Abstract

This paper uses panel data from African countries and a dynamic panel estimator to investigate the effects of corruption on economic growth and income distribution. I find that corruption decreases economic growth directly and indirectly through decreased investment in physical capital and in education. A unit increase in corruption reduces the growth rates of GDP and per capita income by about 1.5 percentage points and between .75 percentage points per year respectively. The results also indicate that increased corruption is positively correlated with income inequality. The combined effects of decreased income growth and increased inequality suggests that corruption hurts the poor more than the rich in African countries.

KEY WORDS: CORRUPTION, ECONOMIC GROWTH, INCOME DISTRIBUTION, DYNAMIC PANEL ESTIMATOR, AFRICA.

JEL CLASSIFICATION: O11, O55, K42

Corruption, Economic Growth, and Income Inequality in Africa[1]

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1 Introduction

Poverty, slow economic growth, and unequal income and wealth distribution are endemic in African countries. Indeed, Africa has made the least progress in improving living standards among the developing regions of the world. Poor economic performance is not limited to resource-poor countries of the Sahel region; it is also a feature of resource-rich countries such as the Democratic Republic of Congo and Nigeria. Coexisting with poor economic performance is widespread corruption, or the *perception* of widespread and increasing corruption in African countries. A recent publication ranked two African countries as the most corrupt countries in the world.[1] Though some critics may take issues with how "objective" these rankings are, there is anecdotal evidence that corruption is widespread in African countries.[2] Yet few studies have attempted to empirically investigate the effects of corruption on economic growth and income distribution in African countries. To what extent does corruption affect economic growth and poverty reduction in Less Developed Countries (LDCs) generally and African countries in particular? If corruption affects economic growth and income distribution, what is the mechanism through which it affects economic performance?

This paper investigates the effects of corruption on economic growth and income distribution in African countries. I do so by using a dynamic panel estimator to estimate a growth equation and an income inequality equation that includes corruption as an additional regressor. The dynamic panel estimator allows me to obtain consistent estimates of the growth equation in the presence of dynamics and endogenous regressors. The objective of economic development is to increase the living standards and the well-being of all citizens in a country. Improvements in the quality of life include increased material well being, widening its distribution, as well as expanding the range of choices available to all citizens. Anything that blocks the chances of improving the quality of life for any group of citizens, especially the poor, blocks the chances for economic development and may retard economic growth. To the extent that corruption has a negative effect on economic growth and increases income inequality, it hampers economic development.

I focus on African countries for a number of reasons. First, with a few exceptions, corruption in African countries is systemic. It is possible that the development impact of systemic corruption is different from that of other types of corruption. Focusing on African countries allows me to study the effects of systemic corruption on economic development. African countries generally tend to have weak and fragile institutions. A large number of African economies are currently undergoing Structural Adjustment Program (SAPs), including the privatization of State-Owned Enterprises (SOEs), mandated by the World Bank and the IMF. Economic restructuring with weak institutions could lead to bad outcomes if there is high level corruption, especially if corruption takes the form of state capture by high level politicians and the bureaucracy. The combination of economic restructuring and weak institutions offers a second reason why studying corruption in Africa is of interest. Thirdly, the private sector in African countries tend to be relatively small and weak as compared to economies elsewhere. Corruption is likely to exacerbate the inefficiencies imparted by the large government sectors, thus further slowing development under such circumstances.

African countries are large recipients of external aid to spur economic development. With high levels of corruption, it is possible that aid will be siphoned into private wealth, thus retarding development. Africa's economic growth since colonial days has been powered by foreign direct investment (FDI) of the extractive variety. In spite of the enormous amount of natural resources, FDI to African countries has been shrinking in both relative and absolute terms in recent years (African Development Bank 2000). This is partly due to corruption in African countries (Brunetti *et al* 1998). Corruption in African countries tend to be of the decentralized and disorganized type in which paying a bribe to one official does not guarantee that a service will be provided. This type of corruption may be more deleterious to growth and development than the centralized and organized type found in Asia. For all these reasons, it is most likely that corruption could have a different effect on economic development in African countries than elsewhere. To the extent that the cause, and the economic effects of corruption may depend on cultural and institutional factors as well as low income levels, focusing exclusively on African countries decreases the cultural and institutional heterogeneity embedded in most cross-national studies of corruption. I note that this is the first paper to use the dynamic panel estimator to investigate the effects of corruption on economic development. I neither limit myself to political corruption, ethical issues of corruption; nor do I concern myself with the causes of corruption. I only focus on the economic consequences of corruption.

While economist recognize the role of corruption in economic performance, most efforts in the literature has focused on the causes of corruption and the effect it has on economic growth. Recently, a few studies have tried to link corruption to income distribution in a sample of countries.[3] None of the studies on corruption has investigated either the causes or consequences of corruption in African countries. As indicated above, in addition to low living standards, income is also highly unequally distributed in African countries.[4] Furthermore, corruption in African countries is systemic and involves high-level political leadership.[5] These facts, combined with the *perception* of widespread corruption in African countries cries for an investigation into the relationship between economic performance and corruption in African countries.

I find that corruption has a negative and statistically significant effect on the growth rate of income in African countries both directly and indirectly. A one point increase in corruption decreases the growth rates of GDP by about 1.5 percentage points per year and of per capita income growth rate by about .75 percentage points per year, respectively. Corruption decreases the growth rate of income directly through reduced productivity of existing resources as well as decrease investment in physical capital. Secondly, I find that corruption is positively correlated with income inequality, as measured by the gini coefficient; a one point increase in the corruption is associated with a 7 point increase in the gini coefficient of income inequality. To the extent that rapid economic growth increases the incomes of the poor and hence reduces poverty, increases in corruption hurts the poor rather than the rich and powerful.

The rest of the paper is organized as follows: Section 2 provides a working definition of corruption and briefly reviews the literature on the economic consequences of corruption. Section 3 presents an econometric growth equation and of the gini coefficient of income distribution that include corruption as an added regressor. Section 4 describes the data and the estimation method while section 5 presents and discusses the statistical results. Section 6 concludes the paper.

2 Working Definition and Literature Review

Corruption means different things to different people depending on the individual's discipline, cultural background, and political leaning. In this paper, I define corruption as the use of public office for private gain. I define public broadly to include private businesses, government, international organizations, and para-statals. Thus corruption can take place in any transaction that involves a public official as I define here. Defined this way, corruption is seen as a special case of the principal agent problem, with the general public as the principal, and the public official as the agent. While a large proportion of corrupt practices is illegal, I do not take a legal approach to the definition of corruption since not all corrupt practices are illegal and not all illegal activities are corrupt practices. Jain (2001) identifies three categories of corruption—grand involving political elite, bureaucratic involving corrupt practices by appointed bureaucrats, and legislative corruption involving how legislative votes are influenced by the private interest of the legislator. The three types of corruption differ only in terms of the decisions that are influenced by corrupt practices. The ultimate result of corruption in each case is the same—the misallocation of resources and inefficiency. My working definition of corruption is broad enough to encompass all three forms of corruption.

Even with this narrow definition, there may still be problems of interpretation and measurement of corruption. For example, when does a "gift" to a public official become a bribe? To what extent is money given to an African public official to influence policy (which is considered bribery) different from a contribution to a congressional campaign in the US (not considered bribery)? There is also the problem of common comparative measures. Suppose corruption takes the form of bribery, does the extent of corruption depend on the absolute size of the bribe? Is a country that has a decentralized corruption (one in which each agent is a "self employed bribery contractor") less corrupt than one in which corruption is centralized ("one stop shopping variety") even though the absolute amount of bribes are higher in the latter system? I do not attempt to answer these issues hence readers should keep these in mind when evaluating my results.

Economists generally see corruption as part of the problem of rent seeking (Tanzi 1997, Shleifer and Vishny 1993, Mauro 1995 among others).[6] In this approach, corruption slows economic growth because it distorts incentives and market signals leading to misallocation of resources, especially human talent, into rent-seeking activities. Second corruption and the opportunities for corrupt practices lead resources, especially human resources, to be channeled into rent seeking, rather than, productive activities. Third, corruption is seen as an inefficient tax on those who are forced to pay it hence it raises the cost of production. Fourth, because corrupt practices are conducted in secrecy and contracts emanating from them are legally not enforceable, corruption increases transactions cost. Fifth, corruption may lead bureaucrats to channel government expenditures into unproductive sectors, such as defense, that offer opportunities for rent seeking (Gupta *et al* 2000). Corruption may also reduce the productivity of resources because it degrades the quality of such resources. For example, corruption can lead to reductions in the quality of education and health care, hence decreased human capital. Finally, corruption increases not only the cost of production but also uncertainty, especially in the case of decentralized corruption, hence decreasing investment in both physical and human capital.

Among the factors found to increase corruption by researchers are low levels of law enforcement, lack of clarity of rules, of transparency and accountability in public actions, too many controls that give too much discretion to the public official, too much centralization and monopoly given to the public official, low relative wages of public officials, as well as the large size of the public sector (Ades and Di Tella 1999, Tanzi 1997, Van Rijckeghem and Weder 2001, Kaufmann and Siegelbaum 1997, and Rose Ackerman 1997). While these studies do not generally agree that all the factors affect corruption all the time, they agree that the larger the government sector, the lower the relative wage of the public sector and the lower the quality of the bureaucracy, the more widespread corruption is likely to be. Although this paper does not deal with the causes of corruption, knowing the causes of corruption can provide guidance on reducing corruption.

The literature has focused on the effects of corruption on economic growth. Mauro (1995, 1997) uses data from a sample of developed and developing countries to investigate the effects of corruption on economic growth. Using a single equation model and employing both Ordinary Least Squares (OLS) and Instrumental Variables (IV) estimating techniques, he finds that corruption has a negative and significant impact on economic growth. Most of the growth impact, he finds, comes through decreased investment in physical capita. Tanzi (1998) and Tanzi and Davoodi (1997) investigate the effects of corruption on economic growth and government expenditures. They find that corruption increases government expenditures but decreases expenditures on maintenance and this leads to reduced economic growth since the new capital cannot be put to use for lack of complementary inputs. They also find that corruption decreases private investment. Mo (2001), using OLS estimates and cross sectional data finds that corruption has a negative effect on the growth rate of a sample of countries. In addition to direct effect, he also finds that corruption impacts growth through private investment, education, and through political instability, with political instability providing the bulk of the growth effect. The total growth of corruption is calculated to be about .5 percentage points. Wei (2000) finds that corruption decreases the inflow of foreign direct investment into a country. Gupta *et al* (1998) find that corruption increases income inequality in a sample of developing countries. Alesina and Weder (1999) investigate whether corrupt governments receive less foreign aid and conclude that corrupt governments receive *more* foreign aid under some circumstances.

Li *et al* (2000) investigate the effects of corruption on income and the gini coefficient of income distribution using data from Asian, OECD, and Latin American countries. They find that corruption increases the gini coefficient in a quadratic way; the gini coefficient is higher for countries with intermediate level of corruption while it is low for countries with high or low levels of corruption. They also find that corruption affects the gini coefficient through government consumption. They, however, do not allow economic growth to influence the gini coefficient. Gupta *et al* (1998) finds that corruption increases income inequality in a sample of developing countries. They also find that increased corruption is associated with decreases in the share of government expenditures devoted to education and health care. Hendriks *et al* (1998) and Johnston (1989) find that the distributional effects of corruption and tax evasion are regressive, hence increases income inequality.

None of the studies mentioned above focuses on Africa. It is possible that cultural norms make African concepts of corruption different from those of other parts of the world. Using only African data to investigate the effects of corruption on development may eliminate some of the intervening variables and hence provide a sharper analysis than has hither to be done. Furthermore, as argued above, the nature of corruption in African countries require that it be studied separately. Although the studies mentioned above do not concentrate on Africa, they provide some guide as to the mechanisms through which corruption affects economic outcome; corruption retards economic growth by decreasing the productivity of existing resources. Secondly, corruption decreases private investment in physical capital as well decreases in human capital, providing another channel through which corruption affects economic growth (Wei 2000, Mauro 1995, Gupta *et al* 1998). Slow growth and corruption interact to increase income inequality. Corruption, investment, and other regressors may not be strictly exogenous in the growth and income distribution equations. I incorporate these ideas in my investigation of the effects of corruption on economic performance in the next section.

3 Model

3.1 Income Growth Rate

The economics literature suggests that corruption has a deleterious effect on economic growth through two main channels; by directly decreasing the productivity of existing resources through lower productive effort, non optimal input mix, degradation of the quality of resources, or through a general misallocation of existing resources, and indirectly, through reductions in investment in both physical and human capital as well as degradation of institutions (Wei 2000, Gupta *et al* 1998, Mauro 1997, Tanzi and Davoodi 1997). Corruption has its own momentum; increased corruption decreases the marginal value of honesty, encouraging more corrupt activities. In this section, I set up a statistical model of the relationship between corruption and economic growth.

The growth equation I estimate is the familiar growth equation popularized by Barro (1991) and estimated by other researchers (Caselli *et al* 1996, Gyimah-Brempong and Traynor 1999, Levine and Renelt 1992, Mankiw, Romer and Weil 1992, Sachs and Warner 1997). I modify the growth equation to include corruption as an added explanatory variable. In its simplest form, the growth rate of income is postulated to depend on investment rate (k), initial level of income (y_0), growth rate of real export ($\dot{x}$), government consumption ($govcon$), and the stock of human capital which I proxy by the educational attainment of the adult population (edu). In addition to these variables, I include corruption ($corrupt$) to measure the quality of institutions in an economy. I specify the growth equation in a linear form for the sake of simplicity. The growth equation I estimate is given as:

$$g = \alpha_0 + \alpha_1 k + \alpha_2 edu + \alpha_3 \dot{x} + \alpha_4 corrupt + \alpha_5 y_0 + \alpha_6 govcon + \epsilon \quad (1)$$

where g is growth rate of real income, ϵ is a stochastic error term, α_is are coefficients to be estimated, and all other variables are as defined above in the text. In accordance with the growth literature, I expect the coefficients of k, edu and $\dot{x}$ to be positive, while *corrupt* is expected to have a negative coefficient. I expect the coefficient of y_0 to be negative if the convergence hypothesis holds for the countries in my sample. I also expect the coefficient of *govcon* to be negative.

There is evidence that investment is not an exogenous variable in growth equations; economic growth affects investment through the acceleration hypothesis just as much as investment affects economic growth.[7] There is also evidence that corruption is not exogenous as it is influenced by economic growth as well as other factors that affect economic growth. Treating k and *corrupt* as exogenous may lead to the usual simultaneous equation bias. I therefore treat them as endogenous regressors in estimating the growth of income equation. Corruption possibly decreases growth directly through decreased productivity and misallocation of existing resources. Indirectly, corruption reduces economic growth through reduction in investment in physical capital. It is possible that corruption has no direct growth effect but still have an indirect growth effect through investment; it could also have no effect on investment yet have a direct growth impact.

3.2 Corruption and Income Inequality

Gupta *et al* (1998), Li *et al* (2000), Hendriks *et al* (1998), and Johnston (1989) argue that corruption increases income inequality through several channels. First, to the extent that corruption decreases economic growth, which is more likely to increase the income share of the poor than the rich, it increases income inequality and poverty. Second, corruption leads to a bias of the tax system in favor of the rich and powerful, thus making the *effective* tax system regressive (Hendriks *et al* 1998), which implies that the burden of the tax system falls disproportionately on the poor.[8] In African countries, the notional tax system is not regressive. However, corruption allows the rich and powerful to escape their tax obligations, hence the tax burden falls almost exclusively on the poor. Corruption leads to the concentration of assets among a few wealthy elite. Because earning power depends, to some extent, on resource endowment (including inherited wealth), the rich are able to use their wealth to further consolidate their economic and political power.

Education in LDCs is a way out of poverty and the poor also benefit from government social programs, such as health care. Corruption decreases the quantity of and effectiveness of social programs that benefit the poor and divert these resources to programs that benefit the rich or provide opportunities for rent extraction, such as defense spending (Gupta *et al* 2000). Even when social programs are not reduced, corruption changes the composition of social spending in such a way as to benefit the rich at the expense of the poor. For example, health care expenditures may be tilted toward building the most "modern" hospital that caters only to the rich at the expense of preventive health care that benefits the poor. In the same way education spending could be skewed towards higher education that benefits the rich rather than towards primary and secondary education that benefits the poor.[9]

Fields (1980) argues that the choice of development strategy influences income inequality as labor intensive development strategy leads to equitable distribution of income while the opposite is true for a capital intensive development strategy. Large subsidies on capital result in a capital intensive development strategy, which increases income inequality. In African countries, production decisions are highly influenced by an elaborate system of taxes and subsidies. While capital is heavily subsidized, labor is taxed at a high rate with the result that businesses choose capital intensive technologies over labor intensive ones. This policy of subsidizing capital is exacerbated by high level corruption in most African countries. This strategy leads to low demand for labor, low wages; a strategy that effectively redistributes the income from the poor to the rich since the subsidies are paid with taxes paid by the poor.

In view of these considerations, I investigate the effects of corruption on income distribution by estimating a simple equation of the determinants of the gini coefficient of income distribution ($gini$). I regress the gini coefficient of income distribution on the growth rate of income, the level of per capita income (y), government consumption, education, and corruption. The gini coefficient equation I estimate is:

$$gini = \gamma_0 + \gamma_1 g + \gamma_2 edu + \gamma_3 y + \gamma_4 corrupt + \gamma_5 govcon + \xi \tag{2}$$

where ξ is a stochastic error term, γ_is are coefficients to be estimated, and all other variables are as defined in the text above. Consistent with the arguments above, I expect *corrupt* to be negatively correlated with the *gini* coefficient while *govcon* is expected to be positively correlated with *gini*.

4 Data and Estimation Method

4.1 Data

The endogenous variables in the model are the growth rate of real income (g) and the gini coefficient of income inequality ($gini$). I measure g alternatively as the annual growth rate of real

GDP (*gdpgrow*) and the annual growth rate of real per capita income in a country (*gnpcapgr*). I measure income inequality by the gini coefficient of income inequality (*gini*). The regressors in the model are k, y_0, $\dot{x}$, per capita income (y), savings rate (gds), import/GDP ratio (m), education (edu), corruption ($corrupt$), ethno-linguistic fractionalization index (elf), and government consumption ($govcon$). Following earlier researchers (Barro 1991, Easterly and Levine 1997, Levine and Renelt 1992, Caselli *et al* 1996, Collier and Gunning 1999, Gyimah-Brempong and Traynor 1999), I measure k as the gross investment/GDP ratio. $govcon$, m, and gds are measured as government consumption/GDP, import/GDP, and gross national savings/GDP ratio respectively, while y is measured as real per capita GDP. $\dot{x}$ is measured as the growth rate of real export earnings, and elf is the probability that two randomly selected individuals in a country do not belong to the same ethno- linguistic group.

Corruption is hard to measure and quantify. For one thing, what is a normally accepted practice in one country or time period in the same country may be considered corrupt in another country or time period. Second, because corruption often involves illegal activities, most corrupt practices are hidden, hence such acts are not easily quantifiable. Instead what the researcher is left with is the *perception* of corruption. There are very few reliable statistics on corruption, hence I use the perception of corruption indices published annually by Transparency International and University of Gottingen as my measure of corruption. The index is an average of different surveys of *perceptions* of corruption in a country in a year. The index is ranked from 0 to 10 with 10 being the least corrupt and 0 the most corrupt. The index has been published annually since 1995 but African countries were not widely covered until 1997 and later. For years prior to 1995, a few of the countries in my sample did not have annual observations for *corrupt*. Fortunately, Transparency International publishes historical data representing the average index of corruption between 1981 and 1994. Where historical data were available for countries, I proxied the corruption data for 1993 and 1994 by the historical data.[10] Where the historical data was not available, that country/year was treated as a missing observation.

While the corruption data from Transparency International is widely cited and used, it has its disadvantages. For one thing, it is based on a survey of *perceived* corruption. What a Western visitor to an African country may perceive as a corrupt practice may be gift giving in the African context. Second, the index says nothing about the degree to which corruption affect resource allocation, hence efficiency. Is corruption decentralized or centralized?, how much money is involved and how many people and what levels of government are involved? The index of corruption I use here does not answer these questions. On the other hand, if a large number of surveys agree that corruption is high in a particular country, one has to put some credence in this index. My results should therefore be interpreted with these data problems in mind.

Data for *gdpgrow*, *gnpcapgr*, y, $\dot{x}$ *gds*, k, *life*, *govcon*, and for the calculation of m were obtained from the World Bank's *World Development Indicators Dataset*, (Washington D.C.: World Bank, 2000). These data sets were updated with data from*African Development Report, 2000*, (New York: Oxford University Press). Data on *edu* was obtained from Barro and Lee (1997) and updated with data from the World Bank's *World Development Report, 1999/2000*. The *gini* coefficient data was obtained from (Deininger and Squire 1996) and supplemented with data from the World Bank's *World Development Report, 1999/2000*. Data on *elf* were obtained from W. Easterly and M. Sewadet, *Global Development Network Growth Data Set*, (Washington DC, World Bank). All nominal variables were converted to real values with 1987 as the base year.

The data are annual observations for a sample of 21 Africa countries for the 1993-1999 period.[11] Not all countries are covered by the survey in each of the seven years in the sample period so I had an unbalanced panel with a total of 125 observations in my sample. Because the estimation method uses differences in the variables, I had a total of 92 usable observations for the regressions. Income inequality data are not generally collected on annual basis, hence I do not have data for all years and countries for which I have data for the other variables. For the *gini* equation, I have 78 observations. Summary statistics of the data are presented in Table I. The summary statistics indicate that growth rate, investment, per capita income, as well as other variables vary greatly across countries. An interesting observation is the low average of the corruption index, indicating that African countries are perceived to be highly corrupt. I note, however, that a few countries in the sample score relatively well in the corruption rankings. One also observes from the sample statistics that average per capita income in African countries is relatively low, is growing too slowly, and is highly unequal distributed.

Figure I presents the plots of the growth rate of real GDP against the index of corruption I use in this study. There is some evidence of a positive correlation between the growth rate of real GDP and *corrupt* although the bivariate evidence is very weak. This relationship may be an example of a situation where strong relationship between two variables (growth rate of real GDP and *corrupt*) can only be revealed after controlling for other variables in the relationship.

4.2 Estimation Method

4.2.1 Growth Equation: The Dynamic Panel Estimator

The growth equation in (1) above is estimated with panel data from 21 African countries for the 1993-1999 period. In panel estimation, neither the Generalized Least Squares (GLS) estimator nor the Fixed Effect (FE) estimator will produce consistent estimates in the presence of dynamics and endogenous regressors (Baltagi 1995). As argued by Caselli *et al* (1996), growth equations, by their nature, are characterized by dynamics and endogenous regressors, hence neither the GLS nor the FE estimator is appropriate. An instrumental variables (IV) estimator that produces consistent estimates in the presence of dynamics is therefore needed.

Arellano and Bond (1991) have proposed a dynamic panel General Method of Moments (GMM) estimator that optimally exploits the linear moment restrictions implied by the dynamic panel growth equation I estimate here. The dynamic GMM panel estimator is an IV estimator that uses all past values of endogenous regressors as well as current values of strictly exogenous regressors as instruments. Estimates can be based on levels, first difference, or on orthogonal deviations.[12] I present estimates for all 3. I use the dynamic panel estimator because I do not have reasonable instruments for the endogenous regressors that could be excluded from the growth equation and partly because the dynamic panel estimator provides consistent estimates in the presence of endogenous regressors. The regression equation can be written in differenced form as:

$$\mathbf{\Gamma \Delta \tilde{y}} + \mathbf{\Delta \tilde{X}' \Theta} + \mathbf{\Delta} \mu = \mathbf{0} \tag{3}$$

where $\mathbf{\tilde{y}}$, $\mathbf{\tilde{X}}$ are vectors of dependent variables and regressors respectively, centered on their period means. μ is the error term, Δ is the difference operator, and Θ is a vector of coefficients. This procedure eliminates all time invariant dummy variables.

The dynamic panel estimator in first differenced form is given as:

$$\hat{\theta} = (\mathbf{\bar{X}'ZA_N Z'\bar{X}})^{\mathbf{-1}}\mathbf{\bar{X}'A_N Z'\bar{y}} \tag{4}$$

where $\hat{\theta}$ is a vector of coefficient estimates, $\mathbf{\bar{X}}$ and $\mathbf{\bar{y}}$ are the vectors of first differenced regressors and dependent variables respectively, $\mathbf{Z}$ is a vector of instruments, and $\mathbf{A_N}$ is a vector used to weight the instruments. The estimator uses all lagged values of endogenous and predetermined variables as well as current and lagged values of exogenous regressors as instruments in the differenced equation. For example, for the equation: $\Delta y_{i3} = \alpha \Delta y_{i2} + \beta \Delta x_{i3} + \Delta \zeta_{i3}$ we use y_{i1}, x_{i1} and x_{i2} as instruments. For the Δy_{i4} equation, $y_{i1}, y_{i2}, x_{i1}, x_{i2}$ and x_{i3} serve as valid instruments. Instruments for other cross sectional equations are constructed similarly. These instruments are correlated with the endogenous regressors but not correlated with the error terms, hence they are "good" instruments. The dynamic panel estimator is an IV equivalent of an efficient Three Stage Least Squares (3SLS) estimator. The estimator requires the absence of serial correlation among the error terms.

Arellano and Bond proposed two estimators—one- and two-step estimators—with the two-step estimator being the optimal estimator. The one-step estimator uses the weighting matrix given by $A_N = (N^{-1}\sum_i Z_i' H Z_i)^{-1}$ where H is $T-2$ square matrix with 2s in the main diagonal, -1s in the first sub-diagonal, and 0s everywhere else. The optimal two-step estimator uses an estimated variance-covariance matrix formed from the residuals of a preliminary consistent estimate of $\hat{\theta}$ to weight the instruments. The optimal choice of $\mathbf{A_N}$ is given as: $A_N = \hat{V_N} = N^{-1}\sum_i Z_i' \hat{\hat{v}}_i \hat{\hat{v}}_i Z_i$ where $\hat{v_i}$ is the residual obtained from a preliminary consistent estimate of θ.

I use the two step estimator to estimate the coefficients of the growth equation because it is more efficient than the one-step estimator. The one-step and two-step estimates will be asymptotically equivalent if and only if the error structure is spherical. However, the nature of the model with endogenous regressors and possible correlated fixed effects leads me to suspect that the conditions for spherical error structure will not be met. Arellano and Honore (1999) argue that in the absence of "good" instruments, the two-step estimator underestimate the standard errors of the coefficient estimates, hence providing inflated "t" statistics. The one-step estimator is not subject to such false sense of precision, hence may be more reliable than the two-step estimator. For these reasons, I also present estimates for the one-step estimator as a check on the validity of my use of the two-step estimates in our discussions.

In estimating the model, I lag all variables by one period to ensure that y_{t-1} can be treated as exogenous in period t. I make two identifying assumptions of no serial correlation among the error terms, and that the endogenous regressors are not considered predetermined for $v_{i,t}$ but are considered so for $v_{i,t+2}$. This allows me to use all values of x_t up to x_{t-1} as valid instruments for $\hat{x_t}$. The linear moment restriction implied by the model is $E[(\Delta\tilde{y}_{it} - \Delta\tilde{X}'_{i,t-1}\Theta)X_{i,t-j}] = 0$ for $j = 2, ..., t-1$, where $X' = (y_{t-1}, X)$ is the vector of lagged endogenous and strictly exogenous regressors. The consistency of the estimates hinges on the assumption of lack of autocorrelation of the error terms. Therefore, I test for the absence of first-order serial correlation of the error terms. I also perform Sargan test of over-identifying restrictions which is a joint test of model specification and appropriateness of the instrument vector. If all regressors are strictly exogenous, both the dynamic panel estimator and the FE estimator are consistent but the latter is efficient.

On the other hand, if there are endogenous explanatory variables, the FE estimator is inconsistent. I therefore use a Hausman (1978) test to test for the strict exogeneity of all regressors used to estimate the growth equation.

4.2.2 The Gini Equation

I do not have panel observations for the gini coefficient so I treat this as a cross-national sample and estimate a cross-national equation accordingly. If economic growth rate and the corruption index are endogenous as argued above, an IV estimation approach will be the appropriate methodology to use. Therefore, in addition to using Ordinary Least Square (OLS), I use IV estimation methodology to estimate the *gini* equation. I alternatively use ethno-linguistic fractionalization index and mortality rate of colonial settlers as an instrument for corruption while I use $\dot{x}$ as an instrument for *gdpgrow* in the gini equation. Staiger and Stock (1998) have argued that when instruments are "weak", IV estimates tend to regress towards OLS estimates while Maximum Likelihood (ML) estimates are not so affected although the latter estimator tends to produce imprecise estimates. Even though the instruments I use are relatively "strong", I nevertheless present Limited Information Maximum Likelihood (LIML) estimates of the growth equation to see if they are different from the other estimates. Therefore I present OLS, IV, and LIML estimates for the *gini* equation.

5 Results

This section presents the regression results. The first sub-section presents the results of the growth equation, the second presents the estimates for the *gini* equation, while the third sub- section is devoted to a general discussion.

5.1 Growth Equation

5.1.1 Coefficient Estimates

The two-step estimates of the GDP growth rate equation are presented in Table II. Columns 2, 3, and 4 present the estimates for the full growth equation using the levels, first difference, and orthogonal deviation forms respectively. All equations include a set of year dummies. The growth equation fits the data relatively well as indicated by the regression statistics. There is no evidence of first-order serial correlation and the joint test of significance rejects the null hypothesis that all slope coefficients are jointly equal to zero at 99% confidence level or better for all estimation methodologies. The Sargan test statistic indicate that the growth equation is well specified and that the instrument vector is appropriate. The Hausman exogeneity test statistic rejects the null hypothesis that all regressors are strictly exogenous. This implies that the dynamic panel estimator is the appropriate estimator to use to estimate the growth equation. Test statistics also reject the null hypothesis that the time dummies are jointly equal to zero at any reasonable confidence level.

The coefficients of k, $\dot{x}$, and *edu* in columns 2-4 are positive as expected, and are statistically significant at $\alpha = .10$ or better. This indicates that the growth rate of real GDP is positively correlated with investment rate, export growth, and education. The positive coefficient of *edu* is consistent with endogenous growth theory which argue that human capital is an important determinant of long term economic growth. The coefficient of y_0 is negative and significant at the 95% confidence level; an estimate that supports the convergence hypothesis. The result is consistent with the results obtained by earlier growth researchers (Barro1991, Renelt and Levine 1992, Caselli *et al* 1996, and Mankiw, Romer and Weil 1992). The coefficient of *govcon* is negative and significant, indicating that increased government consumption leads to decreased growth rate of GDP. This result is similar to the results of earlier research (Barro 1991, Levine and Renelt 1991, Mankiw, Romer and Weil 1991, among others).

The coefficient of *corrupt* is positive, relatively large, and significantly different from zero at $\alpha = .01$ in columns 2-4. A one unit decrease in corruption (one unit increase in *corrupt*) is associated with about 0.6 percentage point increase in the growth rate of real GDP per year in all specifications. A one standard deviation increase in *corrupt* increases the growth rate of real GDP by about 1 percentage point a year. Reducing corruption by one standard deviation (1.71 points out of a 10 point scale) will therefore increase the growth rate of real GDP by 1 percentage point on average in African countries, all things equal. This is a very large direct response given that the average annual growth rate of real GDP in the sample is 3.3% per annum in the sample period. The positive and significant coefficient of *corrupt* is consistent with the results of Mauro (1995, 1997), Li *et al* (2000), Rose-Ackerman (1999), Wei (2000), Tanzi and Davoodi (1997), as well as with the theoretical postulates of Shleifer and Vishny (1993), Ehrlich and Lui (1999), and Braguinsky (1996).

The estimates in columns 2-4 are based on annual data which may be subject to too much noise and, maybe my results are driven by business cycles. To investigate this possibility, I estimate the growth equation based on 3-year averages of the variables. Averaging over three years gives me a total of 52 observations. Coefficient estimates based on the levels estimator are presented in column 5 of Table II. The coefficient estimates in column 5 are *qualitatively* similar to, although less precise than, their counterparts in columns 2-4. This may indicate that my results are not being driven by annual fluctuations in the data.

The estimates presented in Table II are based on the two-step estimator. Arellano and Honore (1999) argue that the two-step estimator sometimes under-estimate the standard errors of the estimates providing a false sense of precision. The one-step estimates are not so disposed. I therefore present the one-step estimates of the growth equation to see if the results presented above depend crucially on the use of the two-step estimator. The one-step estimates are presented in Table III. As in Table II, columns 2-4 present the estimates based on annual data while column 5 present the estimates based on 3-year averages of the variables. The regression statistics indicate that the one-step estimates fits the data reasonably well and that the equation is well specified with appropriate instrument vector.

The coefficient estimates in Table III are of the expected signs and are significantly different from zero at conventional levels. In particular, the coefficient of *corrupt* is positive, relatively large, and significantly different from zero at $\alpha = .01$ in all specifications. Moreover, the coefficients of k, $\dot{x}$, *edu*, y_0, and *govcon* are similar in sign, absolute magnitude, and statistical significance as their two-step counterparts in Table II. I note, however, that the one-step estimate of the coefficient of *corrupt* is about 20% lower in absolute magnitude than its two-step counterpart. Although there are some quantitative differences in the estimates in Tables II and III, the estimates are *qualitatively* the same. I conclude from this exercise that my result that corruption has a large negative and statistically significant effect on the growth rate of real GDP in African countries does not depend on the use of the two-step estimator.

The dependent variable in the estimates presented above is the annual growth rate of real GDP. To test for robustness of my results, I use the growth rate of per capita income as the dependent variable to estimate the growth rate equation. The results are presented in Table IV. The coefficient of *corrupt* remains positive, relatively large, and significantly different from zero at $\alpha = .01$, indicating that corruption leads to decreased growth rate of per capita income. Moreover, the coefficients of other regressors in the per capita income growth equation are as expected and significantly different from zero at conventional levels. I conclude that my results that corruption has a negative impact on the growth rate of income do not depend on the measure of income growth I use. Based on the estimates in Tables II-IV, I conclude that corruption has a relatively large and statistically significant negative effect on the growth rate of income. This result does not depend on the estimation technique or the measure of income growth rate I use.

I estimate a cross-national OLS and IV estimates of the growth equation and compare these estimates with those obtained from the dynamic panel estimator. I do so in order to compare my approach to the approaches that have been mostly used to investigate the relationship between corruption and economic growth by earlier researchers. Acemoglu *et al* (2000) use mortality rates of colonial settlers as an instrument for current institutions in countries around the world and find that settler mortality is strongly correlated with the quality of present-day institutions. Since settler mortality is uncorrelated with current growth rate, it serves as a "good" instrument for corruption. I use settler mortality from Acemoglu *et al* (4th mortality) as an instrument for corruption. Coefficient estimates are presented in Table V. Columns 2 and 3 of panel A present the OLS and IV estimates while panel B presents the first stage estimate of corruption. Compared to the estimates presented in Tables II-IV, the OLS estimates in Table V provide a very poor and inconsistent fit for the growth equation. Although the IV estimates in Table V are of the right signs and some estimates are significantly different from zero, the absolute magnitude of the IV estimates are low and they are less precisely estimated compared to their counterparts in Tables II-IV.

5.1.2 Transmission Mechanism

My results indicate that corruption has a large negative and statistically significant impact on the growth rate of income in African countries. The result does not indicate the mechanisms through which corruption affects growth. In this subsection, I speculate on two mechanisms through which corruption indirectly affects the growth rate of income—investment in physical capital and human capital which I proxy by education. I investigate these channels by estimating a rudimentary accelerator model of investment and an education equation that include *corrupt* as an added regressor.

5.1.2.1. Corruption and Physical Capital Investment:

Although there different models of the determinants of investment in physical capital, I focus on a simple accelerator model for simplicity. I postulate that investment in physical capital is a function of the growth rate of income (g), the savings rate (s), and corruption. If corruption increases the cost of investment, lowers the returns to physical capital, or both, I expect it to have a negative impact on investment. Government consumption is likely to compete with investment for available savings, hence I include it as a regressor in the investment equation. In African countries, most investment in physical capital consists of imported capital equipment, hence import ability acts as a constraint in investment. I therefore include import/GDP ratio as an argument in the investment equation. The investment equation I estimate is:

$$k = \beta_0 + \beta_1 g + \beta_2 s + \beta_3 m + \beta_4 corrupt + \beta_5 govcon + \varepsilon \quad (5)$$

where s, m, ε are savings and import rates and stochastic error terms respectively, and all other variables are as defined in the text above.[14] With the exception of *govcon*, I expect the coefficients of all variables in this equation to be positive. The inclusion of g and *corrupt* as regressors imply that the dynamic panel estimator is the appropriate estimator to use for estimation of the k equation.

5.1.2.2. Corruption and Education:

There are several possible mechanisms through which corruption can negatively affect the stock of education human capital in a country. Among these are lower investment in education due to reduced returns to education that stems from corrupt hiring practices and relatively high returns to rent-seeking activities. Second, corruption may skew the provision of education towards a few well connected elite. To the extent that these people are in the minority, it is most likely that both the *quantity* and *quality* of education in the economy will decrease. Third, corruption may lead to fewer government resources being devoted to the provision of education (Gupta *et al*: 2000). Finally corruption leads to the emigration of those with internationally marketable human capital.[15] I therefore include corruption as an argument in the education equation. Empirical evidence suggests a positive relationship between income level and education, hence capita income is included as a regressor in the education equation. I also include export growth as a regressor to test the hypothesis that openness has a significant effect education human capital stock in a country. Finally, I include investment in physical capital to test whether the stock of education human capital and physical capital are related. The education equation I estimate is:

$$edu = \gamma_0 + \gamma_1 corrupt + \gamma_2 k + \gamma_3 y + \gamma_4 \dot{x} + \zeta \quad (6)$$

where ζ is a stochastic error term, and all other variables are as defined in the text above.

The two-step estimates of the k and *edu* equations are presented in Table VI. Panel A presents the estimates for the k equation while panel B presets the estimates for the *edu* equation. In both panels, columns 2 through present the Levels, first difference, and orthogonal deviation estimates respectively. The coefficients of g, s, and m in the k equation are positive and significant at conventional levels; results that are in accord with prior expectations. The positive coefficient of g in the k equation is consistent with the accelerator hypothesis of investment. The coefficient of *govcon* is negative and significant indicating that government consumption crowds out physical capital investment in African countries. The coefficient of *corrupt* in the k equation is positive and significantly different from zero at $\alpha = .05$, indicating that, all things equal, increased corruption decreases investment rate in African countries. This result is similar to those obtained by other researchers (Wei 2000, Gupta *et al* 1998, Mo: 2001, among others). The positive and significant coefficient of *corrupt* in the k equation, and of k in the g equation indicates that corruption affects the growth rate of income indirectly through reduced investment in physical capital. Furthermore, the fact that both *corrupt* and k are significant in the growth rate equation suggests that the indirect effect is in addition to, and independent of, the direct effect corruption has on the growth rate of income. The indirect growth effect of corruption imply that the direct effect estimated above is a lower bound of the negative impact that corruption has on the growth of income in African countries.

In the *edu* equation, the coefficients of y and $\dot{x}$ are positive and significantly different from zero at $\alpha = .10$ or better. This suggest that there is a positive and statistically significant relationship between per capita income and export growth on the one hand and the stock of education human capital on the other. The coefficient of k is negative but is insignificant in all the three specifications. The coefficient of *corrupt* is positive, relatively large and significantly different from zero at $\alpha = .01$. This indicates that corruption has a statistically significant negative effect on the stock of human capital in African countries. Given that there is a significantly positive relationship between the stock of education human capital and economic growth, the relationship between the stock of human capital and corruption suggests another indirect mechanism through which corruption negatively affects the growth rate of income in African countries.

The estimates from the growth equation indicate that corruption has a large direct negative effect on economic growth. A 1 unit increase in corruption directly decreases the growth rate of real GDP by about 0.62 percentage points and of per capita income by about .25 percentage points per year. The estimates in the k and *edu* equations indicate that corruption has a very large negative effect on investment rate and the stock of education human capital in African countries. The total effect of corruption on the growth of income in African countries is the sum of the direct and indirect effects and is given algebraically as: $dg/dcorrupt = \partial g/\partial corrupt + \partial g/\partial k * \partial k/\partial corrupt + \partial g/\partial edu * \partial edu/\partial corrupt = \frac{1}{1-\alpha_1\beta_1}[\alpha_4 + \alpha_1\beta_4 + \alpha_2\gamma_1]$.[16] Using the statistically significant coefficients to evaluate this expression, the total effect of corruption on the growth rate of real GDP (per capita income) in African countries is about 1.5 percentage points (0.62 percentage points) per year, depending on the estimation methodology. This constitutes about an additional 50% of the average growth rate of GDP (per capita income) during the sample period—a relatively large effect. The growth effect is similar in sign, but larger in magnitude than has been estimated by earlier researchers (Tanzi and Davoodi 1997, Tanzi 1998, Mauro 1995, Gupta *et al* 1998, Li *et al* 2000, Rose-Ackerman 1997, Shleifer and Vishny 1993, among others). I also note that the mechanisms I investigate are similar to (though not the same) those investigated by Mo (2001).[17] I also note that my estimates are much higher than his estimates. It is interesting to note that corruption has a very large indirect growth impact through education. Perhaps, the low stocks of education human capital in African countries makes this indirect channel extremely important as corruption leads to the emigration of educated and skilled workers.

5.2 Corruption and Income Inequality

I investigate the effect of corruption on income distribution by regressing the *gini* coefficient of income distribution on corruption and other regressors using OLS, IV, and LIML estimation methods. Coefficient estimates of the *gini* equation are presented in Table VII. Column 2 presents the OLS estimates. The OLS estimates show that the equation fits the data relatively well for a cross country regression with the equation explaining about 38% of the cross country variation in the gini coefficient. The coefficient of y is positive but insignificant while that of *gdpgrow* is negative and significant at $\alpha = .01$, indicating that high growth rate of income decreases income inequality. This implies that contrary to what some critics of growth argue, economic growth helps the poor in African countries. The coefficient of *edu* is negative and highly significant at conventional levels indicating that widespread increase in human capital is associated with more equitable distribution of income. The size of government consumption is positively associated with income inequality as the coefficient of *govcon* is positive and significant. Perhaps increased government consumption provides opportunities for the wealthy to increase their well-being at the expense of the poor, an interpretation that is consistent with the results of earlier research.

The coefficient of *corrupt* obtained from the OLS estimator in column 2 is negative and significantly different from zero at $\alpha = .05$, indicating that increased corruption is associated with increased income inequality. The OLS estimate of *corrupt* suggests that a 1 unit increase in corruption (1 unit reduction in *corrupt*) increases the gini coefficient of income distribution by about 1.54 points. This result leads me to tentatively conclude that increased corruption increases income inequality in African countries.

The OLS estimates assume that the error terms of the *gini* equation are orthogonal to the regressors. However, as argued above, corruption and economic growth rate are possibly endogenous, hence the orthogonality condition may not be satisfied. This situation may lead to inconsistent estimates. I use an IV estimator that instruments for the growth rate of income and corruption to estimate the *gini* equation as a check on my OLS results. I use elf as an instrument for *corrupt* and $\dot{x}$ as an instrument for the growth rate of real GDP in this equation. The instruments explained .44 and .21 of the variation in *corrupt* and *gdpgrow* respectively, hence they are relatively "strong" instruments. These IV estimates are presented in column 3 of Table VII. In column 4, I present IV estimates of the *gini* equation that uses colonial mortality rate as an instrument for *corrupt*. The IV coefficient estimates of y, *gdpgrow*, *edu*, and *govcon* in columns 3 and 4 are similar in sign and statistical significance to their OLS counterparts.

The coefficient of *corrupt* in columns 3 and 4 is negative, relatively large and significantly different from zero at $\alpha = .05$ indicating that increased corruption is associated with increased income inequality in African countries, regardless of the instrument used for *corrupt*. The fact that the coefficient of *corrupt* is positive and significant when there are additional regressors suggests that *corrupt* is not acting as a proxy for any of the regressors or for that matter any excluded variable that is correlated with any of the included regressors. I note, however, that the coefficient estimate of *corrupt* in columns 3 and 4 is at least three times as large as the OLS estimate of *corrupt* presented in column 2. This suggests that the OLS estimate of *corrupt* may be biased downwards. I therefore base my discussions of the effects of corruption on income distribution on the IV estimates. The IV estimates indicate that corruption is positively correlated with income inequality in African countries, all things equal.

Even though the instruments I use to estimate the effects of corruption on income distribution are relatively "strong", I present LIML estimates of the *gini* equation to see whether these estimates are significantly different from the IV estimates. The LIML estimates presented in column 5 of Table VII are similar in sign and precision to their IV counterparts in columns 3 and 4. They are, however, different from the OLS estimates presented in column 2. I conclude from the estimates in Table VII that corruption increases income inequality in African countries. The result does not depend on the estimation technique.

The coefficient of *corrupt* in the *gini* equation is negative, relatively large, and significantly different from zero at $\alpha = .05$. The conclusion I draw from these estimates is that corruption is positively correlated with income inequality in African countries, all things equal. The result is robust to estimation methodology. A one unit increase in corruption (1 unit reduction in *corrupt*) is associated with between 4 and 7 units *increase* in the gini coefficient of income inequality, all things equal. This indicates that a standard deviation decrease in corruption will be associated with between 7.3 and 12.3 units decrease the gini coefficient of income inequality, units depending on the estimation method used. This is a relatively strong correlation; larger than the distributional impact of growth, government consumption, or for that matter, any policy that could affect the equitable distribution of income. The distributional effect of corruption I find here is similar to the results of earlier researchers (Gupta *et al* 1998, Li *et al* 2000, Hendriks *et al* 1998, Gray and Kaufmann 1998, and Johnston 1989). However, the absolute magnitude of the association I find is much larger than theirs. Perhaps, the low average and slow growing incomes in Africa combined with systemic corruption lead distortions to have larger correlations with income inequality than in other parts of the world.

In addition to the direct effects, corruption may be correlated with income inequality through other channels. The coefficient estimates indicate that increased growth rate of per capita income decreases the gini coefficient of income distribution. The economic development literature suggests that income inequality negatively affects economic growth (Alesina and Rodrik 1994). In addition, the estimates from the growth rate equation show that corruption has a large negative effect on economic growth. Therefore by reducing economic growth rate, corruption may increase income inequality indirectly through decreased economic growth. This implies that the direct correlation between corruption and income inequality I have calculated here is a lower bound estimate of the effect of corruption on income distribution in African countries.

5.3 Discussion

The results presented above indicate that corruption decreases economic growth and is positively correlated with income inequality. Hellman, Jones and Kaufmann (1998) argue that while state capture—the capacity of firms to shape and affect basic rules of the game through private payments to political officials and bureaucrats—is beneficial to the firm, it is highly injurious to the economy as a whole. While state capture in other parts of the world is done by the private sector, in African countries, the captors are the politicians and bureaucrats themselves. This has doubly negative effects on the economies since siphoning public resources by these politicians to establish foreign bank accounts not only rob these countries of needed resources, it also results in serious misallocation of resources and loss of trust in the state itself.

The fact that corruption hurts the poor and therefore the most vulnerable in society raises some ethical issues of fairness. Do the poor have the right to improved living standards as the rich in African countries? Will improving the living standards of the poor necessarily decrease the living standards of the rich in African countries? Alesina and Rodrik (1994) argue that income inequality decreases economic growth through decreases in investment. Second, as Fields (1980) argue, African countries could speed income growth rate by adopting development strategies that expand employment opportunities to the majority of citizens and thus improve income distribution. Since economic growth increases the economic pie, equitable distribution of income will increase the living standards of the rich and the poor alike even though the income *share* of the rich may decrease. It appears that sustained development will imply economic growth with redistribution rather than stagnation with redistribution from the poor to the rich as corruption does.

The growth effect of corruption calculated here is relatively large. This implies that African countries could increase economic performance by reducing corruption. This can be done with appropriate institutional reforms, which could become the cornerstone of sustained economic development. Moreover, African countries can lay this foundation through their own efforts, using domestic resources without "begging" for foreign resources. African countries have generally looked to the international community for development assistance, which has not been forthcoming in recent years. The best estimates of the growth effect of foreign development assistance is about .5 percentage points a year; far lower than the growth effect of corruption calculated in this study (World Bank 1998). This means that African countries could achieve better economic performance by reducing corruption than they could through increase external assistance. More important, this increased economic performance will be sustainable and could be achieved without sacrificing national pride.

Although reducing corruption is easier said than done, a few policies suggest themselves. Among these are policies to reduce the role of the bureaucracy in resource allocation, particularly price controls, excessive indirect taxation, and reducing subsidies that lead to rent seeking activities. While increased reliance on the market for resource allocation and the distribution of goods could, in theory, hurt some poor people, governments could compensate these groups by providing them with direct cash assistance. Second, governments could increase transparency of their activities by explaining policies and reducing the discretion of bureaucrats. For example, in most African countries, simple traffic code is not available to drivers. This allows the police to charge a driver with any offense as a means of extorting a bribe from the driver. Making the traffic code available and explaining it to all drivers will decrease this problem. A third policy is to increase accountability by increasing the size and probability of punishment of both the bribe giver and bribe taker, instead of the usual practice of transferring public officials accused of bribery to another post where he/she can take a bigger bribe. Finally, African leaders should themselves, set good examples of honesty in public life. Generally, policies to reduce corruption will involve institutional reform and should include political liberalization, strengthening of civil liberties and securing property rights as well as international cooperation.[18]

6 Conlusion

This paper uses panel data from a sample of African countries during the 1990s and a dynamic panel estimator to investigate the effects of corruption on the growth rate of per capita income and the distribution of income. Using Transparency International's corruption perception index, I find that corruption decreases the growth rate of income. A one unit increase in corruption index decreases the growth rate of GDP by about 1.5 percentage points, and of per capita income by about .75 percentage points; a relatively large effect given the slow pace of economic growth in Africa. Corruption decreases the growth rate of per capita income directly by decreasing the productivity of existing resources and indirectly through reduced investment. I find that given the level of corruption and other factors, the higher the level of general government consumption, the slower is the growth rate of per capita income. In addition to slowing the growth rate of per capita income, corruption is also associated with high income inequality in African countries suggesting that the poor bear the brunt of the economic effects of corruption in African countries.

The results of this paper suggest that increasing the well-being of the majority of citizens in African countries can be enhanced by reducing corruption. This means that the process of economic development can be achieved by using domestic resources without recourse to asking for external aid. After all, the growth effect of external aid is far less than the effect of corruption on growth. Instead of African countries asking for foreign aid to help in economic development, they could achieve the desired economic performance by reducing corruption through appropriate institutional reforms. This institutional reform will also lead to sustained long term economic growth. The results of this study should, however, be interpreted with caution. The index of corruption I used in the study is based on the *perception* of corruption; perceptions that may be wrong. Second, the index does not indicate whether corruption is organized or not, centralized or decentralized, whether it involves high level officials or not, and to what extent it is pervasive in the economy; factors that will affect the size of the efficiency loss imparted by corruption. For these reasons, the results presented here should be considered indicative rather than definitive.

7 Notes

1. See Transparency International and Gottingen University, *Corruption in the World, 1998*.

2. Anecdotal evidence indicate that the argument about corruption in African countries is not about its existence but about its degree. Indeed a special terminology in African dialects has developed to describe widespread corruption. In Ghana it is *kalabule*, in Nigeria it is *goro* or *cola*, in Cameroon it is *nkunku*, while in Kenya it is *toa kitu kidogo* or *TKK* for short. I therefore do not quibble with whether corruption exists in Africa or not but focus on it impact on economic performance.

3. See Gupta *et al* (1998), Li *et al* (2000), and Ravallion (1997), among others.

4. See the various issues of *World Development Reports*, World Bank's *World Development Indicators*, and the United Nation's *Human Development Report, 1999*, among others.

5. On the other hand because African societies tend to be communal with wealth sharing of the relatively prosperous, what may be considered corruption by the Westerner may not be so hence may not have any negative development effects.

6. See Bardhan (1997) for an excellent review of the theoretical and some of the empirical literature.

7. Gyimah-Brempong and Traynor find evidence that treating investment as exogenous could lead to biased coefficient estimates. Caselli *et al* (1996) argue that most explanatory variables in growth equations are strictly exogenous as most researchers assume.

8. For example, after Jerry Rawlings' coup in Ghana, it was discovered that not a single professional (doctors, engineers, lawyers, architects, consultants, etc) in private practice had ever paid any income tax since the attainment of independence in 1957. Yet teachers, nurses and other workers were taxed very heavily. With a narrow tax base, the tax rate faced by the poor tend to be very high.

9. In most African countries, the ratio of per student expenditure on tertiary and primary education is about 40:1.

10. Of the 125 observations in my sample, 8 country/year observations were proxied by the historical data on corruption.

11. The countries in the sample are: Algeria, Angola, Botswana, Cameroon, Cote d'Ivoire, Egypt, Ghana, Madagascar, Malawi, Mauritius, Morocco, Mozambique, Namibia, Nigeria, Senegal, South Africa, Tanzania, Tunisia, Uganda, Zambia, and Zimbabwe.

12. Orthogonal deviations expresses each observation as the deviation from the average of future observations in the sample for the same country, and weight these each deviation to standardize

the variance. Formally, the orthogonal deviation of the variable x, (x^*_{it}) is given as:

$$x^*_{it} = (x_{it} - \frac{x_{i,t+1} + ... + x_{i,T}}{T-t})(\frac{T-t}{T-t+1})^{.5} \qquad for \quad t = 1, ..., T-1 \tag{7}$$

Arellano and Bond show that if the original errors are uncorrelated and homoskedastic, the transformed errors will also be uncorrelated and homoskedastic.

13. I note that high levels of *corrupt* implies low levels of corruption and vice versa. One should keep this in mind when interpreting the results.

14. In African countries where most capital goods are imported, import capacity acts as a constraint on investment. See Gyimah-Brempong and Traynor (1999) for detailed discussion of the relationship between imports and investment in African countries.

15. For a discussion of the determinants of emigration from African countries to the US and Canada, see Apraku, K. K. (1991), *African Emigres in the United States: A Missing Link in Africa's Social and Economic Development*, (New York: Praeger).

16. I note that this is not the usual multiplier effect since *corrupt* is not being treated as exogenous variable in this study. All what these numbers indicate is the total effect a unit change in *corrupt* has on the growth rate of income growth and the gini coefficient, regardless of the source of the change.

17. I note that while Mo investigate the corruption/political instability channel, I do not do so in this paper.

18. See Kaufmann, D., S. Pradhan, and R. Ryterman with J. Anderson (1998), *Diagnosing and Combating Corruption: A Framework with Applications to Transition Economies*, World Bank Policy Research Paper, (Washington DC: World Bank) for an excellent discussion of policies to fight corruption.

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Table I

SUMMARY STATISTICS OF SAMPLE DATA

Variable	Mean*	Standard Deviation	Minimum	Maximum
corrupt	3.8859	1.7143	0.630	7.8200
gdpgrow	3.3126	3.0126	-7.7781	11.5081
gnpcapgro	1.5788	4.1966	-11.8849	18.7271
y	1052.89	942.78	90.00	3800.00
gov (%)	15.4718	6.0117	7.6250	33.9616
k (%)	19.9494	7.2708	7.8364	54.4148
edu	3.7230	5.1768	0.1000	25.8000
$\dot{x}$	4.9678	9.2914	-22.5841	43.5263
s	15.9997	8.7665	-2.2281	43.6253
m	36.6253	12.8114	11.2669	68.4174
elf	63.9756	23.6336	4.000	93.000
*gini***	42.33	9.63	22.89	62.30
*mortality****	117.5721	425.4756	15.50	2004
N	125			

* these are unweighted averages.
** *gini* has 78 observations.
*** *mortality* has 21 observations

Table II

TWO-STEP COEFFICIENT ESTIMATES OF GDP GROWTH EQUATION+

Variable	Coefficient	Estimates		
	Levels	First difference	Orthogonal dev.	3-Year Av.
k	0.1760	0.1786	0.1759	0.1601
	(4.8394)*	(4.6957)	(4.8395)	(3.241)
corrupt	0.6249	0.6475	0.6250	0.3992
	(8.1938)	(8.0925)	(8.1938)	(3.6047)
edu	0.2248	0.2247	0.2248	0.1668
	(1.5908)	(1.6900)	(1.5968)	(1.8584)
$\dot{x}$	0.1721	0.1728	0.1722	0.1687
	(4.5697)	(4.5293)	(4.5697)	(2.9410)
y_0	-0.0010	-0.0010	-0.0009	-0.0008
	(2.0092)	(2.0145)	(2.0092)	(1.7573)
govcon	-0.4836	-0.4843	-0.4836	-0.2873
	(4.9213)	(4.9153)	(4.9212)	(2.9812)
N	125	125	125	52
First order ser. corr.	0.346 [17]	0.371 [17]	0.446 [17]	1.150 [17]
Joint test of Significance	137.6901 [6]	137.9685 [6]	138.6907 [6]	32.830 [6]
Joint-jg sig. of time dum.	21.4736 [4]	29.6834 [4]	29.9901 [5]	8.2658 [2]
Sargan Test	2.1578 [7]	2.0741 [7]	2.2189 [7]	1.9838 [5]
Hausman m	73.5631 [5]	87.1289 [5]	98.2198 [5]	38.987 [5]

* absolute value of asymptotic "t" statistics calculated from heteroskedastic consistent standard errors in parentheses.

\+ All estimated equation include year dummies

Table III

ONE-STEP COEFFICIENT ESTIMATES OF GDP GROWTH EQUATION+

Variable	**Coefficient**	**Estimates**		
	Levels	First difference	Orthogonal dev.	3-Year Av.
k	0.1560	0.1617	0.1561	0.1373
	(3.7767)*	(2.9797)	(3.7727)	(2.3510)
corrupt	0.4856	0.5487	0.4855	0.3898
	(6.2739)	(4.8350)	(6.3728)	(2.7252)
edu	0.2144	0.2105	0.2143	0.2027
	(1.5829)	(1.6766)	(1.5683	(1. 5363)
$\dot{x}$	0.1451	0.1448	0.1451	0.2419
	(3.3730)	(3.2360)	(3.3731)	(2.1071)
y_0	-0.0009	-0.0009	-0.0009	-0.0012
	(1.7769)	(1.7001)	(1.7770)	(1.6627)
govcon	-0.4599	-0.4621	-0.4598	-0.2814
	(4.0301)	(2.7142)	(4.0030)	(2.3912)
N	125	125	125	52
First order ser. corr.	0.369 [17]	0.201 [17]	0.168 [17]	1.328 [17]
Joint test of Significance	92.8580 [6]	59.4889 [6]	92.6991 [6]	20.7345 [6]
Joint-jg sig. of time dum.	8.9832 [4]	12.6588 [4]	10.9021 [5]	8.0913 [2]
Sargan Test	2.1284 [7]	2.0741 [7]	1.4699 [7]	1.8909 [5]
Hausman m	63.4218 [5]	87.5218 [5]	79.1358 [5]	29.8210 [5]

* absolute value of asymptotic "t" statistics not robust to heteroskedasticity in parentheses.
\+ All estimated equation include year dummies

Table IV

TWO-STEP COEFFICIENT ESTIMATES OF PER CAPITA INCOME GROWTH EQUATION+

Variable		**Coefficient**	**Estimates**	
	Levels	First difference	Orthogonal dev.	3-Year Av.
k	0.1534	0.1544	0.1534	0.1428
	(2.9189)*	(2.8478)	(2.9190)	(1.9261)
corrupt	0.2434	0.2567	0.2434	0.18972
	(3.2642)	(3.3200)	(3.2641)	(2.2198)
edu	0.2835	0.2842	0.2836	0.3289
	(1.6457)	(1.5379)	(1.5458)	(1.6298)
$\dot{x}$	0.1539	0.1542	0.1539	0.1213
	(2.6895)	(2.6361)	(2.8695)	(1.9818)
y_0	-0.0005	-0.0005	-0.0005	-0.0012
	(0.6061)	(0.6055)	(0.6061)	(1.3528)
govcon	-0.5296	-0.5312	-0.5296	-0.4125
	(3.1163)	(3.1332)	(3.1162)	(2.1065)
N	125	125	125	52
First order ser. corr.	0.564 [17]	0.371 [17]	0.546 [17]	0.928 [17]
Joint test of Significance	28.8728 [6]	56.6646 [6]	29.1728 [6]	19.8972 [6]
Joint-jg sig. of time dum.	9.510 [4]	8.3206 [4]	8.5813 [5]	6.6812 [2]
Sargan Test	3.1007 [7]	1.2653 [7]	2.1564 [7]	3.2196 [5]
Hausman m	73.5631 [6]	67.4127 [6]	68.8917 [6]	38.1289 [6]

* absolute value of asymptotic "t" statistics calculated from heteroskedastic consistent standard errors in parentheses.

+ All estimated equation include year dummies

Table V

OLS AND IV ESTIMATES OF GROWTH EQUATION

Panel A: Estimates of Growth Equation

Variable	**Coefficient**	**Estimates**
	OLS	IV (ELF)
k	1. 007	0.1967
	(1.093)*	(1.5819)
corrupt	-2.8217	0.1531
	(1.4185)	(2.2618)
edu	0.3825	0.1609
	(1.7301)	(2.0610)
$\dot{x}$	0.3762	.1088
	(2.0036)	(2.1819)
y_0	-0.0027	0.0286
	(0.8580)	0.386)
govcon	-0.4213	-0.7064
	(1.9617)	(2.6702)
N	21	21
F	14.221	—
$\bar{R}^2$	.3817	—

Panel B: First Stage Regression

Dependent Var: *corrupt*		
mortality	—	-0.2187
	—	(3.8742)
F	—	19.2162
R^2	—	.314

* absolute value of "t" statistics in parentheses.

Table VI

TWO-STEP ESTIMATES OF INVESTMENT AND EDUCATION EQUATIONS+

Panel A: Investment Equation

Variable		**Coefficient**	**Estimates**
	Levels	First difference	Orthogonal dev.
gdpgrow	0.5012	0.9081	0.5012
	(1.6605)*	(2.3732)	(1.6602)
corrupt	0.7223	0.6101	0.7223
	(3.2990)	(2.1687)	(3.2991)
s	0.1688	0.1446	0.1689
	(3.6382)	(2.7034)	(3.6381
m	0.0556	0.0667	0.0556
	(1.7197)	(1.6037)	(1.6998)
govcon	-0.2822	-0.2252	-0.2822
	(1.6300)	(1.9382)	(1.6299)
First order ser. corr.	1.453 [17]	1.445 [17]	1.453 [17]
Joint test of Significance	424.9214 [5]	488.6608 [5]	424.9214 [5]
Joint-jg sig. of time dum.	20.9803 [4]	89.2527 [4]	130.2182 [5]
Sargan Test	5.2297 [8]	4.9482 [8]	5.2297 [8]
Hausman *m*	89.3799 [5]	119.7834 [5]	92.9836 [5]

Panel B: Education Equation

corrupt	2.9612	3.6928	2.9611
	(2.4112)	(3.1026)	(2.4113)
invest	-0.0098	-0.0222	-0.0098
	(0.3496)	(0.7737)	(0.3277)
y	0.0009	0.0011	0.0009
	(2.8320)	(3.1493)	(2.8320)
$\dot{x}$	0.0329	0.0427	0.0329
	(1.6453)	(1.6074)	(1.6452)
First order ser. corr.	-0.418 [17]	-0.917 [17]	0.217 [17]
Joint test of Significance	18.9004 [4]	37.2458 [4]	19.9014 [4]
Joint-jg sig. of time dum.	12.6014 [4]	10.4905 [4]	12.6937 [4]
Sargan Test	4.4008 [5]	4.5071 [4]	4.4000 [4]
Hausman *m*	29.862 [4]	18.2962 [4]	29.863 [4]

* absolute value of asymptotic "t" statistics calculated from heteroskedastic consistent standard errors in parentheses.

+ All estimated equation include year dummies

Table VII

COEFFICIENT ESTIMATES OF GINI EQUATION

Panel A: Estimates of Gini Equation

Variable	**Coefficient Estimates**			
	OLS	IV (elf)	IV (mortality)	LIML
gdpgrow	-1.5420	-1.0809	-0.9812	-1.4111
	(3.4510)*	(2.400)	(2.1428)	(1.9918)
corrupt	-1.5376	-7.2928	-3.9045	-4.3807
	(2.4718)	(2.5280)	(1.9994)	(2.5318)
edu	-0.8367	-0.4610	-0.2891	-1.0481
	(2.7301)	(1.6905)	(2.4894)	(1.6651
y	0.001	0.0013	0.6897	0.0010
	(0.6510)	(0.80)	(1.4297)	(0.551)
govcon	0.4617	1.2247	85972	0.9725
	(1.6691)	(2.092)	(2.7395)	(1.6618)
N	78	78	21	78
F	14.221	41.4628	18.9872	
$\bar{R}^2$	.3817	.4173	.3218	

Panel B: First Stage Regressions

Dependent Var: *corrupt*				
elf		-0.0760		
		(5.331)		
mortality			-0.2187	
			(3.8742)	
F		32.62	19.2162	
R^2		.4474	.3140	
Dependent Var: *gdpgrow*				
$\dot{x}$		0.1756	0.1756	
		(3.7612)	(3.7612)	
F		14.392	14.392	
R^2		.211	.211	

* absolute value of "t" statistics in parentheses.