This is an interior equilibrium where only some of the F firms pay the maximal bribe to an equal number of inspectors. θ^* is strictly less than $\bar{\theta}$, i.e. officials with higher psychic cost of corruption remain honest.

[13] In case the inspectors earned positive salary, this would only require an appropriate change of base. Moreover, by holding prices constant, we are abstracting away from the well-known effect of liberalization on firms' rents and corruption, in order to focus on a different effect. In case liberalization (apart from increasing the number of goods available for consumption) caused prices to decline through competition, this would further increase a corrupt inspector's indirect utility.

(ii) If $F \le \widetilde{M}_{max}$, then $B^* = \frac{F\bar{\theta}}{n^\gamma M} \le c$ and $\widetilde{M}^* = F$. In equilibrium the bribe amount is less than (or equal to) c, and all firms pay the bribe. If there are more inspectors than firms, not all inspectors will be corrupt.

An increase in the number of goods increases the utility from corruption, which induces inspectors with higher psychic costs to accept bribes. Thus $\widetilde{M}^*$ initially increases with n till the number of corrupt inspectors equals F, the total number of firms. At this point, $\widetilde{M}(c) = F$, using which we derive the corresponding number of goods to be at the threshold value of $n_1 \equiv (F\bar{\theta}/cM)^{1/\gamma}$. If the number of available goods is less than n_1, we get case (i). Otherwise, case (ii) holds. Proposition 1 follows.

Proposition 1: *If, due to opening up of trade, the number of goods available for consumption in the economy* (n) *increases, this initially increases the number of corrupt inspectors* $\widetilde{M}^*$*, keeping the bribe amount unchanged at* c (*case* (*i*)). *When* $n = n_1$*, all firms offer bribes to the inspectors, and any further increase in* n *reduces the amount of the bribe, keeping the number of corrupt inspectors unchanged at* F (*case* (*ii*)).

3. Monitoring and Bribery

We now introduce a government anti-corruption agency (the "regulator") that monitors firms to apprehend violators, and assume that the regulator is not corrupt. The regulator randomly monitors a fraction $m \in [0,1]$ of the total number of firms. If a firm is caught violating the regulation, it has pay a penalty of an amount P_F, as well as implement the regulation; the corresponding inspector has to pay a penalty of P_M. The penalty amounts are decided exogenously (perhaps by the judiciary), and are outside the regulator's control.[14] When there is monitoring, the maximum bribe that a firm will be willing to pay is

$$B = c - m(c + P_F) \qquad (5)$$

For expositional ease, in this section, we assume that there are as many inspectors as firms (i.e. $M = F$), and confine our analysis to the interior equilibrium where only some inspectors are corrupt and the maximum bribe is paid.[15] The expected bribe income of a corrupt inspector, under monitoring, becomes $B - mP_M$. It can be shown that a corrupt inspector's indirect utility is then $V(n, B, \theta) = n^{\gamma}(B - mP_M) - \theta$. The inspector, who is indifferent to accepting a bribe, will have a psychic cost of

$$\theta^{**} = n^{\gamma}(B - mP_M) = n^{\gamma}\{c - m(c + P_F + P_M)\}, \qquad (6)$$

where we have substituted the value of B using (5). This gives the number of bribe-accepting inspectors (also bribe-paying firms) as

[14] Higher penalties would reduce the regulator's need for monitoring. However, social conventions (such as "penalty should be commensurate with crime") inhibit the setting of extreme penalties in our paper.
[15] The maximum bribe would be paid if the inspectors have full bargaining power.

$$\widetilde{M} = \frac{M\theta^{**}}{\bar{\theta}} = \frac{M}{\bar{\theta}} n^{\gamma}\{c - m(c + P)\}, \tag{7}$$

where $P \equiv P_F + P_M$. Note that $\widetilde{M}$, as given by (7), represents *total* corruption. Since now there is a regulator carrying out deterrence activities, this total corruption can be decomposed into (i) *detected* (by the regulator) corruption, $m\widetilde{M}$, and (ii) *unchecked* corruption, $(1-m)\widetilde{M}$.

The regulator chooses her monitoring frequency (m) optimally, so as to minimize a weighted sum of three social costs: (i) the cost of, or damage from, unchecked corruption, $\beta_1(1-m)\widetilde{M}$, (ii) the firms' cost of complying with the regulation, $c\{M-(1-m)\widetilde{M}\}$, and (iii) the cost of monitoring, $\frac{1}{2}\delta(mM)^2$.[16] Thus, denoting the weights on the first two costs as w_1 and w_2 respectively, we assume that the regulator minimizes expected social cost Z, where

$$Z = w_1\beta_1(1-m)\widetilde{M} + w_2 c\{M-(1-m)\widetilde{M}\} + \tfrac{1}{2}\delta(mM)^2 \tag{8}$$

In the first term on the R.H.S. of (8), parameter β_1 denotes the marginal damage from unchecked corruption.[17] If, for example, there is a one-to-one correspondence between unchecked corruption and total pollution (i.e. if each corrupt firm, which escapes detection and does not install the green technology, generates one unit of pollution), then

[16] Similar assumptions about the regulating agency's objective function are made by Grieson and Singh (1990), and Bose (1995).
[17] Note that the regulator cares about unchecked corruption rather than total corruption, as her (international) reputation depends on the former and not the latter.

we can also interpret β_1 as the marginal pollution damage. Since greater openness leads to greater international pressure on a government to control corruption (or pollution), we expect the regulator to put more weight on unchecked corruption damage as liberalization progresses and n increases. To capture this idea, we assume that

$$w_1 = \alpha n / N, \tag{9}$$

where $\alpha > 0$ is a constant, and N denotes the total number of goods produced worldwide, i.e. $n \in (n_0, N]$.[18] To reduce notation, we define $\beta \equiv \alpha\beta_1$. In the second term on the R.H.S. of (8), $M - (1-m)\widetilde{M}$ is the total number of compliant firms, which comply with the regulation (i.e. install the green technology) at a cost of c per firm. The third term on the R.H.S. of (8) represents the regulator's quadratic cost of monitoring the mM firms, with δ being the slope of the marginal monitoring cost.

In what follows we consider two versions of the monitoring game. In the first version, analyzed in section 3.1, we assume that the regulator is able to credibly pre-commit to her monitoring frequency, m. Section 3.2 deals with the second version of the monitoring game, where such pre-commitment is not possible. The regulator may find it difficult to pre-commitment because an ex-ante optimal monitoring frequency, chosen by her before the inspectors decide whether to be corrupt or not, will not be ex-post optimal for her to implement, once the inspectors have made their decision. Hence, unless the regulator possesses commitment mechanisms for adhering to announced policies even after they become sub-optimal, her ex-ante monitoring policy will lack credibility with

[18] The lower limit for n is defined in (11).

the inspectors.[19] Finally, in section 3.3, we explain the role of pre-commitment, and further discuss the results obtained in sections 3.1 and 3.2.

3.1 Monitoring with Pre-Commitment

When the regulator can pre-commit to her monitoring frequency, we have a sequential game consisting of the following stages. First, the regulator chooses her monitoring frequency, m, so as to minimize Z. Second, the inspectors decide whether to accept bribes from the firms. Non-bribing firms implement the regulation (i.e. install the green technology). In the third stage, the regulator randomly monitors the firms, and apprehends violators. Firms caught violating the regulation have to pay the penalty P_F (the corresponding inspectors have to pay P_M), as well as implement the regulation.[20]

To derive the subgame perfect Nash equilibrium of this sequential game, we solve it backwards. The solution of the last two stages is given by (5), (6) and (7). While optimally choosing her monitoring frequency in the first stage, the regulator takes into consideration the reaction of the inspectors to any given m, as specified by (7). Substituting (7) and (9) into (8), and minimizing Z with respect to m, we get the optimal monitoring frequency, from the first order condition (FOC), as

$$m^* = \frac{n^\gamma (2c + P)(n/N\, \beta - w_2 c)}{2n^\gamma (c + P)(n/N\, \beta - w_2 c) + \delta \bar{\theta} M} . \tag{10}$$

[19] This issue of time consistency of government policy was first highlighted by Kydland and Prescott (1977), and has been extensively dealt with since then.
[20] In terms of our example, pollution generation, due to production by the non-green firms (i.e. the undetected violators), takes place in a final stage.

To ensure an interior equilibrium, where the regulator chooses a positive monitoring frequency, we assume the following lower limit for n:[21]

$$n > w_2 cN / \beta \equiv n_0 . \tag{11}$$

Then, from (10), we have $m^* < 1$ as $n^\gamma P(\frac{n}{N}\beta - w_2 c) + \delta\bar{\theta}M > 0$. The second order condition (SOC) for minimizing Z is satisfied. Substituting m^* from (10) into (6), we get equilibrium θ^{**} as

$$\theta^{**}_{eqm} = \frac{n^\gamma \{c\delta\bar{\theta}M - n^\gamma P(c+P)(\frac{n}{N}\beta - w_2 c)\}}{2n^\gamma (c+P)(\frac{n}{N}\beta - w_2 c) + \delta\bar{\theta}M} . \tag{12}$$

The effect of liberalization on total (respectively, unchecked) corruption depends on the sign of the derivative of θ^{**}_{eqm} (respectively, $(1-m^*)\theta^{**}_{eqm}$) with respect to n. These derivatives, however, are complicated expressions in terms of the parameters, and cannot be unambiguously signed. Hence, we take recourse to a numerical example, and assume the following parameter values for the remainder of section 3.1:

$$\bar{\theta} = 1,\ N = 100,\ M = 10,\ \gamma = 1,\ c = 0.1,\ \delta = 0.01,\ P = 0.02,\ \beta = 0.2,\ w_2 = 0.1$$

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[21] Recall that $\beta \equiv \alpha\beta_1$. If $n \le w_2 cN / \beta$, weighted marginal corruption damage $(\beta\, n / N)$ will be less than, or equal to, weighted marginal compliance cost $(w_2 c)$, and the regulator will choose not to monitor at all (i.e. $m^* = 0$).

We show that, for these parameter values, the effect of liberalization on corruption is non-monotonic.

Substituting the parameter values into (10), (11) and (12), we have $m^* = \frac{0.22n(0.2n-1)}{0.24n(0.2n-1)+10}$, $n_0 = 5$, and $\theta^{**}_{eqm} = \frac{n\{1-0.0024n(0.2n-1)\}}{0.24n(0.2n-1)+10}$. Note that $0 < m^* < 0.92$ for all $n > 5$, and θ^{**}_{eqm} represents an interior equilibrium for $n < 48.2$. It can be shown that $\partial\theta^{**}_{eqm} / \partial n$ (respectively, $\partial((1-m^*)\theta^{**}_{eqm}) / \partial n$) is greater than, equal to, or less than zero according as n is less than, equal to, or greater than 12.9 (respectively, 9.2). Thus, the impact of liberalization on both total, and unchecked, corruption is described by an inverted-U shaped curve. Proposition 2 follows.

Proposition 2: *When the regulator is able to credibly pre-commit to her monitoring frequency, an increase in economic openness can initially lead to an increase in the level of total (respectively, unchecked) corruption. However, once openness reaches a threshold value (given by n = 12.9 (respectively 9.2)), any further increase in openness can lead to a decrease in the level of total (respectively, unchecked) corruption. A set of sufficient conditions for the existence of such an inverted-U shaped curve is given by our numerical example.*

3.2 Monitoring without Pre-Commitment

When the regulator cannot credibly pre-commit to her monitoring frequency, we have a simultaneous move game, whence the regulator cannot incorporate the inspectors' reaction function while minimizing social cost Z. Instead, the regulator minimizes (8) with respect to m, taking total corruption $(\widetilde{M})$ as given. The FOC gives the regulator's best response as a function of total corruption:

$$m^{**} = \frac{\widetilde{M}(\tfrac{n}{N}\beta - w_2 c)}{\delta M^2}. \tag{13}$$

Again, assumption (11) implies that m^{**} is positive. From (13), we see that monitoring by the regulator is increasing in the level of total corruption.[22] The SOC for minimizing Z is satisfied as $\delta M^2 > 0$. Solving (7) and (13) simultaneously, we get the equilibrium total corruption as

$$\widetilde{M}_{eqm} = \frac{n^{\gamma}\delta c M^2}{n^{\gamma}(c+P)(\tfrac{n}{N}\beta - w_2 c) + \delta\bar{\theta}M}. \tag{14}$$

Differentiating (14) with respect to n, we get

$$\frac{\partial\widetilde{M}_{eqm}}{\partial n} = \frac{n^{\gamma-1}c\delta M^2\{\gamma\delta\bar{\theta}M - n^{\gamma+1}\beta(c+P)/N\}}{\{\delta\bar{\theta}M + n^{\gamma}(c+P)(\tfrac{n}{N}\beta - w_2 c)\}^2}. \tag{15}$$

Thus, $\partial\widetilde{M}_{eqm}/\partial n$ is greater than, equal to, or less than, zero according as n is less than, equal to, or greater than $\left(\frac{\gamma\delta\bar{\theta}MN}{\beta(c+P)}\right)^{\frac{1}{\gamma+1}} \equiv n_2$. Thus we have Proposition 3:

[22] Papers on optimal deterrence, such as Grieson and Singh (1990) and Bose (1995), show this to be the optimal response of regulators in simultaneous move games between potential violators and a regulatory authority.

Proposition 3: *When the regulator cannot credibly pre-commit to her monitoring frequency, an increase in economic openness initially leads to an increase in the level of total corruption. However, once openness reaches a threshold value (*n_2*, as defined above), any further increase in openness leads to a decrease in the level of total corruption.*

In terms of the previously assumed parameter values, $n_2 = 20.4$. Moreover, substituting the parameter values in (11), (13) and (14), we get $n_0 = 5$, $m^{**} = \dfrac{0.1n(0.2n-1)}{0.12n(0.2n-1)+10}$, and $\tilde{M}_{eqm} = \dfrac{10n}{12n(0.2n-1)+10}$. Note that $0 < m^{**} < 0.83$ for all $n > 5$. Moreover, $\tilde{M}_{eqm}$ represents an interior equilibrium for $n < 12$ or $n > 34.6$. Once again, it can be shown that $\partial((1-m^{**})\tilde{M}_{eqm})/\partial n$ is greater than, equal to, or less than zero according as n is less than, equal to, or greater than 13.5. Thus liberalization has a non-monotonic effect on both total and unchecked corruption, as laid out by the following proposition:

Proposition 4: *Suppose the regulator cannot credibly pre-commit to her monitoring frequency, and parameter values are as given in our numerical example. Then, an increase in economic openness within* $5 < n < 12$ *leads to an increase in the level of both total and unchecked corruption. However, any increase in openness beyond* $n > 34.6$ *leads to a decrease in the level of total, and unchecked, corruption.*

3.3 Discussion

The regulator chooses her optimal monitoring frequency to equate the marginal benefit of monitoring (i.e. reduced corruption damage) to the marginal cost (consisting of firms' compliance cost and the regulator's monitoring cost). From (10) and (13), we see that the regulator chooses a positive monitoring frequency as long as weighted marginal corruption damage $(n/_N \beta)$ exceeds weighted marginal compliance cost $(w_2 c)$. When this does not happen (i.e. $n/_N \beta \le w_2 c$) the regulator will choose not to monitor at all (i.e. $m^* = m^{**} = 0$), and both total and unchecked corruptions would equal $\tilde{M}_{max}$ as in section 2. For section 3, however, we exclude this no-monitoring equilibrium by assuming that $n > n_0 \equiv w_2 cN / \beta$.

When the regulator is unable to pre-commit, she chooses her optimal monitoring frequency as the best response to the given level of corruption. To her, the efficacy of monitoring then only lies in increasing the number of detected violators, and decreasing the number of unchecked violators (holding total corruption constant). On the other hand, monitoring under pre-commitment allows the regulator to reduce unchecked corruption both by reducing total corruption (by influencing the inspectors' decision to be corrupt), as well as by increasing detected corruption. Because of this higher marginal benefit of monitoring, the regulator monitors more firms under pre-commitment.[23] Comparing (10) with (13), using (11) and (14), we have

[23] That pre-commitment would result in a higher level of deterrence is also evident from Becker (1968) and Grieson and Singh (1990). Our objective is to show that a non-monotonic relation between liberalization and corruption can exist irrespective of the ability, or otherwise, of the regulator to pre-commit to her monitoring frequency.

$$m^{*} - m^{**} = \frac{n^{\gamma}(c+P)(\tfrac{n}{N}\beta - w_2 c)\{n^{\gamma}P(\tfrac{n}{N}\beta - w_2 c) + \delta\overline{\theta}M\}}{\{n^{\gamma}(c+P)(\tfrac{n}{N}\beta - w_2 c) + \delta\overline{\theta}M\}\{2n^{\gamma}(c+P)(\tfrac{n}{N}\beta - w_2 c) + \delta\overline{\theta}M\}} > 0 \qquad (16)$$

Since (7) shows that higher monitoring leads to lower total corruption, we have the following result:

Proposition 5: *Both total and unchecked corruption are lower, when the regulator is able to credibly pre-commit to her monitoring frequency, than their corresponding values, when the regulator is unable to do so.*

Proof: Follows from (7), (16), and the definition of unchecked corruption, $(1-m)\widetilde{M}$.

In general, in the presence of monitoring by a regulating (anti-corruption) agency, an increase in economic openness has two opposing effects on the corruptible inspectors. There is a “benefit effect” to the inspectors, as bribery becomes a more “desirable” option in the face of greater variety in consumption. As more consumption goods become available, the marginal utility of bribe increases, which induces more inspectors to become corrupt. On the other hand, greater openness also results in greater international pressures on the government to crack down on corruption (or pollution). This raises deterrence activity by the regulator, and the cost of expected penalty to inspectors and firms. This “cost effect” leads to less corruption. When the level of corruption is low, the “benefit effect” exceeds the “cost effect”, and corruption rises with increasing openness. However, when the level of corruption exceeds a threshold, the “cost effect” dominates the “benefit effect”, and corruption decreases with openness. The result is a “Kuznet’s-type curve” in liberalization and corruption.

4. Empirical Evidence

4.1 Strategy and Data

While a comprehensive test of the model is difficult with available data, our objective in this section is to investigative whether there is evidence of a non-linear relation between corruption and liberalization in developing countries, as predicted by our model. As discussed in the introduction, both the “benefit effect” (due to availability of more goods and services) and “cost effect” (due to international pressure to improve quality of governance) of liberalization are likely to be more pronounced in developing rather than developed countries. Hence we restrict our empirical analysis to countries that had a GDP per capita of less than $6000 in purchasing power parity (PPP) terms for the year 2000.[24] The list of countries included in the dataset is given in Appendix 1.

To undertake the empirical investigation we use cross-country data for the various variables. Two key variables in our model are corruption and liberalization. For corruption, we use the “Corruption Perceptions Index” (CPI) compiled by Transparency International for the year 2005.[25] CPI is a subjective index of corruption which relates to “perceptions of the degree of corruption as seen by business people and country

[24] For 2005, the World Bank defined “low income” and “lower middle income” countries as those with Gross National Income per capita of $2,486 and $6,313, in PPP terms, respectively (World Development Indicators database, 2006). Since we are using GDP per capita for 2000, we have chosen $6000 as the cut-off for what we term “developing countries”.
[25] Other studies on corruption such as Bardhan (1997) and Treisman (2000) have reported and used CPI as a measure of corruption. Ades and Di Tella (1999, p.985) have defended the use of subjective indices of corruption for empirical analyses.

analysts". Transparency International has been annually reporting CPI scores for a growing list of countries since 1995. We have modified the scores such that they range from 0 (no corruption) to 10 (highly corrupt).

We use the ratio of import to GDP as a proxy for liberalization. Increasing imports can allow a developing country to increase the number of goods available to it for consumption. Furthermore, in the literature evaluating the determinants of corruption, import to GDP ratio has been used by a number of previous studies as a measure of openness (see Ades and Tella, 1999, Treisman, 2000, and Gatti, 2004 among others). We use data for this variable for the year 2000 available from the *World Development Indicators* (WDI).

GDP per capita has been argued to be another important determinant of the level of corruption.[26] Hence to assess the relationship between import to GDP ratio and corruption, an important control variable for our estimation would be the logarithm of GDP per capita. Data for GDP per capita for the year 2000 is obtained from *Penn World Tables* mark 6.1. In addition, we use the long-term variables provided by Treisman (2000) to control for other institutional features that he argues are important determinants of corruption. The complete list of variables, their description, and their data sources is presented in Appendix 2.

Our dataset consists of 39 countries that had GDP per capita in PPP terms of less that $6000. Table 1 shows the means, standard deviations, and the range for the various variables used in the regressions.

Our basic estimating equation is

[26] Both Ades and Tella (1999) and Treisman (2000) found a negative and significant relationship between corruption and GDP per capita.

$$corr_i = c + \alpha_1 impGDP_i + \alpha_2 impGDPsq_i + \beta X_i + \varepsilon_i, \tag{17}$$

where *i* represents some developing country, *corr* is corruption, *impGDP* is the ratio of import to GDP, *impGDPsq* is the squared value of import to GDP ratio, while *X* represents a vector of control variables and *ε* represents the i.i.d error term. For an inverted-U shaped relationship between *corr* and *impGDP* we would expect $\alpha_1 > 0$ and $\alpha_2 < 0$.

4.2 Regression Results

As a first pass, we do a scatter plot of corruption against the import to GDP ratio, and find an inverted-U relationship between the two variables for developing countries when we fit a quadratic relationship between the two variables (Figure 1).[27] However, to test the predictions our model, we need to control for the level of GDP per capita when assessing the relationship between corruption and liberalization.

Column 1 of Table 2 presents the results where we control for the level of development (logarithm of GDP per capita, *Log(GDPpc)*) when regressing corruption on *impGDP* and *impGDPsq*. The estimated coefficient for *Log(GDPpc)* is negative and significant confirming findings in previous studies that the level of corruption declines as countries develop. While the estimated coefficient for *impGDP* is positive and significant, the estimated coefficient for *impGDPsq* is negative and significant. This confirms that even after controlling for the level of GDP per capita there exists an

[27] In Figure 1, Jordan seems to be an outlier. We get an inverted-U shaped relationship between *corr* and *impGDP* even when we exclude Jordan.

inverted-U shaped relationship between corruption and liberalization. The estimated coefficients for *impGDP* and *impGDPsq* suggest that corruption increases for values of import to GDP ratio of less than 30.23% and decreases thereafter. This is in line with the prediction of our model that as countries liberalize corruption would first increase (when the "benefit effect" dominates the "cost effect" of liberalization) before reversing direction.

To check the robustness of our result, we incorporate the long-term variables provided by Treisman (2000) that he argues are important determinants of corruption.[28] Column 2 of Table 2 presents the regression result and corresponds to regression 4 in Table 3 of Treisman (2000, p.417). The number of observations reduces from 39 to 30 when matching the two datasets. Even after controlling for all the long-term variables, although weaker in significance, we still find an inverted U-shaped relationship between corruption and the import to GDP ratio.[29]

The weaker result for the relationship between corruption and trade liberalization when all the long-term variables are included is perhaps due to the small number of observations. A way to increase the degrees of freedom for the regression would be to drop variables whose estimated coefficients are insignificant for regression 2 (democracy and federal are both significant at 10%). In addition, based on Treisman's finding that the percentage of Protestants in the population is an important determinant of corruption, we include *protestant* and control for *Log(GDPpc)* for regression 3. The results are presented in Column 3 of Table 2. The estimated coefficients for *impGDP* and *impGDPsq* are both

[28] We updated Treisman's data on the fuels, minerals and metals as a percentage of merchandise exports ("fuel") variable by using data for 2000 from the WDI. The other control variables in the Treisman data are long-term variables, and are unlikely to be affected over a few years.
[29] Estimated coefficient for impGDP is significant at 14% level of significance, while impGDPsq is significant at 7% level of significance.

significant at 2% level of significance and suggest that corruption first rises and then falls as the ratio of import to GDP increases. This result provides another robustness check for the inverted U-shaped relation between our variables of interest.

To retrieve results similar to previous work in this area, we drop *impGDPsq* as a regressor and rerun regression 3 (results reported in Column 4 of Table 2). The sign of the estimated coefficient for *impGDP* is negative and significant, confirming the findings of others (e.g. Ades and Di Tella, 1999, Treisman, 2000, and Gatti, 2004) who found the overall (linear) relation between corruption and import to GDP ratio to be negative. However, R^2 falls from 55% to 39% as a result of dropping *impGDPsq*, highlighting the explanatory power of this variable. This suggests that there can be significant non-linearities behind the overall negative relationship between liberalization and corruption in developing countries.

To see if similar non-linearities exist for "developed countries" (i.e. those with GDP per capita more than $6000 in PPP terms for the year 2000) as well, we ran regression 3 using data only for developed countries. Column 5 of Table 2 reports the results. We find that import to GDP ratio is not a significant determinant of corruption in such countries. This perhaps reflects that fact that the "benefit effect" and the "cost effect" of liberalization are less pronounced in developed countries. The estimated coefficient for the *protestant* variable, however, is now negative and significant, paralleling the findings of Treisman (2000).

5. Conclusion

We have shown that an "inverted-U" or a "Kutznet's-type curve" can describe the incidence of bureaucratic corruption that accompanies increased levels of openness and globalization in developing countries. This result was derived analytically for total corruption when the regulator is unable to pre-commit (Proposition 3), and numerically for the other cases (Propositions 2 and 4). Moreover, the regulator's ability to credibly pre-commit to deterrence activities is shown to have a detrimental effect on corruption (Proposition 5).

It should be pointed out that if liberalization decreased (increased) profitability in *some* sectors of the economy, it would decrease (increase) the willingness of firms in those sectors to pay a bribe, and thus decrease (increase) corruption only among public officials enforcing regulations in those sectors. We, however, did not model this obvious link between liberalization and corruption. In our model, the positive effect of liberalization on corruption comes through another, less obvious, channel: the higher willingness of all officials, enforcing regulations in *all* sectors of the economy, to accept a bribe (Proposition 1). Thus, our result suggests that the impact of liberalization on corruption will be sectorally more widespread than what is suggested by the obvious channel.

Empirically we found evidence among developing countries that support the principal prediction of our model. Increase in import to GDP ratio, up to the threshold value of 30.2%, was found to increase perceived corruption in such countries. Increase in import to GDP ratio beyond this threshold resulted in decreased corruption. No such relation was, however, found in developed countries.

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Figure 1: Corruption vs. Import to GDP ratio across Developing Countries

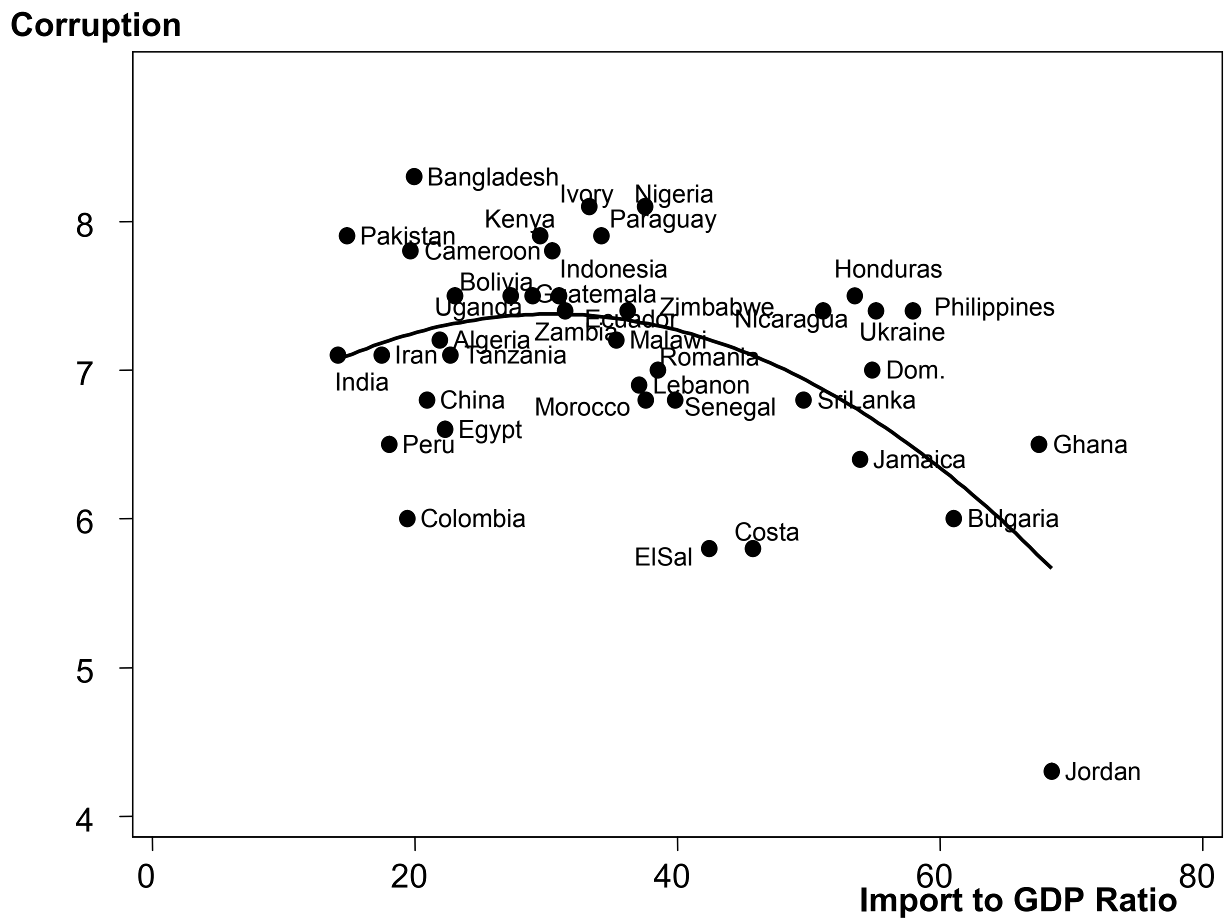

TABLE 1: Summary Statistics for Developing Countries

Variable	N	Mean	Standard Deviation	Range
Corr	39	7.08	0.78	4
impGDP(%)	39	36.00	15.13	54.38
Log GDP per capita	39	7.90	0.66	2.52
Law	39	0.33	0.48	1
Colony	39	0.38	0.49	1
Protestant	39	7.36	11.91	55.5
Entho	33	52.45	31.42	89
Fuel	37	17.17	27.54	99.59
Democracy	39	0.05	0.22	1
Federalism	36	0.08	0.28	1

TABLE 2: Regression Results
Dependent variable: Corruption

	Developing Countries				Developed Countries
	(1)	(2)	(3)	(4)	(5)
Log(GDPpc)	-0.4016*	-0.1455	-0.3188***	-0.371***	-2.431*
	(0.1539)	(0.3065)	(0.1765)	(0.202)	(0.576)
ImportGDP	0.0665***	0.0730	0.0954*	-0.020**	-0.009
	(0.0362)	(0.0468)	(0.0361)	(0.008)	(0.023)
ImportGDPsq	-0.0011**	-0.0011***	-0.0014*		3.44E-05
	(0.0004)	(0.0006)	(0.0004)		(1.65E-04)
Law		0.2685			
		(0.7695)			
Colony		-0.6798			
		(0.5466)			
Protestant		0.0092	0.0015	0.002	-0.021*
		(0.0154)	(0.0094)	(0.011)	(0.007)
Ethno		0.0092			
		(0.0056)			
Fuel		-0.0028			
		(0.0045)			
Democracy		-0.9083***	-0.7984***	-0.797	-0.797
		(0.5060)	(0.4648)	(0.534)	(0.611)
Federal		0.9383***	0.7836***	0.425	0.170
		(0.5100)	(0.4276)	(0.475)	(0.383)
Constant	9.5039*	6.9072**	8.2698*	10.698*	28.080*
	(1.392)	(3.137)	(1.611)	(1.643)	(5.520)
R^2	0.4110	0.6795	0.5516	0.3867	0.8019
N	39	30	36	36	43

Note:
Standard errors are in parenthesis. * , ** and *** indicate significance at 1%, 5% and 10% levels, respectively.

APPENDIX 1: List of Countries in dataset

Algeria	Bangladesh	Bolivia
Bulgaria	Cameroon	China
Colombia	Costa Rica	Dominican Republic
Ecuador	Egypt	El Salvador
Ghana	Guatemala	Honduras
India	Indonesia	Iran
Ivory Coast	Jamaica	Jordan
Kenya	Lebanon	Malawi
Morocco	Nicaragua	Nigeria
Pakistan	Paraguay	Peru
Philippines	Romania	Senegal
Sri Lanka	Tanzania	Uganda
Ukraine	Zambia	Zimbabwe

APPENDIX 2: Variable definitions and their data sources

Variable	Description and Data Source
Corruption	"Corruption Perceptions Index" in 2005. The modified score ranges from 0 (no corruption) to 10 (highly corrupt). Source: *Transparency International*.
GDPpc	Real GDP per capita measured in purchasing power parity terms in 2000. Source: *Penn World Tables Mark 6.1*
ImportGDP	Import to GDP ratio in 2000. Source: *World Development Indicators*
Law	Dummy for common law system. Source: *Treisman (2000)*
Colony	Dummy for former British colony. Source: *Treisman (2000)*
Protestant	Percentage of population professing Protestant faith. Source: *Treisman (2000)*
Ethno	Probability that two randomly selected individuals will not belong to the same ethno-linguistic group as of 1960. Source: *Treisman (2000)*
Fuel	Fraction of total merchandise exports composed of fuels, minerals and metals in 2000. Source: *World Development Indicators*
Democracy	Dummy for democracy. A country is democratic based on the criteria developed by Alvarez (1996). Source: *Treisman (2000)*
Federal	Federal state. Source: *Treisman (2000)*