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ENDOGENOUS CORRUPTION, INEQUALITY AND GROWTH: ECONOMETRIC EVIDENCE

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ABSTRACT

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This paper empirically addresses three questions. First, what is corruption's effect on economic growth? Second, what are the factors that determine corruption? Third, what is the relationship among corruption, economic growth, and income distribution? I use a cross section of countries, both developed and underdeveloped. I find that corruption is an important determinant of both per-capita real growth and of the distribution of income. Corruption is positively and significantly correlated with growth, implying that corruption has efficiency-enhancing qualities. Corruption is positively and significantly correlated with inequality, implying that increased income inequality is associated with greater corruption. The most robust specification, which associates three jointly dependent equations using a two-stage least squares estimation technique, reinforces the proposition that corruption enhances efficiency, justifies inequality's role in determining growth rates, and lends support to the theory of international convergence of growth rates.

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Introduction

This paper empirically analyzes the links among official or governmental corruption, economic growth, and income distribution. I use a cross section of countries, both developed and underdeveloped. I find that corruption is an important determinant of both per-capita real growth and of the distribution of income. Corruption is positively and significantly correlated with growth, implying that corruption has efficiency-enhancing qualities. Corruption is positively and significantly correlated with inequality, implying that increased income inequality is associated with greater corruption. The most robust specification, which associates three jointly dependent equations using a two-stage least squares estimation technique, reinforces the proposition that corruption enhances efficiency, justifies inequality's role in determining growth rates, and lends support to the theory of international convergence of growth rates.

The paper is organized as follows. Section 1 deals with the theoretical relationship among corruption, economic growth and inequality. Section 2 discussed the data used throughout the paper. Section 3 empirically examines the relationship between corruption and growth. Within a "Barro type" growth model, I find that corruption has relatively little bearing on economic growth. These results differ from those of Mauro (1995), who found corruption to be negatively and significantly correlated with growth. In an alternative specification for growth, I find that corruption is significantly and positively correlated with growth, implying that corruption can be efficiency enhancing. Section 4 considers corruption as the endogenous variable. I find that the most significant determinant of corruption is bureaucratic red tape, followed by initial GDP and relative size of the government sector.

Section 5 considers endogenous corruption in the growth model. Again, corruption is positively correlated with higher growth rates. Section 6 analyzes the relationship between corruption and income distribution. First, I test the Kuznets Hypothesis, which is that income inequality is a consequent stage in economic development. Corruption is both included and excluded as an institutional factor in determining inequality. My results lend minimal support to the Kuznets Hypothesis that inequality is a result of economic growth. Second, I investigate an alternative specification for the determinants of inequality. I find that corruption's significance as a determinant of income distribution is dependent upon the inequality specification employed. Third, I control for the endogeneity of corruption as a factor in determining income distribution. Corruption exhibits a negative and significant relationship with income distribution. I also specify a system of three equations, where income distribution, corruption, and economic growth are jointly dependent. In this more robust specification, corruption has a significant positive effect on the growth rate as well as a strong negative effect on the income distribution.

Section 1 - Overview of the Theoretical Model

There are three questions that this paper addresses empirically. First, what is corruption's effect, if any, on economic growth? Second, what are the factors that determine corruption? Third, what is the relationship among corruption, economic growth, and income distribution?

The positive aspects of corruption on economic development were considered as early as Leff (1964). Corruption can theoretically aid economic development in two ways. Corruption can provide an incentive for the public agent to work harder. If this is the case, it exists irrespective of the institutional makeup of a country. Secondly, it can act as "speed money." Therefore, through corruption, the provision of public goods and services can be made more efficient. This type of corruption would only be present in those countries that are known for their bureaucratic red tape.

Schleifer and Vishny (1993), among others, have argued that corruption hinders development. Their model considers the negative effects of a government that exploits it's monopoly power over public goods and services. In Barreto (1998), I presented an endogenous growth model that allows for corruption, as defined by Schleifer and Vishny, and bureaucratic red tape to co-exist. The model shows that corruption and red tape are theoretically consistent with positive real economic growth. It goes on to show that given certain degrees of public bureaucracy, corruption can even have positive growth effects. Although the corrupt equilibrium that alleviates red tape is a second best to no corruption and no red tape, it is preferable to no corruption and red tape. Irrespective of whether or not red tape is present though, I also found that corruption does affect income inequality.

To test the above hypothetical institutional arrangements, consider two economies. In one, public goods are provided by a selfless government and, in the other, public goods are provided by a self-seeking government. One naturally expects the economy with the selfless government to out-perform the one with the self-seeking government. The following growth model can therefore be tested:

$$Growth = \alpha_1 + [\underset{(+/-)}{Corruption},...] \cdot \alpha_i + \varepsilon \qquad 1.1$$

where corruption is an institutional factor that affects growth. The expected signs are below each variable in brackets.

But corruption is not necessarily independent, as the above model assumes; it is the endogenous result of a country's institutional development. What institutional factors would one expect to be associated with corruption? If corruption aids development, then one would expect a strong positive relationship with bureaucratic red tape. If corruption hurts development due to governments flexing their monopoly power, one would expect less provision of public goods at a higher price. Education might play a role in determining corruption. One might expect a more educated population to be less tolerant of corruption. Lastly, corruption might be just a stage in the development process through which every country must pass. Thus, initial GDP might play a role. One might expect the following theoretical corruption model:

$$Corruption = d_1 + Red\ Tape \times d_2 + Govt./GDP \times d_3 + Education \times d_4 + Initial\ GDP \times d_5 + e \quad 1.2$$

(+) (-) (-) (-)

I have already pointed out that if corruption is significant, it is likely to affect a country's income distribution. Therefore, the following model can also tested:

$$Inequality = b_1 + [Corruption,...] \times b_j + h \qquad 1.3$$

(+)

where the other fa ctors that influence inequality are to be determined.

The above three models suggest a system of simultaneous equations where corruption is endogenous and affects both growth and income distribution. Also, if inequality affects growth as some have suggested (Clarke, 1995; Field, 1989), the following model can be tested:

$$Growth = a_1 + [Corruption, Inequality, ...] \times a_i + e_1 \qquad 1.4$$

(+/-) (+/-)

$$Inequality = b_1 + [Corruption,...] \times b_j + \varepsilon_2 \qquad 1.5$$

(+)

$$Corruption = d_1 + Red\ Tape \times d_2 + Govt./GDP \times d_3 + Education \times d_4 + Initial\ GDP \times d_5 + e_2 \quad 1.6$$

(+) (-) (-) (-)

where, apriori, the signs of corruption and inequality in the growth equation are indeterminate.

Section 2 - Description of the Data

The data used in this study come from various sources although I attempt to maintain data consistency. The study employs two data sets. The larger one, *Data Set #1*, contains the same 58 countries that were employed by Mauro (1995). Included are both developed and

Table 1

Data Set #1

	Country		**Country**		**Country**
1	Algeria	21	Hong Kong	41	Pakistan
2	Argentina	22	India	42	Panama
3	Australia	23	Indonesia	43	Peru
4	Austria	24	Iran, Islamic Rep.	44	Philippines
5	Bangladesh	25	Ireland	45	Portugal
6	Belgium	26	Israel	46	Saudi Arabia
7	Brazil	27	Italy	47	Singapore
8	Cameroon	28	Jamaica	48	South Africa
9	Canada	29	Japan	49	Sri Lanka
10	Chile	30	Kenya	50	Thailand
11	Colombia	31	Korea, Rep.	51	Trinidad and Tobago
12	Denmark	32	Liberia	52	Turkey
13	Dominican Rep.	33	Malaysia	53	United Kingdom
14	Ecuador	34	Mexico	54	United States
15	Egypt, Arab Rep.	35	Morocco	55	Uruguay
16	Finland	36	Netherlands	56	Venezuela
17	France	37	New Zealand	57	Zaire
18	Germany	38	Nicaragua	58	Zimbabwe
19	Ghana	39	Nigeria		
20	Greece	40	Norway		

underdeveloped countries. This data set is limited by the lack of availability of corruption and red tape statistics, which are taken from Business International (henceforth referred to as BI) (see Business International Corp., 1984). *Data Set #2* contains 56 countries, where Saudi Arabia and Zaire are excluded due to the lack of income distribution data for these two countries.

2.1 The Business International indices of corruption, red tape and political stability

The indices proxying corruption, red tape and political stability were originally drawn from BI now incorporated in *The Economist Intelligence Unit*, by Mauro (1995). He describes the BI data as follows.

> "...BI is a private firm that sells these indices typically to banks, multinational companies, and other international investors. BI published indices on 56 "country risk" factors for 68 countries, for the period 1980-1983, and on 30 country risk factors for 57 countries, for the period 1971-1979. "Factor Assessment Reports" are filled in BI's network of correspondents and analysts based on the countries covered. Assessment reports undergo further checks at BI's regional level, as well as BI's corporate headquarters, in order to insure accuracy and consistency of the results. The indices reflect the analysts'

perspectives on risk and efficiency factors, and may be taken to represent investors' assessments of conditions in the country in question."

This paper employs three indices for corruption, red tape, and political stability. Corruption and red tape are actual BI indices, while political stability, taken from Mauro (1995), is the simple average of the first six relevant BI indices. BI's definitions of all of these indices are as follows.[1]

1. Political Change - Institutional - "Possibility that the institutional framework will be changed within the forecast period by elections or other means."
2. Political Stability - Social - "Conduct of political activity, both organized and individual, and the degree to which the orderly political process tends to disintegrate or become violent."
3. Probability of Opposition Group Takeover - "Likelihood that the opposition will come to power during the forecast period."
4. Stability of Labor - "Degree to which labor represents possible disruption of manufacturing and other business activity."
5. Relation with Neighboring Countries - "This includes political, economic and commercial relations with neighbors that may affect companies doing business in the country."
6. Terrorism - "The degree to which individuals and businesses are subject to acts of terrorism."
7. Bureaucracy and Red tape - "The regulatory environment foreign firms must face when seeking approvals and permits. The degree to which it represents an obstacle to business."
8. Corruption - "The degree to which business transactions involve corruption or questionable payments."

The value if the indices range from 1 to 10. A higher value is always "good." For example the corruption index for the United States, Mexico and United Kingdom are 10, 3.25 and 9.25, respectively. The political stability index for those same three countries is 9.33, 6.88 and 8.33, respectively.

Red tape and corruption, the two indices of most relevance here, exhibit a strong positive correlation of .84. This is not surprising, since by assumption corruption is more likely in the presence of red tape. A common form of corruption is the type of bribe, or "speed money", that is meant to cut through the public sector red tape that would otherwise hamper business. In such a situation, red tape is

[1] The indices are described in detail in Business International Corporation [1984].

a form of externality associated with the public sector, which the private sector is willing to pay to have reduced. Thus, the less red tape in an economy, the less available and less lucrative is corruption.

In Barreto (1998), I characterize an equilibrium in a neoclassical endogenous growth framework, in which red tape and consequent corruption redistribute income with little or no effect on growth. It has also been argued that public agents might create red tape in order to capitalize on rents from later corruption (Krueger, 1993; de Soto, 1989). A proposition of this paper is that corruption is an endogenous result of red tape and other institutional factors. Another proposition is that corruption is a significant factor in determining growth, particularly when its endogenous nature is specified.

2.2 Indices of Income Distribution

An important objective here is to assess whether corruption affects the distribution of income. I use GINI coefficients to measure inequality. The GINI coefficient is defined as the ratio of the area in between the line of perfect equality and the Lorenz curve, relative to the total area under the diagonal.

The problem lies with finding a consistent data series of income distributions for all countries. The methodology for calculating incomes varies widely from source to source. The World Bank compiles such data, but often draws information from various other sources, none of which can be easily verified for consistency. But even supposing that available data are consistent, they are still infrequently compiled. There is not available, to my knowledge, a single series of cross-country income distribution data for any given year or range of years since 1970.[2]

[2] There are several cross sectional inequality data sets for 1960 as well as 1970, for example Taylor and Hudson (1972) and Taylor and Jodice (1983).

I use income distribution data for 1985 where it is available and as close to 1985 where it is not.[3] When more than one data point for any given country for a given year exists, I simply calculate the average value. Previous studies (Clarke, 1995; Alesina and Rodrick, 1991; Persson and Tebellini, 1991) assume that income distribution changes very slowly. They therefore include inequality data from any year that is available. Although this may be a plausible assumption for developed economies, the evidence for less developed countries suggests that income distribution is relatively volatile. For example, inequality in India improved 23% from 1975 to 1990, while that of Paraguay worsened by 50% from 1973 to 1981, and then improved by 30% from 1981 to 1992.[4] Thus, inequality within a country is a reflection of the various institutional changes that have occurred in that country. This result may not be surprising considering the volatile nature of business and politics in many LDC's.

2.3 Per Capita Real GDP and Per Capita Real GDP Growth Rate

All income and investment data was drawn from Summers and Heston (1991, 1988) but were actually obtained from the National Bureau of Economic Research Penn World Table World Wide Web site. These variables are:

GROWTH - This is the average yearly growth rate of per capita real GDP from 1971 to 1985 in purchasing power parity terms.

GDP and *GDP2* - These are the average per capita real GDP and average per capita real GDP squared for the years 1971 to 1985 in purchasing power parity terms.

GDP70 - This is the per capita real GDP for 1970 in purchasing power parity terms.

INV_GDP - The 1971 to 1985 average of the ratio of gross domestic investment to GDP.

[3] Appendix 1 details the year and source of each data point.

[4] The GINI measures for India are .38 in 1975 and .29 in 1990, according to The World Bank. The GINI measures for Paraguay are .50 for 1973, .55 for 1977, .75 for 1981 and .52 for 1992, according to various sources compiled by Sauma, et al., (1993).

G_GDP - This is the 1971 to 1985 average of the ratio of current government expenditures to current GDP.

2.4 Other Variables

All remaining data series were drawn from The World Bank, *World Tables*, various years. These include:

SED75 - This is the percent of the population that has secondary school education in 1975.[5]

POPGR - This is the average yearly growth rate of the population from 1971 to 1985.

DEF_GDP - This is 1971 to 1985 average of the ratio of the public sector deficit to GDP.

A summary of all of the variables along with their means and standard deviations is presented in Table 2. Table 3 is the correlation matrix.

Section 3 - The Effects of Corruption on Growth

Recent empirical work by Mauro (1995) has suggested that corruption hinders economic growth. I test that proposition using Data Set #1. The hypothesis test may be described as follows.

$$\text{GROWTH} = \alpha_1 + \text{CORRUPT} \cdot \alpha_2 + [\textit{growth factors},...] \cdot \alpha_i + \varepsilon$$

$$H_0: |\alpha_2| > 0$$

$$H_A: |\alpha_2| = 0$$

Table 4 reports the results of regressing growth on corruption alone as well as including various alternative control variables. The model I employ is commonly referred to as a "Barro type" after

Table 2
Summary of Variables

[5] Education statistics for the United States are drawn from the U.S. Bureau of the Census and those from South Africa come from the South African Data Archive.

Variable	Mean	Standard Deviation	Source
SED75	0.491	0.260	The World Bank, *World Tables* , (1993)
GDP70	4.354	3.354	Penn World Tables, Mark 5.6
CORRUPT	6.658	2.583	Business International Corporation, (1984)
REDTAPE	5.971	2.335	Business International Corporation, (1984)
POLSTAB	7.559	1.405	Mauro, (1995)
GROWTH	0.020	0.020	Penn World Tables, Mark 5.6
G_GDP	0.171	0.063	Penn World Tables, Mark 5.6
POPGR	0.019	0.011	The World Bank, *World Tables* , (1993)
GDP	5.313	4.024	Penn World Tables, Mark 5.6
GDP2	44.137	53.404	Penn World Tables, Mark 5.6
LATAM	0.224	0.421	Latin America Dummy Variable
OECD	0.310	0.467	OECD Dummy Variable
INV_GDP	0.197	0.076	Penn World Tables, Mark 5.6

Table 3
Correlation Matrix

	SED75	*GDP70*	*CORRUPT*	*REDTAPE*	*POLSTAB*	*GROWTH*
SED75	1.000					
GDP70	0.787	1.000				
CORRUPT	0.703	0.703	1.000			
REDTAPE	0.633	0.631	0.841	1.000		
POLSTAB	0.488	0.489	0.551	0.586	1.000	
GROWTH	0.121	-0.033	0.134	0.255	0.531	1.000
G_GDP	-0.308	-0.313	-0.274	-0.259	-0.269	-0.229
POPGR	-0.842	-0.622	-0.638	-0.533	-0.484	-0.188
GDP	0.788	0.983	0.709	0.660	0.559	0.100
GDP2	0.718	0.962	0.659	0.636	0.540	0.067
LATAM	-0.106	-0.107	-0.039	-0.115	-0.130	-0.298
OECD	0.826	0.788	0.646	0.548	0.497	0.104
INV_GDP	0.655	0.519	0.593	0.558	0.537	0.475

Table 3 (cont.)
Correlation Matrix

	G_GDP	*POPGR*	*GDP*	*GDP2*	*LATAM*	*OECD*	*INV_GDP*
SED75							
GDP70							
CORRUPT							
REDTAPE							
POLSTAB							
GROWTH							
G_GDP	1.000						
POPGR	0.349	1.000					
GDP	-0.347	-0.615	1.000				
GDP2	-0.279	-0.560	0.971	1.000			
LATAM	-0.176	0.090	-0.149	-0.225	1.000		
OECD	-0.273	-0.782	0.784	0.776	-0.361	1.000	
INV_GDP	-0.447	-0.544	0.573	0.469	-0.107	0.576	1.000

Barro (1989), but the choice of control variables follows Mauro (1995). Note first that the coefficient on corruption is not significantly different from zero in any of the specifications. This result differs from

Mauro's work, where he found corruption to be a statistically significant determinant of the average yearly per capita real GDP growth rate.[6] The difference in results is due, at least in part, to specification error on Mauro's part. With cross sectional studies of this type, inclusion of irrelevant variables or exclusion of relevant variables can make other variables related to growth switch signs or become insignificant.

In light of this possibility, I perform a complete extreme-bounds analysis (Leamer, 1983), henceforth referred to as EBA, with GROWTH as the dependent variable. The analysis is meant to test the sensitivity of an independent variable to the inclusion or exclusion of other independent variables. The same experiment was first done by Levine and Renelt (1992), who find that most of the variables traditionally used in Barro type growth models are actually "fragile" with respect to inclusion and exclusion errors. In other words, as the specification of the growth model changes, significant variables change sign or become insignificant. In fact, the only variables that are really "robust", i.e. remains significant and does not switch signs due to inclusion and exclusion of other variables, is investment as a share of GDP and the political stability index.

The basic Barro type growth model is defined as follows. The four variables are based on economic theory and past empirical studies. The coefficient values and their White corrected standard errors in brackets are the results using *Data Set #1*.

$$\underset{(.014)}{GROWTH = .014} + \underset{(.043)}{.182} * INV\_GDP - \underset{(.001)}{.002} * GDP70 - \underset{(.356)}{.523} * POPGR - \underset{(.021)}{.025} * SED75$$

[6] Mauro uses 1961 to 1985 averages to get his results, but he claims that the results do not change when 1971 to 1985 averages are used instead. See footnote number 25 in Mauro (1995)

Table 4
Corruption and Growth
Dependent Variable: GROWTH

Independent Variables	[1]	[2]	[3]	[4]	[5]	[6]	[7]
C	0.013~	0.025~	0.015	-0.035*	-0.027*	-0.044*	-0.036*
	(.009)	(.019)	(.015)	(.015)	(.015)	(.013)	(.013)
CORRUPT	0.001	0.001	0.000	0.000	0.000	-0.001	0.000
	(.001)	(.002)	(.002)	(.001)	(.001)	(.001)	(.001)
SED75		0.008	-0.025	0.015~	0.024~	-0.003	0.009
		(.018)	(.021)	(.011)	(.015)	(.013)	(.015)
GDP70		-0.002*	-0.002~	-0.003*	-0.003*	-0.003*	-0.002*
		(.001)	(.001)	(.001)	(.001)	(.001)	(.001)
G_GDP				-0.052~	-0.082*	-0.015	-0.045*
				(.038)	(.032)	(.033)	(.027)
POPGR		-0.423	-0.532~				
		(.385)	(.356)				
POLSTAB				0.010*	0.009*	0.008*	0.008*
				(.002)	(.002)	(.002)	(.002)
INV_GDP			0.183*			0.127*	0.114*
			(.043)			(.038)	(.033)
OECD					-0.014~		-0.014*
					(.009)		(.007)
LATAM					-0.019*		-0.017*
					(.006)		(.005)
N	58	58	58	58	58	58	58
R Squared	0.018	0.095	0.356	0.439	0.544	0.542	0.625

White corrected standard errors are in brackets.
* indicates significance of 5% or less
~ indicates significance of 10%
OECD and LATAM are dummy variables for OECD countries and Latin American countries, respectively.

(R^2 = .356, number of observations = 58) Notice that the coefficient on SED75 is the "wrong" sign. Thus, even the basic growth model is not free of specification error.

Table 5 reports the results of the sensitivity analysis using *Data Set #1* with GROWTH as the dependent variable.[7] As expected, the investment to GDP ratio is the most robust determinant of growth. The other three basic growth variables, GDP70, SED75 and POPGR are fragile in that they become insignificant depending upon the specification. Interestingly, the political stability index, POLSTAB, is robust, which highlights its importance as a factor in determining growth. This result is intuitively plausible as well as consistent with those of other

Table 5

Sensitivity Analysis of Basic Variables						
Dependent Variable: GROWTH						
Variable		coef.	S.E.	t	R Sq.	other variables
INV_GDP	base:	0.124	0.034	3.667*	0.225	
	high:	0.171	0.034	5.061*	0.449	GDP70 CORRUPT POPGR OECD LATAM
	low:	0.068	0.034	1.982*	0.335	G_GDP POLSTAB
GDP70	base:	-0.0002	0.0006	-0.317	0.001	
	high:	-0.003	0.0006	-5.313*	0.533	G_GDP INV_GDP POLSTAB
	low:	-0.0004	0.0006	-0.608	0.094	LATAM
SED75	base:	0.009	0.008	1.205	0.015	
	high:	-0.034	0.009	-3.662*	0.444	INV_GDP POLSTAB
	low:	0.0004	0.014	0.030	0.058	G_GDP CORRUPT
POPGR	base:	-0.357	0.175	-2.046*	0.037	
	high:	-0.62	0.214	-2.892*	0.162	GDP70 LATAM
	low:	-0.013	0.32	-0.041	0.438	SED75 G_GDP GDP70 POLSTAB
CORRUPT	base:	0.001	0.001	0.866	0.018	
	high:	-0.003	0.001	-3.431*	0.434	INV_GDP POLSTAB
	low:	0.00002	0.002	0.011	0.067	G_GDP POPGR
POLSTAB	base:	0.008	0.002	4.834*	0.286	
	high:	0.009	0.002	5.429*	0.456	CORRUPT POPGR OECD LATAM
	low:	0.005	0.002	3.231*	0.388	G_GDP INV_GDP LATAM

Number of Observations = 58 in all of the above cases.
All standard errors are White corrected for heteroskedasticity
* denotes White corrected t statistics with significance of 5% and below

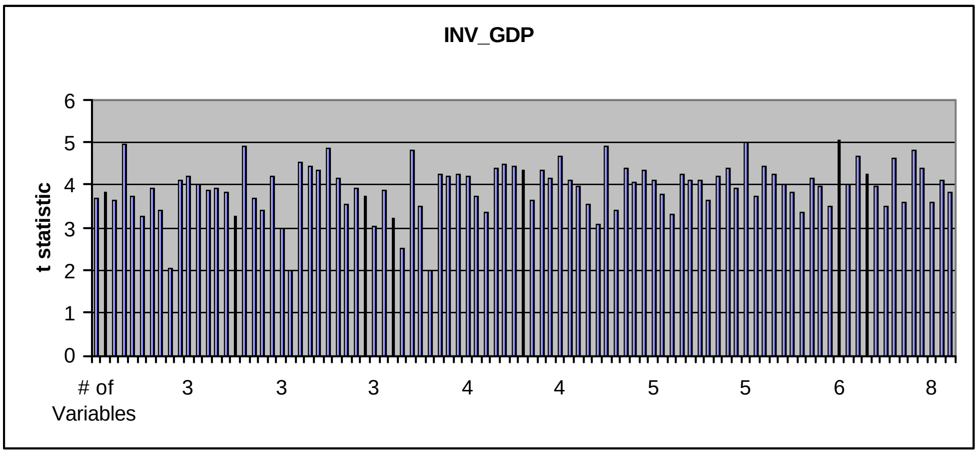
studies (Barreto, 1998; Alesina, Özler, Roubini and Swagel, 1992; Barro, 1991); that is, there is a strong positive relationship between political stability and per capita GDP growth. Corruption is also fragile. Its performance as a regressor in the growth model is comparable to that of the other regressors in the basic model.

To better understand the interaction of these variables with one another as discerned by the extreme bounds analysis, consider graphs [1] through [6]. These graphs show the level of significance of each variable as the model specification changes. Notice the graphs for POSTAB and INV_GDP depict the consistently high significance irrespective of the specification. Also GDP70, although not perfect, performs reasonably well. The four regression in which GDP70 performs badly are the base,

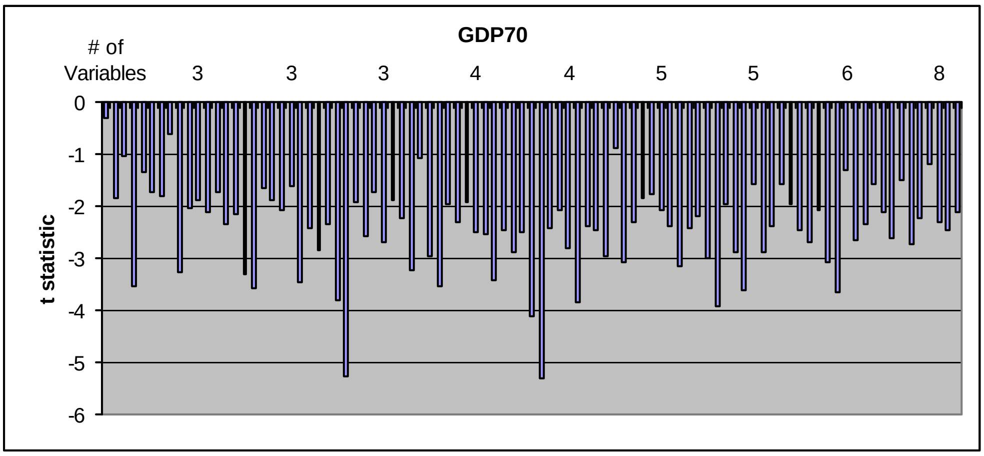
[7] The same sensitivity analysis was also performed on a *Data Set #1* but excluding OECD countries. There was no change in the results.

i.e. where GDP70 stands alone on GROWTH, and regressions in which GDP70 is accompanied by the dummy variables, OECD and LATAM. In all of the other regressions where GDP70 is accompanied by other explanatory variables, it is significant and

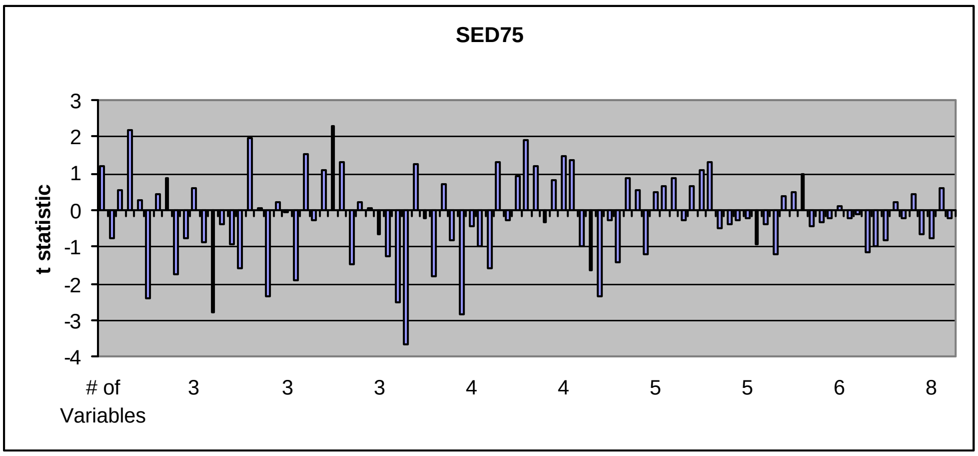
Graph [1]



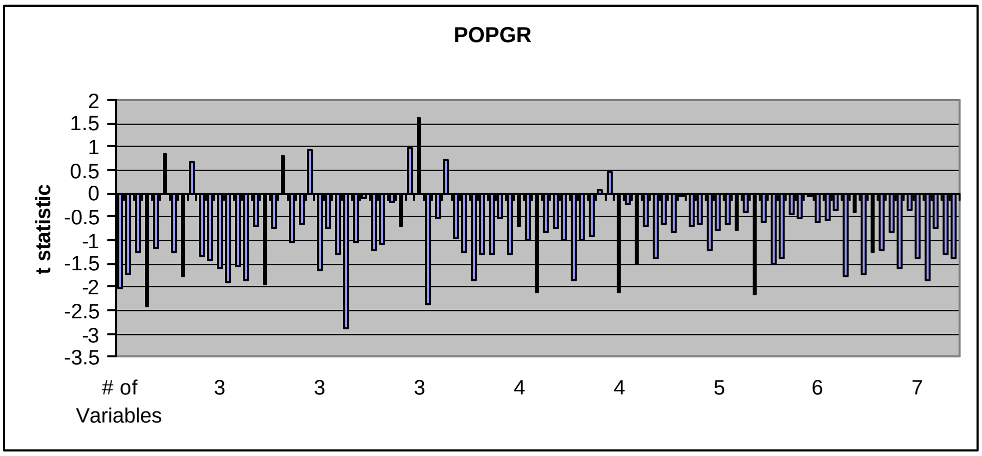
Graph [2]



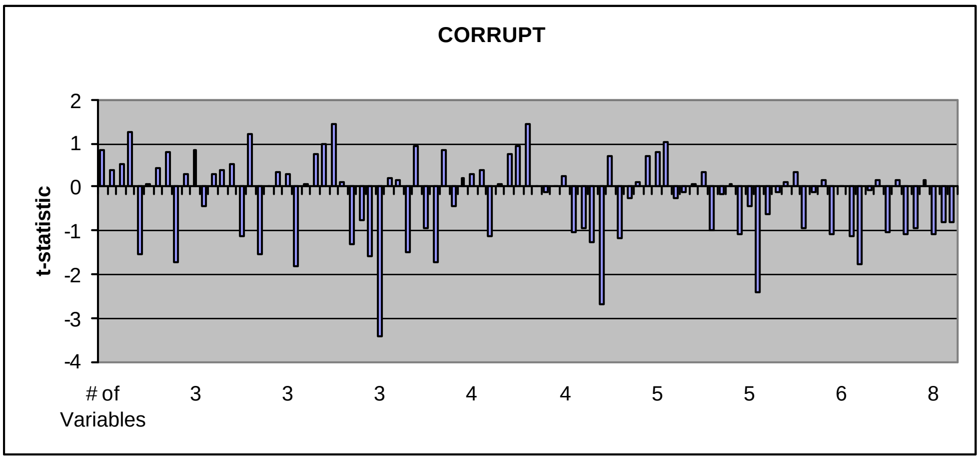
Graph [3]



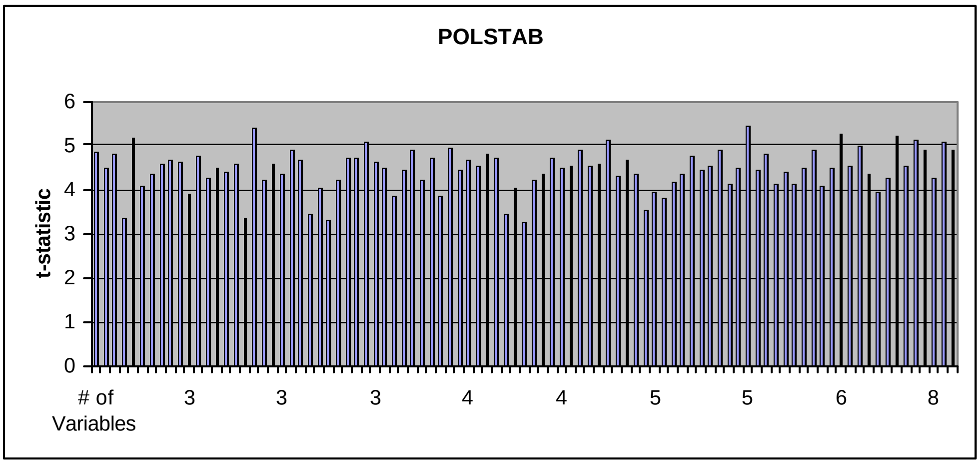
Graph [4]



Graph [5]



Graph [6]



negative. In other words, higher initial GDP per capita is associated with lower growth rates. This is to be expected if one believes the convergence hypothesis.[8] The graphs for SED75 and POPGR depict truly "fragile" variables. As you can see from the SED75 graph, as more variables are added to the regression, the significance of SED75 generally declines. Although the sign of POPGR is consistently negative, i.e. high population growth is consistent with lower per capita GDP growth rates, the nature of the EBA test demands one should be very suspect of the robustness of the results. Finally, consider Graph [5] describing CORRUPT. There is no doubt of its fragility in the growth model. But note that when CORRUPT is significant, it's sign is negative. In other words, more corruption is associated with lower growth. But again, little weight should be put on this conclusion.

The EBA sensitivity test suggests the most robust results should be obtained from the most empirically justifiable starting point. Henceforth, I assume that growth is robustly determined by investment as a share of GDP (i.e. INV_GDP), political stability (i.e. POLSTAB), and initial per capita GDP (i.e. GDP70). The inclusion of other regressors can provide interesting results, but the conclusions drawn from such results should be considered subject to specification errors.

. Table 6 reports the results of selected specifications. Columns [1], [3], [5] and [7] use the entire *Data Set #1* and columns [2], [4], [6] and [8] use *Data Set #1* excluding OECD countries. Columns [1] and [2] report the results of the growth model that is empirically robust according to the above sensitivity analysis. They include only the regressors representing investment, political stability, and initial GDP. Columns [3] and [4] report the results of the same growth model with corruption included. Notice that the coefficient on CORRUPT is not significantly different from zero. Columns [5] and [6] suggests that Latin American countries' growth rates have been

[8] See Barro (1997), page 397 for a simple explanation of the convergence hypothesis.

Table 6
Corruption and Growth
Dependent Variable: GROWTH

Independent Variables	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
C	-.049*	-.050*	-.088*	-.049*	-.042*	-.048*	-.036*	-.040*
	(.011)	(.024)	(.011)	(.013)	(.011)	(.011)	(.017)	(.023)
INV_GDP	.120*	.145*	.129*	.157*	.1025*	.158*	.135*	.159*
	(.029)	(.034)	(.031)	(.036)	(.029)	(.033)	(.034)	(.038)
POLSTAB	.008*	.008*	.008*	.008*	.008*	.008*	.008*	.008*
	(.002)	(.002)	(.002)	(.002)	(.002)	(.002)	(.002)	(.002)
CORRUPT			-.001	-.001~	-.001	-.001	-.001	-.001~
			(.001)	(.001)	(.001)	(.001)	(.001)	(.001)
SED75							-.013	-.008
							(.014)	(.022)
GDP70	-.003*	-.004*	-.003*	-.004*	-.003*	-.002*	-.002*	-.003*
	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)	(.002)
POPGR							-.260	-.221
							(.294)	(.518)
LATAM					-.011*	-.014*		
					(.005)	(.005)		
N	58	40	58	40	58	40	58	40
R Squared	.531	.548	.540	.563	.593	.626	.546	.565

White corrected standard errors are in brackets.
* indicates significance of 5% or less
~ indicates significance of 10%
LATAM is a dummy variable for Latin American countries

disproportionately below those in the rest of the world. Columns [7] and [8] report the results of the basic Barro type growth model plus the variables, POLSTAB and CORRUPT.

An issue that has received considerable attention lately is the effect of income inequality on growth. In light of this, I now include an inequality measure in the model. In theory, inequality might aid growth in that it "...contains the seeds of eventual increase in everyone's income." (Adelmann and Robinson, 1989, p. 951) The basic premise is that the rich save relatively more of their incomes than do the poor and their saving eventually translates into economic growth. Therefore, redistribution of income will only reduce capital accumulation and slow growth (Field, 1989). However, recent work has suggested that inequality hinders economics growth (Clarke, 1995; Alesina and Rodrick, 1991; Persson and Tabellini, 1991).

Graph [7] shows the sensitivity analysis of inequality on growth. It is clear from the graph that there is evidence for the inclusion of inequality in the growth model. Table 7 reports the results of regressions using the smaller *Data Set #2*, as necessitated by the limited availability of information on GINI coefficients. Columns [1] and [2] detail the results of the basic growth models with the inequality measure included. Columns [3] shows the results of the regression where the corruption index and only the robust variables, INV_GDP, POLSTAB and GDP70, are included. Notice that the coefficient on GINI is negative and significantly different from zero in all three cases. Thus, higher levels of income inequality are associated with lower real GDP per capita growth rates. When only non-OECD countries are considered, the results are more robust. Simply put, this evidence supports the notion that greater inequality hurts growth. Notice that the coefficient on corruption not significantly different from zero anywhere.

The results reported in Tables 6 and 7 suggest that investment, political stability, initial GDP and inequality are all important determinants of growth. Specifically, more investment and greater political stability aid growth while income inequality hurts growth. The higher is the initial per capita GDP, the lower is the likely growth rate.

Table 8 reports the effect of a one-standard-deviation change in the right-hand-side variable on the GROWTH. The table is divided into two parts corresponding to *Data Set #1* and *Data Set #2*. In each case, I choose the highest coefficient value among those reported in Tables 6 and 7. The table describes a simple test of economic significance. Although the coefficient on a variable is statistically significant, it does not necessarily imply that changes in the values of that variables corresponds to a large change in the value of the dependent variable. Thus, I classify a right-hand-side variable as economically significant when a one-standard-deviation

Graph [7]

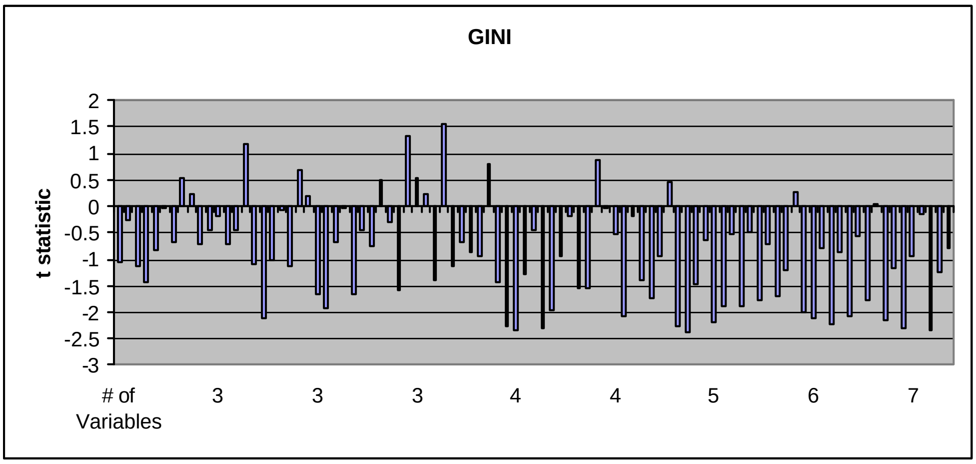


Table 7

Corruption, Inequality and Growth
Dependent Variable: GROWTH

Independent Variable	-----	Data Set #2	-----	Data Set #2 Non-OECD Only		
	[1]	[2]	[3]	[4]	[5]	[6]
C	.043*	-.012	-.023~	.058*	.0003	-.016
	(0.014)	(.020)	(.015)	(.019)	(.025)	(.016)
INV_GDP	.185*	.138*	.123*	.223*	.175*	.165*
	(.042)	(.035)	(.032)	(.042)	(.039)	(.038)
POLSTAB		.008*	.008*		.007*	.008*
		(.002)	(.002)		(.002)	(.002)
CORRUPT		-.001	-.001		-.001	-.001
		(.001)	(.001)		(.001)	(.001)
SED75	-.032*	-.019~		-.035~	-.018	
	(.019)	(.014)		(.025)	(.019)	
GDP70	-.003*	-.003*	-.003*	-.004*	-.004*	-.004*
	(.001)	(.001)	(.001)	(.002)	(.002)	(.002)
POPGR	-.673*	-.151		-1.008*	-.391	
	(.402)	(.455)		(.561)	(.658)	
GINI	-.0005*	-.0005*	-.0004*	-.0007*	-.0006*	-.0006*
	(.0003)	(.0003)	(.0002)	(.0003)	(.0003)	(.0003)
OECD						
N	56	56	56	38	38	38
R Squared	.383	.556	.546	.455	.595	0.587

White corrected standard errors are in parentheses.
* indicates significance of 5% or less
~ indicates significance of 10%
OECD is a dummy variable for OECD countries.

change in the right-hand-side variable implies a 20% or higher change in the value of the dependent variable.

Table 8

All Countries

Variable	N	Mean	Standard Deviation	1 SD effect on GROWTH	Coeficient Source
GROWTH	*58*	*0.020*	*0.020*		
SED75	58	0.491	0.260	-17%	Table 6, Col. 7
GDP70	58	4.354	3.354	-34%	Table 6, Col. 7
CORRUPT	58	6.658	2.583	-13%	Table 6, Col. 7
POLSTAB	58	7.559	1.405	56%	Table 6, Col. 7
POPGR	58	0.019	0.011	-14%	Table 6, Col. 7
LATAM	58	0.224	0.421	-21%	Table 6, Col. 5
INV_GDP	58	0.197	0.076	51%	Table 6, Col. 7
OECD	58	0.310	0.467	-40%	Table 7, Col. 5
GINI	56	39.594	8.807	-22%	Table 7, Col. 3

Non-OECD Countries Only

Variable	N	Mean	Standard Deviation	1 SD effect on GROWTH	Coeficient Source
GROWTH	*40*	*0.019*	*0.024*		
SED75	40	0.348	0.164	-7%	Table 6, Col. 8
GDP70	40	2.597	1.969	-31%	Table 6, Col. 8
CORRUPT	40	5.547	2.248	-12%	Table 6, Col. 8
POLSTAB	40	7.096	1.424	60%	Table 6, Col. 8
POPGR	40	0.024	0.008	-9%	Table 6, Col. 8
LATAM	40	0.325	0.474	-42%	Table 6, Col. 6
INV_GDP	40	0.167	0.070	58%	Table 6, Col. 8
GINI	38	43.585	7.160	-23%	Table 7, Col. 8

Two interesting aspects of Table 8 are worth noting. First, corruption plays a far more important role when only non-OECD countries are considered. Second, when the political stability index and the inequality measure are both included in the regression, as in *Data Set #2*, then the political stability index is half as economically significant. This is probably because low levels of political stability are more likely to associated with higher degrees of income inequality.

Section 4 - Endogenous Corruption

A proposition tested in this paper is that corruption is the endogenous result of bureaucratic red tape as well as other institutional variables. Furthermore, the neglect of the endogeneity of corruption may lead to erroneous conclusions about corruption's effect on economic growth.

In Barreto (1998), I present a neoclassical growth model where corruption is the endogenous result of competition between the public sector and the private sector. In this framework, endogenous corruption is a function of the public sector's share in the production process. The corruption equilibrium, in the eyes of the private sector, is second-best to a "clean" economy, where the public sector produces and distributes its services as if it were a perfectly competitive industry. When red tape is introduced to the model, the corruption equilibrium can be shown to be preferable to both agents in terms of welfare as well as growth, thereby implying efficiency-enhancing corruption. In other words, if corruption serves to alleviate excessive bureaucratic red tape, it can be a "good thing."

The association between red tape and corruption is intuitively plausible and theoretically justifiable. But what are the other factors that influence corruption? Section 1 of this paper discussed the factors that one might expect to influence corruption. The model is specified as follows.

$$Corruption = d_1 + \underset{(+)}{Red\ Tape} \times d_2 + \underset{(-)}{Govt./GDP} \times d_3 + \underset{(-)}{Education} \times d_4 + \underset{(-)}{Initial\ GDP} \times d_5 + e \qquad 4.1$$

Similar to the last section, I performed an extreme-bounds analysis (Leamer, 1983) on corruption as the dependent variable. The underlying model assumption is that REDTAPE belongs in the corruption equation. According to Leamer (1983), REDTAPE would therefore be an "I-variable." The variables in question that are to be tested are "M-variables."

Table 9

Sensitivity Analysis of M Variable affecting Corruption						
Dependent Variable: CORRUPT						
Variable		coef.	S.E.	t	R sq.	Other Variables
G_GDP	base:	-2.434	3.160	-.770	.710	REDTAPE
	high:	-2.434	3.160	-.770	.710	REDTAPE
	low:	.004	3.120	.001	.760	REDTAPE G_GDP SED75 LATAM
SED75	base:	2.834	.797	3.554*	.755	REDTAPE
	high:	2.756	.757	3.642*	.757	REDTAPE SED75 POLSTAB
	low:	.100	1.389	.072	.779	REDTAPE SED75 GINI POLSTAB GDP70 OECD LATAM
GDP70	base:	.221	.055	4.057*	.756	REDTAPE
	high:	.215	.052	4.119*	.757	REDTAPE GDP70 POLSTAB
	low:	.074	.067	1.102	.782	REDTAPE GDP70 POLSTAB SED75 OECD LATAM

Standard errors are all White corrected for heteroskedasticity.
* significant at 5% or below

The results of the sensitivity analysis are presented in Table 9. Notice that all three of the variables in question, G_GDP, SED75 and GDP70 are fragile, but that SED75 and GDP70 perform significantly better that G_GDP. Based on this empirical fact, the "best" model for corruption is therefore:[9]

$$Corruption = d_1 + \underset{(+)}{Red\ Tape} \times d_2 + \underset{(-)}{Education} \times d_3 + \underset{(-)}{Initial\ GDP} \times d_5 + e \qquad 4.2$$

Table 10 presents the results of corruption as the endogenous variable. Columns [1] to [4] consider the entire *Data Set #1,* and columns [4] to [7] consider only non-OECD countries. As expected, bureaucratic red tape is the most significant determinant of corruption, followed by GDP70 and SED75. Notice that the OECD dummy is positively correlated with CORRUPT, which suggests that corruption is disproportionately lower than in OECD countries, a result that reinforces the government expenditure-corruption relationship.

[9] The signs below the equation represent the direction of the correlation with corruption, i.e. a higher relative Initial GDP should be associated with less corruption. But recall that the nature of CORRUPT variable is that a high value represents *less* corruption. In Table 9, as in all the tables, the coeficient signs represent the direction of the correlation with the variable CORRUPT.

Table 10

Endogenous Corruption
Dependent Variable: CORRUPT

Independent Variables	----------- All Countries -----------				non-OECD Countries		
	[1]	[2]	[3]	[4]	[5]	[6]	[7]
C	1.175~	1.129*	1.299*	.977*	.749	.807	.867
	(.823)	(.521)	(.581)	(.505)	(.994)	(.704)	(.704)
REDTAPE	.687*	.687*	.708*	.693*	.789*	.788*	.794*
	(.085)	(.085)	(.082)	(.086)	(.096)	(.094)	(.094)
G_GDP	-.219				.264		
	(2.628)				(2.732)		
SED75	1.686~	1.694*	.473	1.717*	.558	.554	-.033
	(1.043)	(1.027)	(1.344)	(1.037)	(1.458)	(1.448)	(1.503)
GDP70	.136*	.137*	.074	.139*	.199*	.198*	.151~
	(.067)	(.067)	(1.12)	(.068)	(.118)	(.117)	(.111)
OECD			1.266*				
			(.743)				
LATAM			.817*	.438			.716
			(.570)	(.474)			(.606)
N	58	58	58	58	40	40	40
R Squared	.767	.767	.782	.772	.615	.615	.633

OECD and LATAM are dummy variables for OECD countries and Latin American countries, respectively.
Standard errors in brackets are all White corrected for heteroskedasticity.
* significant at 5% or below
~ significant at 10%

An interesting influence on corruption is initial GDP. The coefficient on GDP70 is almost always positive and significantly different from zero. This implies a negative correlation with corruption. Therefore counties with a higher initial GDP, i.e. the more developed ones, tend to have lower corruption. Those same countries also tend to have lower per capita growth rates. Furthermore recall that the evidence that CORRUPT is negatively correlated with growth. (i.e. refer back to tables 6 and 7) In sum, higher initial GDP levels are associated with lower corruption levels and lower corruption levels are associated with lower growth rates. Taken together, these results loosely conform to the theory of international convergence of economic growth rates.

Section 5 - Endogenous Corruption and Growth

This section considers endogenous corruption within the growth model. A simple two-stage-least-squares estimation technique is used. The pivotal issue is the way in which growth is specified. I test three specifications. They are ones described by Table 6, columns [5], Table 6, column [7], and Table 7, column [5]. The specification for corruption employed in all of the following estimations is the same as in Table 10, column [4]. The three two-stage-least-squares estimates are described as follows:

System 1

$$CORRUPT = a_1 + REDTAPE\ a_2 + G\_GDP\ a_2 + GDP70\ a_3 + OECD\ a_4 + LATAM\ a_5 + e_{1.1} \quad 5.1$$

$$GROWTH = b_1 + INV\_GDP\ b_2 + POLSTAB\ b_3 + CORRUPT\ b_4 + LATAM\ b_5 + e_{1.2} \quad 5.2$$

System 2

$$CORRUPT = a_1 + REDTAPE\ a_2 + G\_GDP\ a_2 + GDP70\ a_3 + OECD\ a_4 + LATAM\ a_5 + e_{2.1} \quad 5.3$$

$$GROWTH = b_1 + INV\_GDP\ b_2 + POLSTAB\ b_3 + CORRUPT\ b_4 + SED75\ b_5 + GDP70\ b_6 + POPGR\ b_7 + e_{2.} \quad 5.4$$

System 3

$$CORRUPT = a_1 + REDTAPE\ a_2 + G\_GDP\ a_2 + GDP70\ a_3 + OECD\ a_4 + LATAM\ a_5 + e_{3.1} \quad 5.5$$

$$GROWTH = b_1 + INV\_GDP\ b_2 + POLSTAB\ b_3 + CORRUPT\ b_4 + GINI\ b_5 + OECD\ b_6 + e_{3.2} \quad 5.6$$

The results of the three experiments are reported in Table 11. CORRHAT is the appropriate fitted value from the reduced form equation for CORRUPT. Columns [1] and [2] in Table 11 are the same as columns [4] and [8] from Table 10. Columns [4] and [6] are the same as columns [3] and [5], respectively, except that only non-OECD countries are considered. Notice that the coefficient on the corruption variable is significant only in columns [3] and [7]. In columns [5] and [6], which represent the basic growth model with corruption and political stability added to it, the coefficient on corruption is insignificant. Thus, when corruption's endogeneity is explicitly addressed within the basic model, corruption has little bearing on growth. In column [7], which is the robust growth model with corruption and inequality added to it, all the variables are significant. The results of growth on endogenous corruption suggest that, if corruption plays a part in determining growth rates, it has a positive influence. This evidence supports the proposition that corruption may enhance efficiency.

Table 11

Two-Staged-Least Squares

Growth and Corruption

Stage 1-Dep.Var.: CORRUPT			Stage 2 - Dependent Variable: GROWTH					
				----- Sys. 1 -----		----- Sys. 2 -----		Sys. 3
Independent Variables	[1]	[2]	Independent Variables	[3]	[4]	[5]	[6]	[7]
C	1.104*	.533	C	-.031*	-.047*	-.017	-.007	.037~
	(.538)	(.624)		(.011)	(.011)	(.020)	(.029)	(.028)
REDTAPE	.667*	.782*	INV_GDP	.001*	.001*	.002*	.002*	.0009*
	(.092)	(.114)		(.0004)	(.0004)	(.0005)	(.0006)	(.0004)
G_GDP	3.107*	2.111	POLSTAB	.008*	.008*	.007*	.006*	.008*
	(1.540)	(2.702)		(.001)	(.002)	(.002)	(.003)	(.003)
SED75			CORRHAT	-.004*	-.001	-.003	-.002	-.004*
				(.001)	(.001)	(.003)	(.003)	(.002)
GDP70	.109*	.222~	SED75			-.016	-.024	
	(.076)	(1.527)				(.020)	(.027)	
DEF_GDP			GDP70			-.002	-.004*	
						(.002)	(.002)	
OECD	1.000*		POPGR			-.565~	-.805	
	(.418)					(.407)	(.677)	
LATAM	.862~	.530	GINI					-.137*
	(.590)	(.755)						(.047)
			LATAM	-.010*	-.018*			
				(.005)	(.006)			
			OECD					-.022*
								(.009)
N	53	36	N	53	36	53	36	25
R Squared	.789	.645	R Squared	.492	.586	.554	.582	.489

OECD and LATAM are dummy variables for OECD countries and Latin American countries, respectively.
Standard errors in brackets are all White corrected for heteroskedasticity.
* significant at 5% or below
~ significant at 10%

The most interesting results pertaining to growth are those of column [7]. Only Mauro (1995), has explicitly included corruption in a Barro type growth model. His results are opposed to the current findings. On the other hand, there are several empirical studies that associate inequality to growth with results conforming with these. Furthermore, since the traditional factors that affect growth are included in the specification of corruption and all the signs conform to intuition, it seems that the above system of dependent equations is an appealing specification for corruption and its consequent effect on growth.

Section 6 - Endogenous Corruption and Inequality

The weakness of the results in Table 11, column [7] is the assumption that the inequality measure is exogenous. Theoretical work dating back to Kuznets (1955), followed by extensive empirical studies (Ram, 1995, 1989; Anand and Kanbur, 1992), strongly support a relationship between development and inequality. Of course, it is also intuitively reasonable to believe that a country's level of inequality is a function of its development, as well as various institutional factors.

Kuznets (1955) proposed the hypothesis that during the course of a country's economic growth, inequality increases, reaches a peak, and then declines. Therefore, the theory suggests that inequality is the consequence of a country's early development. The functional form that implies such a relationship is described as follows:

$$Inequality = a + b \cdot GDP + g \cdot GDP^2 \qquad 6.1$$

The inverted U shape of the development inequality relationship implies that the expected signs of b and g are positive and negative, respectively. This next section tests for the presence of a Kuznets process and then explores some alternative specifications.

A few comments regarding the functional form are in order. First, if GDP is zero, then one would expect that inequality should also be zero. Therefore, the only permissible value for a is also zero. Ram (1995) pointed out that this constraint is important and should not be overlooked. Second, other empirical papers extend the inverted-U functional form to include other institutional regressors (Bourguignon and Morrisson, 1990). This is not clearly justifiable if the added institutional regressors are themselves proxies for the level of development in a country. In such a case, the regressors in question should be treated as alternatives to the income terms, not additions to them. In a cross-sectional framework, however this observation does not apply to variables that represent structural differences among observations within the sample.[10]

Table 12 reports the results of the tests of Kuznets' Hypothesis. I find little support for the Kuznets process in its traditional form but some support for it given the $a=0$ constraint. Irrespective of which specification is considered, it is evident that the inequality development relationship is misspecified. In Table 12, column [1], the significance of the coefficient on the constant is extremely high and in column [3], the model fit is poor. It is likely that both columns [1] and [3] are misspecified.

In light of the above results as well as the conclusions from previous work where I found that corruption should have a significant effect on income inequality (see Barreto, 1996), consider the following income-inequality model:

$$Inequality = b_1 + [\underset{(+)}{Corruption}, \underset{(+)}{DPopulation}, \underset{(+)}{Education},...] \times b_{2i} + e \qquad 6.2$$

It is natural that the population growth affects inequality. The populations with the highest birthrates are often the poorest segments of an economy. Thus, the population growth will disproportionately affect the income of one group more than another. It seems plausible that as the general population becomes more educated, the degree of income inequality would decrease. As education improves, so does number of individuals who distinguish themselves. These individuals eventually pose competition to the established wealth. As the competition increases, inequality should therefore decrease.

[10] The exclusion of the constant term as suggested by Ram (1995) also necessarily prohibits the addition of structural regressors, otherwise $inequality(0)=b\cdot GDP(0)+g\cdot GDP(0)^2$ will not hold.

Table 12

Development and Inequality

Dependent Variable: GINI

Independent Variables	[1]	[2]	[3]
C	.457*	.502*	
	(.032)	(.039)	
GDP	-.014	-0.008	.159*
	(.017)	(-0.016)	(.025)
GDP2	.0002	.0003	-.012*
	(.001)	(.001)	(.002)
CORRUPT		-.013*	
		(.007)	
N	25	25	25
R Squared	.471	.539	.067

Standard errors in brackets are all White corrected for heteroskedasticity.
* significant at 5% or below

Table 13 reports the results of the sensitivity analysis. Notice that POPGR is robust to the inclusion of other variables. SED75 is robust at the 10% level. CORRUPT loses its significance depending on the other regressors included and is therefore fragile.

Table 14 reports the results of the three regressions. Although the coefficients on POPGR and SED75 in column [1] and [2] are significant, the coefficient on CORRUPT is not. But in column [3] and [4], when education is omitted from the inequality model, corruption is significant at the 10% level. The results of the test for the determinants of income distribution suggest the following. As is theoretically expected, higher populations growth rates also imply greater inequality, and higher average educational attainment is associated with less inequality. In the absence of education, corruption implies greater inequality.

Table 13

Extreme Bounds Analysis						
Dependent Variable: GINI						
Test Variable		coef.	S.E.	t	R sq.	Other Variables
CORRUPT	high:	.506	.034	15.097*	.520	
	base:	.506	.034	15.097*	.520	
	low:	.002	.006	.405	.841	GDP70 POPGR G_GDP SED75 LATAM
POPGR	high:	6.725	1.173	5.731*	.761	GDP70 DEF_GDP
	base:	5.951	.011	25.613*	.670	
	low:	2.762	1.452	1.905*	.790	SED75 CORRUPT LATAM
SED75	high:	-.350	.091	-3.768*	.765	GDP70 CORRUPT G_GDP
	base:	-.236	.037	-6.451*	.695	
	low:	-.081	.055	-1.47~	.815	DEF_GDP G_GDP LATAM

Table 14

Inequality and Development
Dpendent Variable: GINI

Independent Variable	[1]	[2]	[3]	[4]
C	0.423*	.408*	.360*	.357*
	-0.057	(.050)	(.048)	(.043)
CORRUPT	.003	.001	-.007~	-.006~
	(.006)	(.006)	(.005)	(.004)
POPGR	2.820*	2.762*	4.560*	4.094*
	(1.528)	(1.452)	(1.285)	(1.457)
SED75	-.176*	-.141~		
	(.090)	(.086)		
LATAM		.049*		.057*
		(.020)		(3.211)
N	25	25	25	25
R sq.	.744	.790	.701	.763

OECD is a dummy variables for OECD countries.
Standard errors in brackets are all White corrected for heteroskedasticity.
* significant at 5% or below
~ significant at 10%

Notice that the significance of the constant term is still very high in all of the cases. But, comparing Table 12 to Table 14, the results from the latter estimation provide a somewhat better fit. It would seem that more work needs to be done with respect to test for the determinants of inequality.

Section 7 - Endogenous Corruption, Inequality, and Growth

The results thus far show that corruption has a questionable effect on income distribution and that corruption also seems to aid growth. In this section I construct a system of three jointly dependent equations that I estimate using a two-stage-least-squares estimation technique. I test three different models. All employ the specification for growth from Table 7, column [5] and the specification for corruption from Table 10, column [2]. Model 1 assumes a Kuznets process for inequality, and Model 2 and Model 3 assumes the ad hoc definitions of inequality that was developed in Section 6.

2SLS Model 1

$$Growth = a_1 + a_{2i} \times [Investment/GDP, PoliticalStability, Corruption, Inequality, OECD] + e_1 \qquad 7.1$$

$$Inequality = b_1 + b_{2j} \times [Corruption, GDP, GDP^2] + e_2 \qquad 7.2$$

$$Corruption = d_1 + d_{2k} \times [RedTape, Govt/GDP, InitialGDP] + e_3 \qquad 7.3$$

2SLS Model2

$$Growth = a_1 + a_{2i} \times [Investment/GDP, PoliticalStability, Corruption, Inequality, OECD] + e_1 \qquad 7.4$$

$$Inequality = b_1 + b_{2j} \times [Corruption, PopulationGrowth, Education, LATAM] + e_2 \qquad 7.5$$

$$Corruption = d_1 + d_{2k} \times [RedTape, Govt/GDP, InitialGDP] + e_3 \qquad 7.6$$

2SLS Model3

$$Growth = a_1 + a_{2i} \times [Investment/GDP, PoliticalStability, Corruption, Inequality, OECD] + e_1 \qquad 7.7$$

$$Inequality = b_1 + b_{2j} \times [Corruption, PopulationGrowth, LATAM] + e_2 \qquad 7.8$$

$$Corruption = d_1 + d_{2k} \times [RedTape, Govt/GDP, InitialGDP] + e_3 \qquad 7.9$$

Table 15 reports the results of the above three models. CORRHAT is the fitted value for corruption and GINIHAT is the fitted value for inequality. In summary, the system of equations suggests that corruption aids growth and inequality hinders it. Higher relative investment and political stability are associated with higher growth rates and OECD countries generally have lower growth rates. The effect of corruption on income inequality depends on how inequality is specified. In column [2], the coefficient on corruption is significant and negative, implying that more corruption is associated with less income equality. In column [4], the coefficient on

Table 15

Two Stage Least Squares

Jointly Dependent Variables: GROWTH, GINI & CORRUPT

		Model 1		Model 2		Model 3	
Pre-determined Variables	[1]	[2]	[3]	[4]	[5]	[6]	[7]
	CORRUPT	GROWTH	GINI	GROWTH	GINI	GROWTH	GINI
C	1.048	.051~	.524*	.061*	.408*	.071*	.367*
	(.867)	(.032)	(.039)	(.035)	(.050)	(.036)	(.052)
CORRHAT		-.004*	-.019*	-.004*	.002	-.004*	-.007~
		(.001)	(.008)	(.002)	(.012)	(.002)	(.005)
GINIHAT		-.175*		-.195*		-.227*	
		(.052)		(.065)		(.071)	
GDP			-.005*				
			(.017)				
GDP2			.0003				
			(.001)				
POPGR					2.743*		3.892*
					(1.440)		(1.595)
SED75					-.149		
					(.137)		
INV_GDP		.0008*		.0008*		.0007*	
		(.0004)		(.0003)		(.0003)	
POLSTAB		.008*		.008*		.009*	
		(.003)		(.003)		(.003)	
OECD		-.026*		-.026*		-.031*	
		(.011)		(.010)		(.010)	
REDTAPE	.556*						
	(.146)						
G_GDP	2.720*						
	(1.092)						
GDP70	.335*						
	(.086)						
LATAM					.049*		.057*
					(.019)		(.022)
N	25	25	25	25	25	25	25
R Squared	.851	.456	.537	.520	.790	.557	.761

OECD and LATAM are dummy variables for OECD countries and Latin American countries, respectively.
Standard errors in brackets are all White corrected for heteroskedasticity.
* significant at 5% or below
~ significant at 10%

corruption is insignificant and in column [6] it is significant at the 10% level. Also from columns [4] and [6], higher population growth rates are associated with greater inequality and Latin American countries have a higher propensity for income inequality. Interestingly, the coefficient on education loses significance when the endogeneity of corruption is explicitly considered.

Conclusion

The evidence from this study demonstrates the statistical importance of corruption in the development of a robust model that explains the growth rate of per capita real GDP. It also demonstrates the statistical importance of corruption in determining income inequality. Depending upon how inequality is specified, corruption aids growth at the expense of more unequal distribution of incomes. The results differ significantly from previous work on corruption's effect on growth.

Bibliography

Adelmann, Irma and Sherman Robinson, (1989), "Income Distribution and Development" in H. Chenery and T.N. Srinivisan, eds., *Handbook of Development Economics,* (North-Holland, New York).

Alesini, Alberto, Sule Özler, Nouriel Roubini, and Phillip Swagel, (1992), "Political Instability and Economioc Growth", National Bureau of Economic Research Working Chapter No. 4173.

Alesina, A. and D. Rodrick, (1991), "Distributive Politics and Economic Growth", National Bureau of Economic Research Working Chapter No. 3668.

Anand, Sudhir, and S. M. R. Kanbur, (Feb. 1993), "The Kuznets Process and The Inequality-Development Relationship", *Journal of Development Economics*, Vol. 40, No. 1, p. 25-52.

Barreto, Raul A., (1996), "Institutional Corruption and Paraguayan Economic Development", Ph.D. Thesis, University of Colorado, Boulder, CO, Chapter 2.

Barreto, Raul A., (1996), "Corruption in a Simple Endogenous Growth Model", Ph.D. Thesis, University of Colorado, Boulder, CO, Chapter 3.

Barro, Robert J., (1989), "Economic Growth in a Cross Section of Countries" , *The Quarterly Journal of Economics*, Vol. 98, p. s103-s125.

Borsu, A. and H. Glejser, (1992), "Do Protection, Schooling, Product Per Head and Income Distribution Influence growth? A Cross sectional Analysis", *European Economic Review*, Vol. 36, No. 2, p. 1235-1239.

Bourguignon, F. and C. Morrisson, (1984), "Income Distribution, Development and Foreign Trade: A Cross-Sectional Analysis", *European Economic Review*, Vol. 34, No. 6, (Sept. 1990), p. 1113-1132.

Business International Corporation, *Introduction to the Country Assessment Service*, (New York, NY: Business International Corporation,

Business International Corporation, (1995), *Managing and Evaluating Country Risk*, (New York, NY: Business International Corporation, 1981).

Clarke, George R. G., "More Evidence on Income Distribution and Growth", *Journal of Economic Development*, Vol. 47, No. 2, p. 403-427.

De Soto, Hernando, (1989), *The Other Path*, (New York, NY: Harper and Row).

Fields, Gary S., (1989), “Changes in Poverty and Inequality in Developing Countries”, World Bank Research Observer, No. 4, p. 167-185.

Kmenta, Jan, (1986), *Elements of Econometrics*, Macmillan Publishing Company, New York, New York.

Krueger, Ann O., (1993), “Virtuous and Vicious Cycles in Economic Development”, *Chapters and Proceedings of the American Economic Association*, LXXXIII, p. 351-356.

Kuznets, Simon, (March 1995), “Economic Growth and Income Inequality”, *American Economic Review*, Vol. 45, p. 1-28.

Leff, Nathaniel H., (Nov. 1964), “Economic Development Through Bureaucratic Corruption”, *The American Behavioral Scientist*, Vol. 8, No. 3, p. 8-14.

Levine, Ross and David Renelt, (Sept. 1992), “A Sensitivity Analysis of Cross-Country Growth Regressions”, *The American Economic Review*, Vol. 82, No. 4, p. 942-963/

Mauro, Paulo, (August 1995), “Corruption and Growth”, *The Quarterly Journal of Economics*, No. ___, p. 681-712.

Park, Walter G. and David A. Brat, (1995), “A Global Kuznets Curve?”, *Kyklos*, Vol. 48, No. 1, p. 105-31.

Persson, Torsten, and Guido Tabellini, (Jan. 1995), “Is Inequality Harmful for Growth? Theory and Evidence”, National Bureau of Economic Research Working Chapter No. 3599, (Jan 1991), p. 1-37.

Ram, Rati, “Economic development and Income Inequality: An Overlooked Regression Constraint”, *Economic Development and Cultural Change*, Vol. 43, No. 2, p. 425-434.

Sauma, Pablo, (1993), *La Distribucion del Ingreso en el Paraguay*, (Universidad Nacional de Asuncion, Proyecto ATP/SF-2156-PR, Cromos S.R.L.).

Summers, Robert and Alan Heston, (March 1988), “A new Set of International Comparisons of real Product and Price Levels Estimates for 130 Countries, 1950-1985”, *Review of Income and Wealth*, Series 26, No. 1, p. 1-25.

Summers, Robert and Alan Heston, (May 1991), “The Penn World Tables (Mark 5): An Expanded Set of International Comparisons, 1950-1988”, *The Quarterly Journal of Economics*, No. 106, p. 327-368.

Taylor, Charles L. and David A. Bodice, (1983), *World Handbook of Political and Social Indicators, Third Edition, Volume 1, Cross National Attributes and Rates of Change,* (Wissenschaftszentrum-Berlin).

Taylor, Charles L. and Michael C. Hudson, (1972), *World Handbook of Political and Social Indicators, Second Edition*, (Ann Arbor, MI: ICSPR).

World Development Report, (Oxford University Press, various years).