DEPARTMENT OF ECONOMICS WORKING PAPER SERIES

Macroeconomic Analysis of Corruption in Developing Economies

James P. Gander

Working Paper No: 2011-02

University of Utah
Department of Economics
260 S. Central Campus Dr., Rm. 343
Tel: (801) 581-7481
Fax: (801) 585-5649
http://www.econ.utah.edu

Macroeconomic Analysis of Corruption Among Developing Countries

By James P. Gander*

*Professor Emeritus, Economics Department, University of Utah, Salt Lake City, UT 84112-9300, USA, 801-581-7481, gander@economics.utah.edu

Summary. Based on empirical data, a two-equation game-type corruption reaction function model was developed. A "data to model" approach was used rather than the usual *a priori* approach. The general hypothesis tested was the "monkey see, monkey do" principle. The latest data on corruption among developing countries was obtained from the Enterprise Surveys done by the World Bank Group in 2010. The key variables were the percent of domestic firms expecting to make informal payment to public officials to "get things done," and the percent of foreign firms doing like wise. The time span is from 2002-2010. A variety of econometric methods were used.

In general, the statistical results were quite good and supported the hypothesis. Both reaction equations were positively sloped. Time had a reducing effect on the frequency of domestic corruption, yet it had an increasing effect on foreign corruption. Variations in the frequency of corruption across regions of countries were generally not significant.

JEL Classification: C51; D81; E60; K49; M29

Keywords: Firm, Corruption, Game Model, Developing Countries

January 2011

Macroeconomic Analysis of Corruption in Developing Countries

By James P. Gander

Introduction

In the true spirit of positive economics, I examine the most recent data on corruption in developing countries, using a few and very simple assumptions (not always made explicit). My intention is to use what data are available and to see essentially what the data is telling us about corruption. I do not ignore altogether the need and usefulness of an *a priori* modeling approach as a basis for forming the hypotheses of the positive (*posterior)* empirical approach. But, the modeling exercise is strictly idealistic in the sense that it serves more to orient the empirical work rather than to capture exactly any real world corruption behavior.

The literature on the economics of corruption is extensive. I only give a brief survey here, which admittedly does not do justice to it. Nevertheless, my main concerns are with what data is available and what does it tell us about corruption. I very much let the facts (so called) speak for themselves or more precisely let the selected facts speak for themselves, where the selection is not based on *a priori* reasoning but is based on *posterior* reasoning (from the data to the model, rather than the reverse). The literature very much goes from the model to the data.

To summarize briefly, 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 *a priori* approach is the study by Ades and Di Tella (1999) which first focuses on the individual firm and the role of its market structure (competition) in affecting the amount of corruption engaged in and then turns to the macro data. Another interesting study from the supply side of corruption is Rose-Ackerman (1978 and 1999)'s studies, which examine competition among government officials. 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 descriptive-type profiles of corruption across countries. Their corruption-type questions are similar to those used for the data of the present paper.

In what follows, a simple game theory-type model based on positive *posterior* reasoning is developed in the next section. Then, the econometric models are presented and the data are explained in the following section. The empirical (statistical) results are then presented in the next section. The final section contains a summary and conclusions.

A Simple Game-Type Model

In keeping with the spirit of simplicity, I define two game-type reaction functions, $Y_1 = F_1(Y_2 , t, X)$ and $Y_2 = F_2(Y_1 , t, X)$, both assumed to be linear in form and positively sloped with $F_1(Y_2 , t, X)$ steeper than $F_2(Y_1 , t, X)$. The Y's are indexes of corruption at the country level, t is time (year), and X represents other variables (see, Figure 1 for an illustration). Further, for a given country and year, let Y_1 be the percent of domestically owned firms surveyed responding (yes or no) to the question, "Do you

expected to pay informal payment to public (government) officials?". Similarly, for the same country and year, let Y_2 be the percent of foreign owned firms responding (yes or no) to the same question.

The idea behind the notion of a reaction is that domestic firms see foreign firms engaging in corruption and they decide to do likewise. And, the foreign firms see domestic firms engaging in corruption, and they decide to do likewise. The "if you do it, I will do it" reaction results in a two-way interaction, following the somewhat arcane principle, "monkey see, monkey do." As the percent of yes responses increases for one type of ownership, the percent of yes responses increases for the other type of ownership.

A static equilibrium occurs where the two reaction functions intersect (see, Figure 1). The equilibrium is assumed to exist, be unique, and stable). Over time, the functions may shift and also shift as the X changes. As a result of the shifting, new equilibria are generated. The changing equilibrium corresponds to the real world data on the corruption behavior for a given country. Of course, since the data are based on personal surveys, there may be random response errors. As discussed later, the averaging of the data will minimize this problem.

From the previous discussion on *a priori* versus *posterior* approach, it is important to remember that the game is constructed from the available data on corruption. The modeling exercise itself simply adds a little formality and analytics to what is being measured. The econometric models and estimates thereof add quantitative precision to the exercise and hopefully this addition will serve as a forecasting tool for policy analysis.

Data and Econometric Models

Data: The data come from the Enterprise Surveys of the World Bank Group (2010). The surveys cover some 125 countries (all developing countries with a few exceptions which were deleted for this study) and more than 120,000 firms over the years 2002-2010. Of all the many questions in the surveys, the two questions that are relevant for this study were the responses to the public payment question and firm ownership question discussed earlier. The individual firm responses for a given country, ownership type, and year were aggregated across firms to arrive at a macro average in percent. For example, for Zambia for 2002, 50 percent of the domestic firms surveyed responded "yes" to the corruption payment question. There are many gaps in the time series and cross sections of the data. A given country may have data for only one, two, three, or at most four years. The countries can be treated as individual panels. To preserve degrees of freedom, the countries were also regrouped into regions following the United Nations Conference on Trade and Development guidelines. As such, Africa was coded 1, Latin America and the Caribbean were coded 2, Asia and Oceania were coded 3, and countries transitioning to developed status were coded 4. Thus, there are four panels. This grouping is also used to construct dummy variables. Treating the countries as individual panels resulted in 102 panels due to missing values. Using fewer panels results in multiple time periods within a given panel. For example, Africa = 1 includes Morocco for 2007 and South Africa also for 2007 and several other countries for 2007.

Econometric Models: Let Y_1 be labeled Domestic (DOM for short as shown in Figure 1) and Y_2 be labeled Foreign (FOR for short). The t is labeled year. These are the labels used in the Enterprise Surveys data files. The X represents the three regional dummy variables where DVA is for Africa, DVL is for Latin America and the Caribbean,

and DVO is for Asia and Oceania. The DVT is for the transition countries and is the reference group. The two-equation basic econometric model is given by

(1) DOM = a + b1*FOR + b2*year + b3*DVA + b4*DVL + b5*DVO + e

FOR = A + B1*DOM + B2*year + B3*DVA + B4*DVL + B5*DVO + e',

where the e's are the error terms. A log form of (1) is also specified. The Seemingly Unrelated Regression (SUR) method is used to estimate the parameters of (1) and its log form. Different combinations of the variables are run. Also, a single equation model using the first equation in (1) is run using various combinations of the right-side variables and various estimating methods (such as, fixed effects, random effects, panel and time series analysis, and straight forward linear regression, all methods employing robust standard errors.) The next section will discuss the statistical results.

Statistical Results

As indicated above, various combinations of variables and various estimating methods were used. Not all combinations and methods produced significant results or even different results. Consequently, to conserve space only a selective set of results were reported in the table.

In general, the results in Table 1 are virtually the same and significant as far as goodness of fit goes. There are positive and significant signs for the DOM and FOR coefficients regardless of the model run (see the notes in Table 1 for model details). Similarly, the sign for the year coefficients is always negative and significant regardless of the run (with one positive exception). The dummy variables coefficients were usually not significant except for DVA (Africa region) in a few runs. All standard errors were adjusted for heteroscedasticity. For the first SUR(1) model, the Breusch-Pagan

independence test was rejected. For the second SUR(2) model, the test was accepted as expected.

Referring to the first full SUR(1) model, the domestic reaction equation is positively sloped (1/b1 = 1.09) and steeper than the foreign reaction equation (B1 = 1.02), as expected for stability (although a Chi-sq test of the equality of the coefficients was not rejected, p = .176). The domestic equation shifts inward overtime whereas the foreign equation shifts up over time (see, Figure 1). So, over time, the percent of domestic firms practicing corruption is falling for a given foreign value, while it is rising for foreign firms, for a given domestic value. Both equations follow the "monkey see, monkey do" principle, but over time domestic firms relative to foreign firms are becoming less corrupt.

This result is born out by the single-equation runs (OLS, RE(1), RE(2), and XTPCSE) where DOM increases as FOR increases but decreases over time. Since the negative time coefficient is considerably larger (and significant with a Chi-sq = 21.05 and p = .000) than the positive "monkey see, monkey do" coefficient for the SUR(1) run, the dynamic picture is one of a contracting domestic corruption regime. In other words, there are forces not in the models operating over time which have a negative effect on domestic corruption. The data set used in this paper does not identify these forces, but we can surmise that they exist (for example, laws and regulations against bribery, a better court system, and improvement in the way government administration operates to facilitate domestic business—licenses, permits, contracts, delays, and the like).

Summary and Conclusions

Based on empirical data, a two-equation game-type corruption reaction function model was developed. A "data to model" approach was used rather than the usual *a priori* approach. The general hypothesis tested was the "monkey see, monkey do" principle. The latest data on corruption among developing countries was obtained from the Enterprise Surveys done by the World Bank Group in 2010. The key variables were the percent of domestic firms expecting to make informal payment to public officials to "get things done," and the percent of foreign firms doing like wise. The time span is from 2002-2010. A variety of econometric methods were used.

In general, the statistical results were quite good and supported the hypothesis. Both reaction equations were positively sloped. Time had a reducing effect on the frequency of domestic corruption, yet it had an increasing effect on foreign corruption. Variations in the frequency of corruption across regions of countries were generally not significant.

The interesting policy implication of the results is that over time developing countries are bring under control the practice of corruption to "get things done," at least among domestic firms. On the other hand, foreign firms have been increasing their frequency of corruption over time. It is possible that foreign firms surmise that they are at a competitive disadvantage with respect to domestic firms when dealing with public officials (understandably so, considering the problems of doing business in a foreign country), so bribery is an effective and profitable (presumably) way to "get things done."

As domestic markets and relevant institutions develop and become more 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. Only time will tell.

References

Ades, Alberto and Di Tella, Rafael. "Rents, Competition, and Corruption," *American Economic Review,* September 1995, *89*(4), pp. 982-993.

Becker, Gary S. "Crime and Punishment: An Economic Approach," *Journal of Political Economy,* March/April 1968, *76*(2), pp. 169-217.

Becker, Gary and Stigler, George. "Law Enforcement, Malfeasance and the Compensation of Enforcers," *Journal of Legal Studies,* January 1974, *3*(1), pp. 1-19.

Hellman, Joel S.; Jones, Geraint; Kaufmann, Daniel and Schankerman, Mark. "Measuring Governance, Corruption, and State Capture," Policy Research Working Paper, 2312,

The World Bank, World Bank Institute, Government, Regulation and Finance and *European Bank for Reconstruction and Development,* Chief Economist's Office, April 2000, pp. i-v,1-53.

Méon, Pierre-Guillaume and Weill, Laurent. "Is Corruption an Efficient Grease?" *World Development*, March 2010, *38*(3), pp. 244-259.

Menezes, Flavio. "The Microeconomics of Corruption: The Classical Approach," Economics Working Papers, No. 405, *Graduate School of Economics, Getulio Vargas Foundation (Brazil),* November 2000, pp. 1-13.

Reinikka, Ritva and Svensson, Jakob. "Using Micro-Surveys to Measure and Explain Corruption," *World Development*, February 2006, *34*(2), pp. 359-370.

Rose-Ackerman, Susan. "The Economics of Corruption," *Journal of Public Economics,* February 1975, *4*(2), pp. 187-203.

Rose-Ackerman, Susan. *Corruption: A Study of Political Economy.* New York, Academic Press, 1978.

Rose-Ackerman, Susan. *Corruption and Government: Causes, Consequences, and Reform.* Cambridge, UK, Cambridge University Press, 1999.

World Bank. *Enterprise Surveys, The World Bank Group.* Washington DC, USA, 2010. Also,www.enterprisesurveys.org/Portal/unprotected/RegisterExternal.aspx?LibId-14

Table 1. Econometric Macro Results from Corruption

	SUR(1)	SUR(2)	OLS	RE(1)	RE(2)	XTPCSE
DOM on	FOR .92	.73	.73	.75	.64	.74
	(23.86)	(15.07)	(12.41)	(14.99)	(10.30)	(15.08)
	YR -1.23	-1.87	-1.87	-1.62	-2.30	-1.78
	(-2.57)	(-3.84)	(-3.87)	(-3.58)	(-5.40)	(-4.11)
	DVA 5.58	6.07	6.07		5.70	5.66
	(2.13)	(2.31)	(2.33)		(1.75)*	(2.39)
	DVL 1.35	-1.43	-1.43		-2.95	
	(0.38)*	(-0.40)*	(-0.29)*		(-0.57)*	
	DVO .63	1.75	1.75		2.40	
	(0.22)*	(0.61)*	(0.69)*		(0.72)*	
	CON 2462	3764	3764	3255	4617	3579
	(2.57)	(3.85)	(3.87)	(3.59)	(5.41)	(4.12)
Rsq	.66	.69	.69	.68	.69	.69
FOR on	DOM 1.02					
	(23.86)					
	YR 1.02	-3.46				
	(1.98)	(-4.58)				
	DVA -5.51	2.62				
	(-1.98)	(0.61)*				
	DVL -2.34	-14.89				
	(0.63)*	(-2.60)				
	DVO -0.25	6.00				
	(-0.08)*	(1.28)*				
	CON -2052	6981				
	(-1.98)	(4.60)				
Rsq	.63	.17				

Notes: All results have robust standard errors. Log forms of the models produced similar results and are not reported. GLS for the SUR's runs produced singular error matrices. A 2-step approach was used. Sample size is 155 for all runs. RE(1) has 4 regional panels. RE(2) has 102 country panels. GLS regression was used. FE results were less satisfying and not reported. All coefficients for main variables are significant at $p < .05$ and in most cases $p = .000$. The * indicates a $p > .05$. The (.) has the t values or the z values. All Rsq's are significant. The XTPSCE run is cross section/time series analysis with panel corrected standard errors for heteroscedasticity using linear regression. Blank dummy variables were purposely dropped due to insignificance.

Figure 1. Two Game-Type Reaction Functions

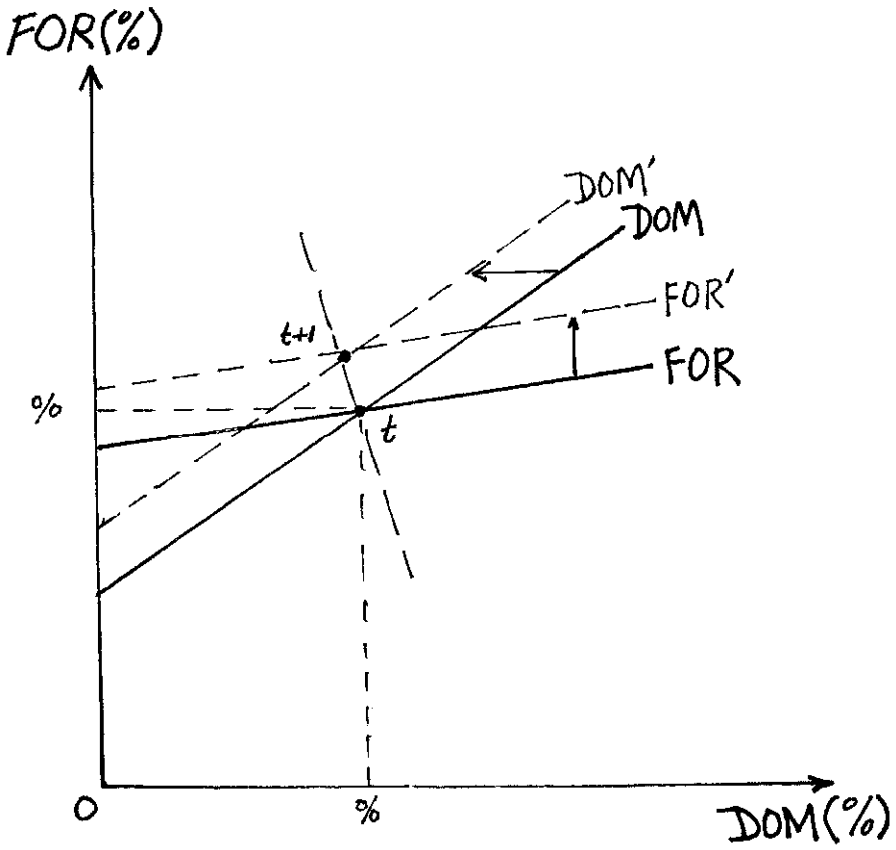

Figure 1. Two Game-Type Reaction Functions