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**INCOME INEQUALITY AND ITS CORRELATES IN
SELECTED SUB-SAHARAN AFRICAN COUNTRIES:
EVIDENCE FROM PANEL DATA**

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the degree of Master of Science in Economics**

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Declaration

I, Adugna Regassa, declare that this thesis titled, “Income inequality and its correlates in selected Sub-Saharan African Countries” and the work presented in it are my own. I confirm that:

This work was done wholly or mainly while in candidature for a master's degree at this University. Where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated. Where I have consulted the published work of others, this is always clearly attributed. Where I have quoted from the work of others, the source is always given. Except for such quotations, this thesis is entirely my work.

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Chair of Department of Graduate Program Coordinator

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TABLE OF CONTENTS

ACKNOWLEDGEMENT	i
TABLE OF CONTENTS.....	ii
LIST OF TABLES	iv
LIST OF FIGURES	v
ABBREVIATIONS	vi
ABSTRACT.....	vii
CHAPTER ONE	1
INTRODUCTION.....	1
1.1 Background	1
1.2 Statement of the Problem	2
1.3 Objective of the Study	3
1.4 Significance of the Study	3
1.5 Organization of the Paper.....	4
CHAPTER TWO	5
LITERATURE REVIEW	5
2. Theoretical Literature Review	5
2.1 The Concept	5
2.2 Empirical Literature Review	6
2.2.1 Brief Overview of Income Inequality.....	6
2.3 Correlates of Income Inequality in Africa.....	8
2.3.1 Gender and Income Inequality in Africa	8
2.3.2 Education and Income Inequality in Africa.....	8
2.3.3. Government Spending and Income Inequality	9
2.3.4 Corruption and Income Inequality in Africa	10
2.3.5 Inflation and Income Inequality	10
2.3.6 Population Growth and Income Inequality.....	11

2.3.7 GDP Growth and Income Inequality	11
2.3.8 Urbanization and Income Inequality	12
CHAPTER THREE	13
DATA AND METHODOLOGY	13
3.1 Type and Sources of Data	13
3.2 Method of Data Analysis	13
3.3 The Model	13
CHAPTER FOUR.....	16
RESULTS AND DISCUSSIONS	16
4.1 Descriptive Statistics	16
4.2 Econometric Modeling.....	27
CHAPTER FIVE	35
CONCLUSION AND IMPLICATIONS	35
REFERENCES.....	37
APPENDIX.....	42

LIST OF TABLES

Table 3.1: Description of Independent Variables Used in the Study.....	15
Table 4.1: Ordinary Least squares estimation with different specifications.....	29
Table 4. 2: Estimates from panel data models	31
Table 4.3: Systems of simultaneous equations (3SLS).....	34

LIST OF FIGURES

Figure 3.1 : Map of countries selected for the study.....	14
Figure 4.1: Box plot for Gini index by country	17
Figure 4.2: Trend of Gini index by country	18
Figure 4.3: The relationship between corruption and income inequality	20
Figure 4.4: The relationship between education and income inequality	21
Figure 4.5: Correlation of Gini disparity with urbanization and government expenditure by country	22
Figure 4.6: Simple regresdsion of Gini index for each year	24
Figure 4.7: Simple regression of Gini index for each country.....	25

ABBREVIATIONS

SSA-	Sub-Saharan Africa
UNDP-	United Nation Development Program
SDG-	Sustainable Development Goals
UN-	United Nation
GDP-	Gross Domestic Product
CPI-	Consumer Price Index
OLS-	Ordinary Least Squares
FD-	First Difference
FE-	Fixed Effects
RE-	Random Effects
CRE-	Correlated Random Effects
OECD-	Organization of Economic Cooperation and Development

ABSTRACT

There is mixed evidence in the literature regarding the relationship between income inequality and its drivers. This study is an empirical analysis of income inequality in selected sub-Saharan African countries. I used a panel data set from 24 Sub-Saharan African countries spanning the decade from 2005 to 2014. Both descriptive and econometric analysis was applied to investigate how income inequality, measured using the Gini index, relates to other macroeconomic variables such as corruption, inflation, population growth rate, urbanization, GDP growth, government spending, mean years of schooling and female labor force participation. The results suggest that most variables have, at best, a very weak relationship with income inequality. Particularly estimates from panel data models indicate that the relationship observed in the pooled regression vanishes once we control for country fixed effects, suggesting a strong individual heterogeneity. Two lessons are drawn from these bizarre results. The first has to do with the possible role of measurement error and the importance of having accurate and complete data. The second is that, if the results, even to a certain extent, are to be trusted, then we should look for other country-specific long-run determinants of income and wealth distribution such as its history and institutions.

Keywords: Income inequality, Gini index, Sub-Saharan Africa

CHAPTER ONE

INTRODUCTION

1.1 Background

Equality is a word that has a different meaning in different concepts. That is why most people care about inequality irrespective of their identity, culture, religion, or ideology. This inequality can be seen within political, social as well as economical dimensions. Our concern is more targeted inequality of economic problems. Inequality can be a signal of a lack of income mobility and opportunity in a society. The oxford advanced Learner's Dictionary states inequality as the unfair difference between groups of people in society when some have more wealth, status, or opportunities than others (Hornby, 1995). The widening of this inequality across the countries has many implications on growth, peace, and security. When we see inequality with economic segments income inequality is one that can be measurable with individual or household income or consumption. Smith (2015) defines income inequality as the disproportionate distribution of total national income among households.

With the recent economic growth seen in many African countries, income inequality and poverty indicators have not progressed as expected. However, Africa remains snowed under by unequal income and wealth distribution. Global growth and the rising of income inequality becomes a hotly debated issue since the global financial crisis. Dabla-norris & Kochhar (2015) support this idea by pointing that since the global financial crisis of 2007-2008 there has been a remarkable rise in income inequality. The increased movement of factors of production without borders and living standards can influence one's income position. This indicates the world becomes more interconnected. Milanovic (2013) points that “the high level of global inequality reflects sizable per capita income inequalities across countries, which account for around three-quarters of global inequality”. Enhance this, the amazing inequalities observable within each of the vast majority of developing countries.

The income distributions became an attractive issue over the course of the 2000s in Africa for different reasons. Voitchovsky (2009) and Soto (2015) pointed that high-income inequality can affect long-run growth. Sustainable Development Goals also give explicit targets related to income distribution to 2030. It says that by 2030 progressively achieve and sustain income

growth of the bottom 40% of the population at a rate higher than the national average. In recent years sub-Saharan African countries record a good improvement in economic performance. However, these aggregate improvement trends do not consider some macroeconomic variables such as income inequality levels and trends in the region (Odusola, Cornia, et al., 2017). Therefore, it is important to see this gap, the experience and draws relevant lesson that could help accelerate in income inequalities.

1.2 Statement of the Problem

Africa is one of the continents where a combination of serious governance, macroeconomic imbalances, poor infrastructure, and other characters of malfunctions interchangeable. Constant and high-income inequality interacts, through political economy, which can hinder growth Amitava et al., (2007). Since the 2000s Africa's economy has become booming because of some improvements in macroeconomic policies and institutions. However, the exciting economic performance does not match the socioeconomic variables such as high levels of income inequality and poverty, which remain as characteristics of many African economies.

Here, there are different reasons why income and asset distribution becomes the interest of many scholars including in Africa. The very rising trend of inequality/income inequality got high attention. The growing body of theoretical and empirical literature surge the implication and effect of rising income inequality on long term growth (Soto, 2015; Voitchovsky, 2009). On the other hand the gradual improvements of democracy in most parts of the region gave hopes for enhancement of broader redistribution (Gyimah-brempong, 2002). The international development debate is also one of the reasons why income inequality gets high attention. The rapid expansion of data bases on inequality measures such as Living Standards Measurement Study Survey, Demographic and Health Surveys, Household Budget Surveys and development of international databases on income inequality have made it more important. Next, the enclosure of income inequality in the Sustainable Development Goals has in fact opened a way to closer study.

The inequality concern especially income or wealth inequality has taken small attention historically from a research, policy and political perspective. In the early post-independence the policy imperative was to modernize the economy and grow, whereas in the 1980s and 1990s, the

focus shifted to managing the foreign debt and stabilizing the macro economy. And more recently with the implementation of the Millennium Development Goals in 2000s the main concern was given to reducing poverty and attaining the mostly social MDGs. In addition reducing poverty and inequality became the achieving goal of the 2030 agenda for sustainable development. As a result, growing attention is now being paid to this issue in policy circles, including in Sub-Saharan Africa where this type of debate has only recently emerged, having been bypassed until now. Inequality is now recognized as a key determinant of most SDGs, its records, the investigation of its determinants, and the debate on how to decrease it have been incomplete so far, due to the importance placed on growth by past development strategies, limited data availability, and the heterogeneity of inequality levels, trends and causes in the region. But in the region, the availability of data calls for major efforts. So, it is important to see selected sub-Saharan Africa's experience in the case of the complex interaction between income inequality and correlates, the key components behind the increasing income inequalities.

1.3 Objective of the Study

The main objective of this research is to examine the correlates of income inequality in selected sub-Saharan Africa.

Specifically, this research aims to:

- a) Analyze the positive and negative relationship of income inequality and its key components on SSA countries
- b) Identify key factors responsible for the income inequality and its correlates in selected SSA countries.
- c) Suggest appropriate and efficient conclusions that can aid the reduction of the income inequality gap in the continent based on our findings.

1.4 Significance of the Study

Widening inequality especially income or wealth inequality has a high major implications for growth, security and macroeconomic stability, such as reducing investment, political and economic instability. It can also increase crisis risk. When we see Africa's experience on income

inequality there are many bottlenecks which impeding rapid improvement. Inequality is now recognized as a key determinant of most SDGs, its records, the investigation of its determinants, and the debate on how to decrease it have been incomplete so far, due to the importance placed on growth by past development strategies, limited data availability, and the heterogeneity of inequality levels, trends and causes in the region

From the historical perspectives inequality or income inequality have got small attention in the region. However, in recent years there is some improvement in policy, institutions, democracy and research to tackle the rise of this inequality. So, it is important to see the correlates of income inequality in selected region to reduce its current high levels. Many indicators are set out in SDG on reducing inequalities. Alliance (2015) specifies that meeting the challenge of high inequality is best understood not only as SDG but, as a general accelerator of the aspirations of the 2030 Agenda.

1.5 Organization of the Paper

The second chapter is devoted to a brief overview of income inequality and its correlates in selected sub-Saharan African countries and a survey of relevant literature. Presentations of the Gini Coefficient and the macroeconomic basis of the model are introduced in chapter three of the study, Chapter four discusses the results and lasts with a chapter of conclusion.

CHAPTER TWO

LITERATURE REVIEW

2. Theoretical Literature Review

There is a debate about distribution of income along the history of economic thought, that there is no agreement among economists about which are the determinants of income inequality. The main reason is that the distribution of income is the final consequence of the entire economic process, and it is well known that there is a lack of unanimity of views even on broad economic issues of that process, which makes it logical to expect no agreement on a topic that has been the source of ideological wars and political revolutions. (Gallo, 2002; Sahota & Rocca, 1980)

2.1 The Concept

We can define inequality in different ways. The Oxford Advanced Learner's Dictionary dictates Inequality as "the state of not being equal, especially in status, rights, and opportunities". It is typically thought of as differences between individuals within a population of a country. The World Bank Group sees the overall income inequality in a country as an important dimension of welfare, since it considers the difference in income across all the population, unlike other welfare indicators that focus on only one group. Income inequality is just one dimension of inequality. Many scholars interpret economic inequality as mostly meaning income inequality, which is inequality in living conditions.

The concept of 'income distribution' is who receives how much income within the specific society. There are two principal concepts regarding income distribution. the functional and the personal or size distribution of income. Economists typically differentiate between two principal measures of income allocation for both analytical and quantitative purposes: the personal or size distribution of income which deals with individual persons or households and the total incomes they receive. How they received that income is not considered. What matters is how much each earns irrespective of whether the income comes from other sources such as interest, profits, rents, gifts, or legacy. The functional or distributive factor share distribution of income explains the

share of total national income that each of the factors of production receives. It investigates the percentage that labor receives as a whole and compares this with the percentages of the total income distributed in the form of rent, interest, and profits.

2.2 Empirical Literature Review

2.2.1 Brief Overview of Income Inequality

The world faces severe income inequality. The gap between the rich and the poor has increased significantly. For example, in 2015, the richest 1 percent of the population owned more assets than the other 99 percent. This matters. Extreme inequality is commonly viewed as unreasonable. Inequality can have many scopes. Economists are concerned particularly with the monetarily measurable aspect which is associated with the individual or household income and consumption. But, this is one view and inequality can be associated with inequality in skills, education, opportunities, happiness, health, life expectancy, welfare, assets, and social mobility (Heshmati, 2004). As (Ray, 1998) indicates, the international disparity of national income is only one sign that something is fundamentally skewed with global development. There are two reasons why we care about income inequality. People can decide in their lifetime, which only they are responsible for and the impact which comes after the consequence of income inequality.

Lewis (1955) and Kuznets (1955) discuss the general framework of income inequality and economic growth, which suggests in the early stages of development, economic growth and income distribution, involved a trade-off. The significant income gap between rural agriculture and urban industry as a consequence, overall inequality would at first increase and then stabilize for some time before decreasing.

In addition, the studies also indicate the recent growth rates recorded in Africa. But there is a genuine concern regarding whether this high growth at the country level can be translated into achieving key development objectives, such as poverty reduction, more equitable distribution of income, enhanced human capital accumulation, and improved infrastructure. Nel (2018) Economic theory and cross-country experience have indicated that the growth drivers by a more diverse variety of economic sectors will be more important if fairly distributed.

Rose & Hatzenbuehler (2009) see the multidimensionality of inequality in the dimension of inequalities in the standard of living such as inequalities in income, education, health, and nutrition. United Nations Development Programme, (2016) defines income inequality as the distribution of income across households or individuals in an economy. This is usually measured using the Gini Index of inequality which varies between zero and 100, with zero reflecting complete equality and 100 indicating absolute inequality.

Income inequality has become a hot development issue across the world. The recent big challenge of our planet is the persistent income inequality. Soto (2015) and Dabla-norris & Kochhar (2015) agree by indicating that high-income inequality can be a signal of lack of income mobility and opportunity, and have a significant effect on growth and macroeconomic stability. That is why we concern about income inequality.

How do we measure income inequality?

Measuring economic inequality examines inequality indices that allow the position of income or wealth distributions in two different situations. According to (Ray, 1998) there are four criteria for inequality measurement when we are interested in comparing the relative inequality of two-income distributions. First, the Anonymity principle: From an ethical point of view, it does not matter who is earning the income. Second is the population principle: Cloning the entire population and their incomes should not affect inequality. That means population size does not matter; all that matters are the proportions of the populations that earn different levels of income. The Third is the Relative income principle: If one income distribution is obtained from another by scaring everybody's income up or down by the same percentage, then inequality should be no difference across the two distributions. Fourth, the Dalton principle: States that if one income distribution can be achieved from another by constructing a sequence of regressive transfers, then the former distribution must be deemed more unequal than the latter. (Dabla-norris & Kochhar, 2015)

2.3 Correlates of Income Inequality in Africa

2.3.1 Gender and Income Inequality in Africa

Gender is the main sign of social and economic exclusion in most societies. Gender norms and stereotypes reinforce gendered identities and constrain the behavior of women and men in ways that lead to inequality Rizzi, (2013). Recent empirical work finds that gender inequality at the global level is an important source of income inequality, with gender gaps in education and health outcomes as the main drivers in developing countries (Gonzale and et al., 2015)

Anyanwu et al., (2016) point to the policy agenda and actions needed to enhance gender equality and women's empowerment in Africa. It explores that social institutions and norms play a critical role in accelerating gender inequality. According to Mitra et al., (2015) educating females is important to improvements in children's health, reductions in fertility rates and increases in labor force participation rates, and better quality of human capital of future generations. Restrictions on women's rights to heritage and assets, and participating in economic activities are strongly associated with larger gender gaps in labor force participation

This signifies that Gender disparities remain among the most persistent forms of inequality across all countries. Gender inequality is considerably one of the greatest tackles to human development. Women and girls are discriminated against in health, in education, at home, and in the labor force participation with negative implications for their freedoms.

2.3.2 Education and Income Inequality in Africa

Education can play an important role in reducing income inequality, as it determines the occupational choice, access to jobs, and the level of play, and plays a pivotal role as a signal of ability and productivity in the job market. The expansion of basic and higher education is important for reducing the wage inequalities Lustig et al., (2016). African Development Report, (2011) defines Human capital as the "stock of economically productive human capabilities" that encompasses knowledge, health, skills, entrepreneurial talent, which led to success in activities. These abilities are formed by mixing innate abilities with education in human beings. (Nemati & Hosseinidoust, 2018)

Many studies point out the relation between education and income inequality. These studies are contradicting the effect of education on income inequality whether it can increase or decrease. For instance Knight and Knight & Sabot, (1983) identify two possible effects. First, the "composition" effect predicts increased inequality as the number of educated populations' increases and decreases as the number expands. Second, the wage "compression" effect, which predicts a decrease of the education premium as the relative supply of educated workers increases, so decreasing income inequality. Walker, (2008) points that the role of wage differential by skills, measured by education can increase inequality globally. Other scholars also discuss that there is a positive relationship between education and income inequality in developing countries. That is as the rate of enrolment in primary grades increase, income inequality could also increase in a country. Balamoune-Lutz & McGillivray, (2015) focus on the generic inequalities of education on the income inequality of northern and Sub-Saharan Africa. A finding signifies the negative relationship between education and income inequality in these selected countries. However, there is also the study that there is no significant relationship between education and income inequality.(Anyanwu et al., 2016; Baah-boateng, 2015; Barro & Lee, 2013)

2.3.3. Government Spending and Income Inequality

Government has the power to play an essential role in reducing inequality. The recent empirical literature identifies fiscal policy as the main driver of government to influence income inequality (Dombia & Kinda, 2019). There is much evidence to suggest that some government spending has led to lower income inequality in many countries (Lustig et al., 2016)

The overall effects of government spending may vary depending on how income is considered and on the period being measured. Government consumption spending may affect income inequality only after a fairly long time lag Bastagli et al., (2016). Government spending is captured by total spending in percent of GDP and is a proxy for the size of the government. Because larger governments tend to be associated with larger distributional policies, including larger in-kind benefits, high public spending would be associated with lower income inequality (Demmou et al., 2015)

2.3.4 Corruption and Income Inequality

Corruption can be defined as the use of public office for private gain. Corruption can be seen as the utilization of official positions or titles for personal or private gain, either on an individual or collective basis, at the expense of the public good, in violation of established rules and ethical considerations, and through the direct or indirect participation of one or more public officials whether they be politicians or bureaucrats. Corruption can create a vicious cycle. That is when denying poor people access to basic social services and resources to improve their lives, people can find private solutions to public failures and disadvantaged groups have no alternative. That is why they cannot escape poverty. (Andvig, 2008; Hope, 2000)

In African countries, corruption is systemic and involves high-level political leadership UNDP Report, (1999). These reports explain that until African countries themselves understand the behavior and values of corrupt politicians and bureaucrats' corruption can hurt them. The 'UN Declaration Against Corruption and Bribery in International Commercial Transactions' emphasized the requirement to 'promote social responsibility and appropriate standards of ethics on the part of private and public corporations, including transnational corporations, and individuals...' Gupta et al., (2002) point out that corruption increases income inequality in the developing world. Nathaniel, (2014) argues that corruption can increase income inequality. (Gyimah-brempong, 2002)

2.3.5 Inflation and Income Inequality

Smith, (2015) defines Inflation as "the rate of increase in the general level of prices, measured by the consumer price index (CPI), the average price of a basket of goods and services consumed by a representative household, or by the GDP deflator, which compares the average price of the GDP basket today and in a base period". Inflation is measured by the change in the Consumer Price Index and tends to disproportionately hurt the poor compared to other income groups and worsens inequality through various channels.

Many studies have been accomplished to illustrate the relationship between income inequality and inflation. There are different ideas concerning the relationship between inflation and income inequality. In developing countries, inflation and income inequality interact and influence each other. Walsh & Yu, (2012) Inflation and income inequality have strong positive relations. Lin et

al., 2017) and Albanesi, (2002) found the non-linear relation between inflation and income inequality. That is a rise in inflation can either reduce inequality or increase inequality, which depends on the initial inflation rate (Ivanova, 2019; N'Yilimon, n.d.).

2.3.6 Population Growth and Income Inequality

According to the United Nations Population Division prediction, the world population would rise to about 8.1 billion in 2025 and reach about 9.6 billion by the year 2050. The greater part of that population will survive in developing countries. Increments of such magnitude come up with a problem of welfare and inequality. One of the developing worlds that the population growth is at a highly alarming rate is the African continent. (Naidoo, 2016)

Nicholas, (2014) discusses that Inequality becomes the second most serious development problem in the world. The growing number of jobless youth in Africa may hinder economic growth, intimidate peace and security, weaken the social structure, and can cause social and political instability in the region. Rougbor & Marrewijk, (2015) argue that countries with high population growth usually delay economically when we compare with low population growth and inequality increases, even if GDP per capita remains the same in other countries. (Engerman & Sokoloff, 2002; Odusola, Nations, et al., 2017)

2.3.7 GDP Growth and Income Inequality

Kuznets, (1955) claimed that at low levels of per capita income, inequality increases with rising per capita income and eventually decreases in the later stage of development. This could be factual because, most developing countries are characterized by a traditional agricultural economy with low productivity potential and as it transforms through the process of economic growth and industrialization, they begin to experience high levels of inequality at the initial phase, which will eventually fall out.). Barro, (2000) used panel data for a large sample of developing and developed countries. Barro's results indicate that income inequality has a positive impact on economic growth within developed countries. However, within developing countries, income inequality affects economic growth negatively.

There is also a negative relationship between income distribution and economic development) was found by other studies, such as Pede & Partridge, (2009). Gallo, (2002) found that there is no definite relationship between inequality and the level of economic growth. (Naidoo, 2016)

2.3.8 Urbanization and Income Inequality

Urbanization is a relevant consequence of development because as countries develop, the proportion of their citizens who dwell in urban areas begins to rise as sections of their populations change from rural areas into urban cities Kuznets, (1955); Annez & Buckley, 2007); UNDP,(2016) explains that one of the reasons of the economic boom in Africa since 2000s was because of urbanization.

In particular, as a result of the lack of empirical evidence on the topic for Sub-Saharan Africa, we do not know the nature of the relationship for this region. (Sulemana et al., 2019)

CHAPTER THREE

DATA AND METHODOLOGY

3.1 Type and Sources of Data

The study is conducted in 24 selected Sub-Saharan African countries using panel data ranging from 2005 to 2014. Figure 3.1 shows the selected countries on a map. I used unbalanced panel data: Angola and Burundi have missing data for 2014, Guinea and Madagascar for 2013 and 2014, Lesotho for 2005 and 2006, and finally Chad and Senegal for 2012, 2013, and 2014.

The source of data for all variables except for the Gini Index and Mean Years of Schooling is the World Bank's World Development Indicators (WDI) database.¹ The Gini Index, a measure of inequality, is from The Standardized World Income Inequality Database (SWIID)² and Mean Years of Schooling is from Lee & Lee(2016); Barro & Lee(2013); United Nations Development Programme(2018).³

3.2 Method of Data Analysis

I employ both descriptive and econometric analysis of the data described above. I have focused on doing the analysis disaggregating by country to see whether there are heterogeneities across countries.

3.3 The Model

In addition to running Ordinary Least Squares (OLS) on the pooled data, I use panel data models to investigate the relationship between the Gini Index and several covariates. Specifically, the analysis builds on Jaumotte et al. (2013). The panel model may be specified as

$$y_{it} = X_{it}\beta + \mu_i + \theta_t + \varepsilon_{it}$$

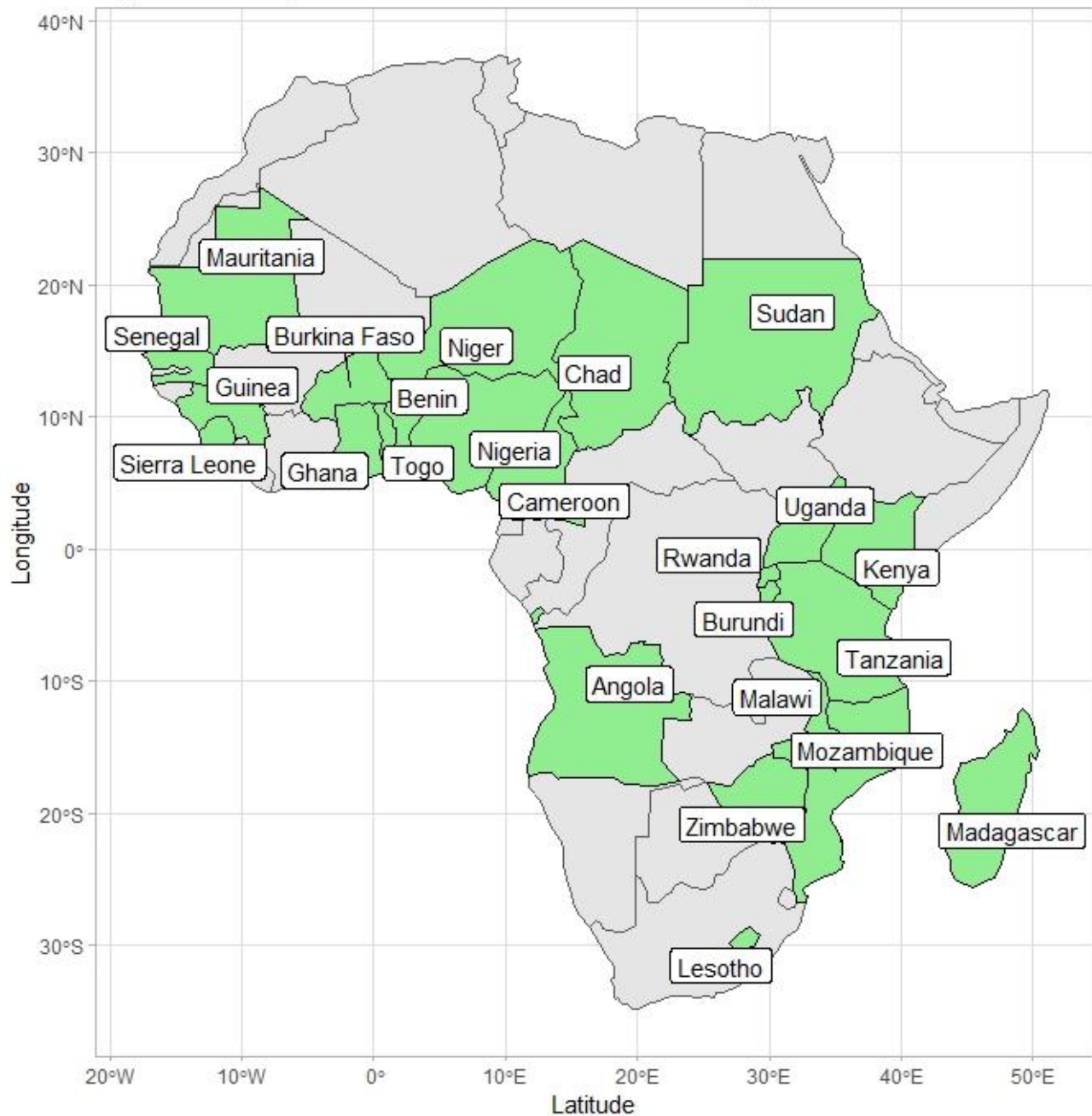
¹<https://databank.worldbank.org/source/world-development-indicators>

² Downloaded from <https://fsolt.org/swiid/>

³ Downloaded from <https://ourworldindata.org/global-education>

Where y_{it} is the Gini index of country i in year t , X_{it} is a vector of covariates, μ_i , and θ_t are country and time fixed effects, respectively, and ε_{it} is the idiosyncratic error term or time-varying error, because it represents unobserved factors that change over time and affect y_{it} . Table 3.1 describes the independent variables in the model (i.e., covariates in X_{it}).

Figure 3.1 : Map of countries selected for the study



I estimated the model using a range of specifications. I also run the random effects and correlated random-effects model. Finally, to account for possible endogeneity, I also run a systems equation.

Table 3.1: Description of Independent Variables Used in the Study

Variable	Description
<i>Corruption</i>	Transparency, accountability, and corruption in the public sector. Measured as an index from 1=low to 6=high.
<i>Inflation</i>	Inflation measured using GDP deflator (annual %)
<i>Population and its growth rate</i>	Size and growth rate of population
<i>Urbanization rate</i>	Percent of urban population
<i>GDP per capita and its growth rate</i>	Per capita GDP measured in 2010 constant dollars and its growth rate
<i>Government Spending</i>	General government final consumption expenditure as a share of GDP (%)
<i>Mean Years of Schooling</i>	Mean years of total schooling across all education levels.
<i>Female LFP</i>	Percent of females above 15 in the labor force (modeled ILO estimate)

CHAPTER FOUR

RESULTS AND DISCUSSIONS

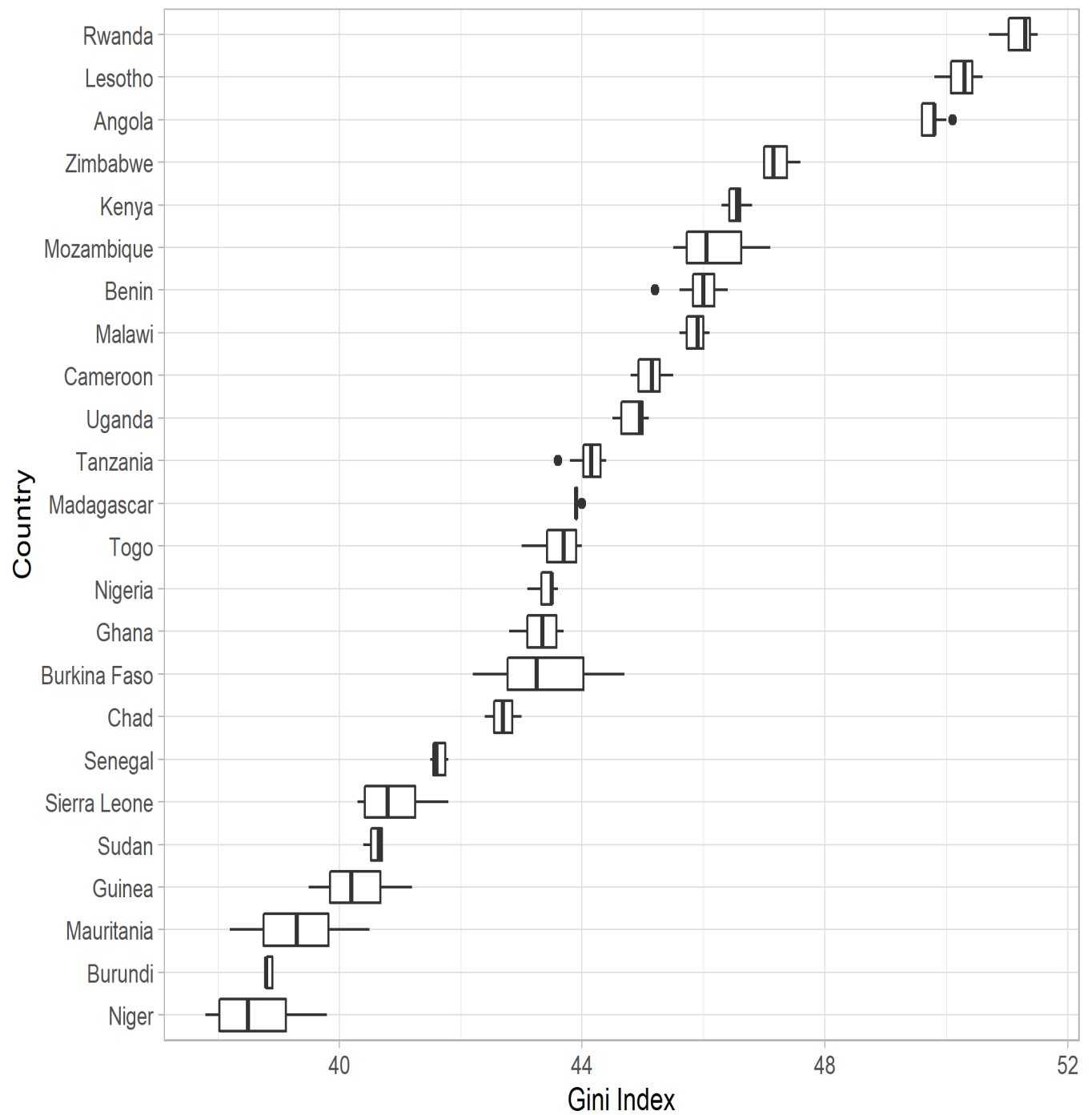
4.1 Descriptive Statistics

In this section, a descriptive analysis of the data will be presented. Table A.1 in the appendix provides summary statistics of the panel data used in this study for each variable. What is striking is that for most of the variables the within standard error is considerably smaller than the between standard error, suggesting high intra-country correlation.

Our main variable of interest is the Gini index, a measure of income inequality. Figure 4.1 summarizes the distribution of this variable for each country using a box plot. Rwanda appears to have the highest income inequality, followed by Lesotho and Angola. On the other hand, Mauritania, Burundi, and Niger have a comparatively low level of income inequality.

A much more complete picture of the trend of income inequality for each country is illustrated in Figure 4.2. The figure makes the comparison across countries difficult as the scales for each graph is different. But in general, we see that there is a wide disparity in the trend across countries. For instance, while Benin, Mozambique, Tanzania, and Togo had an upward trend in their Gini index, Burkina Faso, Guinea, Kenya, Malawi, Mauritania, and Niger, among others, had a clear downward trend. The other important feature displayed in Figure 4.2 is that there is very little variation in the Gini index across time as the narrow ranges in the y axis in the graph for each country indicate.

Figure 4.1: Box plot for Gini index by country



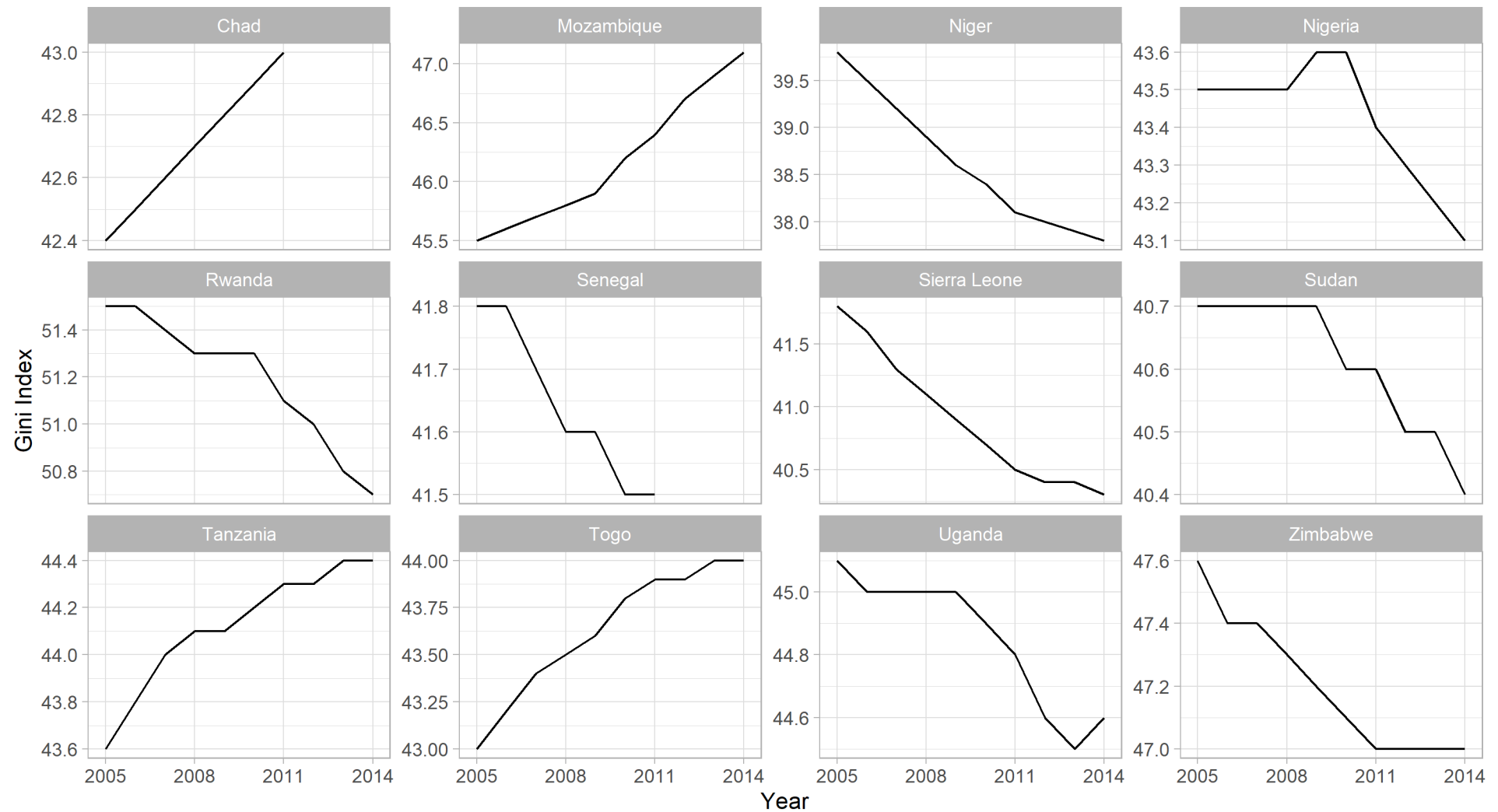
Source: The Standardized World Income Inequality (SWIID) Database

Figure 4.2: Trend of Gini index by country



Source: The Standardized World Income Inequality (SWIID) Database

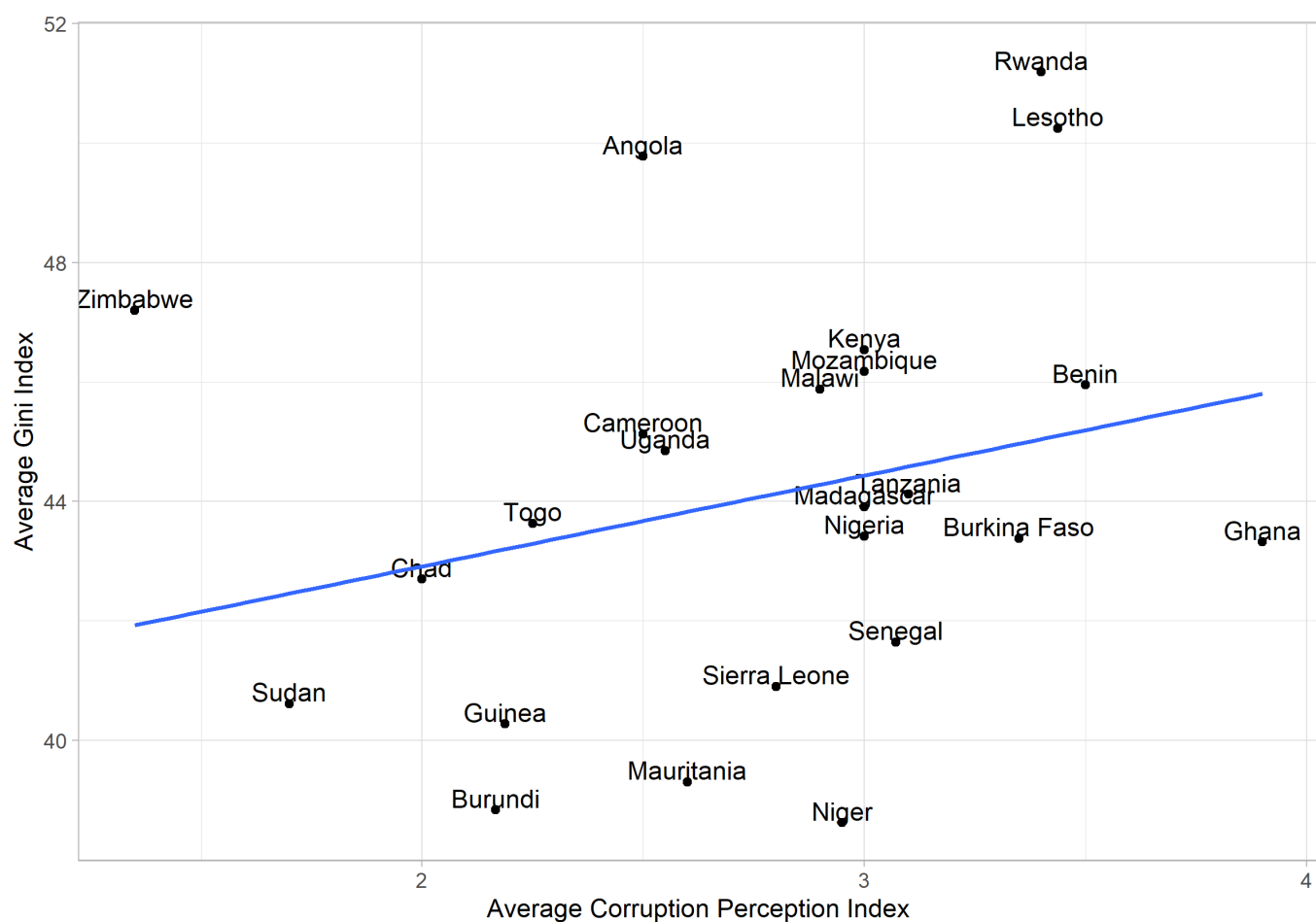
Figure 4.2: Trend of Gini Index by Country (continued)



Source: The Standardized World Income Inequality (SWIID) Database

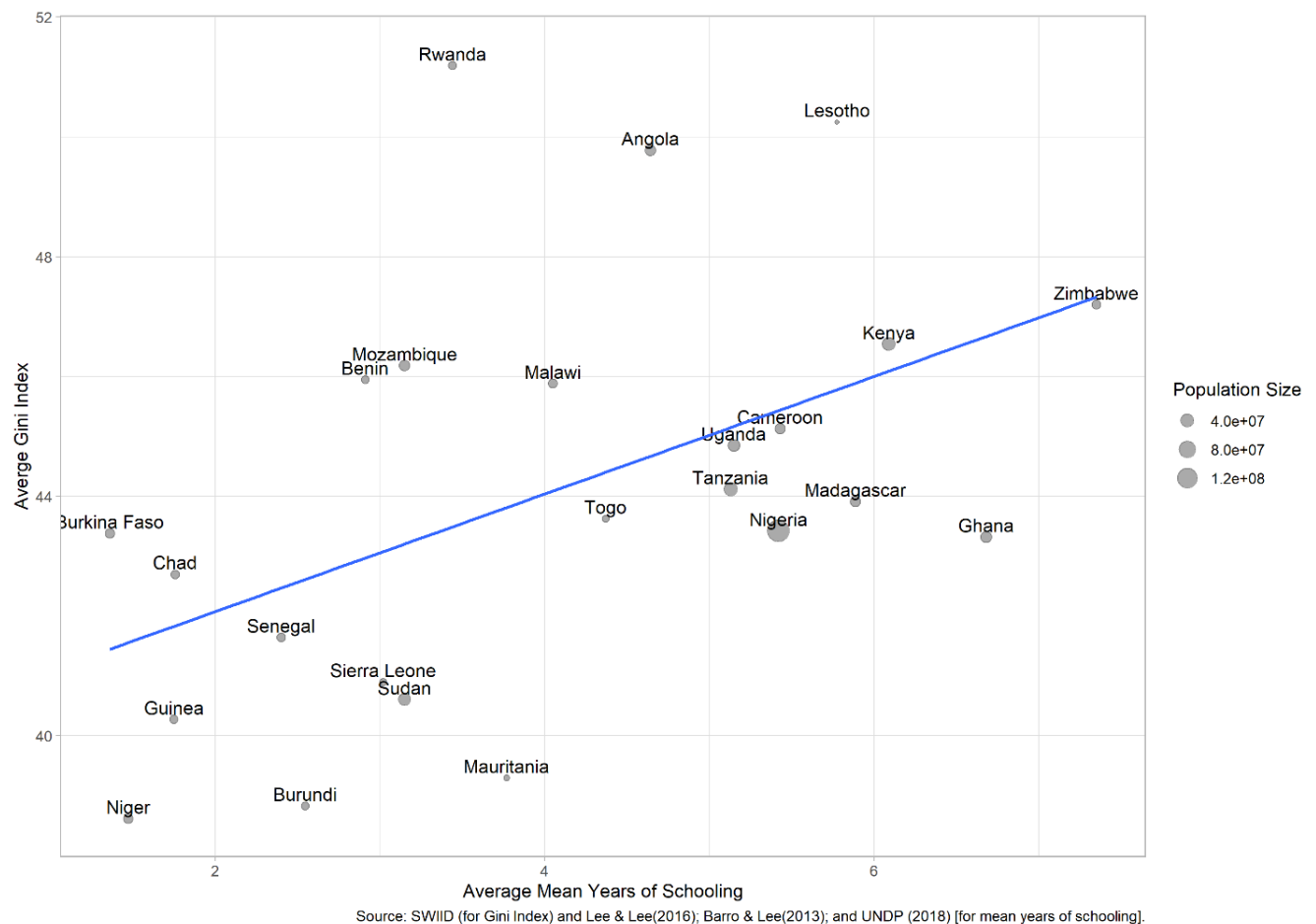
Next, we focus on the relationship between corruption, measured using perception index, and income inequality. Figure 4.3 plots (time) average of corruption perception index against (time) average of Gini disparity index. As can be seen from the figure, there is a positive relationship between the average corruption perception index and income inequality. That is, more corrupt countries in the sample also happen to have high-income inequality. But this result is far from establishing a causal relationship between corruption and income inequality particularly due to omitted variable bias. This question is dealt with in the next subsection.

Figure 4.3: The relationship between corruption and income inequality



Source: Calculation based on SWIID and WDI databases

Figure 4.4: The relationship between education and income inequality



The other result, which is more surprising, is the relationship between education and income inequality. In Figure 4.4 we have a similar plot where now the horizontal axis is the (time) average of mean years of schooling. The scatter plot suggests that there is a positive (albeit weak) correlation between the average mean years of schooling and the average Gini index. But the relationship seems to be driven by population size. In this figure, population size is represented by the size of a point for each country. The more populous countries, like Nigeria, Kenya, Tanzania, and Uganda, happen to have a relatively more educated population and they are also where income inequality is relatively worse.

Two other variables which have received some attention in the literature on their relationship with income inequality are the urbanization rate and government expenditure. In the data I have, both variables are measured as percents: urbanization as the percent of the population living in

urban areas and government expenditure as the size of government expenditure with the GDP (that is expenditure to GDP ratio). This makes the analysis with the Gini index (which is also measured out of 100) easier and interesting. Figure 4.5 plots the correlation coefficient of each variable with the Gini index by country. The figure suggests that the correlation with each variable varies greatly by country. There are only a few countries where the correlation with each variable is weak.

Figure 4.5: Correlation of Gini disparity with urbanization and government expenditure by country



Source: Calculation based on SWIID and WDI databases

One feature of the data I have is that there is very little variation over time for each country in most of the variables. The result in Table A.1 suggests that, except for a few variables, the within standard error is much smaller compared to the between standard error. That is, we would

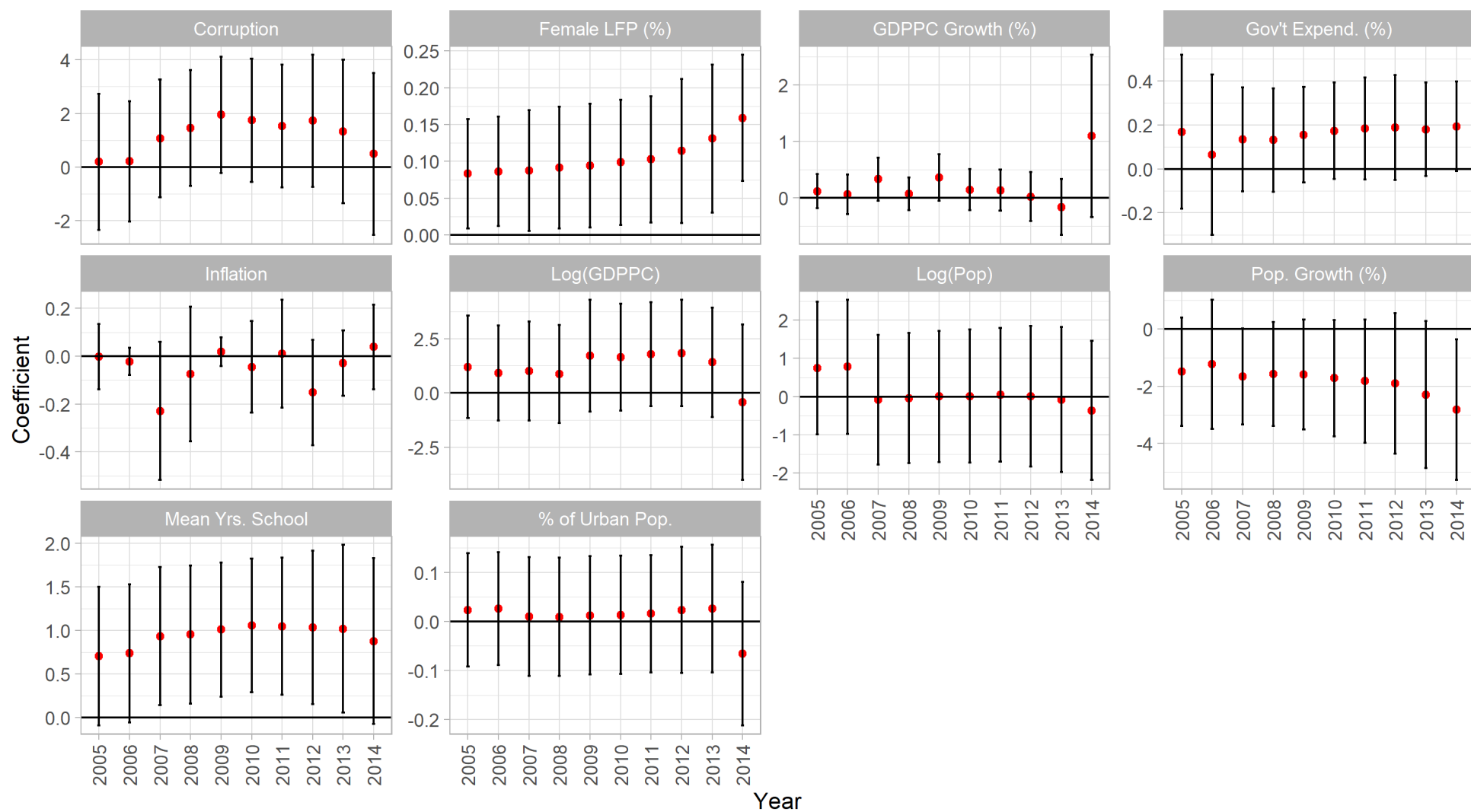
observe more variation across countries for a given year than we would over time for a given country. This suggests that looking at correlations overtime vs. across countries would yield different results. Particularly, since the variation over time is very small, we would expect the correlations to be weaker (or insignificant).

Let's first look at correlations across countries for each year. Figure 4.6 plots the point estimate and the 95 percent confidence interval of a simple linear regression of the Gini index on the indicated variable for each year. Most variables appear to have the expected sign but are statistically insignificant at 5%. Two exceptions are the proportion of females above 15 in the labor force and mean years of schooling. The result suggests that both of these variables have a positive correlation with income inequality. We will further explore these unusual findings in the next section.

The next figure, Figure 4.7, illustrates the results of a simple linear regression of the Gini index for each country. That is, we have the point estimate and the 95% confidence interval of a simple regression where the Gini index is the dependent variable and the indicated variable is the independent variable for each country. This type of analysis enables us to explore heterogeneities among countries. But the downside is that now we have very few observations (which is the number of years, of which the maximum is 10) for each regression.

Indeed, we observe such heterogeneity. For instance, corruption seems to have a positive and statistically significant relationship with income inequality for Uganda, Togo, Sudan, Malawi, and Guinea, but a statistically significant negative correlation for Zimbabwe, Tanzania, and Sierra Leon. We observe the same with mean years of schooling. The positive correlation with mean years of schooling observed in Figure 4.4 seems to be driven by a few countries like Togo, Tanzania, Niger, Ghana, Chad, Cameron, and Benin. On the other hand, a large negative correlation is observed for Sierra Leon, Nigeria, Guinea, and Burkina Faso. One likely explanation for such a heterogeneous relationship is the quality of institutions in each country, something not addressed in the current study, which nevertheless needs to be further looked into.

Figure 4.6: Simple regression of Gini index for each year



Regression based on SWIID and WDI databases

Figure 4.7: Simple regression of Gini index for each country

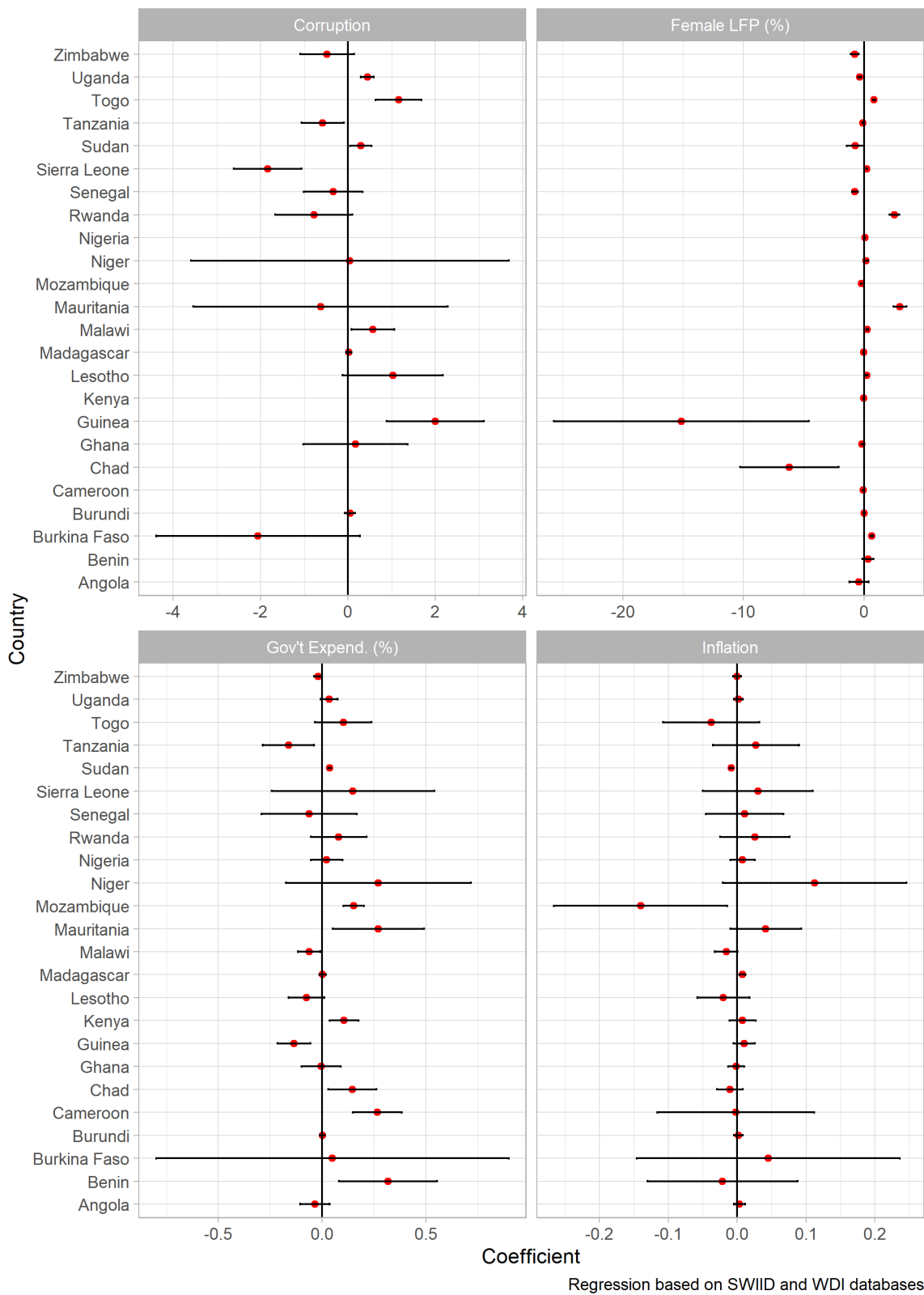


Figure 4.7: Simple Regression of Gini Index for Each Country (continued)

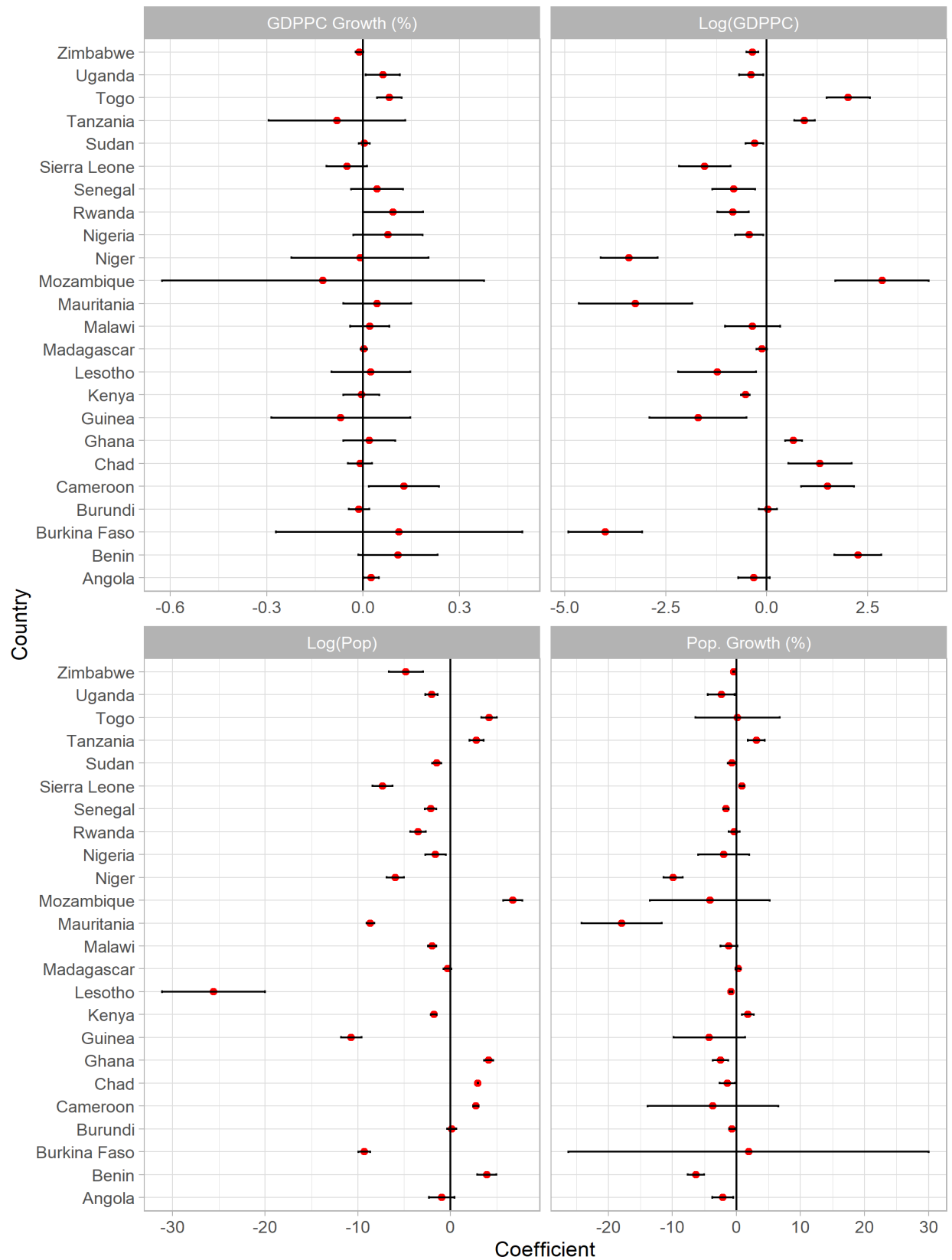
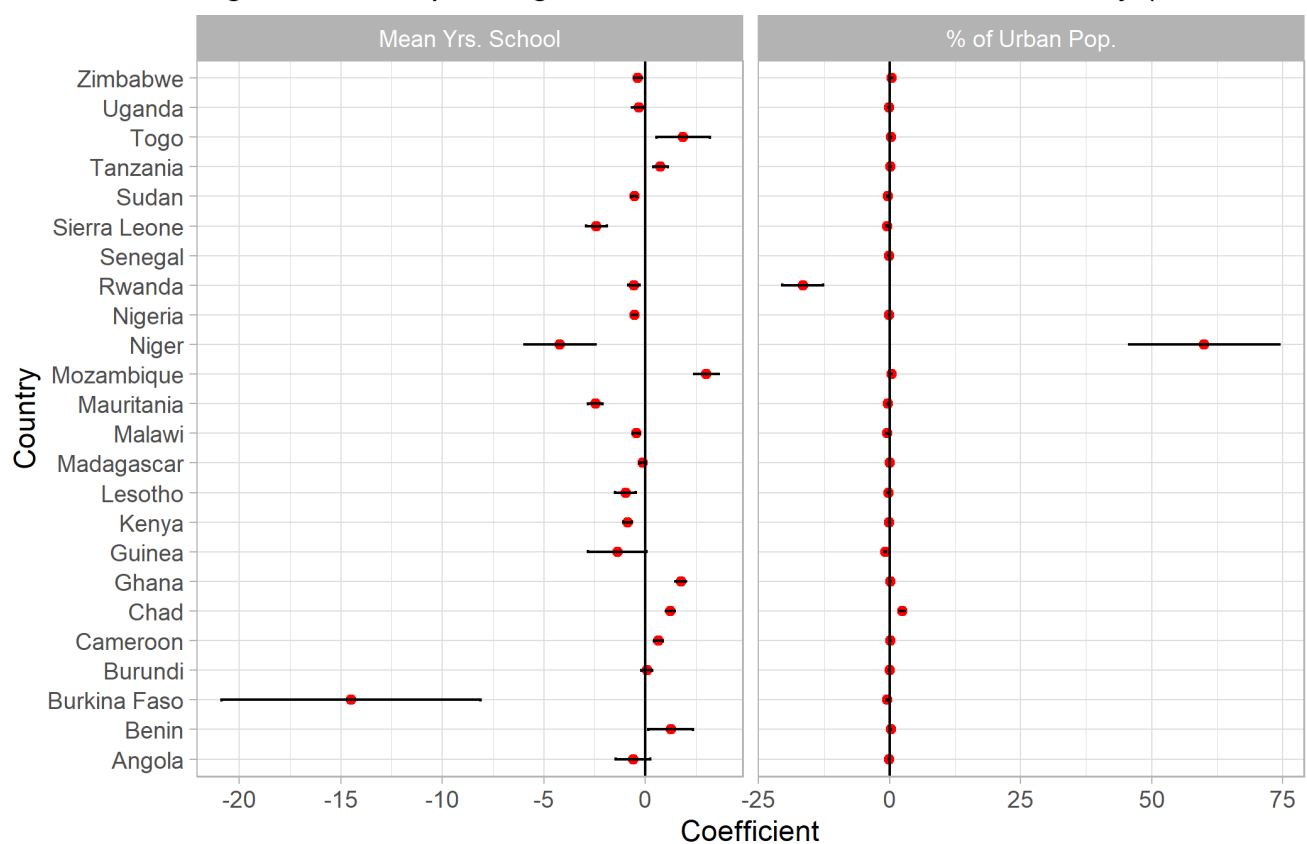


Figure 4.7: Simple Regression of Gini Index for Each Country (continued)



Regression based on SWIID and WDI databases

4.2 Econometric Modeling

This section presents and discusses the results of the econometric analysis that were set out in the methodology section in chapter 3. We start with ordinary least squares (OLS) regression results. For robustness, I run OLS with several specifications and the results are reported in Table 4.1.

In the first column in Table 4.1, I run OLS omitting population and GDP Per capita variables (i.e, their absolute levels and growth rates). In this specification, it appears that corruption, mean years of schooling, and percentage of females above 15 in the labor force have a statistically significant positive effect on the Gini index of a country. The result for corruption is as expected and is robust across all specifications in Table 4.1, except in the last column. The result for female labor force participation is a bit strange. It indicates that the higher the percentage of females in the labor force, the higher will be the Gini index, controlling for all the other variables. And this result, like for corruption, is robust across most specifications. Mean years of

schooling have a statistically significant effect on the Gini index in three out of the five specifications. In particular, it becomes statistically insignificant when we control for both population, GDP per capita, and their growth rates (column 3).

Urbanization is the other interesting variable to look at here. Its coefficient is positive and marginally significant in column 2, whereas it is negative and highly significant in columns 3 and 4, where I have controlled for both populations, GDP per capita, and their growth rates. This result is somewhat consistent with Kuznets, (1955)suggestion about the relationship between urbanization and income inequality at low levels of economic growth. Perhaps one more surprising result is the effect of population. In general, Table 4.1 suggests that both the level and annual rate of growth of the population have a negative relationship with the Gini index. Log of population size one of the few variables statistically significant in the last column, where country dummies are included in the regression. The other significant variable is government expenditure, but the sign is unexpected; that is, more as government spending as a percentage of GDP rises together with the Gini index. I believe this result calls for further investigation about the role of population growth rate and government expenditure in exacerbating or ameliorating income inequality.

Table 4.1: Ordinary Least squares estimation with different specifications

	Dependent Variable: Gini Index				
	(1)	(2)	(3)	(4)	(5)
Corruption	0.865*** (0.287)	0.875*** (0.269)	0.622*** (0.237)	0.548** (0.227)	-0.177 (0.119)
Inflation	-0.018 (0.013)	-0.018 (0.012)	-0.015 (0.011)	-0.022** (0.010)	0.004* (0.002)
% of Urban Pop.	0.011 (0.016)	0.027* (0.015)	-0.076*** (0.019)	-0.104*** (0.019)	0.063* (0.033)
Mean Yrs. School	0.743*** (0.118)	0.396*** (0.140)	0.190 (0.122)	0.235** (0.117)	-0.037 (0.186)
Female LFP (%)	0.080*** (0.013)	0.098*** (0.012)	0.139*** (0.011)	0.145*** (0.011)	-0.008 (0.018)
Log(Pop)		-0.025 (0.225)	-0.657*** (0.229)	-0.806*** (0.221)	-2.028** (0.822)
Pop. Growth (%)		-1.583*** (0.313)	-1.555*** (0.271)	-1.507*** (0.259)	-0.144 (0.163)
Log(GDPPC)			3.419*** (0.392)	4.347*** (0.412)	-0.186 (0.189)
GDPPC Growth (%)			0.029 (0.037)	0.028 (0.036)	0.003 (0.007)
Gov't Expend. (%)			-0.013 (0.030)	-0.014 (0.029)	0.031*** (0.011)
Constant	33.294*** (1.196)	37.603*** (3.383)	27.538*** (3.458)		
Year Fixed Effect	No	No	No	Yes	No
Country Fixed Effect	No	No	No	No	Yes
Observations	226	226	226	226	226
Adjusted R ²	0.380	0.459	0.611	0.646	0.988

Notes:

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

The results in columns 4 and 5, where the regression included year and country dummies, respectively, warrant special attention. From column 4, it appears that controlling for year fixed effects does not appear to alter the results that much when compared to column 3. On the other hand, we get a completely different picture in column 5. Here, all variables, except log of population size and government expenditure become statistically insignificant at 5 percent. This suggests that once we control for country fixed effects, almost all variables do not appear to have any relationship with income inequality. Notice that the R squared from this regression is also the highest, meaning that including country dummies absorbs much of the variation in the Gini index. This result underlines the importance of country-specific analysis that takes into account the heterogeneities that are observed across countries.

Next, we turn to specialized models for panel data. Table 4.2 presents regressions from four variants of models: first difference (FD), fixed effects (FE), random effects (RE), and correlated random effects (CRE). The sample used here is smaller than that used in Table 4.1 because I have removed entire years to make the panel balanced. Hence, the regressions in Table 4.2 are based on a balanced panel for all 24 countries from 2007 to 2011. Remarkably, all the variables considered in Table 4.1 are statistically insignificant here. This is expected for the fixed effects model (column 2) since we have found a similar result from the unbalanced sample in Table 4.1⁴. These results again underscore the intrinsic individual heterogeneity across countries.

Although it makes no difference, I have run the Hausman test for choosing between the fixed effect and the random effect specifications. The p-value of the test was 0.00014, which is small enough to reject the consistency of the random-effects model. Hence, it is best to look at the correlated random effects model (column 4). Instead of assuming that the individual effects are independent of the regressors x_{it} , the CRE assumes that they only depend on the averages over time $\bar{x}_i = \sum_{t=1}^T x_{it}$ (Heiss, 2016). As a result, in addition to the original regressors, it includes their averages over time. The time averages of these variables are indicated with bars in Table 4.2.

⁴ The model in column 5 in Table 4.1 is the least squares dummy variable (LSDV) regression, which, in principle is the same as a fixed-effects regression that is run after demeaning the independent variables

Table 4. 2: Estimates from panel data models

	Dependent Variable: Gini Index			
	FD	FE	RE	CRE
	(1)	(2)	(3)	(4)
Corruption	−0.002 (0.073)	−0.135 (0.114)	−0.033 (0.135)	−0.135 (0.114)
Inflation	0.000 (0.001)	−0.000 (0.002)	0.001 (0.002)	−0.000 (0.002)
% of Urban Pop.	0.041 (0.055)	0.022 (0.049)	0.012 (0.032)	0.022 (0.049)
Mean Yrs. School	−0.070 (0.124)	−0.268 (0.217)	0.139 (0.204)	−0.268 (0.217)
Female LFP (%)	−0.034 (0.025)	−0.035 (0.024)	0.034 (0.022)	−0.035 (0.024)
Log(Pop)	0.731 (2.376)	−1.339 (1.042)	−0.558 (0.499)	−1.339 (1.042)
Pop. Growth (%)	−0.137 (0.255)	−0.387 (0.288)	−0.486 (0.307)	−0.387 (0.288)
Log(GDPPC)	−0.065 (0.141)	−0.004 (0.244)	−0.218 (0.259)	−0.004 (0.244)
GDPPC Growth (%)	0.000 (0.003)	0.002 (0.006)	0.003 (0.008)	0.002 (0.006)
Gov't Expend. (%)	0.003 (0.008)	0.007 (0.011)	0.009 (0.014)	0.007 (0.011)
Corruption				0.059 (0.778)
Log(Pop)				−0.740 (1.287)
Log(GDPPC)				4.680*** (1.306)
% of Urban Pop.				−0.138* (0.076)

Continued on next page

Table 4.2: Estimates from Panel Data Models (*continued*)

	Dependent Variable: Gini Index			
	FD	FE	RE	CRE
	(1)	(2)	(3)	(4)
Mean Yrs. School				1.140** (0.477)
Female LFP (%)				0.156*** (0.042)
Inflation				-0.205* (0.110)
Pop. Growth (%)				0.528 (1.007)
GDPPC Growth (%)				0.835** (0.327)
Gov't Expend. (%)				-0.060 (0.096)
Constant	-0.076 (0.073)		52.853*** (7.636)	39.995*** (11.656)
Observations	96	120	120	120
Adjusted R ²	-0.055	-0.173	0.007	0.325
Notes:	***Significant at the 1 percent level. **Significant at the 5 percent level. *Significant at the 10 percent level.			

The results from the CRE are very similar to those found from the various OLS specifications in Table 4.2, perhaps, except for corruption and population. Here, again we see that both the log and growth rate GDP per capita, mean years of schooling and female labor force participation have a statistically significant positive effect on the Gini index. On the other hand, urbanization and the inflation rate have a (marginally) statistically significant negative effect. The qualitative

differences in the effect of corruption and population (both its level and growth rate) between the OLS estimates in Table 4.1 and the CRE model in Table 4.2 could arguably arise because of the smaller sample we used to estimate the CRE.

Next, we turn to system a model that takes into account possible endogeneity among the variables. It is difficult to make causal interpretations out of the foregoing results. A way around this problem is to estimate a system of simultaneous equations model. From theory and common sense, the researcher suspects that the following variables are endogenous vis-a-vis income inequality: corruption, urbanization, and mean years of schooling. Following this, Table 4.3 presents estimates from a system of structural equations, obtained via three-stage least squares.⁵

Each of the four columns in the table presents the estimated equation in the system corresponding to the four endogenous variables. None of the other endogenous variables have a significant effect on the Gini index, as can be seen from the first column. Interestingly, from columns 2 and 3 we see that the Gini index drives both corruption and the proportion of the population in urban areas. That is having high-income inequality seems to worsen corruption and decrease the percentage of the population living in urban areas. As I have pointed in the literature review section, corruption increases income inequality in the developing world and In particular, as a result of the lack of empirical evidence on the topic for Sub-Saharan Africa, we do not know the nature of the relationship for this region. But this result indicates that it has a negative association between urbanization and income inequality in selected Sub-Saharan Africa. On the other hand, after accounting for possible endogeneity in the system, there does not seem to be any relationship between the Gini index and the schooling variable (column 4.)

⁵The system was estimated using the `reg3` command in Stata 14.

Table 4.3: Systems of simultaneous equations (3SLS)

	(1) Gini Index	(2) Corruption	(3) % of Urban Pop.	(4) Mean Yrs of School.
Corruption	19.90 (24.35)			
% of Urban Pop.	0.693 (1.160)			
Mean Yrs of School.	2.871 (2.452)			
Log(GDPPC)	-13.39 (19.37)		17.74*** (1.671)	0.843 (0.881)
GDPPC growth (%)	0.0306 (0.295)		0.114 (0.234)	0.0284 (0.0671)
Gini Index		0.152*** (0.0446)	-3.764** (1.149)	-0.569 (1.012)
Inflation		0.000463 (0.00246)	-0.0536 (0.0660)	
Log(Pop.)		-0.0723 (0.0580)	-0.629 (1.180)	1.247 (0.739)
Pop. Growth (%)		0.348** (0.112)	-6.277* (2.525)	-2.077 (1.527)
Gov't expenditure				0.116 (0.151)
Constant	44.13 (26.15)	-3.666 (1.996)	107.5* (46.92)	6.805 (29.43)

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

CHAPTER FIVE

CONCLUSION AND IMPLICATIONS

This paper investigates the relationship of income inequality, measured using the Gini Index, with other macroeconomic variables at the aggregate level for a subset of Sub-Saharan African countries. The panel data set used in the study has been severely limited, both temporally and geographically, by missing data for several countries and several years. Hence, only panel data from 24 countries for the years 2005 to 2014 was used.

Both descriptive and econometric analyses suggest that there is individual heterogeneity in the trend of income inequality; that is, it is inherently a country-specific attribute. The results indicate that once we control for fixed country effects, the relationship between the Gini index and most of the variables vanishes. This is particularly true in the models specific to panel data such as fixed effects, random effects, and first differences. It appears most of the macroeconomic variables that are claimed to affect (or at least have some relationship) with income inequality, from theory and empirical studies in other settings, have, at best, tenuous relation with income inequality for the Sub-Saharan African countries considered in this study.

There are a few explanations for this unexpected result to occur in the specific context of Sub-Saharan Africa. One is the problem of measurement error. It is a well-known fact that there are several inaccuracies and omissions in the data of most of the macroeconomic variables collected by African government statistical offices or agencies. Moreover, some of the variables considered in the study, including the Gini disparity index, are broad estimates carrying within them, possibly, a systematic margin of error. This issue would be less of a concern if the economies under question were advanced ones like the OECD countries, where the quality of data is relatively less of a concern and more complete data is available.

A second possible explanation is that income inequality indeed has more to do with a country's inherent features, such as its history and/or institutions than it has to do with contemporaneous macroeconomic variables. For instance, one plausible argument, at least according to my opinion, is that income and wealth inequality is largely determined by colonial institutions that Europeans set up. Indeed, all of the countries considered in the present study have been European colonies in the past. The wide-ranging long-run economic impacts of colonialism,

particularly through its interaction with institutions, have been noted in the literature (Acemoglu et al., 2001; Engerman & Sokoloff, 2002). Another historical institution that could have long-run impacts on the economy is slavery, which surely exacerbates inequality. It is also a historically well-established fact that most African countries were, directly or indirectly, active participants in the slave trade of the 16th---19th centuries. It has ramifications that persisted to the present (Nunn, 2008).

Yet another obvious feature of African societies that has possible implications for income and wealth inequality is ethnic fractionalization. Ethnic fractionalization has been noted to have negatively affected the growth prospects of many African countries. For instance, Easterly and Levine (1997) have shown that the type of ethnic diversity observed in Sub-Saharan Africa helps explain cross-country differences in public policies and other economic indicators. It would not be far-fetched to conjecture that it could have similar effects on the distribution of economic resources.

Unfortunately, this study did not address such deep and long-run determinants. Such analysis, although interesting and insightful, would be more challenging and is best handled in a separate study. But the lessons learned from the present study are suggestive of the peculiarities of African economies when it comes to factors that relate to the distribution of income. I hope that it informs the direction of future research into the nature and causes of income and wealth inequality in the context of Africa.

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APPENDIX

APPENDIX A

Table A.1: Summary Statistics of Variables Used in the Study

Variable		Mean	Std. Dev.	Min	Max.	N/n/ $\bar{T}$
Gini Index	overall	44.09558	3.402192	37.8	51.5	226
	between	.	3.464781	38.62	51.19	24
	within	.	.3769023	42.91558	45.41558	9.416667
Inflation	overall	10.0028	13.82065	-16.76108	100.6577	226
	between	.	6.564358	2.471155	27.02918	24
	within	.	12.23996	-22.37399	93.35443	9.416667
Log(Pop)	overall	16.55779	.8858635	14.5021	18.98829	226
	between	.	.8969706	14.51176	18.86822	24
	within	.	.0763779	16.38662	16.73175	9.416667
Pop. Growth (%)	overall	2.686736	.6982408	-.1517277	3.907245	226
	between	.	.714096	.3316151	3.82411	24
	within	.	.1734571	1.932811	3.9506	9.416667
Log(GDPPC)	overall	6.66789	.6545035	5.021783	8.566913	226
	between	.	.6150995	5.332846	8.17191	24
	within	.	.258332	5.735369	7.295994	9.416667
GDPPC Growth (%)	overall	2.799685	4.027342	-18.49114	18.06597	226
	between	.	1.532768	.0901179	5.244482	24
	within	.	3.740558	-18.04488	18.51222	9.416667
Gov't Expend. (%)	overall	13.88374	6.344742	2.047121	41.88798	226
	between	.	6.349184	5.972756	39.15604	24
	within	.	2.438699	3.142227	21.30963	9.416667
Corruption	overall	2.765487	.6362068	1	4	226
	between	.	.6042698	1.35	3.9	24
	within	.	.223376	2.165487	3.59882	9.416667
Female LFP (%)	overall	65.13243	16.01893	27.86	87.16	226
	between	.	16.32901	28.154	86.0125	24
	within	.	1.579541	59.01143	69.70543	9.416667
% of Urban Pop.	overall	32.32013	12.65159	9.375	62.002	226
	between	.	12.77535	10.39811	59.02056	24
	within	.	1.407873	28.28483	36.37683	9.416667
Mean Yrs. School.	overall	4.073009	1.702685	1.3	8.2	226
	between	.	1.72933	1.36	7.35	24
	within	.	.2523607	3.323009	4.923009	9.416667