UNIVERSITY OF EDUCATION, WINNEBA

EFFECTS OF EDUCATION ON CORRUPTION IN SUB-SAHARAN AFRICA

ABAIDOO-AYIN HENRY

MASTER OF PHILOSOPHY

2023

UNIVERSITY OF EDUCATION, WINNEBA

EFFECTS OF EDUCATION ON CORRUPTION IN SUB-SAHARAN AFRICA

ABAIDOO-AYIN HENRY
220021892

A thesis in the Department of Economics Education Faculty of Social Sciences, submitted to the School of Graduate Studies in partial fulfillment

of the requirements for the award of the degree of Master of Philosophy (Economics) in the University of Education, Winneba

JUNE, 2023

DECLARATION

Student's Declaration

I, **ABAIDOO-AYIN HENRY**, declare that this thesis entitled "Effects of Education on Corruption in Sub-Saharan Africa", with the exception of quotation and references contained in published works which have been identified and duly acknowledged, is entirely my original work, and it has not been submitted either in part or whole for another degree elsewhere.

Signature: .....

Date: .....

Supervisor's Declaration

I declare that the preparation and presentation of this thesis work was supervised in accordance with the guidelines for supervision of thesis/dissertation/project as laid down by the University of Education, Winneba.

Supervisor's Name: Dr. Eric Justice Eduboah

Signature: .....

Date: .....

DEDICATION

With deep gratitude, I dedicate this work to the Almighty God. I extend my heartfelt appreciation to my parents and siblings.

ACKNOWLEDGEMENTS

I express deep gratitude to the Almighty God for guiding me throughout this MPhil journey. The completion of this program has been a remarkable experience, made possible by the unwavering support of numerous individuals.

I am sincerely thankful to my supervisor, Dr. Eric Justice Eduboah, for his exceptional guidance, invaluable feedback, and insightful comments that have greatly influenced the development of this thesis.

I am immensely fortunate to have received enlightening contributions from Dr. Isaac Ampah, whose input and motivation have significantly enhanced this research.

Special appreciation goes to Professor Lucy Effeh Attom, whose nurturing care and support have been invaluable in shaping my academic journey.

I am deeply grateful to my parents, Mr. Abaidoo-Ayin Emmanuel and Mrs. Christina Baidoo, and my siblings, for their unwavering prayers, support, and contributions that have propelled me to this stage in my life.

I extend sincere appreciation to my friends, the Head of the Department, the lecturers, and the non-teaching staff of the Department of Economics at the University of Education, Winneba, for their constant support, motivation, and camaraderie throughout my academic journey.

I am truly indebted to these individuals and groups for their significant contributions to the successful completion of this thesis. Their unwavering support has been invaluable, and I am honored to have had their guidance throughout this endeavor.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Figure **Page**

LIST OF ACRONYMS

ADF	:	Augmented Dicky Fuller
AML/CFT	:	Anti-Money Laundering/Combating the Finance Terrorism
ANOVA	:	Analysis of Variance
CAS	:	Corruption Acceptance Survey
CPI	:	Corruption Perception Index
EOCO	:	Economic and Organized Crime Office
EU	:	European Union
FDI	:	Foreign Direct Investment
FIC	:	Financial Intelligence Centre
GDP	:	Gross Domestic Product
GMM	:	Generalized Method of Moments
ICRG	:	International Country Risk Guide
IMF	:	International Monetary Fund
IPS	:	Im Pesaran Shin
LLC	:	Levin, Lin, and Chu
MDGs	:	Millennium Development Goals
NACAP	:	National Anti-Corruption Plan
OECD	:	Organization for Economic Cooperation and Development
OLS	:	Ordinary Least Square
PAC	:	Pôles anti-corruption
PCA	:	Principal Component Analysis
PCCA	:	Prevention and Combating of Corruption Act
PPP	:	Purchasing Power Parity
PSE	:	Plan Sénégal Emergent

SDGs	:	Sustainable Development Goals
SSA	:	Sub Saharan Africa
TI	:	Transparency International
UN	:	United Nations
UNCTAD	:	United Nations Conference on Trade and Development
UNESCO	:	United Nations Educational, Scientific and Cultural Organization
WDI	:	World Development Indicators
WGI	:	Worldwide Governance Indicators

ABSTRACT

This study investigated the relationship between education and corruption in Sub-Saharan Africa using a panel dataset spanning from 2012 to 2019 and covering 27 countries. Controlling for government effectiveness, trade openness, inflation, and GDP per capita, the 2-step system GMM estimator was employed, with panel pooled OLS and fixed effects estimators for robustness check. The findings reveal a significant positive relationship between lifelong learning and corruption perception, indicating that comprehensive education is linked to lower corruption levels. Again, the results suggest that secondary school education plays a crucial role in combating corruption. By promoting lifelong learning initiatives and increasing secondary school enrollment, societies can work towards reducing corruption levels and fostering transparency and integrity. Furthermore, GDP per capita exhibits a significant negative relationship with corruption perception, suggesting that higher economic development is associated with lower corruption levels. These results offer valuable insights for policymakers in Sub-Saharan Africa, emphasizing the importance of promoting comprehensive education systems by the various ministries of educations, agencies and departments responsible for the implementation of educational policies by governments in the region and economic development to combat corruption effectively. This study contributes to the understanding of the role of education in addressing corruption, providing practical implications for policymakers striving to create more transparent and accountable societies in Sub-Saharan Africa.

CHAPTER ONE

INTRODUCTION

1.0 Background to the Study

The global economy is faced with a prevalent problem called corruption, particularly in sub-Saharan African (SSA) nations (Ibrahim et al., 2015). Transparency International (TI) asserts that combating corruption is essential to achieving the Sustainable Development Goals (SDGs) on all fronts, from ending poverty to addressing the climate catastrophe. If allowed unchecked, it seriously undermines every aspect of sustainable development. Health care goal-setting attempts will be hampered by hospital corruption. Where there is school corruption, educational goals are unlikely to be attained. It will be impossible to alleviate poverty, provide access to clean water, and provide affordable power in locations where corruption obstructs service delivery (Transparency International, 2020).

However, every region of the world is increasingly being affected by corruption, which has quickly become a worldwide concern. The results have been severe, especially in developing countries where public service duties predominate in an atmosphere markedly defined by corruption (Suleiman & Othman, 2017). Criminal activity involving corruption is rampant and is thought to be a very severe sickness (Tanner et al., 2022). Corruption harms not only the country's finances but also social and economic rights, democracy, law enforcement, and economic progress, dimming the future of the country (Poerwanto et al., 2023; Islam et al., 2022; Rasheva, 2022; Sari & Rahardjo, 2019). A violation of power or authority that results in the loss of financial or national assets is one definition of corruption in this correlation, but every decision

or action also has the potential to decrease public values (Komalasari & Saripudin, 2015).

Some individuals think that corruption is becoming a culture; culture is an approach to living. Since corruption is present and practiced everywhere and is almost ingrained in all societal groups, with many (if not all) heavily involved, corruption can be considered a culture. The global devil of corruption has robbed the social context of human understanding, David (2012) has opined.

Based on corruption performance, Transparency international (2019) reports that, forty-three (43) regional nations have either seen declines or have not significantly advanced over the past ten years in relation to Corruption Perception Index (CPI) scores and has an average score of thirty-two (32) as at 2019, having the lowest CPI performance among other regional breaks. Again, more than one in four people, or around 130 million inhabitants in 35 African countries polled, paid a bribe to access basic public services, like healthcare, according to statistics from the 2019 Corruption Barometer. The average corruption rate for sub-Saharan Africa, between 2012 and 2019, has hovered below 38 score as shown in figure 1.

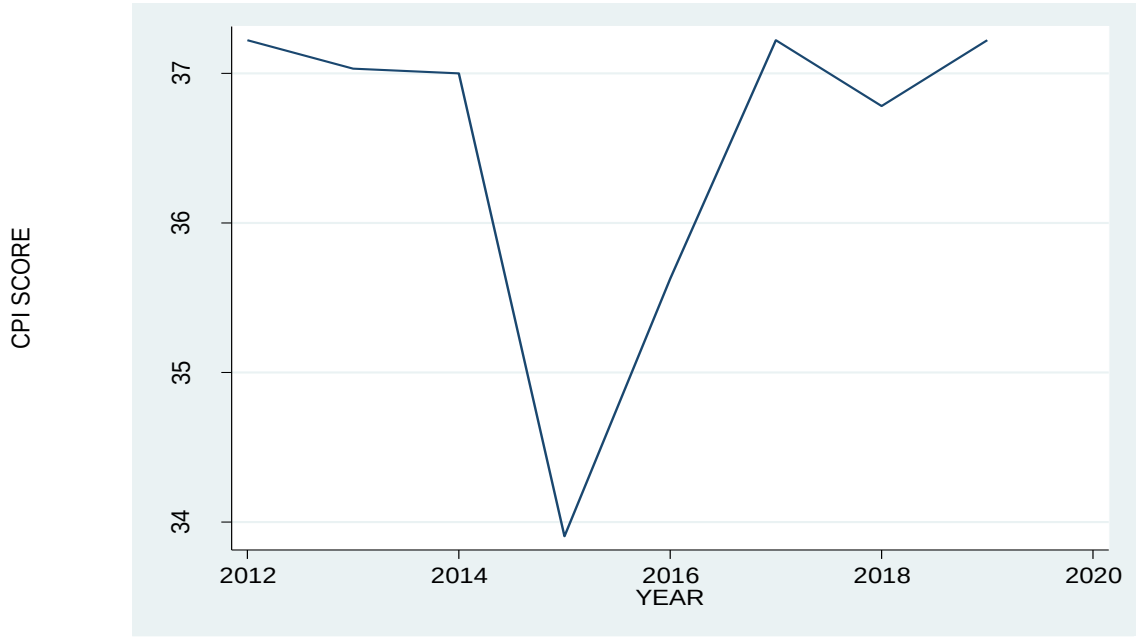

Figure 1: Trend of average CPI scores for sub-Saharan Africa (2012 – 2019)

Source: Author's construct based on data from WDI (2012 – 2019)

It is widely acknowledged that corruption has detrimental effects on the progress of nations, and sub-Saharan Africa (SSA) has, for a considerable period, experienced its negative consequences. According to Desjardins (2019), SSA is identified as one of the most corrupt regions globally, with five out of the top ten most corrupt countries located in Africa. Do the levels of education influence corruption?

Despite the important role education plays in the fight against corruption, in sub-Saharan Africa, more children now have access to a basic education than there were twenty years ago, yet many of them are still not in school. Some students never enroll at all, particularly in unstable countries, and many more begin school but drop out before completing the first cycle (Lewin, 2009; Sifuna & Sawamura, 2010; Majgaard & Mingat, 2012;). Over 32 million children are still not in school, only 2/3 of them make it to the last grade of primary school, and many of those that are enrolled are too

old, repeat years, and don't finish a full cycle of basic education, especially when this includes lower secondary courses (Lewin, 2009).

Fredriksen & Fossberg (2014) argues that Sub-Saharan Africa will be under intense pressure to develop its secondary education system over the next 20 years. This is caused by the secondary education system's existing lack of development in comparison to other world areas, the population's ongoing rapid growth, the rise in enrollment and completion rates at the primary education level, and the rise in the need for skills.

Globally, a total of 258.4 million children, adolescents, and youth, representing one-sixth of the global population were out of school in 2018 for this age group. The rate of gross enrollment in tertiary education in sub-Saharan Africa is the lowest in the world (9% - 2019). According to UNESCO Institute for Statistics (UIS) data for 2018, there hasn’t been any significant progress in the attempt to reduce out-of-school numbers at the global level. At the primary school level, UNESCO reports that 32.2 million children in SSA, out of 59.1 million children worldwide, are out-of-school with reference to primary school age. Figure 2 below shows the dire situation of the out-of-school children of primary school age.

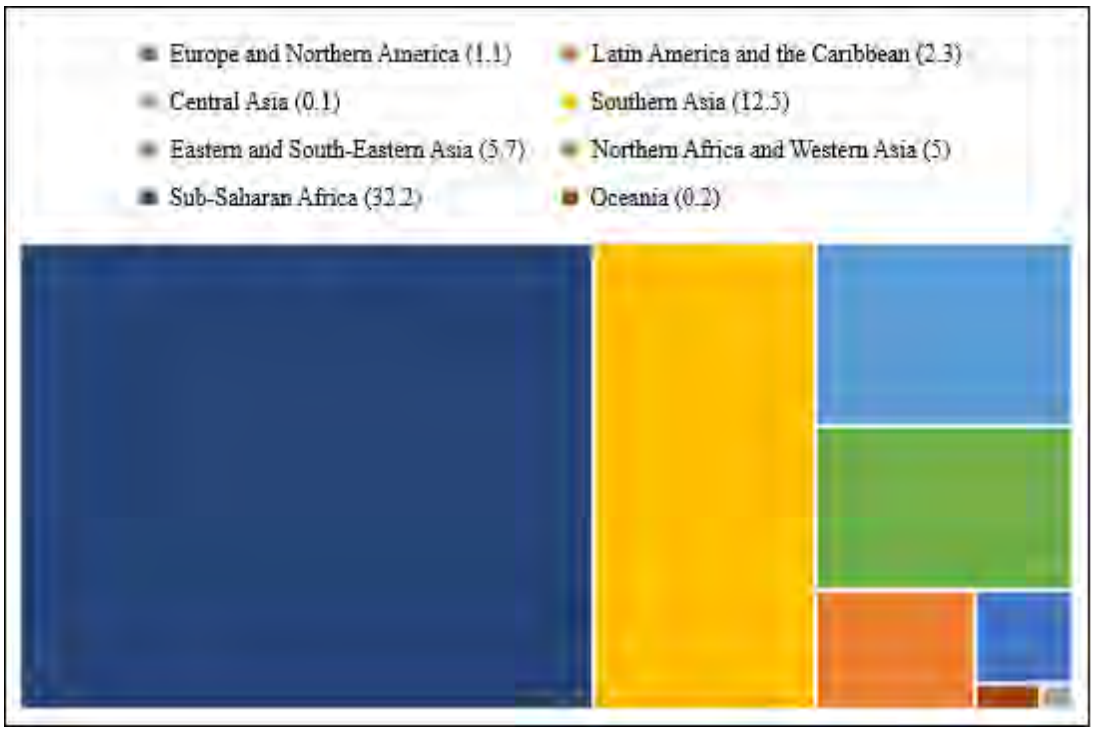

Figure 2: Shows a graph of the out – of – school children of primary school age

Source: Author's construct using data from (UNESCO, 2019)
Note: Figures in brackets are in Millions

At the lower secondary school level, SSA still has the highest out-of-school adolescents. UNESCO reports a total of 28.3 million out-of-school adolescents of lower secondary school age as at 2018-year ending. With respect to upper secondary school level, SSA comes 2nd (37 million) after Southern Asia (64 million) out of a total (world level) of 137.8 million who are out-of-school youth of upper secondary school age as at year ending 2018 (Deloumeaux, 2019).

With a 16.77% completion rate in primary education, Africa has the lowest attainment overall. It falls short of the global average of 16.88%. In addition, Africa has the lowest secondary school completion rate, at 9.17%, much below the 20.68% average for least developed countries (LDCs). The trend in tertiary education attainment is still present,

with Africa having a completion rate of 1.53% compared to LDCs' completion rate of 5.95%. These statistics could provide an explanation for the high percentage of out-of-school youth, child labor, criminality, and other social vices in SSA that deplete the human capital in the region (Farayibi & Folarin, 2021).

On the other hand, the macroeconomic environment also plays a key role in the thriving of corruption. Intuitively, it would seem that richer countries would have lower levels of corruption. Less developed countries typically have weaker legal institutions, more inefficient governments, lower levels of education, and suboptimal government systems—all of which are associated with higher levels of corruption (Dimant & Tosato, 2018).

Lastly, looking at how a country is governed, areas that are thought to have equally poor governance, a study in 2019 by International Monetary Fund (IMF) demonstrates that the governance dividend for countries in sub-Saharan Africa is two to three times more than for the average country in the rest of the world. The Gross Domestic Product (GDP) per capita in sub-Saharan Africa might rise by an estimated 1 to 2 percentage points annually if its governance were to reach global standards (Hammadi et al., 2019).

1.1 Statement of the Problem

Following the findings of (Frost, 2021; Truex, 2011; Ozturk, 2001) on the important role of education in the fight against corruption, the fight against corruption is a long one, involving not just legal means but also the formal inculcation of new ideas in the form of rational thinking and anti-corruption ideals. Through education, the anti-corruption character traits of integrity, tenacity, bravery, responsibility, independence, simplicity, justice, and tolerance will be fostered (Komalasari & Saripudin, 2015).

Lifelong learning, defined by the Southern African Development Community (SADC) in African context as: Lifelong education embodies a comprehensive and forward-thinking concept that encompasses formal, non-formal, and informal learning across an individual's entire lifespan. Its overarching goal is to enable individuals to achieve their utmost personal, social, vocational, and professional development. Lifelong education perceives education holistically, recognizing that learning takes place not only within formal educational settings but also within the home, community, workplace, and through various media channels. These diverse contexts offer opportunities for individuals to acquire and enhance their knowledge, skills, and attitudes (Preece, 2013). Moreover, lifelong learning is increasingly acknowledged as a crucial competency by educators, governing bodies, accreditation organizations, certification boards, employers, third-party payers, and the wider public. It is seen as an essential attribute that individuals must possess to thrive in today's dynamic world (Collins, 2009)

Beets (2005) further asserts that corruption may be linked to education for at least two reasons. First, the vocations for which a person is competent depend on their level of education; for example, a person with minimal education might only be qualified for positions with low pay. Such a person might be persuaded to commit corrupt behaviors to survive. Second, a citizen with a good education may be aware of the negative impacts of corruption on society and, as a result, may be less seduced by it. The career prospects of the populace may also be restricted by short-term or subpar education. As a result, persons in a position to demand such payments may find that corruption is a lucrative source of income.

Again, countries that are richer and better educated are less corrupt according to Glaeser et al. (2006). By simple correlation analysis, countries that have high corruption scores are all known to have some of the best education systems in the world such as Denmark, US, UK, Singapore, etc. Education is perceived to come with higher returns, generally. Countries with educated elites are expected to perform better both socially and economically. Studies by Mauro and Driscoll 1997; Getz and Volkema (2001); Beets (2005) all confirms that there's a strong correlation between higher levels of corruption that persists in a country and low per capita income, low average education, and low achievement of other economic development indicators.

Asongu and Nwachukwu (2015) asserts that, in academic and policy-making circles, there has been much discussion over the effectiveness of education as a tool in the battle against corruption. Their study contributes to our understanding of this nexus in three ways: incremental learning, lifelong learning, and synergistic effects. Then, four key conclusions are established from this nexus. First, one effective weapon in the fight against corruption is education. Second, there is proof that the shift from secondary to postsecondary education has an incremental effect. Thirdly, corruption is negatively impacted by lifetime learning, which is understood as knowledge gained during primary, secondary, and higher education. Fourth, there is evidence of a "synergy effect," as lifelong learning has a greater influence than the sum of the impacts of different educational levels. According to findings from across regions, a nation's level of corruption is inversely related to its level of human development. The literature on corruption frequently highlights education as a crucial element in the battle against corruption. It is believed that education creates ideals that are universal, more rigorous

efficiency standards, and informed, engaged citizens who can hold the government accountable (Morris, 2004).

Evidence from earlier studies indicates that education is crucial in the battle against corruption (Asongu and Nwachukwu, 2015; Cheung & Chan, 2008; Beets,2005). Average levels of corruption are lower in nations with higher levels of education (Frost, 2021). Education is seen as one of the fundamental factors that aids in development from the theoretical perspective. Education plays a major role in enriching peoples' understanding and the world and thereby improving their lives leading to broad social benefits to individuals and society. People's productivity and creativity levels are raised through education, and this promotes entrepreneurship and technological advances. Education plays a crucial role in securing economic and social progress and improving income distribution (Ozturk, 2008). Due to its connection to the development of human resources, education is one of the key elements affecting a nation's level of corruption. Better educated people showed less interest in corrupt activities (Truex, 2011).

However, Dimant and Schulte (2016) argue that higher educational attainment actually can promote corruption. In the case of higher educational attainment, individuals may face increased competition for limited resources, leading them to engage in corrupt practices to secure their position or gain an advantage (Dimant & Tosato, 2018). For example, a cautious estimate suggests that Mobutu Sese Seko, the former President of Zaire, embezzled approximately $5 billion, which was equivalent to the entirety of the country's foreign debt when he was removed from power in 1997 (Svensson, 2005).

The focus on education as a tool in fighting corruption seems to be different in sub-Saharan Africa. Broadening the discussion, the government's educational expenditure

in Africa (including SSA) has always prioritized primary and secondary education over tertiary education because it is more convenient and yields political benefits (Farayibi & Folarin, 2021). Notwithstanding, there has, however, been a marginal increase in the ratio of government spending on education as a percentage of total government expenditure in SSA from 15.60% in 2000 to 16.19% in 2013 and then 17.88% in 2018 (World Bank, 2020).

Not only in the education sector has there been investment, but there has also been a series of investment in anti-corruption frameworks and institutions in the region. According to (Bak et al., 2019; Rahman, 2019; Rahman 2018; Shipley, 2018), the region has adopted several anti-corruption frameworks and institutions such as Anti-Money Laundering laws, Whistle blowers acts, United Nations Convention Against Corruption (UNCAC), Good Governance and integrity reporting Act, Financial Intelligence Centre (FIC), Economic and Organized Crime Office (EOCO), to mention but a few, all in the attempt to significantly reduce corruption in the region. The implementation of these laws and long-term impacts are yet to be seen (Rahman, 2019).

The macroeconomic environment has also aided the activities of corruption in the region. Regarding inflation, rising prices have followed global trends, where inflation has risen more quickly and consistently than anticipated, squeezing earnings due to increases in the cost of living. Even though recent inflation increases may not seem as dramatic as historical averages for sub-Saharan Africa, particularly in nations with fixed exchange rates, they have been largely driven by imports of necessities like food and energy, which make up 50% or more of the region's consumption on average (IMF, 2022). According to intuition, stable economies with low inflation are better at

controlling corruption because they provide economic security, as high inflation rates (caused by quickly rising food prices) can force people to turn to more corrupt ways of making ends meet (Asongu & Nwachukwu, 2015).

As highlighted above, the macroeconomic environment influences the corrupt behavior of the people in the economy. When there is poor governance, for example, the costs of international contract enforcement rise more dramatically. Strong anti-corruption policies are justified in economies that are generally more open given the variety of effects corruption has on both domestic and foreign interests. An economy that is more exposed to global markets would find it best to devote more resources to creating strong institutions and end up with a lower level of corruption than a less open, inward-looking one given the stakes of such significant rewards (Majeed, 2014). Greater levels of openness and trade, or integration in the world economy should reduce the levels of corruption. Increased levels of free trade would remove some administrative goods (such as licenses and permits) from bureaucratic monopolies, reducing the likelihood of corrupt behavior (Dimant & Tosato, 2018).

Asongu & Nwachukwu (2015) examined a panel of 53 African countries using annual data from World Bank Development Indicators for the period 1996-2010 to ascertain the incremental effect of education on corruption. Maria et al., (2021) examined how gross domestic product (GDP) per capita, economic openness, government effectiveness index, inflation, and educational attainment levels in G20 member nations affected the corruption index using 2007–2017 data from 13 G20 member countries. These two articles did extensive work on the relationship between education and

corruption but not in the context of SSA, as this region has its own peculiar challenges that needs urgent attention.

One gap in the literature is the lack of studies that examine the impact of specific educational interventions or programs on corruption levels. While the studies reviewed suggest that higher levels of education are associated with lower levels of corruption, it is unclear which specific aspects of education are most effective in reducing corruption.

Again, most studies relied on cross-sectional data, which provides a snapshot in time. Longitudinal studies tracking changes in education and corruption over time would offer insights into the causal dynamics between the two variables. Some studies mention concerns about endogeneity, but they do not always employ advanced econometric techniques to address this issue.

Despite the potential of education to reduce or increase corruption, the relationship between education and corruption is underexplored. The purpose of this study is to investigate the relationship between education and corruption.

1.2 Objective of the Study

The main objective of the study is to examine the effects of education on corruption in the context of the sub-Saharan African region using 27 countries over a period spanning 2012 to 2019. However, the study has the following specific objectives:

1. To determine the effect of education on corruption in SSA.
2. To examine the synergy effects lifelong learning has on corruption in SSA.
3. To establish the direction of causality between education and corruption.

1.3 Hypotheses

1. H_0: Education does not have a negative effect on corruption in SSA.

   H_1: Education has a negative effect on corruption in SSA.

2. H_0: Lifelong learning does not have a negative synergy effect on corruption in SSA.

   H_1: Lifelong learning has a negative synergy effect on corruption in SSA.

3. H_0: There exists no causal relationship between education and corruption.

   H_1: There exists a causal relationship between education and corruption.

1.4 Significance of the Study

The thesis seeks to add to the body of knowledge in both theoretical and empirical literature. The significance of this study stems from the fact that corruption has stagnated over the last decade in the region and its effects, if not mitigated, can be more devastating. Corruption has been one of the major reasons, among many others, for coup d'états in the sub-region in recent times. Little attention has been given to the importance of education in reducing the devastating effects of corruption in SSA. More than any other region, Sub-Saharan Africa stands to gain from the decline in corruption.

This study will contribute to existing literature as it examines the causal relationship between education and corruption in the SSA region. The role the macroeconomic environment plays in reducing corruption is not neglected. In addition to the above, policy makers will benefit from such a study. Findings from this study, will aid policy direction in improving the incidence of corruption in the Sub region. All in all, policy makers, researchers and development experts will be the sole beneficiaries of the findings in this study.

1.5 Scope of the Study

In order to examine the effect of education on corruption, the study used data for 27 Sub-Saharan African (SSA) nations from 2012 to 2019 to investigate this relationship. The countries were selected mainly due to the availability of data for the selected countries from various sources.

1.6 Organization of the Study

There are five chapters in the study. The background upon which this study is conducted is presented in chapter one. Also, the problem statement, the objectives, the research questions, the significance, the scope, and the organization of the investigation are all presented in the subsections of chapter one. The sub-Saharan economy is briefly discussed in Chapter two, followed by a literature review of theoretical and empirical research works on the connection between education and corruption. Relevant literature on education, corruption and other key macroeconomic variables are reviewed in this chapter. The study's methodology and the methods used to conduct the study are also presented in Chapter three. The regression models were also covered, and the operationalization and presentation of the control variables that were used in the models. The study's findings are presented in chapter four. All analysis, presentation, and interpretation of results from the data analysis was done in this chapter. The literature was used as a point of reference for discussions and analysis. Chapter five brings the study to a close by outlining the summary, conclusion, academic and policy implications based on the research's findings, its limitations, and its future research directions.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.0 Introduction

This chapter provides an overview of the available literature on the relationship between education and corruption, along with key macroeconomic variables. The aim is to support this thesis with the theoretical and empirical foundations. The chapter is divided into four sections. The first section examines the sub-Saharan economy. The second section reviews various theories to support the theoretical framework of this study. The third section explores existing empirical research related to this study. Finally, the fourth section delves into the conceptual framework that will guide the study.

2.1 Overview of Corruption and Education in sub-Saharan Africa Economy

The nations south of the Sahara Desert make up Sub-Saharan Africa. With 1.078 billion people, according to World Bank statistics from 2018, it is the second most populous area in the world (World Bank, 2018a). Sub-Saharan Africa's history, notably that of the 19th and 20th centuries, was primarily characterized by European colonialism, when governments, led by white minorities dominated the economic and political life of most of the continent's nations. Black majority parties and movements struggled for their independence from colonial administrations during the 20th century, engaging in armed conflicts and other violent encounters (Duri, 2020). One major factor contributing to these conflicts is the rulership of corrupt leaders amassing wealth for themselves and their families at the expense of the poor masses.

In comparison to other regions, sub-Saharan Africa will gain the most from reducing corruption, according to a 2019 report by the International Monetary Fund (Hammadi et al., 2019). According to the analysis, if the region's governance, which is now below pace with the rest of the globe, is improved, GDP per capita might rise by 1% to 2% annually. Hence, improved governance and decreased corruption are essential components in achieving the required level of development in sub-Saharan Africa (Duri, 2020).

By 2019, Rwanda, Namibia, Botswana, Cape Verde, and Seychelles were the five least corrupt countries in the SSA. South Sudan, Guinea, the Democratic Republic of the Congo (DRC), and Somalia all struggle to combat corruption and are among the most corrupt countries in SSA. Some countries have been making significant progress in the fight against corruption in recent years, though other countries are also retrogressing. Between 2012 and 2019, the CPI showed a considerable change in seven nations, either positively or negatively (Duri, 2020).

In recent years, many countries in sub-Saharan Africa (SSA) have implemented anti-corruption frameworks and established institutions to reduce corruption within their borders. The following discussion focuses on a selection of these anti-corruption frameworks adopted by some countries in the region to provide an overview of the institutional mechanisms that have been put in place. It is important to note that while many countries in SSA have adopted similar anti-corruption policies, the study concentrates on a few key examples for illustration.

Madagascar returned to democratic elections in 2013 after the coup in 2009 yet the people had to still resort to corrupt activities to survive even after 2018 elections.

Madagascar had to resort to several stringent domestic and international anti-corruption frameworks such as the revised anti-corruption law of 2016 (law No. 2016-020) which was passed in 2004 (Law No. 2004-030), declaration of assets law, Pôles anti-corruption (PAC), asset recovery law, Anti-Money Laundering/Combating the Finance Terrorism (AML/CFT – law No. 2008-043) among several others but the implementation of these anti-corruption policies is weak (Rahman, 2019).

Tanzania has also put in place many more stringent anti-corruption measures in recent years. The existing corruption act of 2007 was improved upon as the Prevention and Combating of Corruption Act (PCCA). Whistle-blower witness protection act, access to information act were adopted in 2015 and 2016 respectively (Rahman et al., 2019). Mauritius, among the few SSA countries that score above 50 of the CPI was ranked 56th out of 180 countries with a score of 51 out of 100 according to TI, yet still battles with corruption. As compared to other countries, Mauritius does well in controlling corruption and has adopted the asset recovery law of 2011, Good governance and integrity reporting act 2015, the declaration of assets acts 2018 among several other measures to fight corruption (Rahman, 2019).

The Democratic Republic of the Congo (DRC) has also taken steps to address corruption. According to Bak et al. (2019), the DRC has established a comprehensive legal framework to combat corruption, and it has made significant progress in recent years. The country ratified the United Nations Convention Against Corruption on September 23, 2010, and set up the Financial Intelligence Centre (FIC), an anti-corruption and money laundering body, in 2009. However, there remain insufficient incentives and effective procedures for enforcing the DRC's anti-corruption laws.

Consequently, the country's anti-corruption framework exhibits numerous shortcomings and weaknesses (Rahman, 2018).

Rahman (2018) also notes that, since 2015, Ethiopia has experienced growing unrest as a result of ongoing corruption and human rights violations. While the country has strong anti-corruption laws in theory, their practical application has been inadequate.

The government of Senegal has made steps to combat corruption, including the establishment of new agencies and the punishing of prior violations. Nonetheless, there are worries that political factors may have influenced the breadth and complexity of the anti-corruption initiatives. These institutions are still developing. From 2012, external donors have supported Plan Sénégal Emergent (PSE), a crucial anti-corruption initiative (Shipley, 2018).

Since transitioning to a multi-party democracy in 1992, Ghana has been recognized as one of the most stable nations in West Africa. While Ghana has implemented several anti-corruption measures, there are concerns that political influences may impact the effectiveness of these initiatives. The country has enacted several laws and mechanisms to combat corruption, including the Whistle-blowers Act of 2006, the Anti-Money Laundering Act of 2008, the National Anti-Corruption Plan (NACAP) passed in 2014, the establishment of the Economic and Organised Crime Office (EOCO) in 2010, and the Office of the Special Prosecutor established by an act of parliament in 2017, among others. It is noteworthy that the police and judicial systems are often cited as areas with higher corruption risks. While there isn't a single comprehensive law targeting corruption, the criminal code outlaws both active and passive corruption (Rahman, 2018).

Despite all these anti-corruption frameworks, the education sector hasn't been neglected totally as a tool for fighting corruption. It has been highlighted that many policymakers in charge of education in developing nations focused primarily on school enrollment or access during the 1970s and 1980s. Over time, it became apparent that simply having access to education did not guarantee having a sufficient degree of fundamental knowledge. Despite increased enrollment rates across the globe, particularly in Sub-Saharan Africa, low quality and high dropout rates gave the impression that many students had not graduated with even the most fundamental levels of reading, writing, and numeracy abilities (Sifuna, 2010).

In sub-Saharan Africa, more kids now have access to basic education than there were twenty years ago, yet many of them are still not in school. Many more begin school but do not finish the fundamental cycle, and some do not enroll at all, especially in weak countries. The Millennium Development Goals (MDGs) and Education for All (EFA) have inspired commitments to significantly increase access to education (Lewin, 2009). Despite recent gains in enrollment, Sub-Saharan Africa still lags behind other developing regions in terms of educational attainment (Eger, 2016).

The out-of-school rate for children to youth for SSA is the highest in the world. UNESCO reports that about 97.5 million children, adolescents and youth of primary, lower secondary and upper secondary age were out of school in 2018. Figure 3 shows the breakdown of the out-of-school rates for the world.

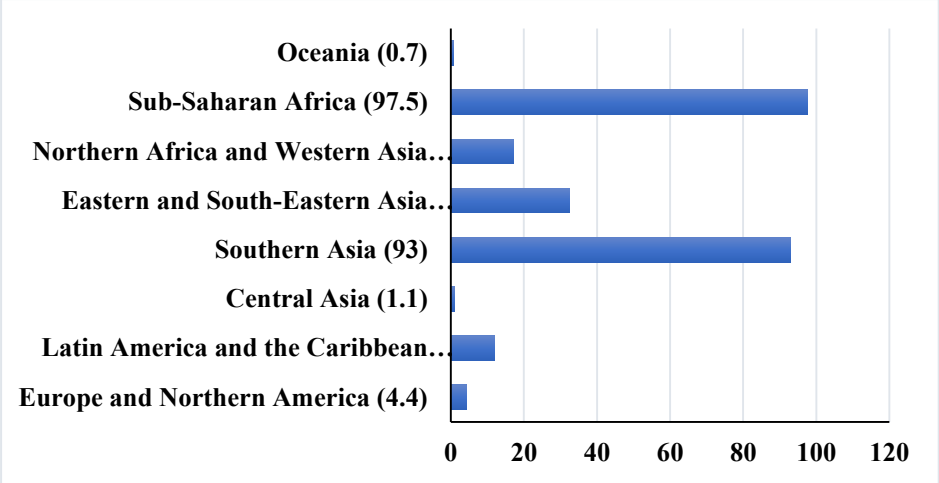

Figure 3: Shows the graph of out-of-school children, adolescents and youth of primary, lower secondary and upper secondary age

Source: Author's construct based on data from (UNESCO, 2019).

Note: Figures in brackets are in millions

The governments in this region, however, continue to invest in the education sector. Government expenditure on education between 1999 and 2011 averaged 2.65% of GDP in SSA (Mbodji, 2023). While there has been a marginal increase in government expenditure on education in sub-Saharan Africa (SSA) over the past two decades, this investment still lags behind other regions of the world (Oloke et al., 2022). For example, the average investment in education by governments in SSA between 2012 and 2020 was 3.63% of GDP, compared to an average of 5.02% of GDP in Latin America and the Caribbean, 4.53% of GDP in East Asia and the Pacific, and 4.18% of GDP in South Asia during the same period (Jaafra & Rachdi, 2022; Appiah, 2017; Akinola & Bokana, 2017). The relatively low investment in education in SSA is a cause for concern, as education is widely recognized as a key driver of economic growth and development (Hu et al., 2023). It is therefore important that governments in the region prioritize education spending and work to improve the quality of education, increase access to

education, and ensure that education is equitable and inclusive. By doing so, governments in SSA can help to ensure that their citizens are equipped with the skills and knowledge needed to thrive in a rapidly changing global economy. Figure 4 below shows the trend of growth in the education expenditure by governments in the region.

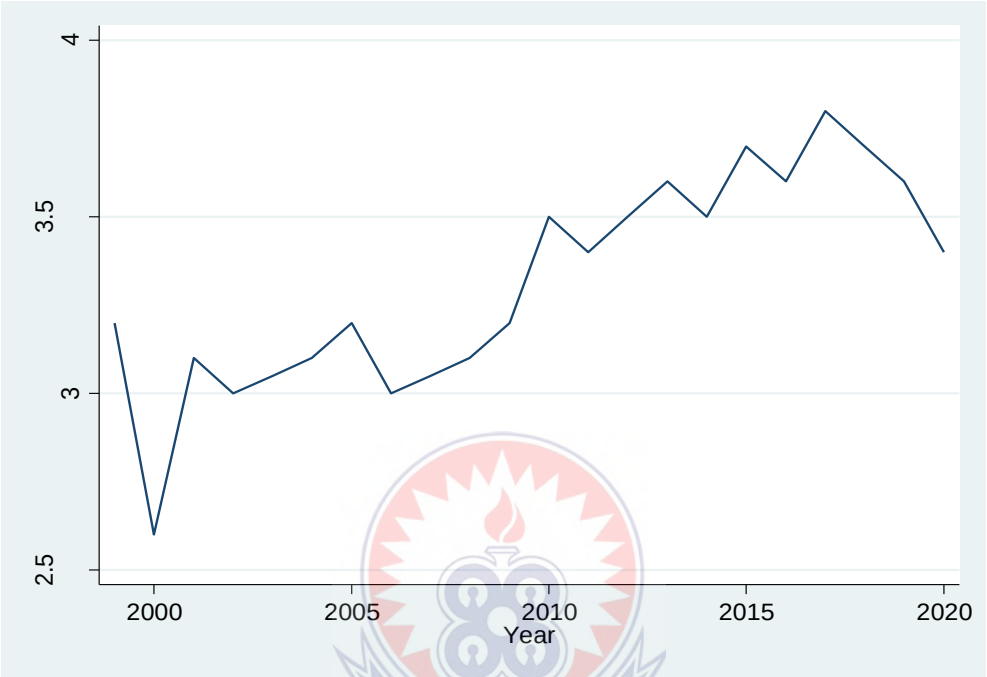

Figure 4: Government expenditure on education, total (% of GDP) for SSA

Source: Author's construct based on data from UNESCO Institute of Statistics (UIS)

2.2 Review of Theoretical Literature

This section presents theoretical reviews on papers relating to education and corruption. The section starts with the context of corruption upon which this study has its grounds. This will be followed by reviews of some relevant theories on the relationship between education and corruption.

The Context of Corruption

Corruption is a phenomenon that has plagued societies across the world for centuries. It is a form of unethical behavior that involves the abuse of public office for personal gain, or the violation of trust placed in an individual or organization. Corruption takes many forms, including bribery, embezzlement, nepotism, and favoritism, and its effects can be devastating, undermining economic growth, social justice, and democracy (Sbardellotto, 2023; Marinova, 2023; Islam et al., 2022; Ghibanu et al., 2022).

Throughout the past few decades, corruption has drawn more attention, and different scholars have given it different definitions. Khan (1996) defines corruption from the normative and positive perspective. The study first defines corruption as deviations from ethical norms. The second definition the study gives to corruption is “actions which harm the public interest”. The third definition the study gives to corruption is “deviations from legal norms”. The first examines actions and is unmistakably normative, whereas the second examines the consequences of actions and it remains normative because the interest of the public may differ across observers. The third definition, which is positive and uses the standard of legal standards to identify deviations, is the one most frequently used in economic and sociological comparisons.

Although there is no universally accepted definition of corruption, the World Bank's (1997) prevalent definition is "the abuse of public office for private advantages or benefits," which encompasses a wide variety of actions from bribery to the theft of public funds. Özkan and Erkan (2011) also defines corruption as the use of public power for private interests among the important problems of less developed, developing countries or developed countries. Since the dawn of civilization, corruption has always

been a component of social relations. At its core, corruption is the misuse of a public position and an entrusted office for personal gain (Graycar, 2015).

Furthermore, while a universally accepted definition of corruption is unattainable, it has been broadly defined as acceptance of cash or other benefits in exchange for contracts, circumvention of rules to serve one's own interests, such as accepting kickbacks from international organizations or development programs, payments for legislative support, and the use of public funds for personal gain, such as ignoring illegal activity or interfering with the justice system. Nepotism, common stealing, overcharging, creating nonexistent projects, salary padding, tax collection and tax assessment frauds are additional examples of corruption (Doig & Theobald, 2013).

Lastly, (Sapsford et al., 2019) asserts that, in order for a government department to perform its regular duties and issue documentation, or as an incentive for them to do so more quickly, or in order that the strict provisions of laws or regulations might be relaxed in specific cases, bribes may be demanded from businesses, especially new or expanding businesses which is a component of corruption.

2.3 Theories on Corruption

The categorization of these theories on corruption in this section follows the work of De Graaf (2018) and Cletus (2022). Due to the overlapping nature of these theories, no one theory can fully fit into one category. The categories are based on the level that the perceived corruption occurs. At the micro level, individuals are perceived to be corrupt while at the meso level, the corrupt behavior of individuals is influenced by the institutional environment or the group one associates with, and the macro level looks at it from the cross-country analysis employing econometric techniques.

Micro Level Theories

At the micro level, the principal-agent and the bad apple theories will be discussed here. The Principal-agent theory focuses on the individual level of analysis, where individuals act as agents of principals, and explores the incentives and motivations that drive individual behavior (Eisenhardt, 1989). Bad apple theory emphasizes the role of individual bad actors who engage in corrupt behavior due to their personal characteristics or situational factors (Cohen et al., 2019).

Principal-agent theory

The principal-agent theory is one of the commonly used theories on corruption. The principal-agent model has been used in economic literature to explain corruption for decades (Groenendijk, 1997). Although the desire for personal gain is frequently believed to be the main driver of public sector corruption, this oversimplifies the nuanced interactions that exist between people and the State. This theory suggests that corruption occurs when there is a principal-agent problem, where the agent (government official) has more information and power than the principal (the public). Education can help citizens to become better informed principals and reduce the opportunity for corruption. Groenendijk (1997) argues that the principal-agent paradigm is predicated on the idea that public officials act as agents to safeguard the principal's interests (whether the public, parliament, or supervisors). However, in practice, the interests of the agents frequently diverge from those of the principal, and although the principal can set the pay-off guidelines in the relationship with the agent, there may be informational irregularities to the agent's advantage that could be used by him or her for personal gain.

One empirical argument for the relevance of principal-agent theory in understanding the relationship between education and corruption is provided by a study by Svensson (2005). The study used randomized controlled trials to examine the impact of information and monitoring on corruption in Ugandan primary schools. The study finds that providing information about school grants and teacher attendance to parents, as well as hiring local monitors to check teacher attendance, led to a significant reduction in corruption. This suggests that greater transparency and monitoring can reduce the moral hazard problem in education, as predicted by principal-agent theory.

Another empirical argument for the relevance of principal-agent theory in understanding the relationship between education and corruption is provided by a study by Mauro (1995) which explores the effect of education on corruption. The study employs a principal-agent framework to examine how the quality of education can affect corruption, with a focus on the relationship between teacher wages and the occurrence of bribery in education.

Bad apple theory

The bad apple theory suggests that corruption is the result of a few individuals who are inherently bad or morally corrupt, and that corruption can be reduced by punishing these individuals (Klitgaard, 1988). In the context of education and corruption, the bad apple theory implies that corruption in education is caused by a few corrupt individuals, such as teachers or administrators, who abuse their power for personal gain.

One study that examines the bad apple theory in the context of education and corruption is by (Lambsdorff, 2002). The study uses data from a survey of 2,400 teachers in eight countries to analyze the prevalence and determinants of corruption in education. The

study finds that corruption is more likely to occur when teachers have low salaries, lack job security, and have limited opportunities for professional development. The study also finds that corruption is more prevalent in countries with weak governance and low levels of economic development.

While the bad apple theory suggests that corruption in education is caused by a few corrupt individuals, empirical evidence suggests that corruption is also influenced by institutional factors, such as governance quality and economic development.

Meso Level Theories

Collective action theory will be discussed at the meso level. Collective action theory focuses on how groups of individuals work together to achieve common goals and overcome collective action problems (Olson, 1965). This theory can also be classified at the macro-level as it examines how collective action can lead to changes in the broader societal context.

Collective action theory

The collective action theory goes beyond conventional principal-agent arrangements and places a strong emphasis on elements like trust and how people perceive other people's behavior (Cletus, 2022). Collective action theory suggests that collective efforts by citizens can help to reduce corruption by increasing the costs of corrupt behavior and promoting collective norms of honesty and accountability (Pellegrini & Gerlagh, 2008). Education can play an important role in facilitating collective action by increasing citizens' awareness of their rights and responsibilities, fostering a sense of

civic duty, and providing them with the skills and knowledge needed to participate effectively in civic life (Ebrahim, 2010).

Several empirical studies provide support for the role of education in promoting collective action and reducing corruption. For example, a study by Svensson (2005) found that increased education levels among citizens in Uganda were associated with a greater likelihood of collective action against corruption. Similarly, a study by Alatas et al. (2013) found that education was a key determinant of citizen participation in anti-corruption campaigns in Indonesia.

Furthermore, the effectiveness of education in promoting collective action against corruption may depend on the quality of education and the availability of civic education programs. A study by Kimenyi and Mbaku (2005) suggests that education quality and civic education programs can help to promote civic engagement and accountability in Africa. Similarly, a study by Mungiu-Pippidi and Johnston (2017) found that civic education programs in Romania contributed to reducing corruption by promoting collective norms of honesty and accountability among citizens.

The collective action theory suggests that education can play an important role in reducing corruption by promoting collective action and accountability. The empirical evidence supports this theory, highlighting the importance of education quality and civic education programs in achieving this goal.

Macro Level Theories

The institutional theory will be discussed at the macro level. Institutional theory focuses on the broader societal context in which organizations operate and explores how institutions shape individual and organizational behavior (DiMaggio & Powell, 1983).

Institutional theory

Institutional theory posits that institutions, such as laws, regulations, norms, and organizational structures, shape the behavior and decision-making of individuals and organizations (North, 1990). In the context of corruption, institutional theory can be used to analyze the role of formal and informal institutions in shaping the incentives and opportunities for corrupt behavior (Treisman, 2000). Education can also affect corruption through its impact on institutional development, such as the development of legal and political institutions.

One empirical study that applies institutional theory to the analysis of education and corruption is by De Rosa et al. (2010). The study uses a cross-country panel dataset to examine the effect of education on corruption and finds that education has a significant negative effect on corruption, controlling for other factors. The study also finds that this effect is mediated by institutional factors, such as the strength of the legal and political institutions in a country.

Another study that applies institutional theory to the analysis of education and corruption is by Batuo et al. (2010). The study uses a cross-country panel dataset to examine the effect of education on corruption and finds that education has a significant negative effect on corruption, controlling for other factors. The study also finds that this

effect is stronger in countries with better institutional quality, such as lower levels of bureaucratic inefficiency and greater rule of law.

2.4 Review of Empirical Literature

In recent years, there has been increasing interest in understanding the relationship between education and corruption, as corruption is a major barrier to economic growth and development. Empirical studies have examined this relationship from different angles, using various econometric techniques and data sources (Alontseva et al., 2023). The results of these studies have been mixed, with some studies finding a negative relationship between education and corruption, while others finding no significant relationship or even a positive relationship (Wysmułek, 2022). This review of the empirical literature on the effect of education on corruption aims to provide a comprehensive overview of the main findings and research methods used in this field, as well as to highlight the limitations and gaps in the existing literature and suggest directions for future research.

2.5 Education and Corruption

Corruption is a major obstacle to development in Sub-Saharan Africa. Ahrend (2002) investigated this relationship, focusing on the role of civil society in monitoring government officials. The study's theoretical model suggests that the impact of education on corruption depends on the monitoring capacities of civil society. If those capacities are well developed, education decreases corruption, whereas it may lead to higher corruption if civil monitoring is low. To test this hypothesis empirically, the study used a corruption perception index compiled by a private risk rating agency called the Political Risk Services Group. This index is compiled using less information than

the Transparency International (TI) Index but has the advantage of being consistently available for a relatively long period (1984-1995) and for a larger number of countries (about 130). The study found empirical evidence to support the theoretical model. Specifically, the results of the country fixed effects regressions indicate that secondary and higher education have a negative impact on corruption. Unlike other studies, the study did not mainly focus on the cross-section distribution, but on the impact of changes in a country's education levels on corruption. The study suggests that education can play a key role in reducing corruption in Sub-Saharan Africa. However, the effectiveness of education in combating corruption depends on the monitoring capacities of civil society. The study relied on a corruption perception index from a private agency, which might not be as widely recognized or reliable as indices like Transparency International's CPI.

Glaeser & Saks (2006) investigated the causes and consequences of corruption in the United States (US). The Justice Department's "Report to Congress on the Activities and Operations of the Public Integrity Division" served as the source for the study's corruption data. This report breaks down the number of federal, state, and municipal public servants who have been found guilty of crimes related to corruption by state. The total number of convictions in each state between 1990 and 2002 was calculated by combining data from the 1999-2002 reports. Data on education and the other independent variables came from the 1990 and 2000 Censuses. Ordinary least squares and instrumental variables estimation techniques were then employed on the set of the available data. The study discovered that many of the fundamental trends that apply to states also apply to countries, even when corruption is measured using convictions rather than opinion polls (which is the norm in cross-country literature). States with

higher per capita income, and more education are generally less corrupt. On general, corruption is lower in states with higher per capita income and levels of education. In other words, states with higher levels of education, and to a lesser extent, richer states, have lower levels of corruption. Less corruption is predicted by historical education levels, such as high school graduation rates in 1928 and Congregationalism in 1850. The study's U.S.-focused findings might not be directly applicable to Sub-Saharan Africa. It doesn't consider the educational aspect in detail.

As more studies had focused on the supply side of corruption (those that make the corrupt payment), the demand side (those that demand and accept such corrupt payments) was investigated by Beets (2005). The study used a total of 90 countries out of the 200 sovereign countries that appeared in the CPI in the year 2000 and were grouped into 4 cohorts for analysis purposes. Based on the CPI scores, the countries were grouped into low corruption countries (17 countries with scores between 7.6 and 10), mid-low corruption countries (16 countries with scores between 5.1 and 7.5), mid-high corruption countries (42 countries with scores between 2.6 and 5.0) and high corruption countries (15 countries with scores between 0 and 2.5). The study then employed a non-parametric statistical measure known as Kruskal-Wallis (KW) across the 4 cohorts over a wide range of measures including education. The literacy rates, school enrollment rates, and the number of pupils per teacher in primary schools were all rather low among the nations with the highest perceptions of corruption. The literacy rates were comparatively high, the percentage of pupils enrolled in school was relatively high, and the number of students per primary school teacher was generally low in countries with lower perceptions of corruption. Together, these education-related characteristics show that corruption and education are associated. The Kruskal-Wallis

test provides information on associations but doesn't establish causation. More in-depth analysis is needed to understand the mechanisms at play.

Rehman and Naveed (2007) conducted a study that examined the determinants of corruption and its relation to growth. Using data from 1995 to 2005, the study employed the Barro cross-country regression framework which relates the dependent variable, corruption perception index (CPI), to two types of variables. The empirical results indicate that real GDP per capita, secondary school enrollment, public spending on education, foreign direct investment, and unemployment rate are important determinants of corruption. One of the most significant variables found in the study is secondary education enrollment. The results indicate that as the enrollment of secondary education increases, corruption becomes less prevalent. This finding is supported by previous studies which suggest that investment in health and education reduces corruption due to less rent-seeking opportunities in these sectors. Higher levels of education not only foster a sense of nationalism and confidence in the community, but also raise public awareness of their rights for the services of the bureaucrats. However, the positive relationship between secondary education enrollment and corruption may seem counterintuitive. One possible explanation is that more educated individuals have a greater capacity to engage in corrupt activities. Yet, the study also notes that OECD and EU countries, which have higher levels of education, tend to have lower levels of corruption compared to developing countries. Additionally, public spending on education is also a significant coefficient in the model, indicating that investment in education plays a crucial role in reducing corruption. The study suggests that education, particularly secondary education, can be an effective tool in combating corruption. However, further research is needed to understand the mechanisms through

which education influences corruption and to explore potential interventions that could strengthen the relationship between education and anti-corruption efforts in Sub-Saharan Africa. The study raises an interesting point about the positive relationship between secondary education enrollment and corruption, but it doesn't provide a comprehensive explanation for this relationship.

Truex (2011) was driven to find answers to these two related questions: (a) Social norms can drive a community toward a high-corruption equilibrium and lower the costs of corrupt activity, but what shapes people's attitudes about corruption? (b) How does acceptability change across various forms of corrupt behavior? In June 2009, Kathmandu, Nepal, hosted the Corruption Acceptance Survey (CAS), which was conducted utilizing a non-probability type of two-stage cluster sampling for 853 respondents. The survey of Kathmandu inhabitants revealed wide disparities in perceptions of several forms of corrupt behavior. The standard OLS estimation technique was then applied to the survey data to answer the 2nd research question which relates to education and corruption acceptance. In general, respondents concurred that widespread bribery was unethical, although there was some disagreement over actions such as small corruption, gift-giving, and favoritism. Education has been shown to be the main factor influencing these sentiments, with better educated respondents displaying less acceptable attitudes toward the full spectrum of corrupt activities. These results imply that expanding educational opportunities in underdeveloped nations may lessen the prevalence of corrupt practices and, ultimately, corruption itself. However, more studies are required to confirm the validity of these conclusions outside of Nepal. The study is limited to Nepal, and its findings might not generalize to other regions. It

does not discuss the possible mechanisms through which education influences corruption acceptance.

Again, Lio et al., (2011) conducted a cross-country study on the use of the internet to reduce corruption. The panel data consisted of 70 countries covering the period from 1998 to 2005. The level of corruption was proxied by the Corruption Perception Index (CPI) provided by Transparency International, as the dependent variable whereas secondary school enrollment, among several control variables, were used as independent variables. The results from both pooled OLS and the Arellano–Bond system GMM estimator used to estimate the dynamic panel data models indicated that the coefficient of secondary education was positive and statistically significant, indicating countries with better-educated people have lower levels of corruption though higher income levels played a role. The study lacks a detailed discussion of the mechanisms by which education might reduce corruption.

In a related study, Kaffenberger (2012) examined the relationship between education and participation in corruption using data from a household survey gathered by the Afrobarometer project, which covers 20 countries in Sub-Saharan Africa and contains more than 27,000 respondents. The information was gathered from March 2008 to June 2009. Education has a highly substantial, favorable impact on participation in corruption, according to the study, which used both a hierarchical linear model and a linear probability fixed effects model to arrive at this conclusion. When people increase their level of education, the positive effect likewise expands and becomes more substantial. A person who has completed elementary school is 2.3 percentage points more likely to bribe than a person who has not attended any formal education, and this

effect gets worse every year. Compared to those with no formal education, those who have completed secondary school are 5.0 percentage points and 3.9 percentage points, respectively, more likely to bribe. These differences are both statistically significant at the 1 percent level. The inclination to bribe among people with technical education is more than double the propensity to bribe among those with high school merely. The likelihood of bribery increases by 13.7 percentage points for those who have completed university and by 10.2 percentage points for those who have completed technical or other non-university post-secondary education; both are significant at the 0.1 percent level. The education systems are frequently corrupt in countries where corruption is rife, including many of the countries in Sub-Saharan Africa. Children learn that bribery is acceptable conduct if they must pay bribes to get good grades, advance to the next grade, and can buy test questions in advance of standardized exams. The longer they are exposed to such a system, the more likely it is that they will accept corruption as the standard and, as a result, be more likely to bribe people. However, the research does not explain why more educated individuals may be more likely to bribe, which is a counterintuitive finding.

Furthermore, the causes of corruption was examined by Forson et al., (2016) in a study using panel data for 22 countries in sub-Saharan Africa, with data from various sources for the period 1996 to 2013. In the study, the causes of corruption were grouped into 3 thematic areas comprising historical roots, contemporary causes and institutional causes. Three different estimation techniques were employed to account for the various impacts of variables on corruption. To measure the impact of education, proxied with the proportion of primary and secondary enrollment, on corruption which was also proxied by CPI from TI, the study employed the fixed-effects and instrumental variable

(IV) techniques. The coefficient of the education variable was negative and statistically significant for all results produced by these estimation techniques. This confirms the series of empirical works that establishes a negative effect between education and corruption. The study does not explore the mechanisms by which education affects corruption and is limited to 22 sub-Saharan African countries.

Uslaner and Rothstein (2016) inquired into the historical roots of corruption. Their main argument was that universal education plays a major role in reducing corruption. The reason why the study focused on the historical root of corruption was due to these three reasons: (a) One of the few factors that has been connected to lower levels of corruption is education. (b) Other aspects that encourage honesty are brought about through education, including a sense of generic trust and national identity as opposed to allegiance to particular sects or groups. (c) Higher education levels contribute to greater levels of wealth and equality for countries, both of which are linked to lower levels of corruption. The year 1870 was used as the reference year for 78 countries for the regression analysis. There is a comparable dynamic relationship between historical levels of education (in 1870) and current (2010) levels of corruption among the 78 countries. Some conclusions made from the study were that countries with high levels of education date to history as they had more educated people some 140 years ago. Again, high levels of corruption still exist in many countries, which indicates that long-term causes rather than more recent institutional improvements are to blame. The research is based on historical data from 1870, which might limit its relevance to contemporary issues.

In a study conducted by Slijepčević et al., (2020), the determinants of corruption pressures at the sub-national government level were examined. The study utilized data from a survey conducted among councilors at the second-tier level in 14 European countries. The sample comprised 5,134 councilors out of a target population of 40,877 councilors, with response rates ranging from 1.9% in Poland to 70.7% in Sweden. The multiple regression analysis was used to examine the determinants of corruption pressures and risks at the local level, where the dependent variable was perceived corruption at the local level (PCL). The study found that the integrity of local councilors, or even their resistance to corruption pressure, increased with the level of education attained. For the whole sample of 14 European countries, local councilors with higher education attainment perceived fraud and corruption as less threatening to local government compared to councilors with a lower degree of education. This result was equally significant in the three models. Furthermore, the study conducted separate analyses for non-transition and post-transition European countries. The individual characteristics of local councilors in terms of education and gender were found to be significant determinants of their perceptions of corruption pressures in non-transition European countries. Women and better-educated councilors had less subjective attitudes that fraud and corruption had a deteriorating impact on the efficacy of local government. The study's findings might be specific to European countries and not easily generalizable to Sub-Saharan Africa.

A study by Maria et al. (2021) assessed the role education plays in reducing corruption while controlling for other macroeconomic factors. The two-stage least squares (2SLS) estimation technique was employed on 2007–2017 data from 13 G20 member countries: Canada, the United States, India, Russia, Argentina, Brazil, Mexico, France,

Italy, the UK, Indonesia, Japan, and South Korea. The main reason for the use of the 2SLS estimation technique was due to the suspicion of endogeneity of the GDP per capita variable with the corruption variable where there is the possibility of causal relationship between these two variables. Due to the high correlation among the education variables (primary, secondary and tertiary enrollments), the study 1st carried out the principal component analysis to create an Educatex variable from these variables as an educational index. The study found out that, neither the lifelong learning index nor the participation in basic education had a significant effect on the level of corruption in any of the G20 countries involved, including developed and developing nations. Enrollment in secondary education had a negative and significant effect on the level of corruption in all categories of countries (all members, developing, and developed countries). Enrollment in tertiary education had a negative and significant impact on corruption levels across the board and in developing nations, but it had a positive impact in developed nations. The research does not thoroughly explore the mechanisms by which education influences corruption, which is important for policymakers.

The study by Jungo, Madaleno and Botelho (2023) titled "Controlling corruption in African countries: innovation, financial inclusion and access to education as alternative measures" explores the impact of financial inclusion and innovation on corruption, considering the moderating role of education. The study employs a representative sample of 46 African countries over three different years (2011, 2014, and 2017) and utilizes feasible generalized least squares (FGLS), instrumental variables – two stages least squares (IV-2SLS), and two-stage generalized method of moments (IV-2GMM) model estimation methods. The findings suggest that education and financial inclusion

significantly reduce corruption, and the interaction between these two factors leads to even further reduction in corruption. Furthermore, the study identifies the specific modality of digital payments and financial inclusion, such as bank credit and debit cards, that contribute to corruption reduction. This study highlights the need for policymakers to consider education as an alternative measure to support financial inclusion and reduce physical cash transactions to fight corruption effectively. Overall, the study contributes to the empirical literature on corruption and provides practical implications for policymakers in African countries. The study focused on specific measures like financial inclusion, which may not fully capture the multifaceted nature of education's impact on corruption.

2.6 The Macroeconomy and Corruption

In a study by Ulman and Bujancă (2014), the relationship between corruption and the macroeconomic environment was investigated. The study used two indices - the Corruption Perceptions Index 2013 (CPI) and the Macroeconomic Environment taken from Global Competitiveness Index 2013-2014 (ME) - and performed two Spearman Rank Correlation tests and two regressions on 100 countries grouped into three stages of development. The results showed a positive correlation between corruption and the level of development of the macroeconomic environment, indicating that corruption is generally related to the development of the macroeconomic environment. The study found that countries with highly developed macroeconomic environments are perceived as less likely to be corrupt, while countries with low macroeconomic environment scores are perceived to be more corrupt. The first regression indicated that countries with low corruption levels tend to have a developed macroeconomic environment, while countries with high corruption levels tend to have lower macroeconomic

environment scores. The second regression showed that countries with well-developed macroeconomic environments are perceived as less corrupt, while countries with emerging or undeveloped macroeconomic environments are perceived as more corrupt. The study relies on perception-based indices (CPI), which may not fully capture the underlying economic dynamics. Additionally, correlations do not imply causation.

Brewer et al., (2008) on the other hand investigated how corruption impacts government effectiveness among Asian countries. The World Bank's Governance Indicators that were used for the study provides data on 213 countries and territories spanning 1996-2005 (the data are biannual, 1996-2002 and annual thereafter). The analysis was then limited to a cross-sectional panel of 1,369 cases. The study then examined the descriptive statistics and measures like correlations, t-tests and analysis of variance (ANOVA) were then carried out to ascertain the similarities and differences between groups. Two major findings in relation to corruption and government effectiveness were made. First, corruption and accountability are significantly correlated with government effectiveness. Countries that had higher government effectiveness were countries with higher scores on the accountability and control of corruption index. The second finding was that corruption had a corrosive effect on government effectiveness across countries. However, government effectiveness was more strongly correlated with control of corruption than the accountability index. The study lacks a detailed discussion of the causative mechanisms behind the correlations observed. It does not explicitly consider different levels of economic development.

In a related study, Kapoor & Ravi (2012) assessed the impact of government effectiveness on corruption. The count model analysis, similar to Fisman and Miguel,

was used to investigate the parking behavior of United Nations diplomats in New York City in order to prove it is strongly and consistently explained by the government effectiveness index of their respective countries. The government effectiveness data of 1998 and the Enforcement indicator for the post-October 2002 period revealed 2 findings of interest. The government effectiveness index, which captures the control for the quality of government institutions, was statistically insignificant in all the model specifications and reverses the coefficient on country corruption control. Moreover, quite remarkably, in the 2nd model, the coefficient on the government effectiveness index is found to be positive and statistically significant. The conclusion that was drawn from the findings was that "if corruption is primarily controlled through government effectiveness, then interventions that focus on social norms or culture will be misplaced and unlikely to succeed". The study is limited to examining diplomatic parking behavior in New York City and may not be fully representative of the global context. It does not explore other factors influencing corruption.

Again, Asongu (2012) conducted a study on why some countries are more effective in the fight against corruption and investigated whether there are other determinants in the fight against corruption across African countries. In an attempt to find answers to these, the study employed panel quantile regression estimation technique on panel data from 46 African countries for the period 2002-2010. The study used corruption-control index, as a proxy for the corruption variable, as the dependent variable and regressed other exogenous control variables on it including political stability, rule of law, government effectiveness etc. Government effectiveness had a positive and significant effect on corruption control. Government effectiveness among other variables gained more importance in the fight against corruption when existing levels of corruption-

control are already high. Conversely, as the fight against corruption increases, government effectiveness in collaboration with other governance indicators become more relevant in the battle against bribery. The study primarily focused on African countries, limiting generalizability. It does not delve into the specific policy mechanisms that connect government effectiveness to corruption control.

Another study was conducted by Ramesh & Vinayagathasan (2018) to examine the impact of corruption on rule of law and government effectiveness. The study 1st used the OLS estimation techniques and the results suggested that there was no statistically significant relationship between control of corruption and government effectiveness. The study then employed the maximum likelihood estimation technique using the Johansen cointegration and error correction model. There was a significant and positive association between government effectiveness and the control of corruption in Sri Lanka using data from the World Bank's Global Governance Indicators covering the years 1996 to 2015 both in the short and long run. Ceteris paribus, when the government controls corruption by an additional unit, government effectiveness increases by 0.856 units in the short run. Granger's causality test also shows that greater government effectiveness may effectively regulate corruption, and that more effectiveness is only possible if the government is strong enough to do it. The OLS analysis initially did not find a significant relationship. The study focuses on Sri Lanka, which might limit generalizability.

With regards to studies on income levels and corruption, Braun & Tella (2001) examined the relationship between corruption and economic development, specifically focusing on the impact of GDP per capita on the Corruption Index using OLS and 2SLS

estimation techniques. They used a sample of 75 countries from 1982 to 1994 and controlled for other factors such as Imports/GDP, Inflation variance, Political rights, among others. Their results showed a positive correlation in the panel, indicating that over time, as GDP per capita increases, the level of corruption also tends to increase. However, they found a negative correlation in the cross-section, indicating that at any given point in time, countries with higher GDP per capita tend to have lower levels of corruption. Both of these relationships were statistically significant. Braun and Tella's (2001) findings suggest that the relationship between corruption and economic development is complex and may vary depending on the time frame and level of analysis. While a positive relationship is observed in the long run, there may be other factors at play in the short term that can lead to a negative relationship. The study relies on aggregated data and does not address the mechanisms linking economic development and corruption effectively.

In a study, Graeff and Mehlkop (2003) also analyzed the relationship between GDP per capita and corruption perception index using OLS and Backward-Regression methods. The dependent variable was the mean of CPI for the years 1998-2000, and the study controlled for other variables such as economic freedom, population growth, and primary enrollment. The sample included 76 countries, and the results indicated a positive and significant relationship between GDP per capita and corruption perception index. These findings suggest that as the GDP per capita of a country increases, its corruption perception index tends to improve, although the effect size may be relatively small. Overall, this study contributes to the understanding of the complex relationship between economic development and corruption, highlighting the importance of economic factors in reducing corruption levels in different countries. The study does

not consider various determinants of corruption, offering a somewhat one-dimensional view.

Felipe et al. (2007) conducted another related study to investigate the role of openness and foreign direct investment (FDI) inflows in deterring corruption. The study used data from the 20 largest economies by Gross Domestic Product (GDP) in 1990 and assessed the degree of country corruption using the International Country Risk Guide (ICRG) indicator for the period from 1981 to 2000. The authors found that GDP per capita is negatively related to corruption, and a one standard deviation increase in per capita GDP leads to a decrease in the corruption index between 1.4 and 2. The coefficient on import intensity, which measures openness to trade, also showed that increased openness to trade decreases corruption. The authors also found that the quantitative effect of a one standard deviation increase in trade openness leads to almost the same decrease in corruption as a one standard deviation increase in FDI intensity. The study employed ordinary least squares and instrumental variable approaches in their analysis to account for potential endogeneity issues. The study focused on the 20 largest economies, potentially missing variations in smaller economies.

In a study by Aidt et al., (2008), the authors used the Generalized Method of Moments (GMM) estimation technique to investigate the relationship between GDP per capita and corruption perception/control of corruption. The dependent variable of interest was the Corruption Perception Index, and GDP per capita was the variable under investigation. The study used two different timeframes for analysis: short-run estimates covering 43 countries from 1995 to 2000, and long-run estimates covering 44 countries from 1970 to 2000. The findings of the study revealed that GDP per capita had a

positive but insignificant relationship with corruption perception/control of corruption both in the short and long run. This implies that changes in GDP per capita were not significantly associated with changes in corruption perception or control of corruption during the timeframes analyzed. However, it is important to note that the authors did not find a statistically significant relationship between these variables, suggesting that other factors may be at play in influencing corruption perception or control of corruption. The findings of the study provide insights into the lack of significant association between GDP per capita and corruption perception/control of corruption, which may indicate the complex and multifaceted nature of corruption and its determinants. The study finds an insignificant positive relationship, indicating that GDP per capita may not be a strong predictor of corruption. However, the study doesn't delve into the potential reasons for this lack of significance or explore other variables that might affect corruption perception.

Moiseev et al. (2020) conducted a study to explore the relationship between GDP per capita and corruption index. The study used data from 45 of the largest economies and covered the period from 2012 to 2018. The authors found that the variation of corruption perception index across the analyzed countries at different time periods is well explained by the variation of GDP per capita. They also compared the performance of plain GDP per capita and GDP per capita adjusted by purchasing power parity (PPP) in explaining the variation of corruption perception index. The authors found that plain GDP per capita is a better predictor for corruption perception index, as it is a better proxy for the living standard across different countries. The authors explained this counterintuitive result by the flaw in the methodology of computing PPP adjustments, as the basket of goods varies drastically across countries. They concluded that

corruption is closely related to the average living standard in a country, as for a bureaucrat it is easier to resist the temptation to engage in corruption if their utility from the bribe is not high. The authors also noted that poor countries tend to have higher levels of corruption compared to rich ones, which can be explained by decreasing marginal utility theory. While the study highlights the importance of plain GDP per capita over PPP-adjusted figures, it doesn't investigate the underlying reasons for the relationship. The paper could benefit from a more in-depth discussion of these causal mechanisms.

Akça et al. (2012) conducted a study to assess the impact of inflation, growth, trade gap, the quality of legislation, the efficacy of government, political stability, and responsibility variables on corruption using panel data method for the period of 2002-2010 in 97 countries from three different income-level groups. The World Bank classified the countries into three income groups: high-income countries (28 countries with income over $12275), middle-income countries (30 countries with income between $3975 and $12275), and low-income countries (39 countries with income below $1005). The data set used in the analysis was obtained from the World Development Indicators (WDI) database. To choose the most accurate method for the study, the authors initially predicted the model using the random effects method and then tested if the error term in the model was related to the independent variables through the Hausman test. Based on the LM and Hausman tests results, the fixed effects model was found to provide the most reliable predictions. The empirical results showed that inflation had a statistically significant and positive effect on corruption in all 97 countries from the three different income-level groups. Inflation, due to its characteristics such as reducing real wages and minimizing the purchasing power of

money, may result in income loss for individuals and groups, leading them to resort to various methods to generate revenue and sustain their economic livelihoods. This can potentially increase corruption acts such as bribery, deception, jugglery, lobbying, and rent-seeking activities. Moreover, continuous and sudden increases in the general level of prices can also result in ambiguity in economic life, which is a significant factor in the emergence and spread of corruption acts. The paper lacks a detailed discussion of the specific channels through which inflation affects corruption. It assumes causality without robustly testing for endogeneity.

Türedi and Altıner (2016) sought to investigate the economic and political factors that influence corruption in developing countries. To Türedi and Altıner (2016), to be able to create policies intended to prevent or lessen corruption, the causes impacting it must be identified. In the study, data from 56 nations for the years 2002 to 2012 were taken into consideration using the fixed effects model with Driscoll-Kraay standard error. Simple statistical tests like correlation and regression analyses were carried out in order to gather preliminary information on the economic and political factors that influence corruption in developing nations before moving on to the econometric analysis. The analysis's findings indicate that inflation increases corruption whereas economic growth, economic freedom, and trade openness all lower it in the countries studied. Also, it is established that democracy and political stability are the political elements that have a decreasing impact on corruption. According to the results of the fixed effects estimates, the inflation rate variable had a negative sign as expected and it was statistically significant at 5% level. The results showed that a 1% increase in inflation rate reduces the corruption control index value by 0.004 units and therefore signifies that inflation increases corruption. According to this finding, the theoretical remark that

"High inflation is a phenomenon that establishes a basis for the income loss of individuals or groups (especially those with fixed incomes) and disturbance in income distribution in society. Those who lose their income as a result are more likely to engage in unlawful and questionable activity" is verified. While the analysis finds inflation to be positively related to corruption, it does not delve deeply into the reasons behind this correlation. It lacks a more in-depth exploration of causation.

In a study by Gokcekus and Knörich (2006), the impact of the quality of openness on corruption was analyzed using regression analysis and several robustness checks. The sample included 133 countries from Transparency International's CPI. The findings showed that the quality of openness has a significant impact on reducing corruption, even after controlling for the actual level of openness. Additional robustness checks were conducted to confirm the appropriateness of linear functional form, the sensitivity of the findings to the selection of CPI as the corruption indicator, and the possible endogeneity and measurement errors. The results were consistent and did not depend on the choice of functional form, the index of corruption, or the inclusion of other relevant variables. The study could provide more information on the specific quality factors related to openness that have a significant impact on corruption, making the findings more actionable for policymakers.

In Neeman, Paserman, and Simhon's (2008) study, a sample of 133 countries was analyzed to examine the relationship between corruption, wealth, and openness. Trade openness was measured using the Wacziarg-Welch Openness Dummy for 1990-1999 and Sachs-Warner Openness Dummies for 1992 and 1984, while corruption was measured using data from 1982 and 1998. The researchers employed OLS and

instrumental variable estimation techniques and used a neoclassical growth model with endogenous corruption. They found that corruption and wealth are negatively correlated, with richer countries tending to be less corrupt and corrupt countries tending to be poorer. However, they also observed a puzzle: if poorer countries experience higher levels of corruption and corruption hampers growth, how did once-poor countries become rich? The authors suggest that in the past, economies were mostly "closed," making it difficult to transfer illicit money outside the country, so the gains from corruption remained inside and became part of the productive capital. In contrast, in today's open economies, corrupt agents smuggle stolen money abroad, depleting their country's capital. The authors tested this hypothesis using cross-country data and confirmed that the effect of corruption on wealth depends on the economy's degree of openness. The analysis is based on correlations without a deep exploration of causation.

Zakaria (2009) conducted an empirical study to investigate the relationship between trade openness and the level of corruption in Pakistan using annual time-series data from 1984 to 2007. The study employed the generalized method of moments (GMM) estimator for their analysis. Corruption was measured as an index ranging from 0 to 6, with higher values indicating more corruption, and data was obtained from the International Country Risk Guide (ICRG). The study found that trade openness and corruption were negatively correlated, with a correlation coefficient of -0.40. This suggests that higher levels of trade openness are associated with lower levels of corruption in Pakistan. The authors also plotted a simple regression between corruption and trade openness for preliminary investigation, which displayed an apparent negative relationship between the two variables. The results of the regressions showed that trade openness had a significant negative effect on corruption, indicating that a more liberal

trade regime is associated with lower levels of corruption. The authors hypothesized that lower tariff and non-tariff barriers reduce opportunities for rent-seeking, such as taking bribes for lower tax payments or exemptions. Additionally, increased competitiveness resulting from trade liberalization leads to lower available rents, further deterring corruption. The study found that the effect of trade openness on corruption was economically significant. A one standard deviation increase in trade openness (2.42) led to a decrease in corruption of about 0.49 points in the corruption index. The association between trade openness and corruption was statistically significant and economically important, providing evidence that higher levels of openness reduce corruption and supporting the argument for trade liberalization policies. The study lacks a detailed exploration of the driving factors behind the correlation.

In a study conducted by Majeed (2014), the relationship between trade and corruption was investigated using panel data from 146 countries between 1984 and 2007. The study employed different techniques of estimation, such as 2SLS, LIML, and GMM, to address the problem of endogeneity and omitted variable bias. The study found that the relationship between trade and corruption is non-monotonic, meaning that trade increases corruption in a linear specification but decreases it in a non-linear specification. The study also argued that complementary policy reforms are necessary to reduce corruption, and not just trade openness alone. The corruption perception index by ICRG was used as it spans a long time period and covers a large number of countries, making it a comprehensive index for corruption. The study's theoretical framework was based on Becker's (1968) work, where individuals make rational choices based on the

relative costs and benefits of illegal (corrupt) activities. The research relies on a cross-sectional analysis, which may not capture the dynamic nature of corruption.

Unver & Koyuncu (2016) conducted a study using annual unbalanced panel data analysis on 154 countries from 2000 to 2013. They sourced their data from PovcalNet Data of World Bank, Transparency International, UNCTAD, WDI, and other sources. The study employed a random effect estimator on three models while a multivariate fixed time effect model (FEM) was estimated. The Hausman test was used to select between fixed time effect model (FEM) and random time effect model (REM) at a 1% significance level. The test results showed that except for Model 1, in all models, REM models were selected. The empirical results showed that poverty variables and inflation rates have statistically significant and positive effects on corruption, while FDI, trade openness, and democracy levels have statistically significant and negative effects. The inflation variable's coefficient was statistically significant and had the anticipated positive sign in all five models. This result suggests that corruption thrives in countries with higher uncertainty and political and economic instability. The openness variable's estimated coefficient had the theoretically expected negative sign and was statistically significant at least at the 1% significance level in all five models. This result suggests that an increase in the degree of openness of an economy lowers the corruption level in that particular economy. The study assumed that causation runs from economic factors to corruption without exploring reverse causality.

2.7 Conceptual Framework

The conceptual framework suggests that there are several factors that can play a role in reducing corruption. One of the key factors is education, which can be divided into four categories: primary, secondary, tertiary, and Educatex**.**

Education can reduce corruption by increasing awareness of rights and promoting resistance to corrupt practices. When people are educated and understand their rights, they are less likely to engage in corrupt activities, and they may also be more likely to report corruption when they witness it. Additionally, education can increase critical thinking skills and promote ethical behavior, which can further reduce corruption. Figure 5 shows the conceptual framework that was used for the study.

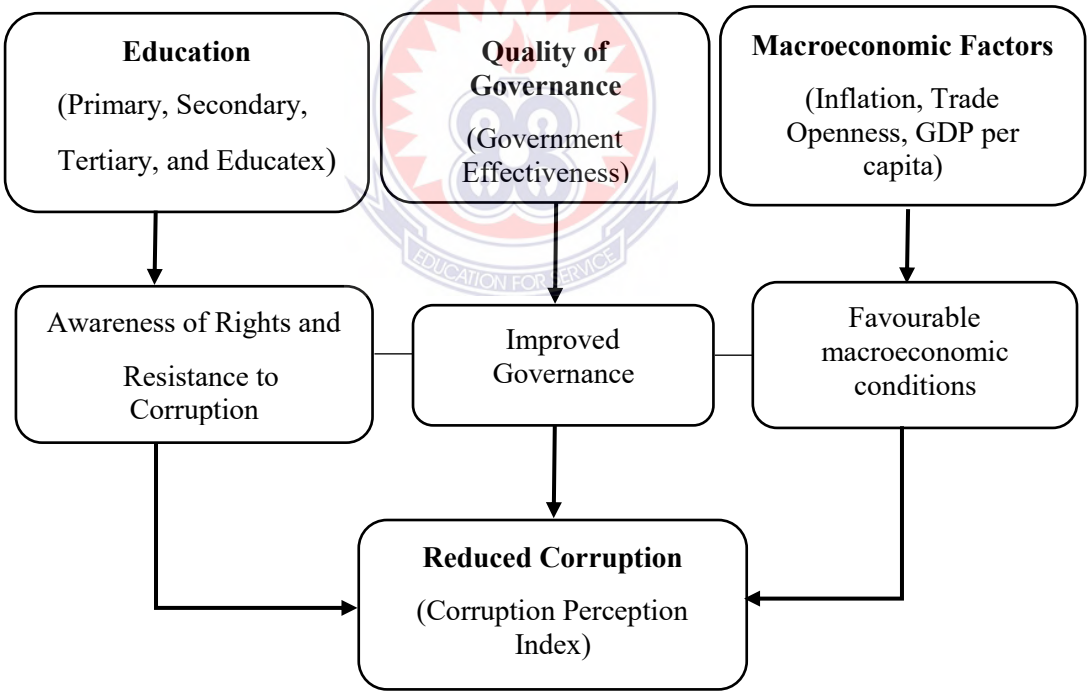

Figure 5: Conceptual framework

Source: Author's own construct (2023)

Another important factor is the quality of governance, which can be measured by the level of government effectiveness. Improved governance can lead to reduced corruption

by establishing transparent processes and systems that hold public officials accountable for their actions. When government institutions are effective and transparent, it becomes more difficult for public officials to engage in corrupt practices without being caught.

In addition to education and quality of governance, macroeconomic factors such as inflation, trade openness, and GDP per capita can also play a role in reducing corruption. Favorable macroeconomic conditions can create an environment that is less conducive to corruption by providing opportunities for economic growth and development that are not dependent on corrupt practices. For example, when inflation rates are low and the economy is stable, individuals and businesses may be less likely to engage in corrupt activities to maintain their financial stability.

In summary, the conceptual framework proposes that reducing corruption can be achieved through several interrelated factors. Education can increase awareness of rights and promote resistance to corrupt practices, while improved governance can establish transparent processes and systems that hold public officials accountable. Favorable macroeconomic conditions can also create an environment that is less conducive to corruption.

2.8 Chapter Summary

This analysis covers a wide range of corruption-related topics, starting with a review of previous studies examining corruption in relation to education and other economic variables. The study started with an overview of the sub-Saharan economy, where anti-corruption frameworks and recent educational policies are discussed. Various theories were also reviewed, including the principal-agent and bad apple theories at the micro

level, collective action theory at the meso level, and institutional theory at the macro level.

The focus of the studies reviewed was the relationship between education and corruption, with some studies exploring the impact of other factors such as financial inclusion, innovation, and macroeconomic variables. The studies generally found that higher levels of education are associated with lower levels of corruption. Specifically, the studies found that secondary and tertiary education had a negative and significant impact on corruption levels, while primary education and lifelong learning had no significant impact. Some studies also found that education moderated the impact of other factors such as financial inclusion and innovation on corruption.

However, there were some inconclusive findings as a result of the methodologies employed. For example, the study by Maria et al. (2021) found that tertiary education had a positive impact on corruption levels in developed countries, which was unexpected and required further investigation. Additionally, some studies focused on specific regions or countries, which limits the generalizability of their findings to other contexts.

One gap in the literature is the lack of studies that examine the impact of specific educational interventions or programs on corruption levels. While the studies reviewed suggest that higher levels of education are associated with lower levels of corruption, it is unclear which specific aspects of education are most effective in reducing corruption.

Again, most studies relied on cross-sectional data, which provides a snapshot in time. Longitudinal studies tracking changes in education and corruption over time would offer insights into the causal dynamics between the two variables. Some studies

mention concerns about endogeneity, but they do not always employ advanced econometric techniques to address this issue.

Another important thing to consider is the direction of causality between education and corruption. While the studies reviewed suggest that education reduces corruption, it is also possible that lower levels of corruption facilitate higher levels of education which can be clarified by further research.

Finally, it is important to note that education is just one of many factors that can influence corruption levels. Other factors such as political institutions, economic development, and cultural values also play important roles in shaping corruption levels. Therefore, any policy interventions aimed at reducing corruption must take a comprehensive and holistic approach.

CHAPTER THREE

METHODOLOGY

3.0 Introduction

In Chapter two, a review of related literature was carried out to reveal several areas which were underexplored by past research. This chapter, however, focused on the methodology that was employed to test the research hypotheses that were outlined in the 1st chapter. The study first began with the research philosophy, followed by the research design and approach that were adopted for this study. To give life to the theoretical and empirical dimensions of this study, detailed descriptions were given to both the theoretical and empirical models adopted for this study. The study then continued with how the variables that were used for this study were measured and the justification for these variables, and the tests that were carried out. The chapter finally concluded with the estimation technique that was used to estimate the coefficients of the empirical model.

3.1 Research Philosophy

This study was conducted under a paradigm that stems from positivism. The philosophical underpinning was the overall guide to this study that determined how the study solved the research problem and whether the objectives of the research were achieved. The positivist research philosophy, rooted in empirical evidence and scientific methods, plays a crucial role in understanding the relationship between education and corruption in Sub-Saharan Africa. By adopting a positivist approach, researchers aim to uncover objective truths and establish causal relationships through rigorous data analysis (Comte, 1880).

Sub-Saharan Africa continues to face challenges associated with corruption, hindering social progress and economic development. To address this issue, empirical research employing the positivist research philosophy is essential. Previous studies have offered varying perspectives on the relationship between education and corruption in the region. Some scholars argue that higher education levels are associated with lower corruption levels (Svensson, 2005), while others contend that education alone might not be sufficient to combat corruption without addressing institutional factors (Aidt, 2009).

Quantitative methods form the backbone of positivist research, allowing researchers to analyze cross-sectional data over the years from various countries in Sub-Saharan Africa. Education indicators such as literacy rates, enrollment rates, and educational expenditure are examined alongside corruption measures, which include indices or survey-based indicators capturing the extent of corruption in each country. Control variables such as inflation, government, and GDP per capita are also considered to ensure robust analyses (Bauhr & Grimes, 2014).

However, it is important to acknowledge the limitations of the positivist research philosophy. While it provides valuable insights, it may not capture the full complexity of the issue at hand. Qualitative research approaches, such as interviews or case studies, could complement the positivist findings by delving deeper into the underlying mechanisms and contextual factors influencing the relationship between education and corruption.

3.2 Research Design and Approach

The research design and approach are critical components of any empirical study, shaping the methodology and data collection process (Bloomfield & Fisher 2019). By utilizing a quantitative methodology, this study aims to provide empirical evidence on the relationship between education and corruption in the region. Quantitative research approach involves systematically measuring and predicting phenomena using standardized tools (Finkbeiner, & Finkbeiner, 2017). It emphasizes the use of quantitative methods to gather and analyze data (Planing, & Planing, 2014). Quantitative research provides a structured and systematic approach to studying and understanding phenomena through numerical data analysis.

The research design ensures a systematic and rigorous investigation, enabling a comprehensive analysis of the impact of education on corruption. To address the research hypothesis and test them, the study employed the correlation research design. Correlation research design is a vital methodological approach within the realm of social sciences and other disciplines. It is employed to investigate and measure the degree and direction of the relationship between two or more variables. This design is particularly valuable for understanding how changes in one variable may relate to changes in another (Makowski et al., 2020; Trochim, 2006). This correlational research design was adopted to analyze the relationship between education and corruption in relation to the economy of Sub-Saharan Africa.

3.3 Theoretical Model Specification

Education, according to theory, has a different effect on corruption (Maria et al., 2021). Theoretical models suggest that education can have both direct and indirect effects on

corruption. Directly, education can increase individuals' moral and ethical standards, making them less likely to engage in corrupt practices (Rothstein, 2011). Indirectly, education can promote economic development, increase political participation, and enhance the rule of law, all of which have been shown to reduce corruption (see Mauro, 1995; Svensson, 2005; Treisman, 2000). Additionally, education can improve administrative efficiency and transparency in public institutions, reducing opportunities for corrupt behavior (Acemoglu & Verdier, 1998). Therefore, it is expected that higher levels of education will lead to lower levels of corruption in a given society.

Based on these foundations and upon principal agent theory, this study will adopt a general equation for the relationship between education and corruption and will be specified as below:

$$Corrupt_{it} = f(EDU_{it}, TO_{it}, INF_{it}, GE_{it}, GDPPC_{it}) \quad \textbf{(1)}$$

Where $Corrupt_{it}$ is indicator for corruption captured by the Corruption Perception Index (CPI), which is the dependent variable, EDU_{it} is an education indicator captured by the enrollment rates for the four measures of education used for this study (i.e., primary, secondary, tertiary and educatex) which is the main independent variable. TO_{it} is an indicator for trade openness, INF_{it} is an indicator for the inflation variable, GE_{it} is an indicator for government effectiveness, and $GDPPC_{it}$ is an indicator for Gross Domestic Product per capita which captures the income levels; are the control variables for the study that can affect corruption, i = 1, 2, 3, ..., 27 is the cross-sectional dimension of countries, t = 1, 2, 3, ..., 8 represent time.

The analytic framework that was adopted for the study was panel data analysis. Longitudinal or panel data analysis refers to the statistical analysis of pooled data which consists of a cross-section of units (e.g., countries, firms, households, individuals) for which there exist repeated observations over time (Hill et al., 2018; Grill, 2017; Verbeek, 2017).

The standard linear regression model can be expressed as follows:

$$y_{it} = \beta_0 + x'_{it}\beta + \varepsilon_{it} \quad \textbf{(2)}$$

Where x'_{it} is a K-dimensional vector of explanatory variables. Compared to the analysis of cross-sectional data, panel data offer researchers a valuable tool to address endogeneity concerns when establishing a connection between an independent variable and an outcome variable (Vomberg & Wies, 2021).

3.4 Empirical Model Specification

Data will then be applied to equation (2) above to make it empirically estimable (see equation 3) in order to empirically examine the relationship between education and corruption, controlling for other factors employing the 2-step GMM estimation technique (Arellano & Bover, 1995; Blundell & Bond, 1998). The 2-step system GMM panel estimation technique is a widely used econometric method for estimating panel data models. This technique is particularly useful when dealing with endogeneity problems that are common in panel data models. Again, GMM is useful when the dependent variable is persistent. For evidence of persistence of the dependent variable, there must be a high correlation of at least 0.800 between the dependent variable and its lag according to the rule of thumb threshold for persistence (See Asongu &

Nwachukwu, 2015). The correlation between the CPI and its lagged values is 0.984 and highly significant (see appendix A), hence 2-step system GMM may be useful.

Including the country-specific term, time-specific term and the idiosyncratic error term yields an estimable empirical equation. The level equation (which is the baseline equation for all the estimation techniques in the study) is specified as:

$$Corrupt_{it} = \psi_0 + \psi_1 Corrupt_{i,t-1} + \psi_2 Prim_{it} + \psi_3 Sec_{it} + \psi_4 Ter_{it} + \psi_5 Educatex_{it} + \psi_6 TO_{it} + \psi_7 INF_{it} + \psi_8 GE_{it} + \psi_9 lnGDPPC_{it} + \varepsilon_{it} \quad \textbf{(3)}$$

Where $\varepsilon_{it} = \eta_i + u_t + v_{it}$. Based on literature, we expect the independent variables to have both positive and negative relationships with the corruption variable as shown in table 1 below:

Table 1: Expected Signs

Contemporary Factor(s)	Sign	Institutional Factor(s)	Sign	Macroeconomic Factor(s)	Sign
Education ($\boldsymbol{\psi_2 - \psi_5}$)	+	Government effectiveness (ψ_8)	+	Inflation (ψ_7)	-
				Trade Openness (ψ_6)	+
				GDP per Capita (ψ_9)	+

Source: Author's Construct following (Forson et al., 2016)

3.5 Justification and Measurement of Variables

Corruption

Corruption is a pervasive phenomenon that undermines economic development, political stability, and social welfare. To effectively combat corruption, it is necessary to have a clear and reliable measure of its occurrence. The Corruption Perception Index

(CPI) by Transparency International is a widely used measure of corruption (Özkan, 2011), that is based on expert assessments and surveys of business people and country analysts. One of the most crucial questions surrounding the topic is whether it is possible to measure corruption and, if so, how. Corruption is a variable that is difficult to quantify. But recently, there has been an exponential rise in the number of indicators used to measure corruption.

Although measuring actual corruption can be difficult, perceptions of corruption can be measured. Nations can be rated in a hierarchy based on how corrupt they are perceived to be, for instance, in their corporate dealings or how they carry out their public duties (Heyneman et al., 2008). The CPI measures perceived levels of corruption in the public sector of countries around the world. It ranks countries on a scale of 0 to 100, where a score of 0 indicates a highly corrupt country and 100 indicates a very clean one. The CPI aggregates data from multiple sources and uses a variety of indicators, such as bribery, embezzlement, nepotism, and favoritism, to assess the extent of corruption in a given country.

Despite criticisms and limitations of the CPI, it remains one of the most widely used measures of corruption due to its broad coverage, comparability across countries and years, and high degree of transparency and accountability in its methodology.

In empirical research, the CPI has been used as a dependent variable to investigate the determinants and effects of corruption. Studies have examined the role of various factors such as economic development, political institutions, cultural norms, and education in shaping corruption levels across countries and over time. For instance, a study by Mauro (1995) found that corruption is negatively associated with economic

growth, while other studies have highlighted the importance of democratic institutions in reducing corruption (Svensson, 2005; Treisman, 2007). Moreover, education has been found to be negatively associated with corruption in some studies, Breen & Gillanders (2015), while others have reported mixed or insignificant effects (Asongu & Nwachukwu, 2016).

In conclusion, the CPI is a widely used and reliable measure of corruption that has been used extensively in empirical research to investigate the determinants and effects of corruption. Despite limitations and criticisms, it remains a valuable tool in efforts to combat corruption and promote transparency and accountability in the public sector.

Educatex (Educational Index for Lifelong Learning)

The concept of lifelong learning is important for individuals and societies to adapt to the changing world. Lifelong learning refers to learning and development that occurs throughout one's life, both in formal educational settings and in other contexts such as workplaces and communities (Kim, 2016). A new variable known as Educatex, which integrates formal education from elementary to tertiary levels, utilizing the principal component analysis (PCA) technique was developed by Asongu and Nwachukwu (2015). Educatex allows for the simplification of a large number of highly correlated variables into uncorrelated components, while retaining most of the original variability. This index aims to address the shortcomings of a comprehensive measurement of lifelong learning in developing countries, specifically in Africa. The index measures lifelong learning in terms of the combined knowledge achieved from primary, secondary, and tertiary education levels, with each level constituting a component of the lifelong learning index (Iheonu & Asongu, 2022).

Primary Enrollment

Primary school enrollment is a commonly used proxy for education in empirical studies. It is defined as the number of children of primary school age who are enrolled in primary schools, expressed as a percentage of the total number of children of primary school age in a given population. This variable captures the extent to which children are accessing basic education in a given country, and it has been used in numerous studies to examine the relationship between education and various economic and social outcomes.

Several studies have found a negative relationship between primary school enrollment and corruption. For instance, Breen & Gillanders (2015) found that primary school enrollment had a negative and significant effect on corruption in a sample of 31 Sub-Saharan African countries. Based on theoretical considerations, primary school enrollment is expected to have a negative effect on corruption (Knack, Stephen; Keefer, 1995; Montinola & Jackman, 2002). Higher levels of primary school enrollment imply that more children are receiving basic education, which in turn can enhance their cognitive abilities and improve their ability to think critically and make informed decisions. This can ultimately lead to a more educated and informed citizenry that is less tolerant of corrupt practices.

Secondary Enrollment

Secondary education is an important aspect of human capital accumulation, and it has been found to have a significant effect on various socio-economic outcomes. In the context of corruption, secondary education is expected to have a negative effect on

corruption as it is associated with increased knowledge, critical thinking, and analytical skills, which can lead to better governance practices and accountability.

The measurement of secondary education is usually done through enrollment rates, which is the number of students enrolled in secondary education as a percentage of the total population of the relevant age group. This measure captures the access to and availability of secondary education in a given country.

Empirical studies have shown mixed results regarding the effect of secondary education on corruption. For example, Breen & Gillanders (2015) found a negative relationship between secondary education enrollment and corruption in Sub-Saharan African countries. Similarly, Asongu & Nwachukwu (2016) found a negative relationship between secondary education and corruption in African countries. While the empirical evidence on the effect of secondary education on corruption is mixed, the theoretical expectation is that it should have a negative effect. This suggests that investing in secondary education can be an effective strategy in reducing corruption in countries.

Tertiary Enrollment

Tertiary enrollment refers to the proportion of the population aged 20-24 who are enrolled in tertiary education. It is measured as the ratio of the number of students enrolled in tertiary education to the total population in the corresponding age group. Tertiary education is defined as any type of education beyond secondary education, including vocational education, undergraduate and graduate programs, and professional education.

Empirical evidence suggests that tertiary education has a negative effect on corruption. As individuals with higher levels of education are more likely to have greater awareness of their rights, they are more likely to hold corrupt officials accountable for their actions. Additionally, higher education can provide individuals with the skills and knowledge necessary to compete in the labor market, reducing their dependence on corrupt practices for economic gain.

Several empirical studies have found a negative relationship between tertiary education and corruption. Breen & Gillanders (2015) found that tertiary education has a negative impact on corruption using data from 31 Sub-Saharan African countries.

However, some studies have found no significant relationship between tertiary education and corruption. For example, Azfar and Gurgur (2008) found no significant relationship between tertiary education and corruption in their study of the Philippines. The empirical literature suggests that tertiary education has a negative relationship with corruption, although there are some mixed findings. Therefore, it can be expected that an increase in tertiary education enrollment will lead to a decrease in corruption.

Government Effectiveness

Government effectiveness is one of the six components of governance measured by the Worldwide Governance Indicators (WGI), developed by the World Bank. It is defined as the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies (Kaufmann, Kraay & Mastruzzi, 2011).

The government effectiveness component is measured on a scale from -2.5 to 2.5, with higher values indicating better government effectiveness. The data is based on expert assessments and surveys of various groups, including private sector firms, non-governmental organizations, and public sector employees.

Empirical studies have shown a positive relationship between government effectiveness and various outcomes. However, the expected sign of the effect of government effectiveness on corruption is not straightforward. Some studies have found a negative relationship between government effectiveness and corruption (Gupta, Davoodi & Tiongson, 2001). It is expected that higher levels of government effectiveness will lead to lower levels of corruption. This is because effective governments are better able to implement and enforce laws and regulations, which can help to deter corrupt behavior. However, the strength of this relationship may vary depending on the specific context and institutional factors at play.

Trade Openness

Trade openness measures how trade-liberalized a nation is by taking into account the total of its exports and imports of commodities and services (Abotsi, 2018). Trade openness is typically measured as the sum of exports and imports as a percentage of Gross Domestic Product (GDP). The World Bank's World Development Indicators (WDI) database provides data on trade openness for countries around the world.

The expected sign of the relationship between trade openness and corruption is not clear-cut. Some studies have found a positive relationship, meaning that as trade openness increases, corruption also increases (e.g., Wei, 2000). This may be because greater trade openness creates more opportunities for rent-seeking behavior and

corruption. However, other studies have found a negative relationship, indicating that as trade openness increases, corruption decreases (e.g., Aidt & Gassebner, 2010). This may be because trade openness promotes competition, reduces rent-seeking opportunities, and increases transparency.

For example, in a study of 41 countries, Aidt and Gassebner (2010) found a negative relationship between trade openness and corruption. They argue that trade openness encourages competition, which reduces the rents available to corrupt officials. Similarly, a study by Bhattacharyya and Hodler (2010) found that trade openness had a negative effect on corruption in a sample of 118 developing countries.

Inflation

Inflation is a measure of the rate at which the general level of prices for goods and services is rising and is typically measured by the Consumer Price Index (CPI). Inflation can have both positive and negative effects on the economy, depending on the rate of inflation and its effects on economic variables such as investment, consumption, and trade.

Empirical studies have found mixed results regarding the relationship between inflation and corruption. High levels of inflation can be harmful to the economy, as they can erode the purchasing power of consumers and lead to economic instability. In terms of the expected sign for the relationship between inflation and corruption, it is not clear-cut. Some studies have found a positive relationship between inflation and corruption, as inflation can increase the incentives for corruption by making it easier for corrupt actors to conceal their activities (Mauro, 1995). However, other studies have found a

negative relationship between inflation and corruption, as high levels of inflation can lead to greater transparency and accountability in government (Aidt & Leon, 2005).

Gross Domestic Product per Capita

Gross Domestic Product (GDP) per capita is a commonly used measure of a country's economic performance. It is calculated by dividing the country's total GDP by its population. GDP per capita can be used as a proxy for a country's standard of living, as it reflects the average income of its citizens.

In empirical studies on corruption, GDP per capita is often used as a control variable or as an independent variable to assess its impact on corruption. One possible expected sign of the relationship between GDP per capita and corruption is negative, meaning that as a country's GDP per capita increases, its level of corruption is expected to decrease.

Several empirical studies have found a negative relationship between GDP per capita and corruption. For example, a study by Wang and Chien (2011) analyzed the relationship between economic growth and corruption in a sample of Asian countries and found that higher levels of economic growth (as measured by GDP per capita) were associated with lower levels of corruption. Similarly, a study by Do and Levchenko (2019) found that higher levels of GDP per capita were associated with lower levels of corruption in a sample of 112 countries.

However, some studies have found a non-linear relationship between GDP per capita and corruption, where corruption may initially increase with GDP per capita before decreasing. For example, a study by Campos et al. (2015) found that the relationship between GDP per capita and corruption was U-shaped, with corruption levels initially

increasing before decreasing at higher levels of GDP per capita. The expected sign of the relationship between GDP per capita and corruption is negative, but the relationship may not always be linear and can be influenced by other factors.

3.6 Sources of Data

For this study on the effects of education on corruption, the study used three sets of data: measures of corruption, measures of the quality of governance, and macroeconomic data (Méon & Weill, 2008). The study employed a panel data approach using secondary data from various sources. The dataset covered the period from 2012 to 2019 for 27 sub-Saharan African countries and included data on corruption, education indicators, and other control variables. The sources of data used in this study were selected based on their reliability, availability, and suitability for the research hypotheses at hand.

Data on corruption was obtained from the Corruption Perceptions Index (CPI) produced by Transparency International (2022). This source was selected because it is widely used in empirical research on corruption and provides a comprehensive measure of corruption across countries. In addition to the CPI, the study also used a measure of the quality of governance to capture the institutional factors that may influence the relationship between education and corruption. Specifically, the study used data on government effectiveness from the Worldwide Governance Indicators (WGI), which is also published by the World Bank (2022). Education indicators, specifically enrollment rates, were obtained from the World Development Indicators (WDI) dataset provided by the World Bank (2023).

Other macroeconomic variables used as control variables, such as GDP per capita, trade openness, and inflation were also sourced from the WDI dataset (2023). These variables were selected because they have been found to be important determinants of corruption in previous empirical studies. The sources of data used in this study were carefully selected to ensure that they provided reliable and accurate information for the analysis. The use of secondary data sources allowed for a large sample size and provided a cost-effective means of gathering data.

3.7 Principal Component Analysis for Educational Index (Educatex)

Principal Component Analysis (PCA) is a multivariate statistical technique used to simplify a dataset by reducing its dimensionality while retaining as much of its variability as possible. It involves transforming a dataset into a new coordinate system that consists of a set of orthogonal linear combinations of the original variables, called principal components. PCA is often used to reduce the dimensionality of a large dataset with many variables, while still retaining the most important information about the data.

A new variable known as Educatex, which integrates formal education from elementary to tertiary levels, utilizing the principal component analysis (PCA) technique was developed by Asongu and Nwachukwu (2015). Educatex allows for the simplification of a large number of highly correlated variables into uncorrelated components, while retaining most of the original variability. Table 2 below shows the results of the component loadings resulting from the application of the PCA statistical technique on the levels of education.

Table 2: Results of the Principal Component Analysis for Educatex

	COMPONENT LOADINGS					
	EPL	**ESL**	**ETL**	**Proportion**	**Cumulative Proportion**	**Eigen Value**
1ST PC	0.039	0.708	0.705	0.611	0.611	1.833
2ND PC	0.992	0.058	-0.113	0.337	0.948	1.011
3RD PC	0.121	-0.704	0.700	0.052	1.000	0.156

PC: Principal Component; EPL: Enrollment at the primary level; ESE: Enrollment at the secondary level; ETL: Enrollment at the tertiary level. Processed with Stata 17 using Data from WDI (2020)

In PCA, the first principal component is chosen to account for the maximum amount of variance in the dataset (61.1% of the variations) and the resulting eigenvalue of 1833, followed by the second and third principal components that accounts for the remaining variance, and so on. The principal components are ranked in descending order of variance, so that the first few components capture most of the variation in the data.

3.8 Pre-estimation Tests

The study conducted three crucial pre-estimation tests to ensure the reliability and robustness of its regression analysis. These tests serve as essential checks before estimating regression models. The first test focused on multicollinearity, which examines the degree of correlation among independent variables in the model. Multicollinearity can impact the stability of coefficient estimates. The second pre-estimation test, the endogeneity test, aimed to detect whether any independent variable might be influenced by unobserved factors, potentially leading to biased results. Finally, the study conducted a cross-sectional dependence test to evaluate whether observations in its panel data were interrelated, a critical consideration in studies involving multiple units or countries. Addressing the outcomes of these tests ensures that the subsequent regression analysis produces accurate and trustworthy research results.

Multicollinearity Test

Resorting to correlation analysis only for the detection of multicollinearity may have its limitation as the relationship among the explanatory variables may be a complex one (Akinbode et al., 2020). Multicollinearity arises when there is an approximate linear relationship among 2 or more independent variables. This test was necessary because of the measures of education variables which are likely to suffer from multicollinearity. This is due to the fact that there is a transition from one level of education to the other and the educational index created from the levels using the principal component analysis still keeps the properties of the various levels.

Cross-Sectional Dependence Test

This study conducted three different cross-sectional dependence tests namely Frees, Friedman and Pesaran tests. Friedman (1937) proposed a nonparametric test (*Rave*) based on Spearman's rank correlation coefficient. It helps in determining cross-sectional dependence (Feng et al., 2021). Frees (1995) proposed a statistic (R^2_{ave}) that is based on the sum of the squared rank correlation coefficients. Pesaran (2004) proposed a standardized version of Breusch-Pagan LM test (*LMs*), suitable for large N samples based on the average of the pairwise correlation coefficients (Mehmood, Aleem, & Rafaqat, 2017). The null hypotheses of these tests are that cross-sectional independence exists, contrasting with the alternative hypotheses proposing cross-sectional dependence. A p-value of 1.0000 indicates that there is minimal to no statistical evidence supporting the rejection of the null hypothesis, which suggests cross-sectional independence. In simpler terms, the test does not offer substantial

backing for the idea that there is cross-sectional dependence among the units within your panel dataset.

Sarafidis and Wansbeek (2012) considers the occurrence of cross-sectional dependence within the error term to be an outcome of inaccuracies in the model's specification. In simpler terms, if the model had been appropriately specified, it would have accounted for cross-sectional dependence, and the resulting error term would have been entirely individual-specific and uncorrelated across different entities.

Endogeneity Test

Endogeneity in regression models refers to the condition in which an explanatory variable correlates with the error term. It can also refer to the correlation between two error terms in structural equation modeling. The presence of endogeneity can lead to biased and inconsistent parameter estimates. Various methods have been proposed to address endogeneity, such as conditional estimating equations models with endogenous selection (Berger & Patilea, 2021), instrumental variables in panel data estimation (Barros et al., 2020), and Gaussian Processes Regression for normative modeling (Xu et al., 2021)

Over the past two decades, there has been a fivefold increase in discussions about endogeneity in prominent academic journals. Despite this growth, endogeneity discussions continue to represent a relatively small portion of the overall research in this field. Endogeneity can arise from various sources, including common-method variance, omitted variables, simultaneity, and measurement error, as highlighted in studies by Wooldridge (2010), Roberts and Whited (2013), and Ullah et al. (2018).

The study adopted the Durbin-Wu-Hausman test to identify potential endogeneity issues. The Durbin-Wu-Hausman test is a widely used method for detecting the endogeneity of individual regressors in regression analysis (Ullah et al., 2018).

3.9 Estimation Procedure

As part of the pre-estimation tests, the study comprehensively assessed the data. This included examining cross-sectional dependence, endogeneity, and multicollinearity. Specifically, cross-sectional dependence and endogeneity tests were conducted to enhance the validity of the analysis, while a multicollinearity test was performed to assess the interrelationships between variables.

Furthermore, to assess the stationarity of the panel data, panel unit root tests were conducted. Specifically, the study applied IPS, LLC, and Hadri unit root tests.

To analyze the relationship between education and corruption, a two-step system GMM approach was employed. To ensure the robustness of the estimates obtained through the two-step system GMM, additional estimations were conducted using pooled OLS and fixed effects models.

To investigate the causal relationship between education and corruption in Sub-Saharan Africa, panel pairwise causality tests were conducted. These rigorous pre-estimation tests and analyses contribute to the robustness and reliability of the study's findings.

3.10 Panel Unit Root Tests

Levin, Lin, and Chu (LLC) Panel Unit Root Test

The LLC (Levin, Lin, and Chu) unit root test is a commonly used method for testing the stationarity of panel data. The LLC unit root test is a panel data test that tests the

null hypothesis that the data is non-stationary. The test was developed by Levin, Lin, and Chu (2002) as an improvement over other panel data tests such as the Im, Pesaran, and Shin (IPS) and the Maddala and Wu (MW) tests. The LLC test is a group-mean panel test, which means that it tests the null hypothesis of a unit root in the individual series as well as in the mean of the series.

The equation specification for the LLC test is as follows:

$$\Delta y_{it} = \alpha_i + \beta_{it} y_{it-1} + \gamma_{it1} \Delta y_{it-1} + \gamma_{it2} \Delta y_{it-2} + \ldots + \gamma_{itp} \Delta y_{it-p} + \varepsilon_{it} \quad \textbf{(4)}$$

Where Δy_{it} is the first difference of dependent variable for country i and time t, α_i is the country-specific constant term, βit is the coefficient on the lagged dependent variable, and $\gamma_{it1}, \gamma_{it2}, \ldots, \gamma_{itp}$ are the coefficients on the lagged first differences of the dependent variable. The term ε_{it} is the error term.

The LLC test is based on the null hypothesis that the individual series in the panel data have a unit root, while the alternative hypothesis is that the individual series are stationary. The test statistic for the LLC test is the t-statistic of the coefficient on the lagged dependent variable, which is calculated as follows:

$$tLLC = \frac{\beta_{it}}{se(\beta_{it})} \quad \textbf{(5)}$$

Where β_{it} is the estimated coefficient on the lagged dependent variable, and $se(\beta_{it})$ is its standard error. If the absolute value of $tLLC$ is greater than the critical value for the specified level of significance, then the null hypothesis of a unit root is rejected, and the series is considered to be stationary. The LLC unit root test is a useful method for testing the stationarity of panel data. The equation specification for the test involves a

first-differenced dependent variable and lagged values of the dependent variable and its first differences. The test statistic is the t-statistic of the coefficient on the lagged dependent variable, and the null hypothesis is a unit root in the individual series.

Im, Pesaran and Shin (IPS) Panel Unit Root Test

The Im, Pesaran, and Shin (IPS) test is a commonly used method to test for unit roots in panel data. It is an extension of the popular Dickey-Fuller (DF) test, and is designed to deal with some of the limitations of the DF test. In particular, the IPS test allows for the presence of cross-sectional dependence in the data, which is an issue that often arises in panel data.

The IPS test is based on the following regression equation:

$$\Delta y_{it} = \alpha_i + \rho_i y_{it-1} + \sum_{i=1}^{k} \gamma_{ij} \Delta y_{t-j} + \varepsilon_{it} \quad \textbf{(6)}$$

Where Δy_{it} is the first difference of dependent variable for country i and time t, ρ is the coefficient of interest, and ε_{it} is an error term. The lagged values of Δy_{it} are included as regressors to control for autocorrelation in the data.

To apply the IPS test, we estimate this equation using OLS, and then compute the IPS test statistic, which is given by:

$$IPS = \frac{T(\hat{\rho}-1)}{\sqrt{(\nu)}} \quad \textbf{(7)}$$

where T is the sample size, $\hat{\rho}$ is the OLS estimate of ρ, and ν is a correction term that accounts for cross-sectional dependence in the data. The IPS test statistic is asymptotically distributed as standard normal under the null hypothesis of a unit root,

and we can compare it to critical values to determine whether to reject or fail to reject the null hypothesis.

The IPS test is often implemented using panel data, where we have multiple time series for different cross-sectional units. In this case, the IPS test takes the following form:

$$\Delta y_{i,t} = \rho y_{i,t-1} + \sum_{j=1}^{p} \beta_j \Delta y_{i-j,t} + \sum_{i \neq j} \gamma_i \Delta y_{i-j,t} + \lambda \bar{y}_i + \varepsilon_{i,t} \quad \textbf{(8)}$$

where the subscripts i and j denote cross-sectional units and lags, respectively, β and γ are lag coefficients, λ is a common intercept, and $\bar{y}_i$ is the cross-sectional average of y_t. This specification allows for both individual-specific and time-specific effects, and can be estimated using standard panel data techniques such as fixed effects or first differences. By accounting for cross-sectional dependence, the IPS test can provide more accurate and reliable results compared to traditional unit root tests.

Hadri Panel Unit Root Test

The Hadri test is a unit root test that extends the Levin, Lin, and Chu (LLC) test by allowing for structural breaks in the series. The test was developed by F. Hadri in 2000 and is widely used in empirical research. The Hadri test is applicable when the data series may have undergone one or more structural breaks but the timing and number of breaks are unknown. The test can be used to determine whether a series is stationary or has a unit root.

The Hadri test is based on the regression equation:

$$\Delta y_{it} = \alpha_0 + \alpha_1 t + \lambda y_{t-1} + \sum_{i=1}^{k} \beta_i \Delta y_{t-i} + \varepsilon_{it} \quad \textbf{(9)}$$

where Δy_{it} is the first difference of the panel variable y, t is a linear trend variable, λ is the coefficient of the lagged dependent variable y_{t-1}, β_i are the coefficients of the lagged first difference variables, and ε_{it} is the error term.

The null hypothesis of the Hadri test is that the series has a unit root, while the alternative hypothesis is that the series is stationary. The test statistic is computed as follows:

$$HT = \frac{T(\beta)}{\beta^2} \quad \textbf{(10)}$$

where $T(\beta)$ is a test statistic for the joint hypothesis of $\beta_1 = \beta_2 = \ldots = \beta_p = 0$, and p is the maximum number of lags of the first difference that are included in the regression. The Hadri test statistic follows a chi-squared distribution with degrees of freedom equal to the number of structural breaks estimated in the series.

To conduct the Hadri test, the researcher first estimates the above regression equation and obtains the value of the test statistic HT. The null hypothesis of the unit root is rejected if the test statistic is greater than the critical value from the chi-squared distribution at a given level of significance. The Hadri unit root test is a useful tool for detecting the presence of a unit root in a time series data that may have undergone structural breaks. By accounting for these breaks, the test provides a more accurate assessment of the stationarity of the series.

3.11 Estimation of Two-step System GMM

The choice of this technique depended strictly on the fact that the number of cross sections used (27 SSA countries) were more than the time periods (8 years) which is a

basic requirement for the use of the 2-step GMM estimator. The choice of the time and number of countries were influenced by availability and completeness of data.

The 2-step system GMM panel estimation technique is based on the Generalized Method of Moments (GMM) framework and it is a combination of two different GMM procedures. Given that the country-specific effects are significant (see appendix D), including country-specific terms and the idiosyncratic error term yields estimable equations for level (adopting equation 2) and 1st difference. The level equation is specified as:

$$Corrupt_{it} = \psi_0 + \psi_1 Corrupt_{i,t-1} + \psi_2 Prim_{it} + \psi_3 Sec_{it} + \psi_4 Ter_{it} + \psi_5 Educatex_{it} + \psi_6 TO_{it} + \psi_7 INF_{it} + \psi_8 GE_{it} + \psi_9 GDPPC_{it} + \varepsilon_{it} \quad \textbf{(11)}$$

The first difference equation is then specified as:

$$Corrupt_{it} - Corrupt_{i,t-1} = \psi_1(Corrupt_{i,t-1} - Corrupt_{i,t-2}) + \psi_2(Prim_{it} - Prim_{i,t-1}) + \psi_3(Sec_{it} - Sec_{i,t-1}) + \psi_4(Ter_{it} - Ter_{i,t-1}) + \psi_5(Educatex_{it} - Educatex_{i,t-1}) + \psi_6(TO_{it} - TO_{i,t-1}) + \psi_7(INF_{it} - INF_{i,t-1}) + \psi_8(GE_{it} - GE_{i,t-1}) + \psi_9(GDPPC_{it} - GDPPC_{i,t-1}) + (\varepsilon_{it} - \varepsilon_{i,t-1}) \quad \textbf{(12)}$$

In the first step of the 2-step system GMM panel estimation technique, the moment conditions are constructed using the lagged levels of the endogenous variables. The first step estimator is consistent but not efficient, as it does not exploit the additional information available in the first differences of the variables.

In the second step of the 2-step system GMM panel estimation technique, the moment conditions are constructed using the first differences of the variables. This estimator is

both consistent and efficient, as it exploits the additional information available in the first differences of the variables. The 2-step system GMM panel estimation technique can be used to estimate a wide range of panel data models, including dynamic panel data models. The two sets of moment conditions in the 2-step system GMM panel estimation technique is given by:

$$\Gamma_1(\beta) = E[z_{it}(\varepsilon_{it} - \mu_i)] = 0 \quad \textbf{(13)}$$

$$\Gamma_2(\beta) = E\left[z_{it}\left(y_{i,t-1} - \mu_i\right)\right] = 0 \quad \textbf{(14)}$$

where $\Gamma_1(\beta)$ and $\Gamma_2(\beta)$ are the moment conditions for the first and second step estimators, respectively, z_{it} is a vector of endogenous variables, $y_{i,t-1}$ is the lagged dependent variable. The 2-step system GMM panel estimation technique involves estimating the first step estimator using the lagged levels of the endogenous variables, and then using the estimates from the first step estimator to construct the moment conditions for the second step estimator using the first differences of the variables. The 2-step system GMM panel estimation technique is a powerful econometric method for estimating panel data models with endogeneity problems. It allows researchers to obtain consistent and efficient estimates of the parameters of interest, even in the presence of endogeneity and other complex modeling issues.

3.12 Post Estimation (Robustness Checks)

To validate the robustness of the estimated coefficients obtained through the two-step system GMM regression in accordance with prior studies (Akinbode et al., 2020; Forson et al., 2016; Lio et al., 2011; Roodman, 2009), additional estimation techniques

were employed, including fixed effect and pooled OLS. Comparing these coefficients allows for a comprehensive assessment of the relationship under investigation.

The two-step system GMM model's coefficient for the lagged dependent variable is expected to fall between the coefficients obtained from the pooled OLS and the fixed effect estimates (Akinbode et al., 2020). Furthermore, the coefficient should indicate convergence by being less than unity in absolute value; otherwise, the validity of the System GMM is compromised (Roodman, 2006). By conducting these additional model estimations, the study ensures robustness in the results and confirms the consistency of the estimated coefficients across different regression techniques.

Fixed Effect

To account for potential time-invariant unobservable heterogeneity across countries, I also estimate the model using the fixed effects (FE) approach. The FE estimator controls for all time-invariant differences across countries that may be correlated with both corruption and education. The FE model specification follows shall be estimated using equation (2). The FE estimator will allow me to identify the within-country variation in the relationship between education and corruption over time, which is particularly relevant if there are country-specific factors that influence both corruption and education but are time-invariant.

Pooled Ordinary Least Squares (POLS)

To investigate the relationship between education and corruption perception in sub-Saharan Africa, we employed a panel of 27 countries covering the period 2012-2019. Our dependent variable is the corruption perception index from Transparency International, which ranges from 0 (highly corrupt) to 100 (very clean). Our main

independent variables are the enrollment rates for primary, secondary and tertiary education, and an educational index known as educatex. We also controlled for inflation, government effectiveness, trade openness, and GDP per capita to account for other potential determinants of corruption perception.

The panel pooled OLS estimation technique allows us to estimate the effect of education on corruption perception while controlling for time-invariant unobserved heterogeneity across countries. The specification of our model for POLS also follows equation (2).

3.13 Specification Testing in Dynamic Panel Models

When using Generalized Method of Moments (GMM) estimation in dynamic panel models, it is important to perform specification tests to ensure that the model is well-specified, and the assumptions of the model are not violated. Two commonly used tests in GMM estimation are the Hansen and Sargan tests.

The Hansen test, also known as the overidentification test, is used to test for the validity of the overidentifying restrictions in the model. The test statistic is based on the difference between the GMM objective function value and its asymptotic variance under the null hypothesis that the overidentifying restrictions are valid. If the test statistic is small and insignificant, then the overidentifying restrictions are valid and the model is well-specified. However, if the test statistic is large and significant, then the overidentifying restrictions are violated and the model is mis-specified.

The Sargan test, also known as the overidentification test for the validity of instruments, is used to test for the validity of the instruments used in the GMM estimation. The test

statistic is based on the difference between the GMM objective function value and the Efficient GMM objective function value, which assumes that the instruments are valid. If the test statistic is small and insignificant, then the instruments are valid, and the model is well-specified. However, if the test statistic is large and significant, then the instruments are invalid, and the model is mis-specified.

The Hansen and Sargan tests are important specification tests to perform when using GMM estimation in dynamic panel models. These tests ensure that the model is well-specified, and the instruments used are valid, which increases the reliability and validity of the results.

3.14 Testing for Residual Serial Correlation

The tests for residual serial correlation are important in dynamic panel models because they help to assess whether the residuals are serially correlated or not. Serial correlation occurs when the error terms in a time series are correlated with one another over time. This can lead to biased and inconsistent estimates of the coefficients in the model and can also affect the efficiency of the estimation procedure. The AR (1) and AR(2) tests are commonly used to test for residual serial correlation in panel data models. The AR (1) test checks for first-order autocorrelation, while the AR(2) test checks for second-order autocorrelation. These tests are based on the lagged residuals and are conducted after running the regression. The null hypothesis of both tests is that there is no serial correlation in the residuals, while the alternative hypothesis is that there is some form of serial correlation. If the null hypothesis is rejected, it suggests that the residuals are serially correlated, and additional steps may be necessary to correct for this.

Empirical studies have shown that ignoring serial correlation in the residuals of panel data models can lead to biased and inconsistent estimates of the coefficients, resulting in incorrect inference and potentially misleading policy implications (Breitung and Das, 2005; Baltagi et al., 2007). These tests have been found to have high power to detect serial correlation and are widely used in empirical studies. Therefore, testing for residual serial correlation, particularly using AR(1) and AR(2) tests, is an important step in ensuring the validity and reliability of the estimates in panel data models.

3.15 Panel Causality test

The empirical analysis employed a pairwise panel causality test to examine the causal relationship between the variables. The test was conducted using panel data, which accounts for both cross-sectional and time-series dimensions. The specifications for the pairwise panel causality test are as follows:

For a unidirectional causal relationship from Education (Educ) to Corruption:

$$Corrupt_{it} = \alpha Corrupt + \sum(\beta Educ) Educ_{it} + \varepsilon_{it} \quad \textbf{(15)}$$

For a unidirectional causal relationship from Corruption to Education:

$$Educ_{it} = \alpha Educ + \sum(\beta Corrupt) Corrupt_{it} + \varepsilon_{it} \quad \textbf{(16)}$$

For a bidirectional (feedback) causal relationship between Education and Corruption:

$$Corrupt_{it} = \alpha Corrupt + \sum(\beta Educ) Educ_{it} + \sum(\gamma Corrupt) Corrupt_{i,t-1} + \varepsilon_{it} \quad \textbf{(17)}$$

$$Educ_{it} = \alpha Educ + \sum(\beta Corrupt) Corrupt_{it} + \sum(\gamma Educ) Educ_{i,t-1} + \varepsilon_{it} \quad \textbf{(18)}$$

In these equations, Corrupt_{it} represents the dependent variable, Educ_{it} represents the independent variable, $\alpha\text{Corrupt}$ and $\alpha Educ$ are intercept terms, βEduc and $\beta\text{Corrupt}$ are coefficients indicating the strength of the causal relationship from education to corruption and from corruption to education, γEduc and $\gamma\text{Corrupt}$ are coefficients representing the feedback relationship, and εit denotes the error term.

The pairwise panel causality test assesses whether the coefficients βEduc and $\beta\text{Corrupt}$ (and γEduc and $\gamma\text{Corrupt}$ for bidirectional relationships) are statistically significant, indicating the presence of a causal relationship between the variables. The significance of these coefficients helps determine the direction and magnitude of the causal influence.

By conducting the pairwise panel causality test, this study aims to uncover the causal dynamics between the variables and provide empirical evidence for their relationship in the panel data context.

3.16 Data Analysis

The research adopted a comprehensive approach, combining descriptive and quantitative analysis to uncover key insights. To facilitate descriptive analysis, visually appealing tools such as graphs and tables were employed.

To ensure robustness, panel unit root tests were conducted on the variables to determine their order of integration, effectively mitigating the risks of spurious regression. This crucial step enabled the utilization of the 2-step estimation technique, deemed the most appropriate given the characteristics of the data. Cointegration is, however, necessary when you have variables that are non-stationary (i.e., have a unit root) and you want to

investigate whether there is a long-run relationship between them. Cointegration tests were not conducted because the variables were found to be stationary at levels, (I(0)), from the unit root tests.

The data analysis was performed utilizing the STATA 17 software package developed by STATA Corporation (2019). The estimation of the sGMM (system GMM) model was executed employing the xtabond2 command, which incorporates built-in tests to assess the validity of the instruments. To enhance the reliability of the outcomes, supplementary estimations were carried out, utilizing the fixed effect model estimated via the xtreg command, indicated by the inclusion of "fe" at the end. Additionally, the pooled OLS (Ordinary Least Squares) model was estimated using the reg command (with robust option). These additional analyses were implemented to ensure the robustness and consistency of the obtained results.

To delve into the causal relationship between construction education and corruption in SSA, a pairwise panel causality test was conducted. This rigorous analysis aimed to uncover any causal connections between the variables under scrutiny. To carry out these analyses, the study relied on cutting-edge software such as Stata version 17 and E-Views 12, ensuring accurate and efficient estimations throughout the research process.

By embracing a multidimensional approach encompassing both descriptive and quantitative analysis, this study sheds light on the relationship between education and corruption in SSA, providing valuable insights for policymakers, researchers, and stakeholders alike.

3.17 Chapter Summary

This chapter presents the methodological framework employed for conducting the study, tailored to its specific objectives. The theoretical foundations of the model utilized in this research draw from principal-agent theory, bad apple theory, collective action theory, and institutional theory. These theories provide a conceptual basis for understanding the relationship between education and corruption.

The study utilized panel data consisting of annual time series data spanning from 2012 to 2019, encompassing 27 sub-Saharan African countries. The selected variables for analysis include the corruption perception index, primary enrollment, secondary enrollment, tertiary enrollment, educatex, GDP per capita, trade openness, inflation, and government effectiveness. These variables were chosen to capture relevant aspects of education and corruption, as well as their potential determinants.

To ensure the reliability of the analysis, the study conducted panel unit root tests, including the IPS, LLC, and Hadri tests, to verify that the variables were not integrated at higher orders than one, thereby avoiding spurious regression.

The primary estimation technique employed in this study was the 2-step system GMM. This methodological approach allows for efficient estimation while considering potential endogeneity and other econometric challenges. Robustness checks were also performed to validate the accuracy and consistency of the estimates derived from the 2-step system GMM.

Finally, the study explored the causal relationship between education and corruption in sub-Saharan Africa using pairwise Granger panel causality tests. This analysis sought

to identify any causal links between these variables and provide insights into the dynamics of their relationship.

The systematic framework presented in this chapter establishes a strong foundation for examining the relationship between education and corruption. It not only guides the estimation process but also informs the interpretation of the results in subsequent chapters.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.0 Introduction

This section focused on presenting and discussing the results obtained from the estimation techniques in the previous chapter. Various theoretical and empirical models used in the methodology framework were tested with data, and the results were discussed accordingly. The section began with the presentation and discussion of descriptive statistics, pre-estimation tests, panel unit root tests, Generalized Method of Moments (GMM) with pooled OLS and fixed effects estimates, as well as pairwise Granger causality test results.

4.1 Descriptive Statistics

Table 3 provides an overview of the sample's descriptive statistics, taking into consideration the panel data structure for the various variables across 27 nations in Sub-Saharan Africa (SSA) using secondary data from 2012 to 2018. It presents both country-level and time-specific statistics, allowing us to observe variations within individual countries over time. The within-country patterns represent deviations from each country's average across the observed time period. The primary descriptive statistics considered include the mean, standard deviation, minimum, and maximum values for each variable.

From table 3 below, the total observations were 216. Between 2012 and 2019, the mean value of 35.576 for the corruption perception index for the SSA region suggests that the average value of the dataset is around this number. The standard deviation is about 11.36, and the minimum CPI value observed during this period is 17 (Burundi in 2013),

which suggests instances of relatively high perceived corruption and the maximum value of 66 (Seychelles in 2012 and 2013) represents lower perceived corruption.

Table 3: Descriptive Statistics

Variable		Mean	Std. dev.	Min	Max	Obs.	
CPI	overall	35.58	11.36	17.00	66.00	N =	216
	between		11.32	19.88	58.19	n =	27
	within		2.24	28.58	43.39	T =	8
Educatex	overall	1.39e-09	1.35	-1.99	4.29	N =	216
	between		1.34	-1.66	3.91	n =	27
	within		0.29	-1.52	1.89	T =	8
Primary Enrollment	overall	105.74	18.81	66.42	147.57	N =	216
	between		18.70	70.48	144.93	n =	27
	within		3.96	93.00	116.01	T =	8
Secondary Enrollment	overall	51.95	22.55	15.06	109.44	N =	216
	between		22.50	21.11	104.29	n =	27
	within		4.28	28.81	72.356	T =	8
Tertiary Enrollment	overall	10.48	8.30	0.82	44.39	N =	216
	between		8.09	1.20	40.12	n =	27
	within		2.36	-0.64	25.10	T =	8
Inflation	overall	4.73	19.74	-67.95	255.31	N =	216
	between		9.97	-30.82	33.50	n =	27
	within		17.12	-32.41	226.53	T =	8
Government Effectiveness	overall	-0.66	0.63	-1.74	1.16	N =	216
	between		0.64	-1.66	1.02	n =	27
	within		0.10	-0.99	-0.38	T =	8
Trade Openness	overall	0.72	0.36	0.22	2.18	N =	216
	between		0.36	0.32	2.03	n =	27
	within		0.08	0.52	0.97	T =	8
GDP per capita	overall	7.12	0.94	5.41	9.76	N =	216
	between		0.95	5.54	9.64	n =	27
	within		0.10	6.80	7.46	T =	8

Notes: Std. Dev. denotes Standard deviation; Obs. denotes Observations

Source: Author's Estimation, 2023

Similarly, the average primary enrollment rate, when considering all data points, stands at around 105.74%. This figure suggests a relatively high average rate of primary school enrollment. However, there is notable variability, as indicated by a standard deviation of approximately 18.81, signifying variations in primary enrollment rates across different time periods and regions. These variations could be attributed to factors like shifts in education policies and demographic changes. The lowest observed primary enrollment rate during the study period is approximately 66.42% (recorded in Niger in 2019), while the highest rate is around 147.57% (noted in Rwanda in 2012). This wide range underscores significant disparities in primary enrollment rates both among countries and over the years.

Moreover, the overall mean secondary school enrollment rate across all observations is approximately 51.95%. The standard deviation is about 22.55, the minimum secondary enrollment rate observed during this period is approximately 15.06% (Niger in 2012), while the maximum rate is approximately 109.44% (South Africa in 2015).

Additionally, when considering all data points, the average tertiary school enrollment rate is approximately 10.48%. This implies that, on average, a relatively modest fraction of the population is participating in tertiary education. However, there is significant variability, with a standard deviation of about 8.30, indicating notable differences in tertiary enrollment rates across various time periods and geographical units. These variations may be influenced by factors such as accessibility to higher education and economic circumstances. The lowest recorded tertiary enrollment rate during the study period is approximately 0.82% (observed in Malawi in 2015), while the highest rate is approximately 44.39% (recorded in Mauritius in 2019). This wide

range underscores substantial disparities in tertiary enrollment rates among both countries and years.

The average Educational Index, considering all data points, is approximately 1.39e-09. This indicates an extremely low mean value for the Educational Index across the dataset. The standard deviation is about 1.35, demonstrating a significant degree of variability in the Educational Index across different time periods and cross-sectional units. During the study period, the lowest recorded value for the Educational Index is approximately -1.99 (observed in Niger in 2012), while the highest value is approximately 4.29 (recorded in Mauritius in 2019). These wide-ranging values reflect substantial disparities in the Educational Index among various countries and over different years.

The mean inflation rate across all observations is approximately 4.73%. This suggests that, on average, inflation rates are relatively moderate across the dataset. However, the standard deviation of about 19.74 indicates a substantial degree of variation in inflation rates across different time periods and cross-sectional units. This variation may be attributed to factors like economic conditions and government policies. The lowest recorded inflation rate during this period is approximately -67.95% (observed in Comoros in 2018), while the highest rate is approximately 255.31% (recorded in Zimbabwe in 2019). These extreme values signify significant disparities in inflation rates among various countries and over different years.

The average government effectiveness score across all observations is roughly -0.66. This indicates that, on average, the perceived government effectiveness in the dataset tends to be on the lower side. The standard deviation, approximately 0.63, reflects some

degree of variation in government effectiveness scores over different time periods and cross-sectional units. This variation may stem from factors related to governance, public administration, and the implementation of policies. During this period, the lowest government effectiveness score was approximately -1.74, observed in Comoros in 2014, while the highest score reached approximately 1.16, recorded in Mauritius in 2014 and 2015.

Trade openness serves as a gauge of a country's level of engagement in international trade and investment. The average trade openness value is 0.72. Notably, the maximum value, reaching 2.18 in Seychelles in 2019, highlights that certain countries in the region demonstrate a relatively high degree of trade openness. Conversely, the minimum score, registering at 0.22 in Burundi in 2017, suggests that some countries tend to have a more closed stance when it comes to international trade and investment. The standard deviation for trade openness in SSA is 0.37, indicating a moderate degree of variability in these values. It's worth noting that there are more countries with lower trade openness values than higher ones, implying that a few nations exhibit very high levels of trade openness.

GDP per capita, a widely accepted indicator of a country's economic performance and living standards, had an average logged value of 7.12 during this period. Notably, the maximum recorded value reached 9.77 in Seychelles in 2019, underscoring that certain countries in the region boast a relatively high GDP per capita. Conversely, the minimum value, standing at 5.41 in Burundi in 2019, indicates that some countries in the region grapple with significantly lower GDP per capita figures. The standard deviation for GDP per capita in SSA is 0.94, signifying a substantial degree of

variability in these values. In essence, these descriptive statistics imply that the average GDP per capita in SSA is relatively modest, exhibiting a high level of divergence across countries, and with the majority of nations in the region experiencing lower GDP per capita levels.

4.2 Pre-estimation Test Results

Multicollinearity Test Results

The study used variance inflation factor to test for the presence of multicollinearity. Following Hair et al., (1995) and O'brien (2007) who asserts that VIF greater than 4 implies multicollinearity is present and hence we can segregate the variables in different regressions to deal with the issue. Secondary and tertiary school enrollments had VIF values which were greater than 4 (i.e., 4.16 and 4.12 respectively, see appendix E(a)) when all variables were included without segregation of the education variables. The segregation of the measures of education (see appendix E(b)) solved the problem hence no significant multicollinearity was detected in the study.

Cross-Sectional Dependence Test Results

De Hoyos and Sarafidis (2006) introduced a Stata tool known as "xtcsd" with the purpose of evaluating the presence of cross-sectional dependence in panel datasets that feature numerous cross-sectional units and a limited number of time-series observations. This command executes three separate testing approaches: it begins with Friedman's test statistic, proceeds to the statistic devised by Frees, and concludes with the utilization of Pesaran's Cross-Sectional Dependence (CD) test. The results are presented in table 4 below.

Table 4: Tests for Cross-Sectional Dependence in Residuals of Estimable Model

Test	Statistic	Value	P-value
Friedman	$R_{ave} = \frac{2}{N(N-1)} \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \hat{r}_{ij}$	-1.609	1.000
Frees	$R_{ave}^{2} = \frac{2}{N(N-1)} \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \hat{r}^{2}{}_{ij}$	-0.019	0.358
Pesaran	$CD_p = \sqrt{\frac{TN(N-1)}{2}} (\sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \hat{\rho}_{ij})$	0.714	0.108

Source: Author's Estimation, 2023

Table 4 presents the estimation of three statistics designed to investigate the existence of cross-sectional dependence in the residuals of the model being analyzed. In all cases, these statistics do not exhibit statistical significance, which corroborates the assumption that there is no cross-sectional dependence in the residuals of the model being estimated. The study calculated the average absolute correlation of the residuals using the "abs" option in the xtcsd command, resulting in an average value of 0.345. This relatively low average correlation indicates strong evidence for cross-sectional independence. In other words, it suggests that, on average, the cross-sectional units in the dataset are not strongly correlated with each other, supporting the assumption of cross-sectional independence.

Endogeneity Test Results

The study initially employed OLS analysis and applied the Durbin-Wu-Hausman test to identify potential endogeneity issues. The Durbin-Wu-Hausman test is a widely used method for detecting the endogeneity of individual regressors in regression analysis. In

this context, it was utilized to assess endogeneity within the OLS regression model (Ullah et al., 2018).

Following the method elucidated by Ullah et al. (2018), the study executed an endogeneity assessment, commencing with the initial step of running Ordinary Least Squares (OLS) regressions for each independent variable in the study (the main dependent variable used for this study was Corruption Perception Index). These independent variables were, in turn, treated as dependent variables one by one. In this process, residuals were predicted for each of these regressions and subsequently employed as regressors. Subsequently, the study probed the significance of the coefficients associated with these residuals.

The regression results unveiled a key distinction: the measures of education (comprising Primary Enrollment, Secondary Enrollment, Tertiary Enrollment, and the composite Educational Index) emerged as exogenous, as the coefficients of their respective residuals exhibited a high degree of insignificance. Conversely, the residuals stemming from the other independent variables, which were deployed as dependent variables, demonstrated notable significance. Notably, Trade Openness, the logarithm of GDP per Capita, Inflation, and Government Effectiveness were identified as endogenous variables based on the high significance of their residuals.

4.3 Panel Unit Root Test Results

It is important to determine the stationarity of the variables used for this study in order to ensure that no variable is integrated of order 2, I(2). Stationarity is an important property because it ensures that the statistical properties of the data do not change over

time. The study adopted Levin, Lin & Chu t*, Im, Pesaran and Shin W-stat, and the Hadri unit root test techniques. The results are presented in table 5 below.

Table 5: Results of Panel Unit Root Tests at Level

Variables	Constant			Constant and trend		
	LLC	**IPS**	**Hadri**	**LLC**	**IPS**	**Hadri**
CPI	-5.760***	0.220	11.485***	-7.301***	-2.287**	2.211**
Educatex	-1.137	1.283	16.925***	-37.03***	-0.838	6.081***
Primary Enrollment	-4.262***	3.197	13.132***	-4.0e+03***	1.467	5.804***
Secondary Enrollment	-0.523	1.820	15.465***	-5.5e+05***	-5.476***	6.798***
Tertiary Enrollment	-0.55	4.650	16.521***	1.2e+05	-4.7384***	6.329***
Inflation	-0.650	-2.07**	5.271***	-6.702***	-1.936**	4.028***
Government Effectiveness	-11.677***	-0.275	10.677***	-1.6e+02***	-1.616*	2.837***
Openness	-7.543***	-1.316*	5.304***	-16.375***	-1.721**	2.751***
GDP per capita	-5.184***	0.474	12.420***	-12.560***	-1.816**	4.033***

*Notes: *, **, and *** indicate significance at 10 %, 5% and 1% respectively.*

Source: Author's Estimation, 2023

Table 5 presents the results of the LLC, IPS, and Hadri unit root tests with constant only and constant and trend, when both are investigated at levels. The findings clearly show that practically all variables are stationary at levels. The study came to the conclusion that the corruption perception index, educatex, primary enrollment, secondary enrollment, tertiary enrollment, government effectiveness, GDP per capita, trade openness, inflation variables are all stationary at levels (i.e., I (0)), based on the panel unit root tests.

4.4 Panel Regression Results

The findings obtained from the estimated System GMM are summarized in Tables 6 and 7. The interpretation of the estimates considers the direction (+/-) of the coefficients, indicating whether a one-unit increase in the independent variable leads to

an increase or decrease in the dependent variable. The magnitude of the effect is determined by the corresponding coefficients (Abotsi, 2018).

In terms of the sign (+/-) of the estimates, variables with positive coefficients exert a negative effect on corruption. This implies that an increase in these variables will correspondingly reduce corruption. On the other hand, variables with negative coefficients exhibit a positive effect on corruption. Thus, an increase in these variables will result in an increase in corruption.

From tables 6 and 7, AR(1) remains significant for all specifications at 1% significance level leading to the rejection of no first order autocorrelation whilst the AR(2) remains statistically insignificant for all specifications. It is expected that the residuals of the 2-step system GMM should contain first order autocorrelation AR(1) but not the second order, AR(2). The conditions for instrument validity and correct model specifications are also met as the Hansen and Sargan coefficients remain statistically insignificant. The implication here is that the models were correctly specified and the instruments used were valid. The wald statistics of joint significance were also highly significant (1% significance level). It should be noted that the cross-groups (27) of all the specifications were consistently more than the instruments (20 and 22) used, hence the issue of instrument proliferation and over specification which could lead a bias of the statistics of the instrument validity tests are avoided (Da Silva & Cerqueira, 2017).

Table 6: Results of 2-Step System GMM (dependent variable: CPI)

Variable	(1)	(2)	(3)	(4)	(5)
Lag of Corruption	0.7237***	0.7050***	0.6812***	0.7492***	0.6947***
	(0.1370)	(0.1398)	(0.1406)	(0.1329)	(0.1239)
Constant	18.3522**	12.8031*	19.4377**	14.0344**	19.2798**
	(8.3077)	(7.2182)	(8.4313)	(6.0141)	(9.0835)
Educatex	0.5947**	-----	-----	-----	-----
	(0.3594)				
Primary	-----	0.0107	-----	-----	-0.0050
Enrollment		(0.0115)			(0.0149)
Secondary	-----	-----	0.0447**	-----	0.0598**
Enrollment			(0.0210)		(0.0297)
Tertiary	-----	-----	-----	0.0441	-0.0655
Enrollment				(0.0438)	(0.0648)
GDP per capita	-0.8798**	-0.1355	-1.0839	-0.5060	-1.0838
	(0.6013)	(0.4205)	(0.7126)	(0.4762)	(0.7045)
Openness	1.2135	0.9300	1.3629	1.0440	1.3402
	(1.3109)	(1.4268)	(1.4564)	(1.2642)	(1.4228)
Inflation	-0.0378*	-0.0398	-0.0451*	-0.0324	-0.0424*
	(0.0230)	(0.0256)	(0.0269)	(0.0201)	(0.0242)
Government	4.2434**	4.6853*	5.0203**	3.8905*	4.9817**
effectiveness	(2.3112)	(2.4694)	(2.4227)	(2.2747)	(2.3850)
Time Effect	Yes	Yes	Yes	Yes	Yes
2012 (dummy)	-----	-----	-----	-----	----
2013 (dummy)	-----	-----	-----	-----	----
2014 (dummy)	-0.0300	0.0384	-0.0117	-0.0231	-0.0004
	(0.4605)	(0.4546)	(0.4430)	(0.4827)	(0.4446)
2015 (dummy)	-0.0407	-0.0008	-0.0204	-0.0392	0.0140
	(0.5727)	(0.6349)	(0.5537)	(0.6020)	(0.5371)
2016 (dummy)	-0.3417	-0.2081	-0.3698	-0.2799	-0.3461
	(0.7054)	(0.7235)	(0.7216)	(0.7065)	(0.7288)
2017 (dummy)	-0.0745	-0.0951	-0.0451	-0.1014	-0.0099
	(0.5249)	(0.5541)	(0.5466)	(0.5316)	(0.5511)
2018 (dummy)	-0.8779	-0.9368	-0.8509	-0.9607	-0.7960
	(0.5460)	(0.5560)	(0.5346)	(0.5699)	(0.5335)
2019 (dummy)	----	----	----	----	----
AR (1)	-2.89	-2.85	-2.77	-3.04	-3.01
	[0.004]	[0.004]	[0.006]	[0.002]	[0.003]
AR (2)	0.69	0.72	0.76	0.65	0.74
	[0.491]	[0.473]	[0.450]	[0.517]	[0.461]
Sargan (OIR)	10.65	11.69	10.27	11.38	10.70
	[0.155]	[0.111]	[0.174]	[0.123]	[0.152]
Hansen (OIR)	5.17	5.75	5.42	5.34	5.33
	[0.639]	[0.569]	[0.609]	[0.619]	[0.620]
Wald (Joint)	2259.66***	2024.42***	2251.43***	2549.88 ***	3168.27***
Instruments	20	20	20	20	22
Countries	27	27	27	27	27
Observations	189	189	189	189	189

*The significance levels 1%, 5% and 10% are denoted by ***, **, and * respectively. Standard errors are in parenthesis (), while p-values are in brackets []. AR(1): First Order Autocorrelation test. AR(2): Second Order Autocorrelation test. OIR: Overidentifying Restrictions test. Time dummies that were omitted were due to issues of collinearity.*

Source: Author's Estimation, 2023

From table 6 (and all other subsequent regression tables), the coefficients for the lag of corruption are consistently significant (***), with a range of values from 0.6812 to 0.7492. The positive and statistically significant coefficients in all columns suggest that past levels of corruption have a strong influence on the current level of corruption. On average, a one-unit increase in the lag of corruption is associated with a range of 0.6812 to 0.7492-unit increase in the Corruption Perceptions Index (CPI) across all specifications.

The coefficient for log of GDP per capita is statistically significant at the 5% level (**) in one out of five specifications. This suggests that, on average, a one-percent increase in the GDP per capita is associated with a 0.8798 unit decrease in the Corruption Perceptions Index (CPI) in the 1st specification. By implication, a rise in GDP per capita leads to a rise in corruption which is not consistent with expectation. However, this is in line with the empirical finding from a study by Maria et al., (2021) who found out that increased GDP per capita leads to a rise in corruption levels and attributed it to sharp inequalities in these developing countries. The findings are however contradictory to the works of (Aidt et al., 2008; Felipe, 2014; Moiseev et al., 2020) who found no significant relationship between GDP per capita and corruption.

The educational index, known as educatex, which is a measure of lifelong learning is significant at 5% significance level and negatively related to corruption as expected. An additional year, dedicated to education in the lifetime of an individual improves the corruption perception score by 0.5947 units holding other factors constant. This finding indicates that as the level of lifelong learning increases, it is associated with higher corruption perception scores. In other words, a higher emphasis on education and

lifelong learning in the region may contribute to a better understanding and awareness of corruption issues, leading to higher reported levels of corruption perception scores. This is in line with the empirical work of Asongu et al. (2015) but contrary to the findings from Maria et al. (2021) who didn't find significant effect on corruption.

Secondary school enrollment is significant at 10% in both 3rd and 5th specification and negatively affects corruption as expected and validates the finding of Maria et al., (2021) who found out that secondary school enrollment significantly reduced corruption in both developed and developing countries of G20 member states. This implies that an increase in secondary school enrollment rate by a unit increases the CPI scores by 0.0447 – 0.0598 units. The result is further in line with the finding of Lio et al., (2011) but contradicts the findings of Forson et al., (2016) who found out that secondary school enrollment was less associated with corruption (i.e. secondary school enrollment had no direct effect on corruption).

Inflation was statistically significant at 10% significance level for 3 out the 5 specifications in the table 6 above. Consistent with expectation, inflation has a positive effect on corruption. A persistent rise in the general price levels by 1 unit leads to a rise in the corruption levels in the region by 0.0378 – 0.0451 units (i.e., specifications 1, 3 and 5). These findings are consistent with the works of (Akça et al., 2012; Altiner, 2016; Unver & Koyuncu, 2016)

Government effectiveness was significant at 5% and 10% significance levels for all the 5 specifications. As expected, government effectiveness negatively affects corruption. This implies that the higher the government effectiveness index, the cleaner the region from corruption. A unit increase in Government effectiveness index leads to an increase

in CPI scores by 3.8905 – 5.0203 units across all specifications. This is in line with the findings from (Asongu, 2013; Brewer et al., 2008; Maria et al., 2021) but contradicts the findings of (Kapoor & Ravi, 2012; Ramesh & Vinayagathasan, 2018) who found government effectiveness to be statistically insignificant.

The absence of significant time-specific effects from the various specifications in table 6 (which suggests that there were no major shifts of the frontier observed for the years featured in the study) led to the replication of same specifications without the time-specific effects in table 7. The results presented in table 7 are very similar to that of table 6.

Comparing the estimates in table 7 to that of table 6, there were only minor reductions in the coefficients, reducing the effects these variables have on corruption. Secondary enrollment and lifelong learning index remain statistically significant at 5% significance levels, in table 7 with signs consistent with those in table 6. GDP per capita, Inflation and government effectiveness produced estimates which were consistent with those produced in table 6 at 5% and 10% significance levels.

Table 7: Results of 2-step system GMM (Without Time Effects)

Variable	(1)	(2)	(3)	(4)	(5)
Lag of Corruption	0.7765*** (0.0889)	0.6868*** (0.1291)	0.7292*** (0.1028)	0.8197*** (0.0946)	0.8261*** (0.1608)
Constant	15.3348*** (5.0537)	7.4801 (8.5865)	29.8620* (15.5094)	18.7962 (12.0081)	8.1473 (10.0570)
Educatex	0.5919** (0.2873)	-----	-----	-----	----
Primary Enrollment	-----	0.0404 (0.0448)	-----	-----	0.0053 (0.0155)
Secondary Enrollment	-----	-----	0.0822** (0.0325)	-----	0.0142 (0.0514)
Tertiary Enrollment	-----	-----	-----	0.1220 (0.0596)	-0.0370 (0.1237)
GDP per capita	-0.7371* (0.4238)	-0.4007 (0.7032)	-3.1059* (1.8498)	-1.7209 (1.3270)	-0.1561 (0.6930)
Openness	0.6065 (1.1282)	0.0139 (1.3662)	2.1396 (2.1079)	1.4145 (1.8229)	0.1221 (1.5858)
Inflation	-0.0366* (0.0212)	-0.0629* (0.0363)	-0.0740** (0.0545)	-0.0583 (0.0553)	-0.0156 (0.0343)
Government effectiveness	3.4821** (1.4968)	4.7647** (2.0844)	5.5532* (2.8417)	3.5218* (2.5307)	2.8815 (2.9401)
Time Effect	No	No	No	No	No
AR (1)	-3.16 [0.002]	-2.76 [0.006]	-2.63 [0.009]	-3.01 [0.003]	-3.02 [0.003]
AR (2)	0.60 [0.551]	0.76 [0.444]	0.82 [0.410]	0.65 [0.518]	0.50 [0.616]
Sargan (OIR)	12.99 [0.449]	13.32 [0.424]	11.82 [0.542]	11.95 [0.532]	18.27 [0.148]
Hansen (OIR)	7.83 [0.854]	10.84 [0.624]	7.71 [0.862]	7.57 [0.870]	15.31 [0.288]
Wald (Joint)	2035.54***	1273.47***	1813.94***	2168.22***	2491.86***
Instruments	20	20	20	20	22
Countries	27	27	27	27	27
Observations	189	189	189	189	189

*The significance levels 1%, 5% and 10% are denoted by ***, **, and * respectively. Standard errors are in parenthesis (), while p-values are in brackets []. AR(1): First Order Autocorrelation test. AR(2): Second Order Autocorrelation test. OIR: Overidentifying Restrictions test.*

Source: Author's Estimation, 2023

4.5 Post Estimation (Robustness Check)

In accordance to studies by (Akinbode et al., 2020; Forson et al., 2016; Lio et al., 2011; Roodman, 2009), the results of additional estimation techniques, including fixed effect and pooled OLS, are displayed in tables 8 and 9 below (with and without time-specific effects). The two-step system GMM model's coefficient for the lagged dependent variable, as expected, fell within the coefficients obtained from the pooled OLS and the fixed effect estimates (Akinbode et al., 2020). Also, the coefficient indicated convergence by being less than unity in absolute value; hence the estimates of System GMM are valid (Roodman, 2006).

The coefficients of the lagged dependent variables were highly significant at 1% significance level for all specifications and ranges from 0.6812 to 0.7492 in table 6 for the GMM estimates with time effect. These figures fall within that of the fixed effect (which ranges between 0.5061 and 0.5480) and the pooled OLS estimates (which ranges from 0.9178 to 0.9321) in table 8 for all specifications with time effects.

Table 8: Results of Pooled OLS and Fixed Effects (With time effect)

	POOLED OLS					FIXED EFFECTS				
Variable	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
Lag of	0.9248***	0.9276***	0.9178***	0.9321***	0.9238***	0.5154***	0.5480***	0.5443***	0.5061***	0.5100***
Corruption	(0.0285)	(0.0283)	(0.0289)	(0.0282)	(0.0293)	(0.0762)	(0.0872)	(0.0865)	(0.0754)	(0.0763)
Constant	8.0060***	3.7127	7.4441***	6.4010**	6.2410*	16.4635	17.9829	20.3570	17.3570	14.7294
	(2.9163)	(2.8392)	(2.7631)	(2.5736)	(3.6380)	(16.3880)	(16.2626)	(16.3061)	(16.6955)	(16.5830)
Educatex	0.3522*	-----	-----	-----	----	-1.0606*	-----	-----	-----	-1.3201
	(0.3522)					(0.5277)				(0.8747)
Primary	-----	0.0098	-----	-----	0.0047	-----	-0.0175	-----	-----	-0.0098
Enrollment		(0.0087)			(0.0104)		(0.0410)			(0.0392)
Secondary	-----	-----	0.0200*	-----	0.0114	-----	-----	-0.0459	-----	0.0272
Enrollment			(0.0104)		(0.0155)			(0.0395)		(0.0689)
Tertiary	-----	-----	-----	0.0465	0.0236	-----	-----	-----	-0.1221**	----
Enrollment				(0.0323)	(0.0429)	19			(0.0573)	
GDP per	-0.7231**	-0.2634	-0.7337**	-0.6169**	-0.6528*	-1.1326	-1.2357**	-1.4574	-1.0558	-0.9281
capita	(0.3304)	(0.2556)	(0.3376)	(0.3067)	(0.3901)	(2.1797)	(2.4607)	(2.1806)	(2.2061)	(2.4446)
Openness	0.5796	0.3220	0.5364	0.5754	0.5230	0.2746	0.5778	0.1786	0.5714	0.4341
	(0.5609)	(0.5706)	(0.5646)	(0.5630)	(0.5834)	(2.7741)	(2.9186)	(2.7895)	(2.7497)	(2.6448)
Inflation	-0.0088**	-0.0088**	-0.0093**	-0.0082**	-0.0091**	-0.0063***	-0.0067***	-0.0066***	-0.0063***	-0.0063***
	(0.0037)	(0.0038)	(0.0039)	(0.0036)	(0.0091)	(0.0021)	(0.0021)	(0.0022)	(0.0021)	(0.0021)
Government	1.0511**	1.0843**	1.2599**	0.9111	1.0574*	-4.3385*	-4.2035*	-4.1279*	-4.4211*	-4.4271*
effectiveness	(0.5778)	(0.5853)	(0.5829)	(0.5855)	(0.6170)	(2.3748)	(2.4177)	(2.4287)	(2.3730)	(2.6448)
Time Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.9697	0.9693	0.9697	0.9695	0.9698	0.3268	0.7180	0.4636	0.4219	0.4037
F-statistic	433.08***	431.63***	433.37***	432.98***	381.52***	22.75***	27.19***	23.95***	22.19***	24.31***
2013	-----	-----	-----	-----	----	4.2011	4.2218	4.2478	4.1765	4.1785
(dummy)						(2.9024)	(2.8883)	(2.9231)	(2.9069)	(2.9056)
2014	-0.0939	-0.0878	-0.0891	-0.0938	-0.0948	3.2921	3.2843	3.3404	3.2465	3.2590
(dummy)	(0.4221)	(0.4200)	(0.4212)	(0.4214)	(0.4258)	(2.3707)	(2.3633)	(2.3945)	(2.3734)	(2.3865)

Table 8: Results of pooled OLS and fixed effects (With time effect) Continued

2015	-0.1582	-0.1213	-0.1569	-0.1467	-0.1563	2.5108	2.4998	2.5084	2.4910	2.5125
(dummy)	(0.4784)	(0.4962)	(0.4777)	(0.4829)	(0.4842)	(1.9935)	(2.0148)	(2.0175)	(1.9867)	(2.0127)
2016	-0.0562	-0.0171	-0.0596	-0.0422	-0.0528	1.9027	1.9152	1.8975	1.8985	1.9149
(dummy)	(0.5551)	(0.5491)	(0.5554)	(0.5547)	(0.5569)	(1.4259)	(1.4466)	(1.4427)	(1.4148)	(1.4395)
2017	-0.0605	-0.0371	-0.0538	-0.0600	-0.0571	1.2971	1.2943	1.2828	1.3010	1.3058
(dummy)	(0.4690)	(0.4777)	(0.4728)	(0.4690)	(0.4742)	(0.8436)	(0.8530)	(0.8534)	(0.8351)	(0.8424)
2018	-0.7965	-0.8015	-0.7925	-0.7992	-0.7923	-----	-----	-----	-----	----
(dummy)	(0.5635)	(0.5555)	(0.5625)	(0.5655)	(0.5618)					
Observations	189	189	189	189	189	189	189	189	189	189

*Notes: *, **, and *** indicate significance at 10 %, 5% and 1% respectively. Robust standard errors are in parenthesis (). 2012-, 2013-, 2018- and 2019-year dummies were omitted by the estimators due to collinearity issues.*

Source: Author's Estimation, 2023

Table 9: Results of Pooled OLS and Fixed Effects (Without time effect)

	POOLED OLS					FIXED EFFECTS				
Variable	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
Lag of Corruption	0.9240*** (0.0280)	0.9270*** (0.0277)	0.9169*** (0.0283)	0.9314*** (0.0276)	0.9227*** (0.0286)	0.5152*** (0.0787)	0.5448*** (0.0881)	0.5407*** (0.0871)	0.5053*** (0.0776)	0.5077 (0.0772)
Constant	8.1969*** (2.7446)	4.0067 (2.6881)	7.6488*** (2.5677)	6.5848*** (2.3964)	6.5462* (3.5002)	21.5579 (2.6586)	24.1784* (13.9319)	24.6753* (14.1898)	22.7241 (14.9069)	20.4059 (14.5329)
Educatex	0.3571 (0.1914)	-----	-----	-----	----	-0.9091* (0.5072)	-----	-----	-----	-1.2748 (0.8806)
Primary Enrollment	-----	0.0095 (0.0086)	-----	-----	0.0043 (0.0104)	-----	-0.0191 (0.0397)	-----	-----	-0.0174 (0.0379)
Secondary Enrollment	-----	-----	0.0204** (0.0101)	-----	0.0121 (0.0156)	-----	-----	-0.0378 (0.0307)	-----	0.0349 (0.0580)
Tertiary Enrollment	-----	-----	-----	0.0471 (0.0323)	0.0233 (0.0439)	-----	-----	-----	-0.1113* (0.0607)	----
GDP per capita	-0.7303** (0.3268)	-0.2673 (0.2520)	-0.7420** (0.3318)	-0.6229** (0.3054)	-0.6704* (0.3874)	-1.0135* (1.9628)	-1.2635 (2.0103)	-1.2865 (1.9168)	-0.9949 (1.9812)	-0.8336 (2.0759)
Openness	0.5745 (0.5575)	0.3126 (0.5685)	0.5310 (0.5614)	0.5696 (0.5597)	0.5223 (0.5798)	0.2130 (2.4188)	0.4964 (2.4873)	0.2121 (2.4113)	0.4467 (2.4002)	0.3369 (2.3381)
Inflation	-0.0080** (0.0035)	-0.0079** (0.0037)	-0.0084** (0.0037)	-0.0074** (0.0033)	-0.0082** (0.0036)	-0.0048*** (0.0017)	-0.0055*** (0.0015)	-0.0051*** (0.0017)	-0.0049*** (0.0016)	-0.0050*** (0.0016)
Government effectiveness	1.0660* (0.5574)	1.1017** (0.5682)	1.2775** (0.5663)	0.9244* (0.5599)	1.0820 (0.5930)	-4.2095* (2.4007)	-4.0483* (2.3202)	-4.0228 (2.3930)	-4.2760* (2.3783)	-4.3141* (2.3635)
Time Effect	No	No	No	No	No	No	No	No	No	No
R-squared	0.9692	0.9688	0.9692	0.9691	0.9693	0.4215	0.7252	0.5528	0.4747	0.4856
F-statistic	866.46***	832.51***	855.34***	867.41***	662.13***	28.38***	39.89***	30.66***	29.59***	27.07
Countries						27	27	27	27	27
Observations	189	189	189	189	189	189	189	189	189	189

*Note: *, **, and *** indicate significance at 10 %, 5% and 1% respectively. Robust standard errors are in parenthesis ().*

Furthermore, the coefficients of the lagged dependent variable are again significant at 1% level of significance for all specifications and ranges from 0.6868 to 0.8261 for the GMM estimates (without time effects) in table 7. These figures also fall within that of the fixed effects and pooled OLS estimates in table 8 when the time-specific effects dummies are dropped. The range for the estimates of the fixed effects are 0.5053 to 0.5448 and that of the pooled OLS are from 0.9169 to 0.9314.

Considering the results for the time-specific effects in table 8, secondary school enrollment remains significant at 10% significance level for pooled OLS estimates with their expected sign which is also consistent with that of GMM in table 6. The fixed effects estimates produced significant but unexpected sign for tertiary enrollment which is not consistent with that of the GMM estimates in table 6. GDP per capita also remained significant at 5% and 10% significant levels for 5 specifications for both fixed effects and pooled OLS with unexpected signs which are still consistent with the signs produced by the GMM estimates.

In table 9, secondary school enrollment remains significant at 5% significance level with the expected sign for the pooled OLS. However, tertiary enrollment is significant for the fixed effect at 10% significance level without the expected sign. GDP per capita produced significant results for 5 of the specifications at 5% and 10% significant levels similar to the results of the GMM estimates in table 7. The fixed effects estimates, however, have signs which are not consistent with that of the GMM estimates in table 7 though significant at 10% for all specifications in relation to government effectiveness.

As expected, inflation remains highly significant for both fixed effects and pooled OLS estimates (for all specifications in tables 8 and 9) at 1% and 5% significance levels consistent with that of the estimates of GMM in table 6. The pooled OLS produced significant estimates for government effectiveness with expected signs consistent with the GMM estimates in table 6. The fixed effects estimates, however, produced signs which are inconsistent with that of the GMM estimates in table 6 though significant.

The educational index was not significant in both tables 8 and 9 which is inconsistent with the estimates of the GMM in table 6.

4.6 Panel Pairwise Granger Causality Results

The panel pairwise Granger causality test was conducted to investigate the causal relationship between education variables (primary; secondary; tertiary enrollments; and the lifelong learning index, educatex) and corruption perception index (CPI) from Transparency International. The 2-step system GMM estimation results revealed that only educatex and secondary school enrollment variables were statistically significant. Lags were included up to lag 2. Including lagged variables in the causal relationship analysis up to lag 2 allows for examining the influence of past values of the variables on the current values. By considering lagged variables, the analysis captures potential delayed effects and dynamics in the relationship between education and corruption. Table 10 shows results of pairwise granger causality.

Table 10: Results of Panel Pairwise Causality Test

Null Hypothesis:	Obs	F-Statistic	Prob.
EDUCATEX does not Granger Cause CPI	162	2.547	0.082*
CPI does not Granger Cause EDUCATEX		1.469	0.233
PRIMENROL does not Granger Cause CPI	162	1.823	0.165
CPI does not Granger Cause PRIMENROL		0.275	0.760
SECENROL does not Granger Cause CPI	162	0.679	0.508
CPI does not Granger Cause SECENROL		0.051	0.951
TERENROL does not Granger Cause CPI	162	3.639	0.029**
CPI does not Granger Cause TERENROL		3.556	0.031**

*Notes: *, **, and *** indicate significance at 10 %, 5% and 1% respectively. Obs.: Observation, Prob.: probability, Primenrol: primary enrollment, Secenrol: secondary enrollment, Terenrol: tertiary enrollment, CPI: corruption perception index.*

Source: Author's Estimation, 2023

From table 10 above, the finding suggests that the relationship between tertiary education and corruption is not only contemporaneous but also exhibits a certain degree of persistence or feedback effects. It highlights the importance of considering the historical context and dynamics when examining the causal relationship between education and corruption. On the other hand, the Granger causality test indicated that lifelong learning Granger causes corruption perception index at 10% level of significance, indicating a unidirectional causal relationship from lifelong learning to corruption perception.

4.7 Summary on the Findings of the Hypotheses Tests of the Study

Hypothesis one tested the effect of education on corruption in SSA. At 1% and 5% significance levels, the null hypothesis of education has no effect on corruption in SSA was rejected. The coefficients of the education variables were positive as a priori expected. We therefore conclude that education negatively affects corruption in SSA.

Hypothesis two tested the synergy effect of the educational index on corruption in SSA. The null hypothesis that lifelong learning does not have a negative synergy effect on corruption was rejected at 5% significance level. As expected, the coefficient of Educatex was positive and significant. Again, the coefficient of the Educatex variable was bigger than the coefficients of the levels of education. We therefore conclude that the educational index has a negative synergy effect on corruption in SSA.

Hypothesis three tested the direction of causal relationship between education and corruption. At 10% significance level, the null hypothesis that lifelong education does not granger causes corruption was rejected. We can therefore conclude that lifelong learning granger causes corruption in SSA.

CHAPTER FIVE

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

5.0 Introduction

This last chapter concludes the study on the effects of education on corruption in Sub-Saharan Africa. It, first, presents a summary of the various findings of this study and the conclusions that were drawn based on the objectives outlined in this study. This will then be followed by policy recommendations from the practical implications and findings from this study to governments and various policy makers who are operating and may be operating in the sub-Saharan Africa territory. The limitations and direction for future studies finally concludes this study.

5.1 Summary

This study investigated the relationship between education and corruption in Sub-Saharan Africa using a panel dataset spanning 2012 to 2019 and covering 27 countries. The introductory chapter served as the gateway to the research study, providing an introduction to the key themes and components of the study. It again set the stage for the entire research study, introducing the key concepts, the research problem, research hypotheses, and the significance of the study. It established the context for the subsequent chapters, which delved into the literature, methodology, empirical analysis, and conclusion and recommendations. An overview of the available literature on the relationship between education and corruption and some key macroeconomic variables were then presented with the aim of supporting this thesis with the theoretical and empirical foundations. The study then proceeded to the presentation of the methodology used for the study. Various methodologies were then employed to give

life to the data to empirically and test the theories. The study conducted unit root tests to determine the stationarity of the variables first before employing various estimation techniques in order to avoid spurious regressions.

The main estimation technique which was used was the 2-step system GMM and the pooled OLS and Fixed effects estimators were used as robustness checks.

Based on the 2-step system GMM estimation, the results revealed that only educatex and secondary school enrollment were found to be statistically significant in their impact on corruption perception. This suggests that both lifelong learning and secondary education have a significant effect on reducing corruption.

Furthermore, the causality analysis showed that there is a bi-directional causality between tertiary enrollment and corruption perception index. This implies that tertiary education and corruption perception influence each other mutually. On the other hand, the causality test indicated that lifelong learning (educatex) Granger causes corruption perception index.

Considering these findings, it can be concluded that education, particularly secondary education and lifelong learning, plays a significant role in combating corruption. The results suggest that promoting secondary education and emphasizing lifelong learning initiatives may contribute to reducing corruption levels.

5.2 Conclusions

The educational index was found to be significant and had a causal relationship with corruption, indicating that higher levels of lifelong learning, as captured by educatex, are associated with lower levels of corruption in sub-Saharan Africa. This suggests that

promoting continuous education and improving educational opportunities across all levels can be effective in combating corruption in the region. Secondary enrollment was found to be significant, suggesting that increased secondary education participation is associated with lower levels of corruption.

This highlights the importance of promoting access to and quality of secondary education as a potential strategy for reducing corruption in the region. Considering these findings, it can be concluded that education, particularly secondary education and lifelong learning, plays a significant role in combating corruption. The results suggest that promoting secondary education and emphasizing lifelong learning initiatives may contribute to reducing corruption levels.

Furthermore, the negative and significant coefficient for inflation suggests that higher inflation rates are associated with lower levels of corruption in sub-Saharan Africa. This finding may be attributed to the perception that higher inflation erodes the value of bribes and reduces the incentives for engaging in corrupt practices.

Also, the negative and significant coefficient for GDP per capita suggests that higher levels of per capita income are associated with lower levels of corruption perception scores. This finding implies that improving economic conditions and increasing overall wealth in sub-Saharan African countries can contribute to reducing corruption when other indicators are healthy in the region.

Lastly, the positive and significant coefficient for government effectiveness indicates that stronger and more effective governance is associated with higher levels of corruption perception scores. This finding suggests that improving government

efficiency, transparency, and accountability should be a priority in efforts to reduce corruption in sub-Saharan Africa.

The study highlights the importance of education, economic development, and governance in addressing corruption in sub-Saharan Africa. While primary and tertiary education did not show a significant association with corruption perception, secondary education, educational index, GDP per capita, inflation, and government effectiveness were found to be significant factors. These findings emphasize the need for comprehensive strategies that focus on improving education quality, economic conditions, and governance practices to effectively combat corruption in the region.

5.3 Recommendations

Based on the study's findings, the following recommendations are proposed for consideration:

- First of all, there is the need for ministries of education, agencies and departments in the region responsible for educational policies to strengthen the education systems. Given the significant impact of secondary education on reducing corruption, governments should prioritize improving access to quality secondary education. This can be achieved by investing in infrastructure, ensuring qualified teachers, and developing relevant curricula that promote ethical values and integrity.
- Comprehensive policies aimed at improving overall educational development, as measured by the Educatex index, should be promoted. Ministries of Education should therefore collaborate with Ministries of Finance to secure funding for holistic education development programs, and international

development organizations should provide technical assistance and financial support. Investing in a well-rounded education system, including primary, secondary, and tertiary levels, contributes to a more informed and vigilant society, less tolerant of corruption.

- Ministries of Finance should develop and implement economic growth policies in collaboration with Central Banks and Economic Development Agencies. Policies that promote economic growth, including initiatives to increase GDP per capita and control inflation rates, should be implemented. The research revealed that higher GDP per capita and lower inflation rates are associated with more positive corruption perceptions. Economic growth can act as a deterrent to corrupt practices.
- To combat corruption effectively, Sub-Saharan African governments should collaborate with international organizations such as the United Nations, World Bank, and regional development banks. This collaboration enables access to funding and technical support for education and governance improvement initiatives. Ministries of Foreign Affairs should lead the coordination of these efforts. By partnering with international organizations, Sub-Saharan African countries can secure the necessary funding and expertise to enhance education systems and strengthen governance practices. This collaborative approach is key to reducing corruption and fostering a brighter future for the region.
- Civil society organizations should receive encouragement and support to actively monitor government activities, promote transparency, and hold public officials accountable. A vigilant and well-informed society is inherently less tolerant of corrupt practices, making civil society a critical player in this effort.

To further this cause, Civil Society Organizations should collaborate closely with Ministries of Interior and Ministries of Justice. This collaboration fosters constructive dialogue, advocacy, and oversight activities that can contribute significantly to combating corruption. It empowers civil society to play an active role in ensuring transparency and accountability in government operations, reinforcing the drive to reduce corruption in Sub-Saharan Africa.

5.4 Limitations of the Study

One notable limitation of this study is the constraint imposed by the limited availability of data covering an extended time period for the countries included in the study. The study relies on longitudinal data to examine the effect of education on corruption in sub-Saharan Africa. However, due to data unavailability or incompleteness, it was necessary to exclude certain countries from the sample. Consequently, the findings and conclusions drawn from this study may not fully capture the dynamics and nuances present in the excluded countries. The limited data availability restricts the study's ability to provide a comprehensive and holistic understanding of the relationship between education and corruption in the region.

5.5 Direction for Future Research

The study covers a specific time period from 2012 to 2019, and the effects of educational policies on corruption might take longer to manifest fully. It is important to consider the long-term effects of education on corruption and acknowledge that the observed results might not capture the full extent of the relationship. Future research efforts should strive to address this limitation by seeking access to more extensive and complete datasets that encompass a broader range of countries and a longer time frame.

By doing so, researchers can enhance the robustness and generalizability of their findings, thereby offering more comprehensive insights into the topic under investigation.

Again, Sub-Saharan Africa is a diverse region with significant variations in cultural, economic, and political contexts across countries. The aggregated analysis might overlook the heterogeneity within the region, potentially masking country-specific dynamics and nuances that could impact the relationship between education and corruption.

Also, while this study focuses on the aggregate relationship between education and corruption, future research could explore the micro-level mechanisms through which education influences corruption. Investigating individual-level data or case studies can provide a deeper understanding of the causal pathways and specific educational interventions that effectively reduce corruption.

Furthermore, exploring the mediating factors that operate between education and corruption can enrich our understanding of the underlying mechanisms. For example, examining the role of institutional quality, social capital, or political participation as mediating factors can provide insights into the contextual dynamics that shape the relationship.

Finally, assessing the impact of specific educational policies and interventions on corruption can contribute to evidence-based policymaking. Conducting rigorous policy evaluations, such as randomized control trials or quasi-experimental designs, can provide robust evidence on the effectiveness of educational interventions in reducing corruption.

REFERENCES

Abotsi, A. K. (2018). Tolerable level of corruption for foreign direct investment in Europe and Asia. *Contemporary Economics*, *12*(3), 269–284. https://doi.org/10.5709/ce.1897-9254.277

Acemoglu, D., & Verdier, T. (1998). Property rights, corruption and the allocation of talent: a general equilibrium approach. *The economic journal*, *108*(450), 1381-1403.

Ahrend, R. (2002). Press freedom, human capital and corruption. *DELTA working paper*, (2002-11).

Aidt, T. S. (2009). Corruption, institutions, and economic development. *Oxford review of economic policy*, *25*(2), 271-291.

Aidt, T. S., & Gassebner, M. (2010). Do autocratic states trade less?. *The World Bank Economic Review*, *24*(1), 38-76.

Aidt, T. S., & Leon, G. (2016). The democratic window of opportunity: Evidence from riots in Sub-Saharan Africa. *Journal of Conflict Resolution*, *60*(4), 694-717.

Aidt, T., Dutta, J., & Sena, V. (2008). Governance regimes, corruption and growth: Theory and evidence. *Journal of comparative economics,* 36(2), 195-220.

Akça, H., Ata, A. Y., & Karaca, C. (2012). Inflation and corruption relationship: Evidence from panel data in developed and developing countries. *International Journal of Economics and Financial Issues,* 2(3), 281–295.

Akinbode, S. O., Olabisi, J., Adegbite, R. R., Aderemi, T. A., & Alawode, A. M. (2020). Corruption, government effectiveness and human development in sub-Saharan Africa.

Akinola, G. W., & Bokana, K. G. (2017). Human capital, higher education enrollment and economic growth in the SSA countries (panel model approach). *Journal of Economics and Behavioral Studies*, *9*(6 (J)), 215-226.

Alatas, V., Cameron, L., Chaudhuri, A., Erkal, N., & Gangadharan, L. (2009). Gender, culture, and corruption: Insights from an experimental analysis. *Southern Economic Journal*, *75*(3), 663-680.

Alontseva D. L., Lamanov, E. N., Olga Anatolyevna Lavrishcheva, & Khrushchev, E.

G. (2023). Combating corruption in the educational environment as a condition for improving the quality of education. *Perspektivy Nauki I Obrazovaniâ*, *62*(2), 732–748. https://doi.org/10.32744/pse.2023.2.43

Appiah, E. N. (2017). The effect of education expenditure on per capita GDP in developing countries. *International Journal of Economics and Finance*, *9*(10), 136. https://doi.org/10.5539/ijef.v9n10p136

Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The review of economic studies*, *58*(2), 277-297.

Arellano, M., & Bover, O. (1995). Another look at the instrumental variable estimation of error-components models. *Journal of econometrics*, *68*(1), 29-51.

Asongu, S. A. (2013). Fighting corruption in Africa: do existing corruption-control levels matter?. *International Journal of Development Issues*, *12*(1), 36-52.

Asongu, S. A., & Nwachukwu, J. C. (2016). The role of governance in mobile phones for inclusive human development in Sub-Saharan Africa. *Technovation*, *55*, 1-13.

Asongu, S., & Nwachukwu, J. (2015). The incremental effect of education on corruption: evidence of synergy from lifelong learning. *Economics Bulletin*, *35*(4), 2288-2308.

Azfar, O., & Gurgur, T. (2008). Does corruption affect health outcomes in the Philippines?. *Economics of Governance,* 9, 197-244.

Bak, M., Vrushi, J., & Mpararo, E. (2019). Democratic Republic of the Congo: Overview of corruption and anti-corruption. *Transparency International*. http://www.jstor.org/stable/resrep20485

Baltagi, B. H., Song, S. H., Jung, B. C., & Koh, W. (2007). Testing for serial correlation, spatial autocorrelation and random effects using panel data. *Journal of econometrics*, *140*(1), 5-51.

Bauhr, M., & Grimes, M. (2014). Indignation or resignation: The implications of transparency for societal accountability. *Governance*, *27*(2), 291-320.

Beets, S. D. (2005). Understanding the demand-side issues of international corruption. *Journal of Business Ethics*, *57*, 65-81.

Bhattacharyya, S., & Hodler, R. (2010). Natural resources, democracy and corruption. *European Economic Review,* 54(4), 608-621.

Bloomfield, J., & Fisher, M. J. (2019). Quantitative research design. *Journal of the Australasian Rehabilitation Nurses Association*, *22*(2), 27-30.

Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of econometrics*, *87*(1), 115-143.

Braun, M., & Di Tella, R. (2001). Inflation and corruption (pp. 01-28). *Division of Research*, Harvard Business School.

Breen, M., & Gillanders, R. (2015). Political trust, corruption, and ratings of the IMF and the World Bank. *International Interactions*, *41*(2), 337-364.

Breitung, J., & Das, S. (2005). Panel unit root tests under cross-sectional dependence. *Statistica Neerlandica*, *59*(4), 414-433.

Brewer, G. A., Choi, Y., & Walker, R. M. (2008). Linking accountability, corruption, and government effectiveness in Asia: an examination of World Bank governance indicators. In *Comparative Governance Reform in Asia: Democracy, Corruption, and Government Trust* (Vol. 17, pp. 227-245). Emerald Group Publishing Limited.

Campos, N. F., Dimova, R., & Saleh, A. (2015). Political institutions, lobbying, and corruption. *Public Choice,* 162(3-4), 429-455.

Chalkiadaki, A. (2018). A systematic literature review of 21st century skills and competencies in primary education. *International Journal of Instruction*, *11*(3), 1-16.

Cheung, H. Y., & Chan, A. W. (2008). Corruption across countries: Impacts from education and cultural dimensions. *The Social Science Journal*, *45*(2), 223-239.

Cletus, U. U. (2022). Theories of corruption and their applications in business environment. *BW Academic Journal*, 7-7.

Cohen, D. K., Kim, Y., & Cho, Y. (2019). Understanding corruption from a micro and macro perspective. *Journal of Public Affairs Education*, 25(2), 141-153.

Collins, J. (2009). Lifelong learning in the 21st century and beyond. *Radiographics*, *29*(2), 613-622.

Comte, A. (1880). *A general view of positivism*. Reeves & Turner.

Da Silva, P. P., & Cerqueira, P. A. (2017). Assessing the determinants of household electricity prices in the EU: a system-GMM panel data approach. *Renewable and Sustainable Energy Reviews*, *73*, 1131-1137.

David, I. O. (2012). Corruption: Definitions, theories and concepts. *Arabian Journal of Business and Management Review (OMAN Chapter)*, *2*(4), 37.

De Graaf, G. (2007). Causes of corruption: Towards a contextual theory of corruption. *Public Administration Quarterly*, 39-86.

De Rosa, D., Gooroochurn, N., & Görg, H. (2010). Corruption and productivity: firm-level evidence from the BEEPS survey. *World Bank policy research working paper*, (5348).

Deloumeaux, L. (2019). New Methodology Shows 258 Million Children, Adolescents and Youth Are Out of School.

Desjardins, J. (2019). Visualizing Corruption Around the World. *Visual Capitalist*. Visualizing corruption around the world - MINING.COM

DiMaggio, P. J., & Powell, W. W. (1983). The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields. *American Sociological Review,* 48(2), 147-160.

Dimant, E., & Schulte, T. (2016). The nature of corruption: An interdisciplinary perspective. *German Law Journal*, *17*(1), 53-72.

Dimant, E., & Tosato, G. (2018). Causes and effects of corruption: what has past decade's empirical research taught us? A survey. *Journal of Economic Surveys*, *32*(2), 335-356.

Do, Q. T., & Levchenko, A. A. (2019). Comparative advantage, international trade, and fertility. *The Review of Economic Studies,* 86(4), 1625-1668.

Doig, A., & Theobald, R. (2013). Introduction: Why corruption?. In corruption and democratisation (pp. 1-12). Routledge.

Duri, J. (2020). Overview of corruption and anti-corruption in sub-Saharan Africa.

Ebrahim, H. B. (2010). Dominant discourses of teachers in early childhood education. *Perspectives in Education*, *28*(4), 80-88.

Eger, K. (2016). An analysis of education reform in sub-Saharan Africa.

Eisenhardt, K. M. (1989). Building theories from case study research. *Academy of management review*, *14*(4), 532-550.

Farayibi, A. O., & Folarin, O. (2021). Does government education expenditure affect educational outcomes? New evidence from sub-Saharan African countries. *African Development Review*, *33*(3), 546-559.

Finkbeiner, P., & Finkbeiner, P. (2017). Quantitative research approach. *Social Media for Knowledge Sharing in Automotive Repair*, 183-257.

Forson, J. A., Baah-Ennumh, T. Y., Buracom, P., Chen, G., & Peng, Z. (2016). Causes of corruption: Evidence from sub-Saharan Africa. *South African Journal of Economic and Management Sciences*, *19*(4), 562-578.

Fredriksen, B., & Fossberg, C. H. (2014). The case for investing in secondary education in sub-Saharan Africa (SSA): Challenges and opportunities. *International Review of Education*, *60*, 235-259.

Frost, P. (2021). How does education influence individuals perception of different types of corruption ? A quantitative study including 21 European.

Getz, K. A., & Volkema, R. J. (2001). Culture, perceived corruption, and economics: A model of predictors and outcomes. *Business & society*, *40*(1), 7-30.

Ghibanu, I. A., Ștefan, M. C., Andreiana, V. A., & Stoica, G. (2022). The management of the corruption phenomenon and its approaches. *Valahian Journal of Economic Studies*, *13*(2), 67-76.

Glaeser, E. L., & Saks, R. E. (2006). Corruption in america. *Journal of public Economics*, *90*(6-7), 1053-1072.

Gokcekus, O., & Knörich, J. (2006). Does quality of openness affect corruption?. *Economics Letters*, *91*(2), 190-196.

Graeff, P., & Mehlkop, G. (2003). The impact of economic freedom on corruption: different patterns for rich and poor countries. *European Journal of Political Economy,* 19(3), 605-620.

Graycar, A. (2015). Corruption: Classification and analysis. *Policy and Society*, *34*(2), 87-96.

Grill, C. (2017). Longitudinal data analysis, panel data analysis. *The international encyclopedia of communication research methods*, 1-9.

Groenendijk, N. (1997). A principal-agent model of corruption Introduction: Neo-institutional economics and corruption. *Crime, Law & Social Change*, 27, 207–229.

Gupta, S., Davoodi, H., & Tiongson, E. (2001). Corruption and the provision of health care and education services. In *The political economy of corruption* (pp. 123-153). Routledge.

Hair, J. F. A. (1995). Multivariate data analisys with readings, Joseph F. Hair, Rolph Anderson, Ronald L. Tatham, William C. Black.

Hammadi, A., Mills, M., Sobrinho, N., Thakoor, M. V. V., & Velloso, R. (2019). *A governance dividend for sub-saharan Africa?*. International Monetary Fund.

Heyneman, S. P., Anderson, K. H., & Nuraliyeva, N. (2008). The cost of corruption in higher education. *Comparative education review*, *52*(1), 1-25.

Hill, R. C., Griffiths, W. E., & Lim, G. C. (2018). *Principles of econometrics*. John Wiley & Sons.

Ibrahim, M., Kumi, E., & Yeboah, T. (2015). Greasing or sanding the wheels? Effect of corruption on economic growth in sub-Saharan Africa. *African Journal of Economic and Sustainable Development*, *4*(2), 157-173.

Iheonu, C., & Asongu, S. (2022). Democracy and lifelong learning in Africa. *European Xtramile Centre of African Studies WP/22/067*.

Islam, K. N., Parvin, T., & Biswas, M. H. A. (2022). Dynamic optimization applied to a criminological model for reducing the spread of societal corruption. *Khulna University Studies*, 832-844.

Jaafra, M., & Rachdi, H. (2022). Education and economic growth: Is there a role for governance? A comparison between mena and OECD countries. *Eurasian Journal of Social Sciences*, *10*(4), 236-251.

Jungo, J., Madaleno, M., & Botelho, A. (2023). Controlling corruption in African

countries: innovation, financial inclusion and access to education as alternative measures. *International Journal of Social Economics*, (ahead-of-print).

Kaffenberger, M. (2012). *The effect of educational attainment on corruption participation in sub-Saharan Africa* (Doctoral dissertation).

Kapoor, M., & Ravi, S. (2012). Determinants of corruption: government effectiveness vs. cultural norms. *The BE Journal of Economic Analysis & Policy*, *12*(1).

Kaufmann, D., Kraay, A., & Mastruzzi, M. (2005). Governance matters IV: governance indicators for 1996-2004. *World bank policy research working paper series*, (3630).

Khan, M. H. (1996). The efficiency implications of corruption. *Journal of International Development*, *8*(5), 683-696.

Kim, J. (2016). Development of a global lifelong learning index for future education. *Asia Pacific Education Review*, *17*(3), 439-463.

Kimenyi, M. S., & Mbaku, J. M. (2005). Corruption, growth, and governance in resource-rich countries. *Journal of African Economies*, 14(4), 570-604.

Klitgaard, R. (1988). Controlling corruption. Univ of California Press.

Knack, S., & Keefer, P. (1995). Institutions and economic performance: cross-country tests using alternative institutional measures. *Economics & politics*, *7*(3), 207-227.

Komalasari, K., & Saripudin, D. (2015). Integration of anti-corruption education in school's activities. *American Journal of Applied Sciences*, *12*(6), 445.

Lambsdorff, J. G. (2002). Making corrupt deals: contracting in the shadow of the law. *Journal of Economic Behavior & Organization*, *48*(3), 221-241.

Larrain, F., & Tavares, J. (2007). Can openness deter corruption? The role of foreign direct investment.

Levin, A., Lin, C. F., & Chu, C. S. J. (2002). Unit root tests in panel data: asymptotic and finite-sample properties. *Journal of econometrics*, *108*(1), 1-24.

Lewin, K. M. (2009). Access to education in sub-Saharan Africa: patterns, problems and possibilities. *Comparative Education*, *45*(2), 151-174.

Lio, M. C., Liu, M. C., & Ou, Y. P. (2011). Can the internet reduce corruption? A cross-country study based on dynamic panel data models. *Government information quarterly*, *28*(1), 47-53.

Majeed, M. T. (2014). Corruption and trade. *Journal of economic integration*, 759-782.

Majgaard, K., & Mingat, A. (2012). *Education in sub-Saharan Africa: A comparative analysis*. World Bank Publications.

Makowski, D., Ben-Shachar, M. S., Patil, I., & Lüdecke, D. (2020). Methods and algorithms for correlation analysis in R. *Journal of Open Source Software*, *5*(51), 2306.

Maria, N. S., Susilowati, I., Fathoni, S., & Mafruhah, I. (2021). The effect of education and macroeconomic variables on corruption index in G20 member countries. *Economies*, *9*(1), 23.

Marinova, I. S. (2023). Freedom of information laws and open government data as anti-corruption measures. *International Science Journal of Jurisprudence & Philosophy*, *2*(2), 1-7.

Mauro, P. (1995). Corruption and growth. *The quarterly journal of economics*, *110*(3), 681-712.

Mauro, P., & Driscoll, D. D. (1997). *Why worry about corruption?* (Vol. 6, pp. 1-19). Washington, DC: International Monetary Fund.

Mbodji, Y. C. (2023). Effects of public expenditure on education on gender inequality in education in sub-Saharan Africa (SSA). *Review of Education*, *11*(2), e3398.

Méon, P., & Weill, L. (2008). Is corruption an efficient grease?. *World Development,* 36(10), 1881-1894.

Moiseev, N., Mikhaylov, A., Varyash, I., & Saqib, A. (2020). Investigating the relation of GDP per capita and corruption index. *Entrepreneurship and Sustainability Issues*, *8*(1), 780.

Montinola, G. R., & Jackman, R. W. (2002). Sources of corruption: A cross-country study. *British Journal of Political Science,* 32(1), 147-170.

Morris, S. D. (2004). Corruption in Latin America: an empirical overview. *Secolas Annals*, *36*, 74-92.

Mungiu-Pippidi, A., & Johnston, M. (2017). Controlling corruption through collective action: Evidence from Romania. *Journal of Communist Studies and Transition Politics,* 33(3), 296-318.

Neeman, Z., Paserman, M. D., & Simhon, A. (2008). Corruption and openness. *The BE Journal of Economic Analysis & Policy,* 8(1).

North, D. C. (1990). Institutions, institutional change, and economic performance. Cambridge University Press.

O'brien, R. M. (2007). A caution regarding rules of thumb for variance inflation factors. *Quality & quantity*, *41*, 673-690.

Oloke, E., Olanipekun, W. D., Mabinuori, O. T., Ojo, L. B., & Aderemi, T. A. (2022). Government educational spending and human capital development in ECOWAS sub-region: implication for sustainable development. *Studia Universitatis Babes-Bolyai Oeconomica*, *67*(3), 37-52.

Olson, M. (1989). Collective action. *The invisible hand*, 61-69.

Özkan, B., & Erkan, B. (2011). The causality and relation of corruption with basic macro-economic tables (charts). *Chinese Business Review*, *10*(8).

Ozturk, I. (2008). The role of education in economic development: a theoretical perspective. *Available at SSRN 1137541*.

Pellegrini, L., & Gerlagh, R. (2008). Causes of corruption: a survey of cross-country analyses and extended results. *Corruption, development and the environment*, 29-51.

Planing, P., & Planing, P. (2014). Quantitative research approach. *Innovation Acceptance: The Case of Advanced Driver-Assistance Systems*, 141-247.

Poerwanto, H., Setiyono, J., & Sunardi. (2023). Corruption as a violation of human rights, economic, social and cultural human rights perspective. *International Journal of Law and Politics Studies*, *5*(1), 119–129. https://doi.org/10.32996/ijlps.2023.5.1.14

Preece, J. (2013). Africa and international policy making for lifelong learning: textual revelations. *International Journal of Educational Development*, *33*(1), 98-105.

Rahman, K. (2018). *Overview of corruption and anti-corruption in Ethiopia*.

Transparency International.

Rahman, K. (2019). Mauritius: Overview of corruption and anti-corruption.

Rahman, K. (2019). Overview of corruption and anti-corruption in Madagascar. *Transparency International Anti-Corruption Helpdesk*.

Rahman, K., Kukutschka, R. M. B., & Kaninda, S. (2018). *Overview of corruption and anti-corruption in Ghana*. Transparency International. http://www.jstor.org/stable/resrep20502

Rahman, K., Kukutschka, R. M. B., Banoba, P., & Cooksey, B. (2019). *Overview of corruption and anti-corruption in Tanzania*. Transparency International. http://www.jstor.org/stable/resrep20479

Ramesh, R., & Vinayagathasan, T. (2018). Corruption, rule of law and government effectiveness: A co-integration approach to Sri Lanka. 158–169.

Rasheva, N. (2022). Corruption and economic security: legal approaches to understanding and peculiarities of law enforcement practice. *Advances in Law Studies*, *10*(3), 41–45. https://doi.org/10.29039/2409-5087-2022-10-3-41-45

Roberts, M. R., & Whited, T. M. (2013). Endogeneity in empirical corporate finance1. In *Handbook of the Economics of Finance* (Vol. 2, pp. 493-572). Elsevier.

Roodman, D. (2006). How to Do xtabond2. In *North American Stata Users' Group Meetings 2006* (No. 8). Stata Users Group.

Roodman, D. (2009). How to do xtabond2: An introduction to difference and system GMM in Stata. *The stata journal*, *9*(1), 86-136.

Rothstein, B. (2011). Anti-corruption: the indirect 'big bang'approach. *Review of International Political Economy*, *18*(2), 228-250.

Sapsford, R., Tsourapas, G., Abbott, P., & Teti, A. (2019). Corruption, trust, inclusion and cohesion in North Africa and the Middle East. *Applied Research in Quality of Life*, *14*, 1-21.

Sari, V. K., & Rahardjo, M. (2019). Corruption and its effects on the economy and public sectors. *Journal of Applied Economics in Developing Countries*, *4*(1), 48-53.

Sbardellotto, F. R. (2023). The phenomenological nature of corruption-A complex, perennial and destabilizing event of social and political relations. *Seven Editora*.

Shipley, T. (2018). Country profile: Senegal: Overview of corruption and anti-corruption.

Sifuna, D. N., & Sawamura, N. (2010). Challenges of quality education in Sub-Saharan Africa-Some key issues. *Hauppauge, NY: Nova Science Publishers*.

Slijepčević, S., Rajh, E., & Budak, J. (2020). Determinants of corruption pressures on local government in the EU. *Economic research-Ekonomska istraživanja*, *33*(1), 3492-3508.

Suleiman, N., & Othman, Z. (2017). Corruption typology: A review of literature. *Chinese Business Review*, *16*(2), 102-108.

Svensson, J. (2005). Eight questions about corruption. *Journal of Economic Perspectives,* 19(3), 19-42.

Tanner, C., Linder, S., & Sohn, M. (2022). Does moral commitment predict resistance to corruption? experimental evidence from a bribery game. *Plos one*, *17*(1), e0262201.

Treisman, D. (2000). The causes of corruption: A cross-national study. *Journal of Public Economics,* 76(3), 399-457.

Triesman, D. (2007). What have we learned about the causes of corruption after ten years of cross-national research. *Annual Review of Political Science*, *10*, 232.

Truex, R. (2011). Corruption, attitudes, and education: Survey evidence from Nepal. *World Development*, *39*(7), 1133-1142.

Türedi, S., & Altıner, A. (2016). Economic and political factors affecting corruption in developing countries. *Int. J. Eco. Res*, *7*(1), 104-120.

Ullah, S., Akhtar, P., & Zaefarian, G. (2018). Dealing with endogeneity bias: The generalized method of moments (GMM) for panel data. *Industrial Marketing Management*, *71*, 69-78.

Ullah, S., Zaefarian, G., & Ullah, F. (2021). How to use instrumental variables in addressing endogeneity? A step-by-step procedure for non-specialists. *Industrial Marketing Management*, *96*, A1-A6.

Ulman, S. R., & Bujancă, G. V. (2014). The corruption influence on the macroeconomic environment. Empirical analysis on countries development stages. *Procedia Economics and Finance*, *16*, 427-437.

Unver, M., & Koyuncu, J. Y. (2016). The impact of poverty on corruption. *Journal of Economics Library,* 3(1), 100–110.

Uslaner, E. M., & Rothstein, B. (2016). The historical roots of corruption: State building, economic inequality, and social trust. *American Behavioral Scientist,* 60(10), 1231-1245.

Verbeek, M. (2017). *A guide to modern econometrics*. John Wiley & Sons.

Vomberg, A., & Wies, S. (2021). Panel data analysis: a non-technical introduction for marketing researchers. In *Handbook of Market Research* (pp. 411-467). Cham: Springer International Publishing.

Wang, D. T., & Chien, L. (2011). The relationship between economic growth and corruption: The case of Asian countries. *Journal of Knowledge Globalization, 4*(1), 38-51.

Wei, S. J. (2000). How taxing is corruption on international investors?. *Review of economics and statistics,* 82(1), 1-11.

Wooldridge, J. M. (2010). *Econometric analysis of cross section and panel data*. MIT press.

Wysmułek, I. (2022). Corruption in the public schools of Europe: A cross-national multilevel analysis of education system characteristics. *International Journal of Comparative Sociology*, 00207152221096841.

Zaefarian, G., Kadile, V., Henneberg, S. C., & Leischnig, A. (2017). Endogeneity bias in marketing research: Problem, causes and remedies. *Industrial Marketing Management*, *65*, 39-46.

Zakaria, M. (2009). Openness and corruption: A time-series analysis. *Zagreb International Review of Economics & Business*, *12*(2), 1-14.

APPENDICES

APPENDIX A

Pairwise correlation matrix

	CPI	L.CPI	LNGDPPC	PRIENR	SECENR	TERENR	INF	GOVEFF	OPENNESS	EDU
CPI	1	0.984***	0.646***	0.023	0.600***	0.541***	-0.050	0.857***	0.496***	0.596***
L.CPI		1	0.657***	0.008	0.597***	0.559***	-0.043	0.858***	0.505***	0.601***
LNGDP			1	-0.211***	0.783***	0.728***	-0.071	0.726***	0.560***	0.783***
PRIENR				1	0.095	-0.050	0.095	-0.002	0.017	0.053
SECENR					1	0.831***	-0.029	0.608***	0.393***	0.959***
TERENR						1	-0.034	0.664***	0.285***	0.954***
INF							1	0.037	0.009	-0.030
GOVEFF								1	0.459***	0.664***
OPENNESS									1	0.355***
EDU										1

Notes: CPI denotes corruption perception index, L.CPI denotes lag of CPI, LNGDPPC is the log of Gross domestic product per capita, INF is Inflation, GOVEFF is government effectiveness, OPENNESS is trade openness, PRIMENR is primary enrollment, SECENR is secondary enrollment, TENENR is tertiary enrollment and EDU represents educatex.

Source: Author's Estimation, 2023

APPENDIX B

List of twenty-seven (27) sub-Saharan African countries used in the study

No.	Country
1	Benin
2	Burkina Faso
3	Burundi
4	Carbo Verde
5	Cameroon
6	Chad
7	Comoros
8	Cote d'Ivoire
9	Democratic Republic of the Congo
10	Ethiopia
11	Ghana
12	Guinea
13	Lesotho
14	Madagascar
15	Malawi
16	Mali
17	Mauritania
18	Mauritius
19	Mozambique
20	Niger
21	Rwanda
22	Sao Tome and Principe
23	Senegal
24	Seychelles
25	South Africa
26	Tanzania
27	Zimbabwe

APPENDIX C

Pairwise Granger Causality Tests			
Date: 10/14/23 Time: 07:00			
Sample: 2012 2019			
Lags: 2			
Null Hypothesis:	Obs	F-Statistic	Prob.
EDUCATEX does not Granger Cause CPI	162	2.54748	0.0815
CPI does not Granger Cause EDUCATEX		1.46903	0.2333
PRIMENROL does not Granger Cause CPI	162	1.82309	0.1649
CPI does not Granger Cause PRIMENROL		0.27478	0.7601
SECENROL does not Granger Cause CPI	162	0.67946	0.5084
CPI does not Granger Cause SECENROL		0.05081	0.9505
TERENROL does not Granger Cause CPI	162	3.63932	0.0285
CPI does not Granger Cause TERENROL		3.55625	0.0309
PRIMENROL does not Granger Cause EDUCATEX	162	0.60308	0.5484
EDUCATEX does not Granger Cause PRIMENROL		0.38864	0.6786
SECENROL does not Granger Cause EDUCATEX	162	3.55133	0.0310
EDUCATEX does not Granger Cause SECENROL		1.30788	0.2733
TERENROL does not Granger Cause EDUCATEX	162	2.77752	0.0653
EDUCATEX does not Granger Cause TERENROL		8.37812	0.0003
SECENROL does not Granger Cause PRIMENROL	162	0.26981	0.7639
PRIMENROL does not Granger Cause SECENROL		0.34215	0.7108
TERENROL does not Granger Cause PRIMENROL	162	0.23087	0.7941
PRIMENROL does not Granger Cause TERENROL		0.53718	0.5855
TERENROL does not Granger Cause SECENROL	162	1.26090	0.2863
SECENROL does not Granger Cause TERENROL		9.17194	0.0002

Notes: Obs.: Observation, Prob.: probability, Primenrol: primary enrollment, Secenrol: secondary enrollment, Terenrol: tertiary enrollment, CPI: corruption perception index.

APPENDIX D

Pooled OLS Results for Country-Specific Effect Test

Variable	(1)	(2)	(3)	(4)
Lag of Corruption	5.68e-15*** (1.57e-15)	7.08e-15*** (1.67e-15)	5.78e-15*** (1.53e-15)	6.24e-15*** (1.44e-15)
Constant	-1.42e-14 (4.12e-14)	2.13e-13* (1.18e-13)	7.11e-14 (4.87e-14)	-4.26e-14 (4.02e-14)
Educatex	-1.44e-14 (1.03e-14)	----	----	----
Primary Enrollment	----	-4.56e-16 (4.75e-16)	----	----
Secondary Enrollment	----	----	-1.77e-15** (7.06e-16)	----
Tertiary Enrollment	----	----	----	3.74e-15** (1.59e-15)
GDP per capita	-7.14e-17*** (2.07e-17)	-8.23e-17*** (2.21e-17)	-7.43e-17*** (2.03e-17)	-8.71e-17*** (2.29e-17)
Openness	-4.89e-14 (3.98e-14)	-3.34e-14 (4.13e-14)	-5.78e-14 (3.94e-14)	-3.12e-14 (3.87e-14)
Inflation	-6.61e-17** (3.16e-17)	-5.62e-17 (3.56e-17)	-6.08e-17* (3.49e-17)	-8.39e-17** (3.29e-17)
Government effectiveness	-7.55e-14*** (2.77e-14)	-2.21e-14 (2.51e-14)	-7.30e-14** (2.87e-14)	-6.42e-14** (2.80e-14)
Country Effect	Yes	Yes	Yes	Yes
Benin	2.41e-13*** (4.99e-14)	-6.69e-14 (4.14e-14)	2.48e-13*** (5.29e-14)	1.58e-13*** (4.98e-14)
Burkina Faso	1.88e-13*** (4.66e-14)	-1.70e-13*** (5.16e-14)	1.74e-13*** (4.78e-14)	1.47e-13*** (4.41e-14)
Burundi	----	-2.90e-13*** (9.40e-14)	----	----
Cabo Verde	5.80e-13*** (1.11e-13)	----	6.23e-13*** (1.20e-13)	4.20e-13*** (1.10e-13)
Cameroon	1.76e-13*** (3.38e-14)	-2.76e-13*** (8.14e-14)	1.85e-13*** (3.44e-14)	1.20e-13*** (3.46e-14)
Chad	2.64e-14 (2.42e-14)	-4.10e-13*** (1.16e-13)	3.91e-15 (2.68e-14)	4.81e-14** (2.37e-14)
Comoros	8.78e-14*** (2.64e-14)	-4.15e-13*** (1.11e-13)	1.04e-13*** (2.62e-14)	6.68e-14** (2.61e-14)
Cote d'Ivoire	2.19e-13*** (4.65e-14)	-3.92e-13*** (9.64e-14)	2.15e-13*** (4.76e-14)	1.97e-13*** (4.88e-14)
Democratic Republic of the Congo	8.10e-15 (1.83e-14)	-5.80e-13*** (1.50e-13)	1.00e-14 1.73e-14	-1.81e-15 (1.79e-14)
Ethiopia	1.13e-13*** (3.62e-14)	-6.09e-13*** (1.50e-13)	8.63e-14** (3.79e-14)	7.15e-14** (3.43e-14)

Pooled OLS Results for Country-Specific Effect Test (Continuation)				
Ghana	3.27e-13*** (6.84e-14)	-5.07e-13*** (1.28e-13)	3.42e-13*** (7.29e-14)	2.35e-13*** (6.62e-14)
Guinea	7.40e-14*** (2.35e-14)	-7.10e-13*** (1.74e-13)	6.39e-14*** (2.37e-14)	4.39e-14* (2.42e-14)
Lesotho	2.32e-13*** (5.51e-14)	-6.75e-13*** (1.75e-13)	2.47e-13*** (5.91e-14)	1.49e-13*** (5.02e-14)
Madagascar	2.94e-14* (1.70e-14)	-8.16e-13*** (2.11e-13)	1.44e-14 (1.72e-14)	2.20e-14 (1.51e-14)
Malawi	7.84e-14** (3.46e-14)	-8.58e-13*** (2.24e-13)	6.67e-14* (3.40e-14)	7.19e-14** (2.96e-14)
Mali	7.53e-14*** (2.69e-14)	-9.21e-13*** (2.24e-13)	6.60e-14** (2.65e-14)	6.29e-14*** (2.34e-14)
Mauritania	1.38e-13*** (3.31e-14)	-8.86e-13*** (2.21e-13)	1.21e-13*** (3.37e-14)	1.40e-13*** (3.34e-14)
Mauritius	1.06e-12*** (2.12e-13)	-1.65e-13** (6.69e-14)	1.10e-12*** (2.17e-13)	9.31e-13*** (2.27e-13)
Mozambique	6.07e-14** (3.05e-14)	-1.07e-12*** (2.72e-13)	4.09e-14 (2.93e-14)	3.57e-14 (2.78e-14)
Niger	3.67e-14 (3.69e-14)	-1.16e-12*** (2.86e-13)	-3.17e-15 (3.88e-14)	3.69e-14 (3.01e-14)
Rwanda	2.06e-13*** (7.74e-14)	-1.13e-12*** (3.05e-13)	1.77e-13** (8.01e-14)	1.39e-13** (6.99e-14)
Sao Tome and Principe	2.17e-13*** (4.86e-14)	-1.13e-12*** (2.87e-13)	2.43e-13*** (5.61e-14)	1.07e-13** (4.57e-14)
Senegal	1.69e-13*** (5.15e-14)	-1.23e-12*** (-1.23e-12)	1.53e-13*** (5.40e-14)	1.09e-13** (4.76e-14)
Seychelles	1.42e-12*** (3.18e-13)	----	1.49e-12 (3.18e-13)	1.50e-12*** (3.54e-13)
South Africa	6.26e-13*** (1.31e-13)	-8.75e-13*** (2.25e-13)	6.83e-13*** (1.35e-13)	5.67e-13*** (1.39e-13)
Tanzania	4.29e-14 (3.66e-14)	-1.44e-12*** (3.61e-13)	9.28e-15 (3.78e-14)	4.94e-14 (3.05e-14)
Zimbabwe	----	-1.48e-12*** (3.67e-13)	----	----

Notes: *, **, and *** indicate significance at 10 %, 5% and 1% respectively.

Source: Author's Estimation, 2023

APPENDIX E

Results for Variance Inflation Factor (VIF) Test for Multicollinearity

a. Results of VIF for all variables

Variable	Educatex	Prim	Sec	Ter	Inf	GDPPC	TO	GovEff
VIF	----	1.14	4.16	4.12	1.02	3.69	1.91	2.66

Note: Educatex was dropped due to multicollinearity. Prim: Primary Enrollment, Sec: Secondary Enrollment, Ter: Tertiary Enrollment, Inf: Inflation, GDPPC: Gross Domestic Product Per Capita, TO: Trade Openness, GovEff: Government Effectiveness

Source: Author's Estimation, 2023

b. Results of VIF for segregated variables based on the measures of education

Variable	Educatex	Prim	Sec	Ter	Inf	GDPPC	TO	GovEff
VIF (1)	2.02	----	----	----	1.01	3.41	1.86	3.41
VIF (2)	----	1.04	----	----	1.02	3.14	1.86	2.13
VIF (3)	----	----	1.87	----	1.01	3.50	1.84	2.27
VIF (4)	----	----	----	1.93	1.02	3.27	1.89	2.60

Note: Prim: Primary Enrollment, Sec: Secondary Enrollment, Ter: Tertiary Enrollment, Inf: Inflation, GDPPC: Gross Domestic Product Per Capita, TO: Trade Openness, GovEff: Government Effectiveness

Source: Author's Estimation, 2023