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The Impact of Corruption on Economic Performance in Sub-Saharan Africa

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Abstract
The debate over how corruption affects economic growth and development has become more prominent recently and many studies have been conducted on this issue. However, different researchers have obtained mixed results regarding the impact of corruption on economic performance. Some scholarly articles suggest that corruption hinders development (called 'Sanders'), while others argue that corruption can sometimes promote development (known as 'greasers'). Moreover, different methods used to analyze the effect of corruption have produced mixed impressions. This research paper aims to address this gap in the existing literature by analyzing the effect of corruption on economic growth and development across a sample of 36 sub-Saharan countries and 6 North African countries from 2007 to 2021, and how this effect varies across the Sub-Saharan region. The study found that there is a positive correlation between corruption and economic growth and development. In other words, countries with higher scores on the Corruption Perception Index tend to experience better economic growth and development. This implies that corruption has a negative impact on economic growth and development.
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1 Introduction

Throughout human history, corruption has been a harmful social issue that arose during the formation of governance systems in tribes and clans. This was due to the tribal leader and chief using established procedures for their gain. Corruption has spread due to the absence of proper institutions, leading to a cycle of violence and political instability. These practices are present in all aspects of society, leading to conspiracy and favoritism. This source of evil affects not only developing nations but also developed nations.

Throughout the latter half of the 20th century, corruption became a global issue that has greatly affected the way organizations operate. This has involved widespread bribery of high-ranking officials by corporations, often encouraged by foreign or local groups with an interest in strategic assets such as oil fields and diamond mines. The effects of corruption have been felt far beyond the borders of individual countries, with globalization revealing that corruption in one country can have a negative impact on the development of many others. Today, corruption continues to exist in every political system around the world and has evolved into increasingly complex schemes in some areas.

Corruption is a sign of deep-seated institutional weaknesses and results in inefficient economic, social, and political outcomes. It hinders economic growth, discourages both foreign and domestic investments in the long-term, contributes to inflation, reduces the value of national currencies, leads to decreased funding for education and healthcare, increases military spending, diverts skilled individuals away from productive activities, contributes to the underground economy, distorts market operations and resource allocation, creates income inequality and poverty, reduces tax revenues, and leads to higher rates of child and infant mortality. Overall, it undermines the legitimacy of both government and the market economy. (Akçay, S. 2006; 29).

Corruption is not limited to any particular region in the world and can be found in both small and large, poor and rich, developing and developed, and authoritarian and democratic societies. Its negative socio-economic effects have been increasingly recognized in recent years, both in advanced and developing countries. The magnitude and management of corruption varies across societies and regions, with its roots often found in bureaucratic and political institutions. Corruption can hinder a government's ability to enact and implement policies in areas such as environmental regulation, health and safety regulation, social safety networks, macroeconomic stabilization, and contract enforcement. The causes of corruption can be linked to historical, cultural traditions, level of economic development, political institutions, and government policies (Treisman 2000). Moreover, corruption has been cited as the reason for the failure of economic development in some countries by impacting investment and economic growth (Mauro 1995) It arises in both political and bureaucratic offices and can be petty or grand, organized or unorganized (Inegbedion 2004) with More corrupt countries more likely to be less developed and to have more meager prospects for future growth (Mauro, 1995).

Due to growing concern over the impact of corruption on economic and social development both in developing and developed countries, numerous studies in recent years have been devoted to exploring the relationship between economic growth and corruption.

The theoretical and empirical study of corruption by scholars before the 1980s was a field largely limited to the fields of sociology, political science, history, public administration, etc. (Ahmad, Ullah, & Arfeen, 2012). Since then, because of the concern about the prevalence of corruption and its popularity, academics and practitioners especially economists have increasingly focused on corruption and have shown great interest in taking it into account in their respective case studies possible analytic evidence linked to the economic performance (growth and development) of a country. During the last decades, a growing body of research has been devoted to the issue of corruption and development (Bardhan, 1997). Causality in the relationship between economic growth and corruption runs in both directions. Low levels of development make it difficult to fight corruption and enforce formal rules, while at the same time, high levels of corruption can slow down development by reducing and distorting investments.

There are two opposing approaches in the economic literature regarding the debate on the relationship between corruption and economic development. On the one hand, Advocates or economists such as Murphy et al (1993); Gould and Amaro-Reyes (1983); the United Nations (1989); Shleifer and Vishny (1993), Mauro (1995), Tanzi and Davoodi (1997), and Mo (2001) claim that corruption slows down the wheels of business and commerce and is detrimental to economic growth. They point out that corruption generates an environment of political and social instability; it lowers investment or decreases the quality of public investment projects leading to lower economic growth. Contrasting with this view, Huntington (1968) and Leff (1964), Friedrich (1972), Nye (1967), and Acemoglu and Verdier, (1998) argue that corruption is beneficial for economic growth. According to them, corruption greases the wheels of business and commerce and facilitates economic growth and investment. Thus, increases efficiency in an economy helping to speed up many bureaucratic regulations and processes, allowing for the revitalization of the economy, with companies winning contracts, generating jobs and rents

This paper offers an overview of the general academic debate on corruption in both developed and developing countries in general and Africa in particular with the relationship between corruption and economic development representing the basis for the current academic concern over corruption. Taking a closer view of the previous studies on these relationships, some results show a positive relation and the majority of some results show a negative relationship while few of these studies' finding makes us understand that their results can be positive or negative depending on the state of a nation at a particular period. Because developing countries mostly from Sub-Saharan Africa are always in the top ten of the most corrupt countries and these countries are the ones mostly afflicted with, high poverty index and, low life expectancy rates combined with continued internal conflicts, this paper will extend its study to know the relationship between corruption, economic growth and this human development affecting Sub-Saharan Africa and to examine how this effect varies across the Sub-Saharan Africa regions.

The bulk of recent research focuses on determinants of economic welfare, e.g., the level of per capita GDP and its growth rate, the quality of the public infrastructure, public expenditure allocation, total investment, and foreign direct investment. This paper critically examines the relationship between corruption, economic growth, and economic development. The focus is on whether corruption hinders or facilitates these economic variables and how corruption varies across the studied region. In Section II, I provide detailed literature reviews of the two opposing views. Section III delves into corruption in Sub-Saharan Africa. Section IV provides details on the data used and the methodology adopted. Section V discusses the empirical findings and, finally, in Section VI, I present the conclusions.

2 Literature VIEW

Considering that there does not exist a common recipe for the impact of corruption on economic growth and development that applies to all countries economic growth exhibits differently depending on each country at a particular time and condition. The effect of corruption on economic growth has been a widely debated topic over the long history of economic thought specifically applied to this theoretical and empirical question; to date, an absolute ruling on whether or not corruption impedes or augments economic growth has yet to be established.

Sophisticated econometric analysis has been undertaken and the empirical results obtained, yet a clear and robust channel through which the two variables are related remains an important but unanswered question among prominent economists. It should remain clear that my research discusses the relationship between corruption affecting economic growth and its effect on development.

2.1 Negative View

Studies on the deleterious effects of bad and dishonest government seem to make up the lion's share of the attention that development economics pays to the issue of which many of its findings have significantly influenced the better policies to put in place for a prosperous economic performance.

Mauro (1995) in his paper tries to identify the channels through which corruption and other institutional factors affect economic growth and to quantify the magnitude of these effects using Business International's (1984) corruption index of the period between 1980 and 1983 in 67 countries. His findings were that corruption lowers private investment, thereby reducing economic growth, even in subsamples of countries in which bureaucratic regulations are very cumbersome. The negative association between corruption and investment, as well as growth, is significant, both in a statistical and economic sense. He also explained in his paper that, the continued inefficiency of institutions over time played a considerable role in bringing about low economic growth, thus leading to poverty today which justifies the fact that poor countries tend to have corrupt, cumbersome bureaucracies and to be politically unstable. Another, Mo (2001) in his study of the role of corruption in economic growth developed a new analytical framework to estimate the effects of corruption and the channels through which it affects the rate of GDP growth in which they observed that, a 1% increase in corruption level reduces the growth rate by about 0.72% or, expressed differently, a one-unit increase in the corruption index reduces the growth rate by 0.545 percentage points and they identify political instability as the most important channel through which corruption affects economic growth which accounts for about 53% of the overall effect, with human capital and private investment as the other two most important factors. In a related study to that above, Empirical analysis of the direct and indirect channels of the effect of corruption on economic growth by Pellegrini and Gerlagh (2004) suggests that corruption slows down growth through its effect on investments and trade policies. They find that a one standard deviation decrease in corruption leads to an increase in growth of 1% per year, for a given initial income level while the long-term income level increases by 140 percent. In addition to the above studies, Aidt, (2009) took a critical look at the debate concerning the "Sanders" and the "Greasers" hypotheses, The "Sanders" believe that corruption is an obstacle to development, while the "Greasers" believe that corruption can (in some cases) foster development. The author's findings show that the evidence supporting the "greasing the wheels' hypothesis" is very weak and shows that there is no correlation between corruption and GDP growth but instead, he uncovers a strong negative correlation between growth in genuine wealth per capita which is a direct measure of sustainable development - and corruption. He concluded that corruption may have little average effect on the growth rate of GDP per capita, which is likely the source of unsustainable development. A recent study by Lucas Dutra de Paulo et al (2022) investigated the effect of corruption on the economic development of Latin American and Caribbean countries using panel data covering the period from 2000 to 2018 and leveraging two-way fixed-effect and system generalized method of moments estimators. Their result supported the debate that corruption "sands the wheels" of development showing that, a one standard deviation increases in corruption, as measured by the reversed Transparency International's corruption perception index, is associated with a decrease of 12.2% in gross domestic product per capita and a decrease of 3.05% in economic growth. Also, using a panel Granger causality test indicates a bidirectional causality between higher corruption and lower economic development providing evidence that corruption is associated with lower investment in physical capital and lower foreign investment flow.

In other studies, E. Anoruo, and H. Braha (2005) investigate the effect of corruption on economic growth for 18 African countries using panel unit root and the Phillips-Hansen fully modified OLS procedures. His results from the Phillips-Hansen fully modified OLS procedure reveal that corruption retards economic growth directly by lowering productivity, and indirectly by restricting investment while Nazar Mustapha(2014) examines the impact

of corruption on countries' GDP per capita using the pool OLS, The Fixed Effect, and the Random effect estimations to test the hypothesis that there is a strong negative impact on corruption with results showing that all three tests had shown a strong statistically significant negative impact of corruption on the GDP per capita. Mamun Miah et al (2021) conducted a study to determine the impact of corruption on the economic growth of Bangladesh, India, and Pakistan. The researchers used the ECM ARDL Model and the Fixed Effect Model to investigate the long and short-run effects of corruption on these countries. The results of the fixed effect model showed that a 1 percent increase in corruption leads to a decrease in GDP by 0.07 units. This indicates a negative relationship between corruption and economic growth. On the other hand, when trade increases by 1 percent, growth will increase by 0.09 units on average. This suggests a positive relationship between trade and economic growth. From the panel ARDL model, the researchers found that there is a long-run positive impact of corruption on growth, although it is not statistically significant. However, the long-run impact of trade has a significant positive effect on economic growth in all three countries under study. Wycliffe Mugun (2021) investigated the effect of corruption on economic growth in Eastern Africa using Hausman Specification tests to use either the fixed effects or random effect panel estimation. His result from the Random effect model showed that corruption had a negative and statistically significant relationship with economic growth whereas fixed effect model results on public resource equity had a negative and statistically insignificant relationship with economic growth. His findings concluded that corruption decreases the growth rate of per capita income directly by decreasing the productivity of existing resources and indirectly through reduced investments and also discourages investment savings and a culture of hard work among Eastern African countries

Ugur M. and Dasgupta N. (2011) conducted a study on the impact of corruption on the growth of low-income countries (LICs) by analyzing the existing empirical evidence on the direct and indirect effects of corruption on growth. The study found that corruption has a direct negative impact on growth in LICs. Specifically, an increase of one unit in the perceived corruption index results in a reduction of 0.59 percentage points in the growth rate of per capita income in LICs. Additionally, corruption also affects growth indirectly through various transmission channels such as investment, human capital, and public finance/expenditure.

Yuan-Hong Ho and Chiung-Ju Huang (2015) examine the corruption-economic growth nexus in four Asian Tiger Economies using the panel vector autoregression (PVAR) model from 1995 to 2011 results showing that corruption has a negative impact on the economic growth meaning for every 1 point improves in the corruption perceptions index score results in a 5 percent increase in GDP growth rate. A significantly positive impact on a country's economic growth rate was attained using the degree of economic freedom and the growth rate of domestic exports. In a related study, Dreher and Herzfeld (2005) present cross-section regressions to estimate the effect of corruption on economic growth and GDP per capita as well as on six possible transmission channels, including human capital for 71 countries in the period 1975-2001. Calculating the direct and indirect effects of corruption from the regression estimates, they find that an increase in corruption by about one index point reduces GDP growth by 0.13 percentage points and GDP per capita by 425 US$.

Dzhumashev (2014) focuses on examining the effects of bureaucratic corruption on economic growth and how this relationship is influenced by the quality of governance, the size of public spending, and economic development. His result shows that the interaction between corruption and governance shapes the efficiency of public spending by distorting the structure and size of government spending, which determines the growth effects of corruption. He further finds that the prevalence of corruption declines with economic development and the level of corruption varies across countries due to the differences in the development and institutional environments

2.2 Positive view

Several authors object to the negative picture of corruption. They claim that corruption can have beneficial effects on economic and political development in a country that deals primarily with the effects of bribery. In supporting the idea that corruption positively affects economic growth, Early studies in this context regardless of the common perception among scholars that corruption is growth reducing, placing it in a model of developing economy as a developing factor is even worse in some eyes as many people consider corruption a taboo. Leff (1964) disputed in his analysis that corruption might grease the wheels of the activities of public officials in countries in which bureaucratic regulations are cumbersome with an emphasis that corruption increases social welfare. Huntington (1968) in his study, he argues to the fact that corruption reduces administrative delays in government agencies. Both authors' views were that corruption can help to speed up many bureaucratic regulations and processes and allow for the revitalization of the economy, with companies winning contracts, and generating jobs and rents for a country's growth. Other studies like Lui, (1985) examined Myrdal's hypothesis by developing an equilibrium queuing model of bribery where customers can decide to pay bribes to

buy better positions in the queue. He also demonstrated a Nash equilibrium base on the server who wants to maximize either bribe revenue or bribe revenue net of the cost of service will also choose an optimal speed of service that can speed up the service when bribery is allowed meaning the server is unlikely to slow down the allocation process when bribery is allowed. In line with this argument, Acemoglu and Verdier (1998) consider an economy where contracts are necessary to encourage investments by which contract enforcement requires that a fraction of the agents work in the public sector and do not accept a bribe. Their findings were that; It may be optimal to accept certain corruption and not fully enforce property rights and also, in other to encourage development, less developed economies may choose lower levels of property rights enforcement and more corruption. They also found that in case of any riskless profit over a certain range, it is possible simultaneously to reduce corruption, increase investment, and achieve a better allocation of talent.

Studies of the "greasing the wheels' hypothesis such as Méon & Laurent Weill, (2010) analyze the interaction between aggregate efficiency, corruption, and other dimensions of governance for a panel of 54 developed and developing countries to test whether corruption may act as an efficient grease for the wheels of an otherwise deficient institutional framework. Their findings show that corruption is consistently detrimental in countries where institutions are effective, but that it may be positively associated with efficiency in countries where institutions are ineffective which thus concludes the evidence of the grease the wheels' hypothesis. Meanwhile, C. A. Ighodaro and Sunday O. Igbinedion (2020) empirically examined the relationship between corruption and economic growth in fifteen West African countries in a period from 2000 to 2018 using panel fully modified ordinary least squares for estimation. Based on linear estimation, their result shows that corruption has a direct relationship with economic growth thereby supporting the hypothesis that corruption greases the wheels of economic growth rather than sand the wheels of economic growth. In other studies, Podobnik et al. (2008) analyze the dependence of the Gross Domestic Product (GDP) per capita growth rates on changes in the Corruption Perceptions Index (CPI) for the period 1999–2004 for all countries in the world. They find that an increase of CPI by one unit leads to an increase of the annual GDP per capita growth rate by 1.7% and also after regressing only the European countries with transition economies, their results show that an increase of CPI by one unit generates an increase of the annual GDP per capita growth rate by 2.4%.

2.3 Mixed view

Ahmad et al. (2012**)** explore the linear quadratic empirical relationship between corruption and economic growth based on a panel data set over the period 1984-2009 for 71 developed and developing countries. They argue that though empirical literature has shown a linear relationship between corruption and economic growth, it hasn't differentiated between growth-enhancing and growth-reducing levels of corruption. As such they present evidence that suggests the existence of a hump-shaped relationship between corruption and long-run economic growth while suggesting different channels through which corruption hinders economic growth which include reduced domestic investment, reduced foreign direct investment, overblown government expenditure, distorted allocation of government expenditure away from education, health, and the maintenance of infrastructure and towards less-efficient public projects that provide more scope for manipulation and bribe-taking opportunities

Swaleheen & Stansel (2007) uses a panel of 60 countries in the period 1995- 2004 on an econometric model that accounts for the fact that economic growth, corruption, and investment are jointly determined and include economic freedom explicitly as an explanatory variable. They found results contradicting the generally accepted view that corruption lowers the rate of growth. They find that corruption reduces economic growth in countries with low economic freedom (where individuals have limited economic choices). However, in countries with high economic freedom, corruption is found to increase economic growth. That is, corruption lowers growth when the economic agents have very few choices (i.e. when economic freedom is low); but, if people face many choices (i.e., if economic freedom is high), corruption helps growth by providing a way around government controls. Another study by Shrabani Saha and Kunal Sen (2021) examines the role of political regimes, in mediating corruption–growth relationships using panel data from over 100 countries for the period 1984–2016 using various panel estimation techniques including FE, TSLS, and Dynamic-Panel-System-GMM methods of different measures of democracy and corruption. They find clear evidence that the corruption–growth relationship differs by the type of political regime, and the growth-enhancing effect of corruption is more likely in autocracies than in democracies with marginal effect analysis shows that in strongly autocratic countries, higher corruption may lead to significantly higher growth, while this is not the case in democracies. Meanwhile, E. Spyromitros and M Panagiotidis (2022) empirically examined two aspects of corruption; its measurement and its effects on the economic performance of 83 developing countries in the period 2012–2018 using AR (1) and FM-OLS data processing techniques. They find that corruption is an obstacle to development ("sand the wheels"

effect) as a result of high levels of corruption and bureaucratic inefficiency that can hinder investment and growth. While in some cases when other factors favor it, the relationship can be reversed in some countries ("grease the wheels" effect), confirming the predictions of the developing countries' political economy theory developed in the last decades. They also show that different regions pose Different levels of corruption and impact economic growth. Other authors like Dzhumashev (2014) focus on examining the effects of bureaucratic corruption on economic growth and how this relationship is influenced by the quality of governance, the size of public spending, and economic development. His result shows that the interaction between corruption and governance shapes the efficiency of public spending by distorting the structure and size of government spending, which determines the growth effects of corruption. He further finds that the prevalence of corruption declines with economic development and the level of corruption varies across countries due to the differences in the development and institutional environments. Thach, Duong, & Oanh (2017) analyze the impact of corruption on economic growth by using data from 19 Asian countries in the period of 2004-2015 with D-GMM data processing techniques and quantile regression. Their results show that corruption is a hindrance to the economic growth of those Asian countries and different levels of corruption at different quantiles impact economic growth differently. That is to say, at the quantile level from 0.1 and 0.5, corruption impacts positively on economic growth, or vice versa, from levels of 0.75 and 0.90, it is negative. And also, Cieslik et al (2018) used an open economy version of the endogenous growth model with international capital mobility to study the effects of corruption. In the model, corruption negatively affects the host country's investment stocks and growth through the uncertainty caused by corruption. Using GMM methods, the authors tested the effect of corruption on the growth rate of real per capita GDP and investment ratio using a sample of 142 countries from 1994-2014. Results show that lack of corruption has a positive and statistically significant effect on economic growth by increasing investment.

3 Empirical Analysis

In this chapter, I will present the methodology that will be used to estimate the impact of corruption on economic development in SSA as a benchmark model presenting the model and then describing the data and the variables used in the model.

3.1 The model Specification

This research aims to analyze the impact of corruption on economic growth and development considering a panel data sample of 36 Sub-Saharan African countries and 6 North African countries in an interval period from 2007 to 2021. The following model equations are used for the econometric analysis.

Eqn 1:

$$GDP_{PCit} = \beta_0 + \beta_1 Corruption_{it} + \beta_2 WGI_{it} + \beta_3 UrPo_{it} + \beta_4 InVR_{it} + \beta_5 HC_{it} + \beta_6 EFI_{it} + \alpha_i + \varepsilon_{it}$$

Eqn 2:

$$HDI_{it} = \beta_0 + \beta_1 Corruption_{it} + \beta_2 WGI_{it} + \beta_3 UrPo_{it} + \beta_4 InVR_{it} + \beta_5 HC_{it} + \beta_6 EFI_{it} + \alpha_i + \varepsilon_{it}$$

- α_i is an error term that represents the effects of all the time-invariant effects that have not been included in the model;

- ε_{it} is an error term that is different for each individual at each point in time

3.2 Data and variables

Past studies have illustrated that higher levels of corruption are associated with lower levels of human development, economic freedom, wealth, health, and education. This study investigates the relationship between corruption and economic performance for a sample of African countries using a model in line with Meon & Sekkat (2005). Thus, in equation 1 above economic growth, expressed as GDP per capita growth rate, is determined by a few explanatory variables which are the Corruption perception index, investment ratio to GDP, population growth, (human capital) school enrolment, Economic Freedom index, World Governance Indicators and in equation 2 Human Development Index is also determined by the explanatory variables above.

Data is gathered from different sources for this study. The data related to the dependent variable, which is the Human Development Index, is obtained from the United Nations Development Programme (UNDP). The data on GDP per capita is collected from the World Bank World Development Indicators. The Corruption Perception

Index data is obtained from Transparency International. For the other control variables, the investment ratio data is extracted from the International Monetary Fund database, urban population data is extracted from the United Nations Population Division, and data on human capital (school enrolment) is obtained from the United Nations Development Programme database. The Worldwide Governance Indicators (WGI) data are extracted from the World Bank, and data on economic freedom comes from The Heritage Foundation, Washington. An explanation of data measurement is found in Table 1 below.

Table1: Summary of data variables, measurement, and abbreviation

Variable Name	Measurement	Abbreviation
Human Development Index	the geometric mean of three basic dimensions of human development with a value of result between 0 and 1	HDI
Economic Growth	Gross Domestic Product per capita (constant 2017 international $)	GDP pc
Corruption Perception Index	based on 13 surveys and corruption assessments compiled by various reputable organisations that score countries according to the perceived level of public sector corruption on a scale of 0-100, where 0 means highly corrupt and 100 means very clean.	Corruption
Worldwide Governance Indicators	By six dimensions of standard normal units of the governance indicator ranging from around -2.5 to 2.5	WGI
Urban population	(% of the total population)	UrPo
Investment rate	Gross Fixed Capital Formation (% of GDP)	InvR
Human capital	expected years of schooling	HC
Economic Freedom Index	By 12 aspects of economic freedom are grouped into four broad categories graded on a scale of 0 to 100	EcFI

3.3 Descriptive Statistics

Presented in Table 2 are summary statistics on various variables included in the model, namely: corruption perception index, economic growth, human development index, human capital, investment rate, economic freedom, urban population, and worldwide Governance Indicators. It is worth noting that the standard deviations of the different series are generally low. This observation can be attributed to the logarithmic transformation of the series which helps in minimizing the variances among the different values of the variables. Moreover, the corruption index ranges from 0 to 100, where 0 indicates highly corrupt and 100 indicates very clean. Similarly, HDI ranges from 0 to 1, where 0 represents low human development and 1 represents very high human development. For the other variables, a lower score indicates poor performance while a higher score represents better performance.

Table 2: Descriptive statistics of the data

Covariate	Mean	Median	Max	Min	StdDev	Sum Sq Dev
GDP per capita	5902.9	3308.3	33345.9	705.0	6297.8	24352482712.2
Economic Freedom Index	54.9	55.7	77.0	0.0	9.8	58494.8
Corruption perception index	32.6	30.0	70.0	0.0	11.4	80408.1
World Governance Indicators	-0.7	-0.7	1.0	-47.0	2.0	2370.9
Investment Rate	4.2	2.7	57.9	-18.9	6.1	23045.4
Urban Population	45.2	43.1	90.4	9.9	17.6	191114.2
Human Capital	10.6	10.4	15.4	3.9	2.3	3313.0
Human Development Index	0.5	0.5	0.8	0.3	0.1	8.6

The study shows that the average values of the variables considered are GDP pc at 5902.9, Corruption perception index at 32.6, and HDI at 0.5. Standard deviations are 6297.8 for GDP, 11.4 for corruption, and 0.1 for HDI. Based on the results, it can be deduced that the GDP distribution among the studied countries is heavily skewed and unequal, indicating a significant disparity. However, the distribution of corruption levels is relatively uniform among countries, signifying a high degree of homogeneity. Moreover, the HDI distribution is relatively stable and uniform, which suggests a low degree of volatility.

3.4 Correlation Coefficient

I have used ExPanD, a tool built on the R package Shiny, to present the correlation coefficients in the figure below. This helps me identify a possible relationship between the variables. Generally, a correlation coefficient value greater than 0.50 indicates that the variables are strongly positively correlated, while a value less than -0.50 indicates that the variables are negatively correlated. The actual correlation also depends on the effect of the variable under consideration on the other. Figure 3 and Figure 4 depict various sample groups in which countries are classified. These groups are A (African countries), B (Sub-Saharan African countries), C (Sub-Saharan Africa excluding Central African countries), D (Sub-Saharan Africa excluding East African countries), E (Sub-Saharan Africa excluding West African countries), and F (Sub-Saharan Africa excluding Southern African countries).

Fig1 A

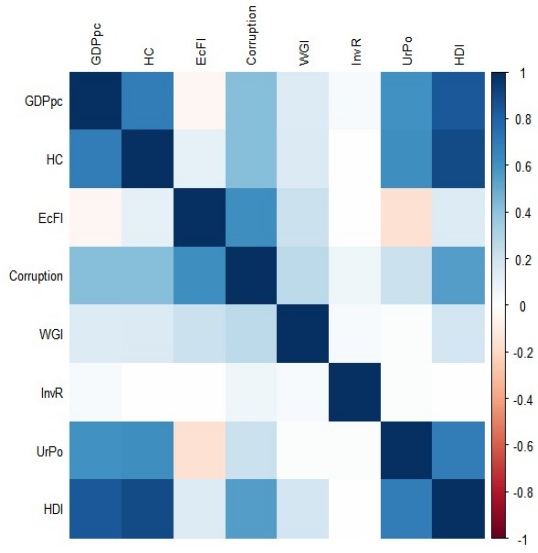
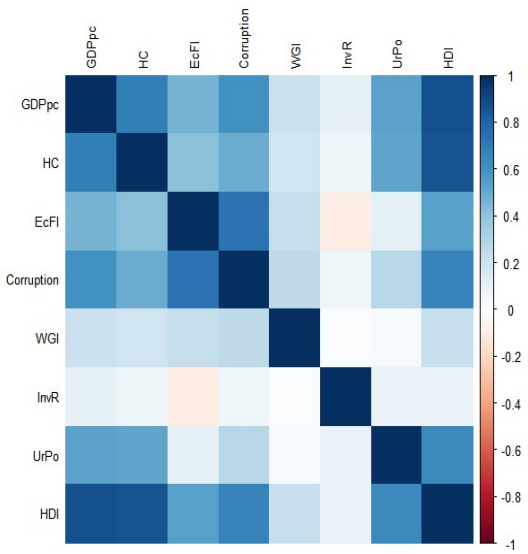


Fig1 B



Correlation Matrix of Variables (Source: Authors Computation from R)

Based on my analysis of the correlation figures above, it appears in Fig1A that there is a negative correlation between GDP pc and the economic freedom index though not strongly correlated while GDP pc is positively correlated to corruption, human capital, and urban population rate also, GDP pc does not correlate with investment rate and World Governance Indicators. the human development index is positively correlated with human capital, corruption, and urban population rate while it does not correlate with economic freedom, WGI, and investment rate. In Fig1B, GDP pc is positively correlated with all the independent variables except investment rate which does not correlate with GDP pc. Also, the human development index shows the same correlation as GDP pc.

3.5 REGRESSION ANALYSES

3.5.1 Model Validation

Using the PLM package on the R studio platform, the F test and LM test are conducted for FE and RE models respectively Both models were found to be appropriate for these tests, so the Pooled OLS model was discarded. The Hausman test was then conducted to determine the better model between FE and RE and the results are presented in table 3 below.

Fixed Effect		**Random Effects**	
Method	p.value	Method	p.value
F test for individual effects	F < 0.001	Lagrange Multiplier Test - (Honda)	F < 0.001

Table 3. Methods applied to choose the appropriate model.

The small p-value suggests that the null hypothesis of zero variance in individual-specific errors should be rejected. This means, that both the FE and RE are appropriate models, pooled OLS is discarded, and proceed to choose between the fixed-effects model and random-effects model. Hausman test is run to choose from the fixed-effects model and random-effects model. The results are presented below.

Method	p-value
Hausman Test to choose between FE and RE	F < 0.001

the Hausman test

The p-value less than 0.05 suggests rejecting null hypotheses of random effects. Hence, the fixed effect method is better for our model.

3.5.2 Estimation Results

3.5.2.1 Main Result

The study employs both fixed and random effects as well as pooled OLS techniques to estimate the effect of corruption on growth (Model 1) and development (Model 2). The investigation aims to examine the impact of corruption on growth and whether it varies across the regions of Sub-Saharan Africa. Table 4 shows the overall results for the three models of the two equations for the selected African countries. Additionally, Table 5 presents a summary of the results for the countries in Sub-Saharan Africa.

Table 4: Regression results for Africa

	Dependent variable					
	GDP per capita			**Human Development Index**		
	Pooled Ols	**FE**	**RE**	**Pooled Ols**	**FE**	**RE**
EcFI	-0.273	0.163	0.155	-0.041	-0.003	-0.004
	(0.036) ***	(0.019) ***	(0.019) ***	(0.019) **	(0.009)	(0.009)
	t = -7.631	t = 8.766	t = 8.047	t = -2.135	t = -0.326	t = -0.412
Corruption	0.337	0.047	0.041	0.247	0.058	0.067
	(0.038) ***	(0.021) **	(0.021) *	(0.021) ***	(0.010) ***	(0.010) ***
	t = 8.877	t = 2.286	t = 1.939	t = 12.022	t = 5.717	t = 6.387

WDI	0.042 (0.026) t = 1.575	0.001 (0.007) t = 0.150	0.003 (0.008) t = 0.379	0.015 (0.015) t = 1.030	0.001 (0.004) t = 0.329	0.001 (0.004) t = 0.297
InVR	-0.002 (0.026) t = -0.078	-0.006 (0.009) t = -0.639	-0.003 (0.010) t = -0.295	-0.020 (0.014) t = -1.428	0.005 (0.005) t = 1.044	0.003 (0.005) t = 0.716
UrPo	0.221 (0.034)*** t = 6.505	0.020 (0.065) t = 0.299	0.159 (0.058)*** t = 2.734	0.231 (0.019)*** t = 12.316	0.702 (0.032)*** t = 21.758	0.627 (0.030)*** t = 20.941
HuC	0.455 (0.036)*** t = 12.814	0.072 (0.029)** t = 2.475	0.073 (0.029)** t = 2.519	0.653 (0.019)*** t = 33.715	0.348 (0.014)*** t = 24.213	0.367 (0.015)*** t = 25.200
Constant	-0.000 (0.025) t = -0.000		0.000 (0.097) t = 0.000	-0.000 (0.015) t = -0.000		-0.000 (0.056) t = -0.000
R^2	0.612	0.208	0.204	0.879	0.843	0.833
F Statistic	136.607***	21.301***	155.271***	739.107***	506.997***	3,023.832***

Note: Significance codes : ***0.1%, **1%, *5%, '10% The numbers presented in parentheses indicate the standard errors of the regression coefficients

Table 5: Regression results for the SSA

	GDP per capita			**Human Development Index**		
	P Ols	**F E**	**R E**	**P Ols**	**FE**	**RE**
EcF	0.079 (0.042)*	0.081 (0.015)***	0.084 (0.015)***	0.110 (0.024)***	-0.014 (0.011)	-0.009 (0.012)
Corruption	0.277 (0.043)***	0.044 (0.016)***	0.046 (0.016)***	0.223 (0.024)***	0.063 (0.012)***	0.075 (0.013)***
WGI	0.037 (0.028)	0.0004 (0.006)	0.001 (0.006)	0.018 (0.016)	0.002 (0.004)	0.001 (0.005)
InvR	0.045 (0.028)	-0.013 (0.007)*	-0.012 (0.007)	0.010 (0.016)	0.005 (0.006)	0.003 (0.006)

UrPo	0.242	0.152	0.185	0.255	0.783	0.677
	(0.033)***	(0.046)***	(0.044)***	(0.019)***	(0.035)***	(0.033)***
HuC	0.380	0.007	0.009	0.575	0.334	0.359
	(0.036)***	(0.021)	(0.021)	(0.021)***	(0.016)***	(0.016)***
Constant	0.000		-0.000	-0.000		-0.000
	(0.027)		(0.110)	(0.015)		(0.062)
R^2	0.607	0.170	0.183	0.874	0.838	0.821
F Statistic	136.959***	17.027***	119.093***	616.259***	430.377***	2,443.297***

Note : Significance codes : ***0.1%, **1%, *5%, '10%. The numbers presented in parentheses indicate the standard errors of the regression coefficients

Table 4 presents the estimates of model (1) and (2) results, which include six variables considered significant for GDP per capita. In model (1), the table shows that for fixed effects (FE) and random effects (RE), less than 20% of the variables account for the variance in GDP per capita. However, for pooled OLS (PO), 60% of the variables can explain the variance. Notably, for the FE model, the economic freedom index (EcFI), corruption, and human capital (HC) show a positive and significant effect at a 0.1% significance level for ECFI and a 10% significance level for both corruption and HC. At the same time, worldwide governance indicators (WGI), investment rate (InVR), and urban population (URPo) have a positive but insignificant effect on the GDP per capita. The estimation results of both pooled OLS and random effects techniques suggest that corruption and human capital have a significant positive impact on growth at a 0.1% significance level each, while the economic freedom index (EcFI) has a negative impact at a 0.1% significance level.

In model (2), the estimates show that 83% of the variables explain the variance for the human development index. All the models indicate similar results, suggesting that corruption, URPo, and HuC have a significant positive association on the human development index at a 0.1% significance level, while EcFI has a negative association in all the models at a 0.5% significance level on PO and an insignificance level on FE and RE. Additionally, WGI and InVR have an insignificant positive association with human development.

Table 5 presents the estimated results for the Sub-Saharan Africa region. The results indicate that in model 1, EcFI, Corruption, and UrPo significantly impact growth at a 0.1% significance level each. On the other hand, InVR has a negative impact at a 10% significance level for the FE model. For the RE model, InVR has an insignificant negative effect, and for the PO model, it has an insignificant positive effect. The results in model (2) are similar to those presented in Table 4.

The study's first objective was to examine corruption's effect on economic growth and development in Sub-Saharan Africa. Data analysis on this objective was based on the null hypothesis that corruption does not affect economic growth in SSA. The fixed effect model was the preferred model based on the Hausman specification test. The results presented in Tables 4 and 5 above showed that Corruption had a positive and statistically significant association with economic growth and development at a one percent significance level.

Research has shown that there is a positive correlation between corruption and human development. This means countries with higher scores on the Corruption Perception Index tend to have better growth and human development rates. For instance, if a country's Corruption Perception Index score increases by one point, its growth and human development rates also increase by 0.044 and 0.063 points respectively. This is evident in the scatter plot in the appendix below that illustrates a positive correlation between HDI and the Corruption Perception Index, indicating that higher Corruption Perception Index scores are associated with higher HDI scores. The upper-right area of the scatter plot depicts countries with high HDI, while most countries are

concentrated in the lower-left area, indicating low scores for both HDI and Corruption Perception Index. Increasing the Urban Population Rate and Economic Freedom Index by one point can raise growth by 0.15 and 0.08, respectively. Similarly, a one-point increase in the Urban Population Rate and Human Capital can increase human development by 0.78 and 0.33 points, respectively. These results are consistent with results from Ho & Huang (2015) based on the PVAR model indicating that a 1-point increase in the corruption perceptions index score results in a 5% increase in the GDP growth rate. Similarly, Podobnik et al. (2008) found that a one-unit increase in the CPI is associated with a 1.7% increase in the GDP per capita growth rate. In summary, my results support the notion that corruption, lack of economic freedom, and high urban population negatively impact economic growth. Additionally, corruption, urban population, and low human capital hinder economic development which supports the debate of the "sand the wheels" hypothesis. The investment rate also shows a negative effect on economic growth which is consistent with results from, Mauro (1997) discovered that an increase in the investment rate by over 4 percentage points leads to an annual growth rate of over half a percentage point in per capita GDP. While the urban population rate shows a positive effect on both economic growth and development. The evidence shows that urban population is important for economic growth in Sub-Saharan Africa (SSA). It also suggests that urbanization is more effective in promoting growth in developing countries. This is logical because most economic activities that drive growth in SSA countries are concentrated in urban areas. The results are consistent with a 2009 World Bank report that argues that urban concentration is crucial for fostering growth in economies at the early stages of development.

3.5.2.2 Robustness Checks

Although the fixed effects (FE) estimates are consistent with prior research, it is still important to test their robustness. This is particularly relevant given the European financial and economic crisis of 2007-2008 which originated as a small local policy shock in Greece. The crisis quickly spread and led to the euro crisis of 2009-2010, which threatened the survival of the euro and could have had far-reaching consequences for the global economy. Moreover, the ongoing COVID-19 pandemic, which began in Wuhan, China in December 2019, has further emphasized the need for robustness checks.

To ensure the accuracy of the Fixed Effects (FE) estimates, I conducted another regression analysis using the Sub-Saharan African countries in the sample between 2012 and 2017, and the estimation results are presented in Table 6 below. I also performed an alternative panel data estimate by replacing the GDP per capita PPP (constant 2017 international $) with the GDP growth rate as the dependent variable while maintaining the other variables as independent. This analysis was performed on the same sample of 36 SSA countries in an interval period from 2007 to 2021 with results presented in table 7 below.

Table 6: Summary Result of Robust Check

	Dependent Variables					
	GDP per capita			**Human Development Index**		
	P O	**F E**	**R E**	**P O**	**F E**	**R E**
EcFI	0.164	0.031	0.036	0.180	0.009	0.018
	(0.058) ***	(0.016) **	(0.016) **	(0.033) ***	(0.012)	(0.014)
	t = 2.837	t = 1.978	t = 2.214	t = 5.408	t = 0.785	t = 1.304
Corruption	0.192	0.022	0.029	0.173	0.009	0.019
	(0.057) ***	(0.016)	(0.017) *	(0.033) ***	(0.012)	(0.014)
	t = 3.341	t = 1.339	t = 1.759	t = 5.228	t = 0.729	t = 1.396
WGI	0.028	0.0004	0.001	0.020	0.001	0.001
	(0.038)	(0.006)	(0.006)	(0.022)	(0.004)	(0.005)
	t = 0.741	t = 0.070	t = 0.175	t = 0.897	t = 0.328	t = 0.170
InvR	0.070	-0.013	-0.011	0.020	0.004	-0.001
	(0.038) *	(0.007) *	(0.008)	(0.022)	(0.006)	(0.007)
	t = 1.844	t = -1.793	t = -1.466	t = 0.928	t = 0.736	t = -0.110
Ur Po	0.224	0.221	0.283	0.268	1.023	0.735
	(0.044) ***	(0.076) ***	(0.068) ***	(0.025) ***	(0.058) ***	(0.051) ***
	t = 5.054	t = 2.897	t = 4.187	t = 10.533	t = 17.659	t = 14.514

HC	0.438	-0.017	0.007	0.578	0.274	0.341
	(0.047) ***	(0.033)	(0.033)	(0.027) ***	(0.025) ***	(0.027) ***
	t = 9.212	t = -0.517	t = 0.223	t = 21.185	t = 10.973	t = 12.572
Constant	0.000		-0.000	0.000		0.000
	(0.037)		(0.115)	(0.021)		(0.070)
	t = 0.000		t = -0.000	t = 0.000		t = 0.000
R^2	0.621	0.079	0.118	0.875	0.759	0.708
F Statistic	76.589***	3.498***	37.647***	326.768***	128.977***	680.288***

Note: Significance codes: ***0.1%, **1%, *5%, '10%

Table 7: Results of Pooled OLS, FE, and RE from 2007-2021

	Dependent variable:		
	GDP growth		
	POOLED OLS	FIXED EFFECT	RANDOM EFFECT
EcFI	-0.036	-0.198	-0.066
	(0.065)	(0.111) *	(0.078)
	t = -0.554	t = -1.779	t = -0.846
Corruption	0.106	0.143	0.117
	(0.067)	(0.119)	(0.081)
	t = 1.584	t = 1.204	t = 1.449
WGI	-0.001	-0.012	-0.001
	(0.044)	(0.043)	(0.043)
	t = -0.020	t = -0.287	t = -0.020
InvR	0.049	0.072	0.066
	(0.043)	(0.054)	(0.047)
	t = 1.133	t = 1.340	t = 1.403
UrPo	-0.192	-0.980	-0.203
	(0.051) ***	(0.344) ***	(0.073) ***
	t = -3.778	t = -2.844	t = -2.786
HC	-0.111	-0.187	-0.140
	(0.056) **	(0.155)	(0.076) *
	t = -1.977	t = -1.203	t = -1.850
Constant	-0.000		-0.000
	(0.042)		(0.062)
	t = -0.000		t = -0.000
R^2	0.061	0.052	0.043
F Statistic	5.813***	4.534***	24.039***

Note: Significance codes: ***0.1%, **1%, *5%, '10%

The findings presented in Table 4 indicate that there are notable differences in the inferences drawn when the study period is reduced from 2007-2021 to 2012-2017. Specifically, the results regarding corruption control show a positive but insignificant relationship. This change in results can be attributed to several crises during the study period, such as the European financial and economic crisis and the COVID-19 pandemic, which have led to an increase in corruption worldwide.

3.6 Conclusion

The literature on corruption and economic growth has two contradicting hypotheses. One states that corruption negatively impacts growth, while the other argues that it can positively impact economic performance. This paper investigates this relationship in 36 Sub-Saharan African countries, including 5 North African countries, to proxy the effect of corruption and how it varies across the region. Using a dataset covering up to 41 countries in the period between 2007 and 2021, three techniques were used for the regression model: the fixed effect, random effects, and the pooled OLS model. Based on the Hausman specification test, the fixed effect model was preferred. The results from the fixed effect model revealed that corruption had a positive and statistically significant relationship to economic growth and development. This positive association stands in the context that the higher the performer in the corruption perception index (where 0 represents the highest level of perceived corruption and 100 is the lowest level of perceived corruption), the more a country's growth and development. My research findings indicate a positive long-term relationship between corruption control and economic growth and development. This relationship is consistent with the “sand the wheels” hypothesis, as corruption control has a positive relationship with growth and development, while corruption itself has a negative impact. Thus, the analysis tends to support the ‘sand the wheels' on the Sub-Saharan African countries. The research shows that corruption levels differ across regions in Sub-Saharan Africa. The tables in the appendix demonstrate that corruption is most prevalent in countries in the central region, followed by those in the west and east regions, while the southern region has the lowest corruption rates.

Considering that crises can increase corruption and Sub-Saharan Africa is rife with various crises like economic, pandemic, political instability, and ethnic violence, corruption is pervasive in this region.

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Appendix:

A. List of Sub-Saharan African countries used in the study.

Sub-Saharan Africa countries

Angola, Burundi, Benin, Burkina Faso, Botswana, Central African Republic, Cote d'Ivoire, Cameroon, Congo, Dem. Rep., Congo, Rep., Cabo Verde, Ethiopia, Gabon, Ghana, Guinea, Gambia, The, Guinea-Bissau, Kenya, Madagascar, Mali, Mozambique, Mauritania, Mauritius, Namibia, Niger, Nigeria, Senegal, Sierra Leone, Chad, Togo, Tanzania, Uganda, Zambia, Rwanda, South Africa, Seychelles

North African countries

Algeria, Egypt, Arab Rep, Morocco, Tunisia, Libya

B. Tables

Table B1: mean value of the main variables for each country over the period 2017-2021

Country	GDP pc	EFI	Corruption	WG I	InvR	UrPo	HC	HDI
Angola	7366.73	48.32	20.93	-0.91	-2.04	62.64	10.54	0.55
Benin	2861.90	56.74	35.47	-0.25	1.50	45.21	11.49	0.51
Botswana	13888.50	69.71	60.00	0.60	1.88	65.81	12.35	0.69
Burkina Faso	1847.60	58.63	36.27	-0.45	1.23	27.01	7.80	0.41
Burundi	779.15	49.80	19.73	-1.24	0.71	11.85	10.51	0.42
Cabo Verde	6068.05	62.54	55.47	0.45	7.09	63.65	12.85	0.66
Cameroon	3513.48	52.76	24.93	-0.95	1.84	53.97	11.50	0.54
C. A. Republic	937.63	49.44	23.07	-1.54	1.62	40.16	7.19	0.38
Chad	1650.88	47.33	19.33	-1.36	2.94	22.55	7.35	0.38
C. Dem Rep	951.94	45.24	19.93	-1.62	5.09	42.25	9.42	0.45
Congo Rep	4436.31	43.20	21.00	-1.08	12.68	65.09	11.16	0.57
Cote d'Ivoire	4214.08	57.89	29.20	-0.86	1.24	49.06	9.00	0.50
Ethiopia	1649.71	52.11	32.00	-1.00	2.61	19.05	8.79	0.45
Gabon	14245.28	56.71	32.07	-0.58	6.14	87.43	12.68	0.69
Gambia	2001.41	56.48	30.73	-3.63	4.93	58.46	8.55	0.48
Ghana	4471.28	59.54	42.20	0.09	6.25	53.38	11.10	0.60
Guinea	2149.50	52.79	23.73	-1.11	4.33	34.92	8.98	0.44
Guinea-Bissau	1758.27	50.52	19.33	-1.08	3.48	41.74	10.04	0.46
Kenya	4082.71	56.65	25.40	-0.58	1.14	25.31	10.43	0.56
Madagascar	1528.38	60.55	27.87	-0.70	5.87	34.57	10.17	0.50
Mali	2049.54	56.21	30.20	-0.73	3.22	39.18	7.41	0.41
Mauritania	5079.55	53.89	27.67	-0.82	7.11	50.12	8.52	0.53
Mauritius	19527.17	74.95	52.73	0.89	3.23	41.19	14.70	0.78
Mozambique	1165.76	54.11	27.20	-0.55	20.89	33.92	9.83	0.43
Namibia	9698.40	61.23	48.60	0.37	4.64	45.82	11.79	0.61
Niger	1099.47	53.55	31.13	-0.70	5.82	16.33	5.64	0.37
Nigeria	4967.01	56.29	25.60	-1.10	1.25	46.90	9.27	0.51
Rwanda	1753.86	63.39	47.33	-0.31	2.63	17.08	8.67	0.51
Senegal	3043.16	56.65	39.33	-0.20	3.17	45.49	8.67	0.49
Seychelles	25172.24	56.13	52.07	0.34	15.19	55.03	13.64	0.79
Sierra Leone	1569.59	49.74	28.13	-0.66	8.85	40.47	9.15	0.45
South Africa	13658.01	62.01	44.60	0.19	1.93	64.28	13.63	0.70
Tanzania	2232.03	58.45	32.80	-0.43	2.99	30.95	8.78	0.51
Togo	1809.14	50.67	28.47	-0.82	3.07	39.63	12.13	0.50
Uganda	2036.57	61.19	26.20	-0.53	3.38	21.59	10.69	0.51
Zambia	3190.62	56.72	33.80	-0.32	4.72	41.44	10.93	0.55

TablesB2 1 and 2 Present the least and best performance on the Corruption perception index for 2007-2021 period

Table B2 1			Table B2 2		
Country	**MeanValue**	**Region**	**Country**	**MeanValue**	**Region**
Chad	19.33	Central	Benin	35.7	West
Guinea-Bissau	19.33	West	Burkina Faso	36.27	West
Burundi	19.73	East	Senegal	39.33	West
Congo, Dem. Rep	19.93	Central	Ghana	42.20	West
Angola	20.93	Central	South Africa	44.60	Southern
Congo, Rep	21.00	Central	Rwanda	47.33	East
Central African Rep.	23.07	Central	Namibia	48.60	Southern
Cameroon	24.93	Central	Seychelles	52.07	East
Kenya	25.40	East	Mauritius	52.73	East
Nigeria	25.60	West	Cabo Verde	55.47	West
Mozambique	27.20	East	Botswana	60.00	Southern
Mauritania	27.67	West			
Sierra Leone	28.13	West			
Togo	28.47	West			
Cote d'Ivoire	29.20	West			

Figure C1. Scatterplot of Average CPI Vs Average HDI