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## Microeconomics of corruption among developing economies

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**Microeconomics of Corruption Among Developing Economies**

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Working Paper No: 2011-01

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## Microeconomics of Corruption Among Developing Economies

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### **Abstract**

A simple micro model of a firm's investment decision made under the uncertainty of the success of a bribe of a government official is developed. The probability of success of the bribe is a function of the amount paid to the official to "get things done." The operational model runs the amount of the bribe on such determinants as firm size, country size, shareholder ownership, political instability, and court system. The data covers the periods 2002-2005 and 2006-2010, includes 150 developing countries and has data on some 72,000 firms. Several econometric estimation methods were used. The findings support earlier studies, to wit, firm size and country size are inversely related to the index of corruption. Political instability and the court system were positively related to corruption. Policy implications of the findings are discussed.

Keywords: Firm, Corruption, Uncertainty, Developing Countries

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### **1. Introduction**

Bribing government officials to “get things done” is rampant among firms in all developing economies. This is not to say that bribes do not exist in developed economies. They do, but this paper focuses on the developing economies. Bribing government officials occurs at all levels and phases of government such as licenses and permits, regulations, tax reporting, utility connections (water, electric, and telephone) and similar business involvements. Bribes are not limited to just domestic businesses. Foreign multinational firms also use bribes to “get things done” and to lower the risk of their foreign direct investments. The firm data used ultimately in the present paper does distinguish between domestic and foreign owned firms. I focus on the domestic firms (which have less missing values), but there is a data point dealing with the percent of ownership of the domestic firm by a foreign investor.

At issue in this paper is the development of a simple micro model of a firm’s investment decision under the uncertainty of the success of a bribe. The probability of success of a bribe is controlled by the firm’s bribe expenditure (or cost). The firm by spending (investing as it were in bribes) on bribes creates a climate or atmosphere of what I call “bribe acceptability” on the part of government officials. The more lavish the bribe, the more acceptability and the higher in the eyes of the firm is the probability of success of the bribe. The micro model is used later as a motivator to examine the micro data on bribes across some 150 developing economies involving interviews with some 43,707 to 71,789 firms, depending on the data set used.

The classical economic approach to the microeconomics of corruption (or bribery) as simplified by Menezes (2000, and the literature cited therein) and before him by Becker (1968), Becker and Stigler (1968), and Rose-Ackerman (1975, 1978), takes a buyer (government official)-seller (firm) approach involving specific types of information (like prices, quantities, quality, bribes, probability, profit gains, and penalties if caught). Closer to the micro approach used in the present paper is the study by Ades and Di Tella (1999) which focuses on the individual firm and the role of its market structure (competition) in affecting the amount of corruption engaged in. Their perspective was from the opposite side of the corruption problem as studied by Rose-Ackerman (1978 and 1999), who examined competition among government officials. A related cross-country (59 developed and developing countries) study by Fisman and Gatti (2002) looks at the relationship between corruption and government decentralization (state and local versus central). A very recent macro study by Méon and Weill (2010) examines the effect of corruption on country productivity based on the quality of government institutions. Although not a regression study as is the present paper, Hellman, et al. (2000) questioned some 3,000 firms in 20 developing countries (with the exception of Russia) to obtain responses for several profiles of corruption across countries. Their corruption-type questions are similar to those used in the Enterprise Surveys, The World Bank Group (2010) to obtain the data used in the present paper. More on the data will be forthcoming shortly.

In what follows, the next section develops a simple, uncertainty, firm model using game theory principles. Then, the following section describes in detail the sample data, the operational models, and the econometric results. The final section has a summary and some conclusions.

## **2. A Simple Uncertainty Firm Model**

The present model is an adaptation of a similar model by Gander (2007) and is close in spirit to Ades and Di Tella (1999)'s approach.

The firm's profit function is assumed to have two positions, one reflecting a successful bribe where all things are "done" right (licenses, permits, regulations relaxed, taxes relaxed, and all utilities connected in time) and one reflecting a failed bribe where all things do not get "done." The probability of a successful bribe is given by  $P$  and a failed bribe by  $(1 - P)$ . Given the climate of "bribe acceptability" as indexed here by Beta,  $\beta$ , the probability as perceived by the firm is determined by  $\beta$ . It is assumed that the firm can control this climate by its bribe expenditures given simply by  $\beta$ . The probability function,  $P(\beta)$ , is for heuristic purposes and to obtain an optimizing model assumed to have a maximum where  $\partial P(\beta)/\partial \beta = 0$ ,  $P < 1$ , and  $\partial^2 P(\beta)/\partial \beta^2 < 0$ .

For a given  $\beta$ , the expected profit function can be given by

$$(1) \quad E\pi = P(\beta)\pi_s(K) + (1-P(\beta))\pi_f(K),$$

where net profit (suppressing all other inputs except capital,  $K$ ) when all things are done right is given by  $\pi_s(K) = \text{Gross Profit} - \beta$  and net profit when all things are not done right is given by  $\pi_f(K) = \text{Gross Profit} - \beta$ . The model solution can be given by a two-stage approach. In the first stage, the optimum  $\beta^*$  is determined independently by  $\partial P(\beta)/\partial \beta = 0$ . Then, with  $\beta^*$  given, function (1) is optimized where  $\partial E\pi/\partial K = 0$ . A simpler approach is to assume that the optimum  $K^*$  is given exogenously and independent of the function,  $P(\beta)$ . The expected profit function based on  $\beta$  can be given by

$$(2) \quad E\pi(\beta) = P(\beta)\pi_s(K^*) + (1-P(\beta))\pi_f(K^*).$$

Function (2) is optimized where  $\partial P(\beta)/\partial \beta = [\pi_s(K^*) - \pi_f(K^*)][\partial P(\beta)/\partial \beta] = 0$ . The more realistic case but more complicated (and not considered here) is to assume that the probability function

depends on  $\beta$  and  $K$ ,  $P(\beta, K)$ , with  $\beta$  positively related to  $P$ , as before, but with  $K$  either positively or negatively related to  $P$ , depending on the nature of the bribery situation. A large investment,  $K$ , may only require a relatively low maximum  $P$ , whereas a small investment may require a high maximum  $P$  to make the bribery deal worthwhile.

Implicitly, based on function (2), given some measure of corruption,  $\beta = F(K, \dots)$ . In the next section, this function is made operational for the econometric study.

### **3. Sample Data, Operational Models, and Econometric Results**

#### *3.1 Sample Data Description*

The sample data consist of two sets of data, one covering the 2002-2005 time period and the other covering the 2006-2010 time period. Both time sets were produced by face-to-face personal interviews with company officials using a standard set of questions for each interview. The defense of the survey technique to gather data on corruption is discussed by Reinikka and Svensson (2006). The data are contained in the Enterprise Surveys, conducted by private contractors for the World Bank Group and are available on the web site of the World Bank (2010).

Each company, establishment, business, enterprise, or firm was interviewed only once for a given country and given year. There are 150 developing countries involving some 43,707 to 71,789 firms, depending on the time period. There are no time repeats for a given firm. Each interview is unique unto itself by country, by year, and by industrial sector. Since each firm interview has its own identification (*idstd*), panel data analysis based on firms is not useful for the number of firms equals exactly the number of groups (panels). Because of the unique way the data is produced and organized, robust standard least squares (OLS), fixed- and random-effects GLS regressions and robust logit analysis were feasible (time series and firm panel

analysis methods were not possible). It is noted that while the surveys consisted of several hundred questions, only those relevant to analyzing corruption and feasible for statistical analysis were selected. It is also noted that for some combination of variables, there are a large number of missing values. The sample sizes in the tables to follow reflect this.

### 3.2 Operational Model

The general operational model is given by

$$(3) \quad \text{CORR} = a + b_1 * \text{Size} + b_2 * \text{year} + b_3 * X + e,$$

where depending on the data set, the dependent variable, CORR, at the firm level is indexed by the percent of sales used for unofficial gifts/payments to government officials to “get things done,” coded either by j7a for the 2006-2010 period or c239 for the 2002-2005 period. This firm-level index is more direct and up-to-date than the frequently used country-level averages of corruption such as the *International Country Risk Guide's (ICRG)* corruption index (See, for example, Fisman and Gatti, 2002). Throughout this paper, the actual codes used in the data sets are used to facilitate future research using the sets. In some cases, the name itself is used, like with size and income. The size variable for the firm for the 2006-2010 data set is based on employment (small < 20, medium 20 to 99, and large > 100. coded 1, 2, and 3). The income size for the 2002-2005 data set is for the country wherein the firm resides and is coded by rankings given by the World Bank (low, lower-medium, upper-medium, high, and high-oecd, coded 1, 2, 3, 4, and 5). The country income size classes are rankings which are based on absolute values and, therefore, comparable across countries. Actual firm size is based on employment as explained below. Country size serves as a control variable to see if corruption for a given firm is affected by the size of the country. The variable year is coded a14y for the 2006-2010 period and simply year for the earlier period. The e is the error term.



The X's vary with the data set. For the 2006-2010 data set independent variables include, b3 (percent of firm owned by the largest shareholder), j2 (percent of senior management time spent on government regulations), j30e (political instability as an obstacle to current operations—no obstacle to very severe coded 0 to 4), h7a (court system is fair, impartial, and uncorrupted—strongly disagree to strongly agree coded 1 to 4), and a7 (establishment is part of a large firm, coded yes=1 with 6,000 observations and no = 2 with 37,000 observations so establishment and firm are the same). This last variable is used to select the domestic firms used in the regressions. The j12 variable (informal gift requested when applying for an import license coded yes = 1 and no = 2) is used as the dependent variable in the logit analysis. While there are many variables with a large number of missing values, the actual regression samples are still relatively large.

The X's for the 2002-2005 data set represent a similar set of survey questions but they use different variable labels. As indicated earlier, the dependent variable is given by c239 and the country size and year variables are given by income and year respectively. The X's include ownership (a value of 1 for foreign and 2 for domestic, used to select the domestic firms), c203b (percent of firm owned by the foreign private sector), c203c (percent of firm owned by the government/state), c205a (percent owned by the largest shareholder), c238 (percent of senior management's time dealing with government regulations), c206a (number of operating facilities by firm in the given country—a surrogate for firm size), and c262a1y (average number of permanent employees one year previous to interview—also a surrogate for firm size). The variable c242d1 (gift/payment requested by tax inspector, coded yes = 1 and no = 2) is used in the logit analysis as the dependent variable..

The logit regression model is similar to equation (3) as to the X's. The dependent variable is j12 for the 2006-2010 period and c242d1 for the 2002-2005 period. In both cases since the original data values were coded 1 and 2, they were converted to 1 and 0 (yes and no) to run the logit regression. The maximum likelihood estimation (MLE) method is used to estimate the coefficients of the logit model.

It is noted that with the large number of variables available and the many variables with large missing values, the best judgment was brought to bear on what variables were used and how they were used statistically. All runs were by STATA V9 and V10. Future researchers may use other variables and use them in a different way. So be it! The econometric results are presented in the tables to follow.

### *3.3 Econometric Results*

The present study as indicated before is micro and uses the latest data available. As such it is difficult to make a direct comparison to all the variables in the Ades and Di Tella (1999) study which is macro and uses a variety of data sources from much earlier time periods (1980-83 and 1989-90). Relatively close are h7a (court system ...) and j30e (political instability ...) to their POL variable. These two variables occur in the 2006-2010 data set. Also, country income size and their GDP variable are comparable "level of development" variables. The country size variable occurs in the 2002-2005 data set.

The econometric results in Table 1 for the 2002-2005 period are based on robust OLS, FE, RE, and logistic regression and represent the best judgment as to choice of variables and estimating methods. The basic robust OLS coefficients are all highly significant with the one exception, the coefficient for c203b (foreign investors). The two firm-size proxies have negative coefficients, indicating that large firms have relatively less corruption (percent of sales used for

unofficial gifts and payments to “get things done.”). The key here is the word “relative.”

While this falls as firm size increases, the absolute amount of gifts and payments very likely increases, although the data set will not allow a verification of this conjecture.

A negative coefficient for the year variable indicates that over time, corruption has fallen for the early period. The same results were observed for the recent data set to be reported on shortly. The coefficients for the year variable were not significant in any of the other estimation methods for either data set. Also, as indicated earlier, the same firm is not interviewed repeatedly over the years, so changes over the years could be the result of many factors, including changes in interviewing techniques as well as different firms.

Government ownership of the firm (c203c) is inversely related to corruption as expected. Shareholder ownership (c205a) is positively related to corruption, as expected. Management time (c238) spent dealing with government regulations is positively related to corruption, as expected. Country size (income), comparable to Ades and Di Tella’s (1999) level of development is inversely related to corruption. This micro result is consistent with their macro findings.

The FE and RE results (using country as the panel or group variable) are generally consistent with the basic OLS results, although a few coefficients are not significant.

A robust logit regression was used with c242d1 (gifts and payments requested by the tax inspector, yes=1 and no=0) as the index of corruption (other similar indexes did not work as well). The significant and negative coefficient for firm size (c2621y) indicates that the log of the odds ( $P/1-P$ ) of corruption will fall as firm size increases. The odds ratio itself can be recovered by calculating  $OR = \text{EXP} * b_i$ . The inverse response is not as expected, although on second

thought, small firms are more “at the mercy” of the tax inspector and, therefore, are more likely to seek tax breaks by bribery.

The remaining variables in the logit model produce results consistent with the basic OLS results. The log of the odds of corruption ( $P/1-P$ ) falls as the percent of government owned firms (c203c) increases, as expected. The log of the odds of corruption increases as the percent of ownership by the largest shareholder (c205a) increases, as expected. A similar log response is found for the percent of senior management time spent dealing with government regulations (c238), as expected. The log of the odds of corruption falls as the income size of the country increases, as found by Ales and Di Tella (1999).

The econometric results in Table 2 for the 2006-2010 period are based on the same methods of estimation as used for the results in Table 1. The coefficients for the robust basic OLS regression are all significant and sign-wise match the previous results. The two variables not in the previous results, j30e (political instability ...) and h7a (court system ...), match Ales and Di Tella’s (1999) political rights variable (POL). While they found unexpected results, the less freedom, the less corruption!, the present results show that as political instability increased, corruption also increased, as expected. What was unexpected is the negative sign for the coefficient h7a (court system ...), indicating that the more fair the court system is, the more corruption there is! In other words, the better is the judicial system of a country, the more corruption there is. In some strange way, a better judicial system tolerates more corruption. It is as if more corruption is needed rather than less to get around a better judicial system that stands as an obstacle to corruption. “The tougher the police, the tougher the criminals have to be.”

The FE and RE results (again using country as the panel) for those coefficients that are significant (firm size, b3, j30e, j2 and h7a) are consistent in sign and magnitude with the basic OLS results. No surprises occur.

The robust logit regression analysis was feasible for two variables, size and court system. The other variables were either not significant or had too many missing values. The significant coefficient for firm size has the usual negative sign, indicating that as firm size increases, the log of the odds ( $P/1-P$ ) of corruption decreases, as expected. Again, the odds ratio can be recovered as explained earlier. The significant coefficient for h7a (court system ...) has a negative sign, which is the opposite from the basic OLS results. The logit results indicate that as the court system improves, the log of the odds of corruption falls, as one would hope. The difference between the two results may be due partly to the model specification, one using the amount of spending on bribery (the Beta in the theory section) and one using the odds of bribery (from the P in the theory section). It is entirely possible for these two responses to move in the opposite direction. More has to be spent but this does not necessarily increase the odds of success. The increased amount spent to get around the improved court system may not in itself be sufficient to also increase the odds of success.

#### **4. Summary and Conclusions**

A simple micro model of a firm's investment decision made under the uncertainty of the success of a bribe of government officials to "get things done" was developed. The probability of the success of a bribe was made a function of the amount spent on gifts and payments to government officials. The model was then used to motivate an operational model relating an index of corruption to various determinants (or causes) of the amount of corruption such as firm size, country size, top shareholder ownership, political instability, court system, domestic

ownership, and government ownership. The data were from the Enterprise Surveys by The World Bank Group (2010). Two sets of data were used, one for 2002-2005 and one for 2006-2010.

The econometric results were based on the two time periods using several methods of estimation. Only the main findings are summarized here. For the “percent of sales used for unofficial gifts and payments to government officials” used as an index of corruption, it was found, among other findings, that firm size, country size, and time were inversely related to corruption for the earlier data set and firm size and time only for the recent data set. It was also found that the “percent owned by the largest shareholder” was positively related to corruption for both data sets. It was further found for the recent data set that “political instability” and the “court system” were positively related to corruption. Using logit analysis with a yes/no (1,0) index of corruption, it was found among other findings that firm size and country size were inversely related to the log of the odds of the corruption index for the earlier data set and firm size only for the recent data set.

The present analysis provides additional insights into the causes of corruption, using the most recent data available at the firm level. Some conclusions are at odds with certain developing country policies and processes. For example, the negative effect of firm size on corruption may be at odds with an anti-trust industry policy aimed at limiting the size of the firm. The same might be said for limiting shareholder ownership, so there is more diffusion and investor competition. Also, more government ownership of firms is at odds with developing country policy efforts to encourage more private domestic ownership. Efforts to improve the court system (with the hope of reducing corruption) are at odds with the level of corruption, yet, on the other hand, such improvement was found to reduce the odds of corruption. Such an

inconsistence makes for difficult policy decisions on the part of developing countries.

Reducing the odds of a successful bribe, may not curtail the amount spent on a bribe. Much depends on the firm's risk attitude and its history of bribery.

A possible policy implication of the "year" results is that over time it appears that developing countries are bring under control the practice of corruption to "get things done," at least among domestic firms. To elaborate briefly, as domestic markets and relevant institutions develop and become more efficient and transparent, many of the business "services" formerly realized by practicing corruption will now be supplied at a price by other firms (for example, brokers and lobbyists). The cost to "get things done" will become more institutionalized and transparent, so, for example, the firm's cost of obtaining a speedy utility connection (electric, water, and telephone) will be internalized into the price of the connection and subject to competitive market forces. Such market developments over time should also benefit foreign owned firms and reduce the practice of corruption among them. In any case, such policy issues are left for future research.

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Also, [www.enterprisesurveys.org/Portal/unprotected/RegisterExternal.aspx?LibId-14](http://www.enterprisesurveys.org/Portal/unprotected/RegisterExternal.aspx?LibId-14)

Table 1. Econometric Results for Earlier Period				
2002-2005				
Dep Var	c239 (% of sales to G/P)			c242d1
Variable	OLS	FE	RE	Logit
constant	324	.919	342	-.007
	(8.32)	(9.49)	(1.65)*	(- 0.13)*
c206a (# establishments per firm)	-.001	-.0005	-.0005	
	(-4.76)	(-1.14)*	(- 2.19)	
c262a1y (# of employees)	-.0002	-.0001	-.0001	-.0001
	(-3.13)	(-2.03)	(-2.30)	(-2.92)
Year	-.161		-.169	
	(-8.28)		(-1.64)*	
c203b (% owned by foreign investors)	.086	.106	.104	
	(1.00)*	(1.27)*	(1.33)*	
c203c (% owned by government)	-.011	-.010	-.010	-.0038
	(-16.10)	(-8.40)	(-15.44)	(-6.42)
c205a (% owned by top shareholder)	.0037	.0017	.0018	.0035
	(4.28)	(1.65)*	(2.13)	(6.65)
c238 (% management time on gov reg)	.049	.042	.043	.006
	(9.19)	(7.64)	(8.08)	(5.30)
income (size of country)	-.370		-.488	-.333
	(-22.93)		(-4.22)	(-24.43)
Sample n	21,306	21,306	21,306	21,211
# of groups (country panels)		94	94	
R-square	.058	19.75(F)	358(W)	732(W)

Notes: The \* indicates not significant,  $p > .05$ . The (.) has t or z, 23 out of 31 are significant,  $p = < .05$ , many with  $p = .000$ . All firms are domestic. The F or W statistic depends on the run. The c242d1 is a yes/no index of corruption relating to G/P requested by tax inspector.

Table 2. Econometric Results for Later Period				
2006-2010				
Dep Var	j7a (% of sales to G/P)			j12
Variable	OLS	FE	RE	Logit
constant	.5015	-.495	.647	-1.844
	(10.52)	(-0.76)*	(1.01)*	(-13.86)
Size (# of employees)	-.650	-.593	-.600	-.129
	(-5.05)	(-2.79)	(-3.46)	(-1.99)
a14y (year)	-2.496			
	(-10.51)			
b3 (% owned by top shareholder)	.014	.010	.012	
	(4.75)	(2.45)	(3.05)	
j30e (political instability)	.169	.185	.104	
	(3.53)	(2.55)	(1.10)*	
j2 (% management time on gov reg)	.024	.035	.036	
	(3.46)	(1.82)*	(2.63)	
h7a (court system)	.1000	.036	.057	-.056
	(4.75)	(0.74)*	(1.47)*	(-4.17)
Sample n	4,341	2,719	2,719	4,411
# of groups (country panels)		82	82	
R-square	.081	9.98(F)	31.7(W)	22.93(W)

Notes: The \* indicates not significant,  $p > .05$ . The (.) has t or z, 16 out of 22 are significant,  $p = < .05$ , many with  $p = .000$ . All firms are domestic. The F or W statistic depends on the run. The j12 is a yes/no index of corruption relating to request for G/P when applying for an import license.