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Does Education Matter for Income Inequality? Evidence from Sub-Saharan Africa

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Abstract

The issue of income equality has become of great concern on a global scale. Since the 2008 global financial crisis, economists and other socioeconomic analysts have observed the state of the income and wealth gap between the top ten percent rich and the lower forty percent poor of populations, and its far-reaching impact on the lives of ordinary people. Income inequality has become a global challenge and the effects are felt in both developed and developing countries. The socioeconomic disparity between the rich and poor is pronounced in developing countries, and recent trends of growing inequality are being observed in developed countries. This research examines the effect of education on income inequality and GDP per capita, using a panel dataset of 18 selected sub-Saharan countries for the period from 1994 to 2015. The panel models are estimated, using the fixed effects, random effects and generalised methods of moments estimation techniques.

The results show that the relationship of education and its impact on income inequality is dependent on the level of education being assessed. High resource input in tertiary education increases income inequality, while high resource input in lower educational levels reduces income inequality. Overall, increases in government expenditure on education lead to increase in inequality and a fall in GDP per capita. These results show possible inefficiencies in the allocation of educational resources in sub-Saharan countries during the period of investigation. Government spending on education does not reduce inequality or boost income unless it is done efficiently. To reduce income inequality and increase average income, educational resources must be efficiently allocated with priority given to the educational levels of the highest proportions of the population.

Keywords: Income inequality; education inequality; inequality; sub-Saharan Africa

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List of Abbreviations

OECD	Organisation for Economic Co-operation & Development
UNDP	United Nations Development Programme
SSA	Sub-Saharan Africa
WDI	World Development Indicators
GDP	Gross Domestic Product
SDGs	Sustainable Development Goals
FDI	Foreign Direct Investments
UNESCO	United Nations Educational, Scientific and Cultural Organization
GMM	Generalised Method of Moments Model
FEM	Fixed Effects Model
REM	Random Effects Model
Diff-GMM	Difference Generalised Method of Moments
SYST-GMM	System Generalised Method of Moments
PRI-EXP	Expenditure on primary education
SEC-EXP	Expenditure on secondary education
TERT-EXP	Expenditure on tertiary education
EDU-ATT	Educational attainment
GDPC	GDP per capita
GOV SPEND	Government expenditure
LIT RATE	Adult literacy rate
POV HC	Poverty headcount
PTR-PRI	Pupil-teacher ratio, primary
PTR-SEC	Pupil-teacher ratio, secondary
PTR-TERT	Pupil-teacher ratio, tertiary
SEC-EXP	Expenditure on secondary education
UNEMPL	Unemployment

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CHAPTER 1: INTRODUCTION

1.1 Background of the study

The issue of income inequality has become a major concern for both developed and developing countries. Although some countries have made strides in closing the gap between the rich and the poor, income inequality varies greatly across the economies of sub-Saharan Africa, particularly within the southern African region. (International Monetary Fund, 2016)

According to the Organisation for Economic Co-operation & Development (OECD) 2008 report on inequality, “the persistence of high rising income inequality over recent decades is a growing concern for policy makers worldwide and has received increasing attention from economists and has become [of] interest for public debate” (OECD, 2008; Clement, 2015; Dabla-Norris, 2015).

As defined by Roy and Husain (2019), inequality is an “uneven distribution of rights among individuals or groups, where rights encompass rights to participate in the political process, rights over economic resources, rights over access to education, rights to healthcare and so on. Inequality can be broadly classified into horizontal inequality and vertical inequality. Horizontal inequality refers to inequality between socially constructed groups such as religious or ethnic. Vertical inequality is inequality among individuals belonging to different income or expenditure groups” (Roy and Husain, 2019).

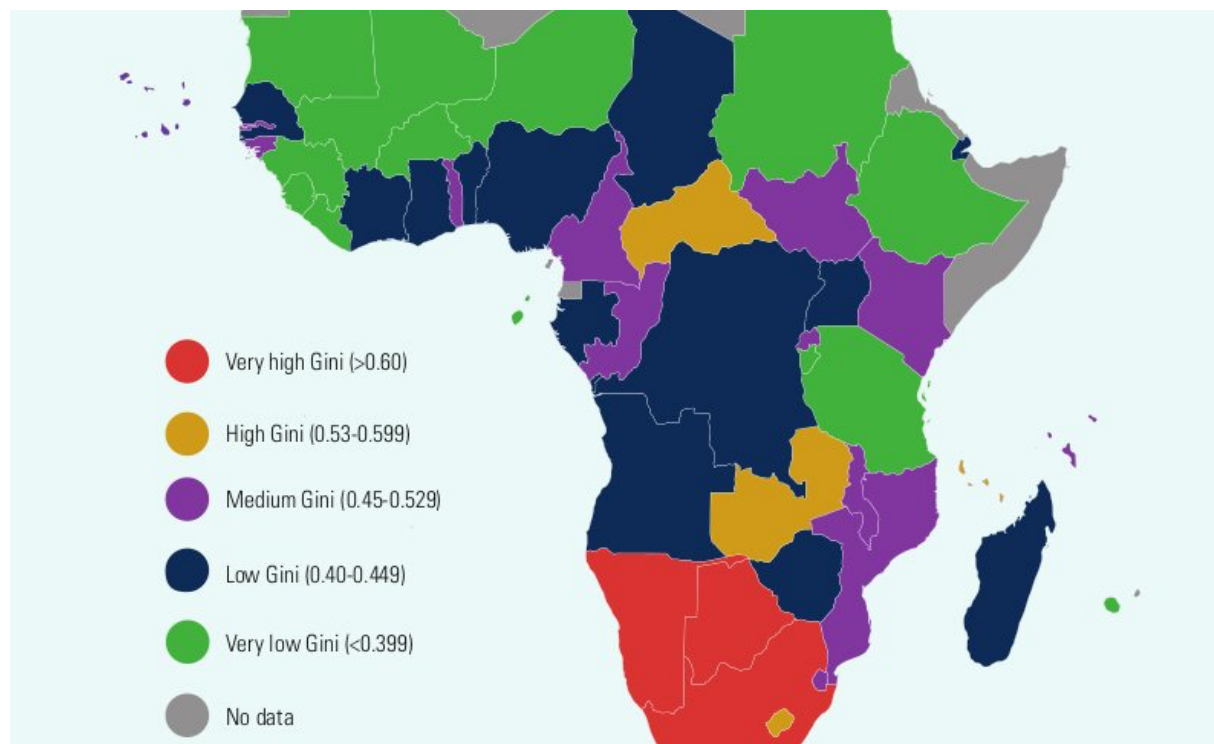
The widespread presence of global inequality can be attributed to the “integration of national markets through trade and financial” globalisation, the evolution of required technology skills and other related influences (United Nations Development Program (UNDP), 2017). Inequality leads to volatility and instability.

Furthermore, the unfavourable socioeconomic conditions caused by income inequality are a challenge for most developing countries within sub-Saharan Africa. The UNDP research report on *Income Inequality Trends in sub-Saharan Africa* considers inequality as a “by-product of regressive taxes, unresponsive wage structures and inadequate investment in education, health and social protection for vulnerable and marginalized groups” (UNDP, 2017).

The study shows that “ten of the nineteen most unequal countries globally” are in sub-Saharan Africa (SSA) and seven outlier countries are driving this inequality.

In addition, 17 countries which are “predominantly agricultural economies [in] West Africa, experienced declining inequality, whereas 12 countries predominantly in Southern and Central Africa and economies characterised by important oil and mining sectors, recorded an inequality rise” (UNDP, 2017).

Figure 1.1 Mapping of Income Inequality in Africa



Source: World Bank (WDI), 2016

“In South African context, there is a large disparity between big earners and ordinary workers in the South African economy. CEOs of large entities listed on the Johannesburg Securities Exchange (JSE) earn between 120 and 1,332 times more than the average pay at their companies.” On average, South African CEOs earn an average of 541 times the country’s per capital GDP. “This is significantly higher than in the US (483.1) and the UK (229.1).” “The share of total income going to the top 10% income earners in SA is 60%–65%. In Europe it is 30%–35%, in the US 45%–50% and Brazil 50%–55%” (UNDP, 2017).

The 2030 Agenda for Sustainable Development has clearly defined a global focus on reducing poverty and inequality by making it a policy imperative for all nations, both developed and developing. To achieve the sustainable development goals (SDGs), it rests on the shoulders of all nations to realise sustainable development for all and meet the objective to “leave no one behind” (UNDP, 2017).

The report further discloses the most critical dis-equalising factors of inequality as:

- i. “Rising foreign direct investments (FDI) in extractive industries;”
- ii. “Suboptimal structural transition of the economy from a low-inequality crop agriculture to high inequality sectors, such as livestock production, commerce, transport, and formal and informal services in both urban and rural areas, which drives inequality in a number of countries” (UNDP, 2017).
- iii. “And an unequal distribution of socioeconomic and physical facilities (for example: roads, electricity, schools, hospitals, water and sanitation) between rural and urban areas, which drives income disparities” (UNDP, 2017).

The UNDP research findings highlight the fact that “education is key to social mobility, but it cannot generate the quantum of jobs needed to tackle the time bomb of the youth population bulge without strong institutions and sound economic reforms, that prioritise agricultural modernisation, national and regional value chains, and industrialisation” (UNDP, 2017).

The report also highlights that an “important factor driving inequality in Africa” stems from an “unequal distribution of national resources” (UNDP, 2017).

This paper seeks to examine the role of education and its significance in reducing income inequality. It assesses the contributing factors in attaining higher levels of education, which narrows the inequality gap. The study seeks to test whether education narrows the inequality gap, and whether a higher rate of investment in education makes a difference to income inequality?

One of the key assumptions investigated further is whether the poor are more disadvantaged in accessing quality education due to their low income. This links to the central research question in this study: Does education matter for income inequality? Therefore, the paper explores the notion of a positive linear relationship between the education and income, which draws linkages between

quality education and income inequality, and by further extension, linkages between education inequality and poverty.

Empirical studies have proven that education is “an important means to reduce inequality, particularly in developing societies” (Saint-Paul & Verdier, 1993).

Furthermore, studies undertaken by Glomm and Ravikumar espouse that “education increases capabilities and facilitates access to remunerative jobs” (Glomm & Ravikumar, 1992).

This linkage “between human capital and growth has been well documented in endogenous growth models.” Other studies show evidence that it is “inextricably linked to the health, social, economic and security status of individuals and societies” (Roy & Husain, 2019).

1.2 Problem definition and research questions

The issue of income inequality has become of great concern on a global scale. Since the 2008 global financial crisis, economists and other socioeconomic analysts have observed that the state of income and wealth gaps between the top ten percent rich and the lower forty percent poor in populations, have far-reaching impacts on the lives of ordinary people.

Income inequality has become a global challenge and the effects are felt in developed as well as developing countries. The socioeconomic disparity between rich and poor is quite pronounced within developing nations, and recent trends of growing inequality are being observed in developed countries.

This can be seen in the recent election outcomes that have elected populist and nationalist types of leaders, whose rhetoric appeases the expectations of the masses to protect their borders, create jobs and encourage national protectionism of trade. Some of these reactions are due to growing income inequality and wealth distribution between the rich and the poor.

A recent World Bank (2016) research report finds that there are many factors driving income inequality. The report makes the point that “the nature of inequality has changed, with the role of skills and labour market factors having grown in importance in explaining poverty and inequality” (World Bank, 2016). The assessment is that the changing landscape is moving toward reskilling and upgrading of labour.

A study by World Bank (2017) identifies education in relation to income inequality as a key driver of income inequality. Nomba (2017) summarises it thus: “This study reveals that labour market incomes are the largest contributor to inequality in South Africa, contributing more than 90 per cent of the overall Gini coefficient between 2006 and 2015. It shows that access to higher levels of education and stable labour market incomes are key determinants for households to achieve economic stability in South Africa.”

The UNDP report, *Income Inequality Trends in sub-Saharan Africa* (2017), lists the factors that decrease income inequality as: 1) higher quality education, 2) increased efficiency in tax administration, 3) enhanced agricultural productivity, 4) structural transformation.

As in the case of South Africa and a number of other Southern African states, the effect of education on income inequality has remained a challenging issue. Research results are not unanimous on the “causal relationship between poverty and education” (Shahabadi, Nemati, Hosseinidoust, 2018). There are numerous empirical “studies investigating the effect of education on income distribution”. Authorities such as Lam and Deborah (1991) “concluded that there is a positive relationship between education and income inequality in selected Islamic countries”. However, “authorities, such as Ram (1984), Park (1996) and Digdowiseiso (2009), find no significant relationship between education and income inequality” (Shahbadi, 2018; Shahbadi, Nemati & Hosseinidoust, 2018).

Therefore, the key research questions that this paper seeks to answer are:

- What impact has education on income inequality?
- Is there a relationship between education and income levels?

This study aims to confirm the importance of education in reducing income inequality within developing countries in sub-Saharan Africa. It examines the correlation between income inequality and education, and will add to the body of research on the issue of income inequality by unpacking dimensions of inequality within sub-Saharan Africa, It further expands on the determinants and drivers of income inequality, through examining the role of education in reducing inequality and specifically income inequality.

1.3 Research objectives and hypotheses

This study seeks to examine the relationship between education and income levels. The specific objective of the research is;

- To examine the relationship between education and income inequality in sub-Saharan Africa.
- To examine the relationship between education and income levels in sub-Saharan Africa.

1.4 Justification of the study

Many developing countries are often faced with the triple challenges of inequality, unemployment and poverty. Particularly in the case of the African context, there is widespread unemployment among the educated and the young.

There are sufficient empirical studies to show the benefits and returns on education at primary, secondary and tertiary levels. Shimeles's African Development Bank studies (2016) of education and reducing inequality in developing countries concludes that "if governments do not expand opportunities to people from poor families to rise out of poverty through educational means, then existing inequality could widen even further."

The study of the relevance of education and income inequality is therefore an important issue for most developing nations throughout the world. The challenge of reducing the levels of inequality is becoming important in the agenda for policy discussion, for both developing and developed nations, whereas issues of inequality were previously primarily a developing country issue. However, since the 2008 global financial crisis, and the advent of globalisation, the issues of inequality are on the rise. Not only is inequality increasing but the nature of inequality is changing.

Therefore, this study's relevance in analysing the effects of education on inequality becomes central to the solutions sought for reducing income inequality, especially in the context of sub-Saharan countries, where its levels are highest.

The intention of this study, therefore, is to enhance the body of discourse on a regional basis, but also in a cross-country comparison, in order to amplify the solutions employed by those countries struggling with the highest levels of inequality.

Developing African countries should aim to increase educational attainment for their less skilled and lower income earners through policies prioritising investment in higher education (Hershbein, Kearney & Summers, 2015). This has proven, in the long-run, to be “the most effective and direct way to increase economic security, reduce poverty, and expand upward mobility in society” (Hershbein, et al., 2015).

1.5 Organisation of the dissertation

The format of the study has been organized as follows:

Chapter one provides an overview and creates the context of the issues and determinants of income inequality, making comparative findings of both global and regional analysis.

Chapter two provides an analysis of the existing body of research and a review of the literature on education and income inequality, as well as its effect on economic growth. This chapter reviews empirical research examining the effect of income inequality and education.

Chapter three provides the research methodology undertaken and covers empirical findings of data extracted from the World Development Indicators (WDI), and Standardized World Income Inequality databases. It shows quantitative causes of inequality, by comparing measures of Gini coefficients across countries within sub-Saharan Africa, with the unit of analysis as the individual country.

Chapter four analyses the results of the data and findings of empirical evidence, in order to articulate recommendations.

Finally, *Chapter five*, provides a summary of the main findings with concluding policy recommendations for African governments.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

The relationship between income inequality and educational attainment has been well researched, at both a microeconomic and macro level. These studies have confirmed a link between income inequality and education. However, the findings suggest a complicated relationship. This chapter provides an overview of empirical and theoretical perspectives and adds to the literature by examining the macroeconomic effects.

2.2 Definition of concepts

Most research on inequality focuses on income differentials between rich and poor. The fact of the matter is “that access to basic services, such as education, health care, essential infrastructure (like water, sanitation, and electricity) provides an individual, irrespective of background, the opportunity to advance and reach his or her human potential” (World Bank Report, 2018).

“Less than one-third of adults have completed primary education in many sub-Saharan African countries. In most western European countries, by contrast, nearly all adults have completed primary education and, in many cases, one-third of adults have a tertiary degree” (OECD, 2021).

Educational attainment

Educational “attainment refers to the highest level of education that an individual has completed.” (Bankole, 2013). “By tracking attainment levels across countries and over time, the UIS provides unique insights into the benefits that can arise from education – from the earning potential of individuals to the economic growth and well-being of societies at large” (OECD, 2021).

The OECD income inequality indicator reported that “less than one-third of adults have completed primary education in many sub-Saharan African countries.” (OECD (2021)

The Income Inequality (Indicator) summarises the issues surrounding income inequality in western developed nations versus that of sub-Saharan African nations, “in most western European countries, by contrast, nearly all adults have completed primary education, and, in many cases, one-third of adults have a tertiary degree” (OECD, 2021)

Income

Income is defined by OECD Data Organization (OECD.data.org) as “household disposable income in a particular year. It consists of earnings, self-employment and capital income and public cash transfers; income taxes and social security contributions paid by households are deducted” (OECD, 2021).

“The income of the household is attributed to each of its members, with an adjustment to reflect differences in needs for households of different sizes” (OECD, 2021).

Income inequality

Data and definition presented by *OECD.data.org* on income inequality defines the measure of income inequality between individuals by the following indicators:

- “The Gini coefficient is based on the comparison of cumulative proportions of the population against cumulative proportions of income they receive, and it ranges between 0 in the case of perfect equality and 1 in the case of perfect inequality.” (OECD, 2021)
- “S80/S20 is the ratio of the average income of the 20% richest to the 20% poorest;” (OECD, 2021)
- “P90/P10 is the ratio of the upper bound value of the ninth decile (i.e. the 10% of people with highest income) to that of the first decile” (OECD, 2021).
- “P90/P50 of the upper bound value of the ninth decile to the median income; and P50/P10 of median income to the upper bound value of the first decile” (OECD, 2021).
- “The Palma ratio is the share of all income received by the 10% of the population with the highest disposable income, divided by the share of all income received by the 40% of the population with the lowest disposable income” (OECD, 2021).

2.3 Theoretical review:

2.3.1 Income inequality and educational attainment

As Benos (2013) argues, “the relationship between income inequality and educational attainment might go in both directions. On one hand, rising inequality should encourage investments in education through increased returns. On the other hand, it might prevent these investments for those people belonging to the bottom of the income distribution because of resources’ constraints.”

The OECD research, reporting on inequality trends, states that “In 2015, 73.1% of the population living in households whose head did not have a formal education, versus 2.6% of those living in households whose head had attained an education beyond upper secondary school, were poor. Between 2006 and 2015, the population living in households with heads who had completed primary school experienced the fastest decline in poverty. Similar patterns are true for individuals: in 2015, 55.0% of individuals with no formal education were poor, compared to 2.6 percent of those who went beyond upper secondary” (World Bank, 2019).

Furthermore, the World Bank report released earlier this year on inequality in South Africa, “notes an improvement in skills and education were instrumental for poverty reduction in South Africa, although returns to education, especially to the semi-skilled occupations, have been decreasing in recent years. It further observes that, “poverty declines with rising levels of education” (World Bank, 2019).

A review of literature on South Africa reflects an interesting observation on the causes of its high inequality and points out that its high level of income inequality is a legacy issue inherited from the apartheid era, as a generational trap. The report also “stressed that education and skills were the main avenue to address the inequalities, as many poor South Africans were unemployable and unskilled.” It stressed that wealth inequality was much higher than income inequality. The research further expands on the racial “character” of South Africa’s inequality, which is steeped in racial colours of black versus white, and is further perpetuated by spatial divides and land ownership issues. This illustrates the relationship between spatial inequality and social inequality and the effect this has on human, social and economic development.

2.3.2 Education and inequality

Several economic theories, starting from Kuznets (1955), consider rising inequality as an inevitable feature of growth at a certain stage of economic development. The overarching premise is that “industrialisation widens the income gap between the rural and urban population and increases overall inequality, because the share of the less egalitarian urban population rises” (Honkkila, 1999).

This is depicted as the famous ‘U’ curve by Kuznets, “used to explain the increase in inequality in western Europe shortly after World War II, and in some developing economies at the start of their industrialization and growth period” (Honkkila, 1999).

The UNDP 2019 report suggests that “one of the factors to explain the differences in income inequality in the current stage of world development has been the lagged effect of education and the long-term consequences that unequal access to human capital accumulation will have for the income distribution over the medium-term” (UNDP, 1997).

Honkkila’s research reinforces this notion, in concluding that “this explanation can be applied both to the developing countries where basic education is still not guaranteed for the whole population, and to the industrialized countries where rapidly changing labour markets increase the demand for skilled workers and the returns to human capital in some knowledge-based sectors” (Honkkila, 1999).

2.4 Empirical literature

Research outcomes provide mixed views and are inconclusive on results of “the relationship between education and income inequality. Most studies found a negative relationship between income inequality and a country’s average educational attainment” (Ram, 1984).

For instance, Barro (1999) demonstrated “the effects of several factors on income inequality, including educational attainment.” The findings reflect “a negative relationship for primary education attainment, but a positive relationship for higher education attainment” (Wells, 2016). Therefore, when “populations had a higher average number of years primary education per person inequality was lower, but when populations had a higher average number of years of higher education per person, inequality was higher” (Barro, 1999). Studies by Nielsen and Alderson, (1995), Barro, (2000) and Bourguignon and Morrison (1990) have “shown that higher levels of enrolments at secondary level are associated with decreased income inequality”. Also, the studies show that there was a “positive relationship between higher education enrolments and income inequality” (Wells, 2016).

The literature review showed inconclusive results between “the direct relationship between educational inequality and income inequality.” However, research study by Braun “found a positive relationship between the two factors” (Braun, 1988; Park, 1996). While other studies

“have found a negative relationship. Ram’s findings showed that income levels have diverged, even if educational levels have improved (Ram, 1984).

Educational attainment and income inequality

Recent studies conducted by Ifa and Guetat (2018) found a positive “relationship between public spending on education and GDP per capita, in Tunisia and Morocco” (Ifa & Guetat, 2018). Research findings by Rahman (2013) demonstrated the relationship between GDP per capita and literacy rate.

This means government spending on education at the primary and secondary levels can reduce income inequality. Education is seen as one of the most effective ways to reduce income inequality. Education creates more economic opportunities, determines the type of job and level of payment available to an individual, and plays a pivotal role as a signal of ability and productivity in the labour market (Shahabadi, 2018)

Sylvester (2000) found that countries with higher levels “of income inequality also have higher subsequent expenditures for public education, relative to GDP” (Sylvester, 2000).

Previous empirical studies by De Gregorio and Lee (2002) estimated the relationship between income inequality and education outcomes, using a seemingly unrelated regression technique, but did not consider country-fixed effects. A significant finding of the study showed that “income inequality increases with education inequality and decreases with the average level of education” (Lee, 2002). They also found a negative and significant relationship between educational attainment and income inequality.

2.5.1 Positive relationship

Positive relationships have been found between the two factors in the direct relationship between education and income inequality. Some empirical research has found positive relationships (Braun, 1988; Park, 1996). Research by Nielsen and Alderson (1995), Barro (2000) and Bourguignon and Morrisson (1990) has shown that higher levels of enrolments at secondary level are associated with decreased income inequality. Wells (2016) reported “positive relationship between higher education enrolments and income inequality”.

Barro’s studies (1999) demonstrated the “effects of several factors on income inequality, including educational attainment” (Barro, 1999). The findings were “a negative relationship for

primary education attainment, but a positive relationship for higher education attainment” (Wells, 2016). Therefore, when “populations had a higher average number of years primary education [per] person, inequality was lower, but when populations had a higher average number of years of higher education per person inequality was higher” (Barro, 1999).

2.5.2 Negative relationship

There are numerous studies which have analysed the drivers of income inequality including Nielson (1994), Nielson and Alderson (1997); Xu and Zou (2000). These studies make reference to direct and indirect factors which drive the level of income inequality. The primary factors of inequality which have been discussed and analysed in literature include economic development, demographic factors, environmental and cultural factors. Therefore, a change in income inequality was shown to be directly or indirectly affected by a change in one or the other factors.

Alderson and Nielsen (2002) found that “the average level of education continues to exert an important negative influence on income inequality in advanced industrial societies” (Wells, 2016). “These results indicated that secondary enrolments had an effect independent of development processed” (Lee & Lee, 2018). “In less developed societies the negative effect of secondary enrolments could be attributable to an increased importance of education during urbanisation, or a shift from agricultural to industrial societies” (Lee & Lee, 2018).

Lee & Lee (2018) found a negative relationship between educational attainment and the Gini index.

“Checchi (2003) investigated the issue using an unbalanced panel of 108 countries for the period 1960–1995” (Checchi, 2003). The key finding was a “robust negative correlation” depicted between “income inequality and secondary education enrolment” (Checchi, 2003). “The effect is stronger when considering females’ access to any level of education. These results support the view that poor families are prevented from accessing school by their low incomes” (Checchi, 2003).

2.6 Chapter summary

In summary, income inequality is a growing concern for both developed and developing countries. The research overwhelmingly highlights the effects of economic inequality as a social problem. However, “in many instances, too much inequality can be destructive, because it might hinder long

term growth, decrease the incentive for productivity and the desire to take on risks and create wealth.”

The intention is for the research study to form an input into the big challenge of inequality and poverty that remains a persistent challenge for the sub-Saharan region as a whole. This research work will ultimately add voice to the solutions by reiterating that education and attending to the skills gap are priority actions for agendas of countries in the region. This point cannot be underestimated, and the sooner governments acknowledge the changing nature of inequality, and apply structural reforms and policies to support poverty reduction, to narrow the inequality gap, the greater the impact on income distribution for all peoples.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Introduction

This chapter aims to give a detailed outline of the methods used to address the research questions. The first section gives an overview of the structure of the research and how it has been conducted. The second section explains the variables used, how they were measured, their respective data sources and justifications. The third section gives an analytical framework that explains how the analysis has been conducted. The fourth section gives details about the statistical regression model linking the dependent and independent variables to be used for the analysis. The final section gives an evaluation of the robustness of the methodology presented by exploring limitations.

3.2 Research design

This research is primarily quantitative in nature and uses Panel data analysis. Panel data analysis is a statistical method used to analyse two-dimensional cross sectional and longitudinal data. Yaffee (2003) defines “panel data analysis as a method of studying an exacting subject within multiple sites, periodically observed over a defined time frame” (Mahabbati, 2016).

3.3 Data sources and sample size

The data used in the analysis is secondary data sourced from the World Bank World Development Indicators database for the period 1994 to 2015. Data from 18 of the 46 sub-Saharan African countries was used, as these countries had consistent data for the period of 22 years..

Somalia, Equatorial Guinea and Eritrea were not included because they do not have Gini index data. Table 3.1 below shows the level of income inequality of the selected countries according to UNDP (2017). The Gini index used for this classification will be explained under the variable description.

Some variables in the WDI (World Bank World Development) database have insufficient data points to give statistically reliable results, thus forcing the need for some empirical estimations which might deviate from the true values. This compromises the reliability of the data and hence the reliability of the whole study. For example, the most recent Gini estimate for Senegal was

2011, hence the need to estimate it for the other years, thus exposing the investigation to gross inaccuracies.

Table 3.1: Inequality classification of the selected countries¹

COUNTRY	GINI INDEX (World Bank estimate)	GINI CLASSIFICATION
Botswana	53.3	High Inequality
Burundi	38.6	Very low inequality
Cote d'Ivoire	41.5	Low inequality
Eswatini	54.6	High inequality
Ethiopia	35.0	Very low inequality
Ghana	43.5	Low inequality
Kenya	40.8	Low inequality
Madagascar	42.6	Low inequality
Mauritius	36.8	Very low inequality
Namibia	59.1	High inequality
Niger	34.3	Very low inequality
Rwanda	43.7	Low inequality
Senegal	40.3	Low inequality
South Africa	63	Very high inequality
Tanzania	40.5	Low inequality
Togo	43.1	Low inequality
Zambia	57.1	High inequality
Zimbabwe	44.3	Low inequality

Gini > 0.6 is classified as very high inequality, Gini between 0.53 and 0.599 is classified as high inequality, Gini between 0.45 and 0.529 is classified as medium inequality, Gini between 0.40 and 0.449 is classified as low inequality, Gini < 0.399 is classified as very low inequality

To answer the two research questions, appropriate measurements for income inequality, education level and economic growth were used. For income inequality, the Gini coefficient was used. For the level of education, percentage of total government expenditure spent on education, literacy rates, teacher-pupil ratios and education attainment levels were used. For economic growth, GDP growth rate figures were used.

¹ Inequality classification by UNDP based on 2016 Gini index figures from the World Bank (WDI)

3.4 Analytical framework

3.4.1 Income inequality and education

To test the relationship between income inequality, education and education inequality, the panel data approach used by David Coady and Allan Dizioli (2017) is used in this study. The country-panel specification used is as follows:

$$gini_{it} = \beta_0 + \beta_1 edu_att_{it} + \beta_2 edu_exp_{it} + \beta_3 lit_rate_{it} + \beta_4 pri_exp_{it} + \beta_5 sec_exp_{it} + \beta_6 ptr_pri_{it} + \beta_7 ptr_sec_{it} + \beta_8 ptr_tert_{it} + \beta_9 edu_exp + \sum_{k=10}^{14} \beta_k X_{k,it} + \alpha_i + \varepsilon_{it} \dots \dots \dots 1$$

Where *subscripts 'it'* refer to country *i* and year *t* respectively, *Gini* and *edu_att* are defined Gini coefficient and educational attainment which represent proxies for income inequality and education respectively; *edu_qual* is a measure of education inequality. *X* denotes other variables that impact income inequality independently of education outcomes, including inflation, poverty headcount, gdp growth and unemployment; α captures unobserved time-invariant country-fixed effects, and ε captures other unobserved determinants that can vary across countries and time periods.

Persistence of income inequality and endogeneity of educational measures must be taken into account (Coady & Dizioli, 2017). Income inequality is persistent in nature meaning that it usually changes very slowly over time with almost negligible variance over the sample period, implying some possibly unobserved slowly changing factors (Coady & Dizioli, op. cit.). ‘Endogeneity’ of education measures means that the relationship between education and education inequality may reflect reverse causation, hence unobserved factors may cause bias. To take these issues into account, dynamic panel estimation had to be used (Coady & Dizioli, op. cit). The dynamic panel specification of the basic equation 1 is defined as;

$$gini_{it} = \beta_0 + \beta_1 gini_{it-1} + \beta_2 edu_att_{it} + \beta_3 edu_exp_{it} + \beta_4 lit_rate_{it} + \beta_5 pri_exp_{it} + \beta_6 sec_exp_{it} + \beta_7 ptr_pri_{it} + \beta_8 ptr_sec_{it} + \beta_9 ptr_tert_{it} + \beta_{10} edu_exp + \sum_{k=11}^{15} \beta_k X_{k,it} + \alpha_i + \varepsilon_{it}$$

Where $gini_{it-1}$ is the lag of dependent variable and all variables are as defined prior.

3.4.2 Education and gdp per capita

To test the relationship between GDP per capita and education the following panel data specification was used:

$$gdppc_{it} = \alpha_1 + \alpha_2 gdppc_{it-1} + \alpha_3 edu_{it} + \alpha_4 X_{i,t} + \mu_i + \gamma_i + \varepsilon_{it}$$

Where *gdppc* refers to GDP per capita as a proxy for income level which is the dependent variable; *edu* represents all 9 educational measures in the variable description and *X* denotes other variables that impact income inequality independently of educational outcomes – in this case these are unemployment, poverty headcount, gdp growth, government spending and inflation.

3.5 Description of variables

3.5.1 Dependent variables

3.5.1.1 Income inequality

The *Gini index* measures how equitably a resource is distributed in a population; in this case, the resource is income (Farris 2010). It measures the inequality among income distribution values. A Gini index value of 100% represents complete inequality where one person receives all the available income and everyone else gets nothing, while a Gini index value of zero signifies perfect equality where everyone receives the same income. The Gini index values used in this study were sourced from the World Bank WDI database, which is an internationally credible data source for development indicators. The Gini index is easy to interpret and also avoids references to an unrepresentative average. However, it is a relative measure, meaning that sometimes it may be possible for the Gini index for a developing country to rise while the number of people in absolute poverty decreases (Mellor, 1990).

3.5.1.2 Income level

GDP per capita, PPP (constant 2011 international \$) is the “gross domestic product converted to international dollars using purchasing power parity rates.” The data used is “in constant 2011 international dollars” and was sourced from the WDI database. In this investigation, GDP per capita will be used as a proxy for the average level of income. (Databank, World Bank).

3.5.2 Independent variables

Education

Literacy rate is the percentage of the population aged 15 years and over who can both read and write with understanding a short simple statement on their everyday life (UNESCO Institute of Statistics, 2009). It therefore measures the ability of the primary education system to impart basic literacy to the population. A high literacy rate signifies a robust and effective primary education system. The literacy rate data used in this research was also sourced from the WDI indicators, and are reliably credible.

Government expenditure on education, represents the total public expenditure on education as a percentage of total public expenditure (UNDP, 2017). It measures the importance of education to the government relative to alternative public investment choices and also assesses the government's commitment to human capital development. The higher the government expenditure on education, the greater the priority given to education by the government in comparison to other public investments (UNDP, 2017).

Expenditure on primary/secondary/tertiary education represents the total public expenditure on primary/secondary/tertiary education as a percentage of total public educational spending (UNDP, 2017) It gives an idea of the level of education mainly prioritised by the government.

The pupil-teacher ratio refers to the average number of pupils per teacher at a specified level of education. It measures the level of human capital resources input in relation to the size of the student population. According to Urquiola and Verhoogen (2009) there is a negative relationship between the pupil-teacher ratio and pupils' performance. Thus, the pupil-teacher ratio can be used to measure the quality of the educational system.

Educational attainment at least completed lower secondary, population 25+, total (%) (cumulative) is a percentage distribution of the population aged 25 and above who would have completed lower secondary school education. It is an indicator of the quantity of a country's human capital, and also a reflector of the structure and performance of the education system and its accumulated impact on human capital formation. (UNESCO Institute of Statistics, 2009) Educational attainment can also be used as a proxy for the quantity and quality of the human capital stock in a country, since it is closely related to people's skills and competencies (UNESCO Institute of Statistics, op. cit.).

Education inequality is the Gini coefficient of educational attainment based on the data from Barro and Lee (2015). The estimation technique used follows the procedure used by Coady and Dizioli (2017). Incorporating education inequality in the analysis allows the findings to take into consideration the relative distribution of educational resources.

To answer the first question, an analysis of the relationship between income inequality and education was carried out. According to Gregorio & Lee (2003), education is a significant factor in income inequality. “Higher educational attainment and a more equal distribution of education play pivotal roles in reducing income inequality” (Lee, 2003).

This leads to the formulation of the following hypothesis:

H₀: Education reduces income inequality.

H₁: Education has no impact on income inequality.

This hypothesis was tested by a regression model discussed in section 3.4.

For the second research question, the following hypothesis was formulated:

H₀: There is a positive relationship between education and income levels.

H₁: There is no relationship between education attained and income levels.

3.5.3 Control variables

Inflation, as measured by the consumer price index, reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly”. Blejer and Guerrero (1990) showed that inflation worsens income inequality. This motivated the use of inflation as a control variable.

Unemployment refers to the share of the labour force that is without work but available for and seeking employment. Blejer and Guerrero (1990) showed that high unemployment levels lead to high inequality. Therefore, unemployment was used as a control variable.

Table 3.2: Variable notation and sources

QUANTITY	VARIABLE MEASURE	NOTATION	SOURCE
Dependent variables			
Income Inequality	GINI index (World Bank estimate)	<i>Gini</i>	WDI
National Income	GDP per capita, PPP (constant 2011 international \$)	<i>gdppc</i>	WDI
Independent variable			
Education	Literacy rate, adult total (% of people ages 15 and above)	<i>lit_rate</i>	WDI
	Government expenditure on education, total (% of government expenditure)	<i>edu_exp</i>	WDI
	Expenditure on secondary education (% of government expenditure on education)	<i>sec_exp</i>	WDI
	Expenditure on tertiary education (% of government expenditure on education)	<i>tert_exp</i>	WDI
	Expenditure on primary education (% of government expenditure on education)	<i>pri_exp</i>	WDI
	Pupil-teacher ratio, primary	<i>ptr_pri</i>	WDI
	Pupil-teacher ratio, secondary	<i>ptr_sec</i>	WDI
	Pupil-teacher ratio, tertiary	<i>ptr_tert</i>	WDI
	Educational attainment, at least completed lower secondary, population 25+, total (%) (cumulative)	<i>edu_att</i>	WDI, Barro and Lee database
Control variables			
Economic growth	GDP growth (annual %)	<i>gdp_growth</i>	WDI
Poverty	Poverty headcount ratio at \$1.90 a day (2011 PPP) (% of population)	<i>pov_hc</i>	WDI
Inflation	Inflation, consumer prices (annual %)	<i>inflation</i>	WDI
Unemployment	Unemployment, total (% of total labour force) (modelled ILO estimate)	<i>unempl</i>	WDI
Government spending	Expense (% of GDP)	<i>Gov_spend</i>	WDI

Note: WDI=World Development Indicators

Inflation has a positive insignificant coefficient. The models do not provide any conclusive evidence regarding the effect of inflation on the Gini index. Government spending has a positive and highly significant effect on the Gini index. The higher the government's spending as a percentage of GDP, the more unequal the income distribution. This might be due to inefficient government spending and too much government expenditure going on projects that mostly benefit high income earners (Kweka & Morrissey, 2000).

3.6 Estimation approach

3.6.1 Hausman test

“The Hausman test detects endogenous predictor variables in a regression model. Endogenous variables have values that are determined by other variables in the system. “Having endogenous variables in a model will cause ordinary least squares estimators to fail, as one of the assumptions of OLS is that there is no correlation between a predictor variable and the error term” (Hausman, 1978).

In this study, the Hausman test has been used to aid in the selection of the model between the fixed effects model and the random effects model. The null hypothesis is that the preferred model is random effects. The alternative hypothesis is that the model is fixed effects.

3.6.2 Generalised method of moments

Generalised method of moments (GMM) refers to a group of estimators constructed from the orthogonality conditions of the data generating model i.e. there is no need to give specifications about distributions. Generalised method of moments estimation can be used for a dynamic panel data estimator as it controls for endogeneity, omitted variable bias, unobserved panel heterogeneity and measurement errors. GMM uses instrumental variable estimation and the instruments must be exogenous. There are two methods of estimating parameters using GMM, namely, System GMM and Difference GMM.

3.6.2.1 Difference v. System GMM

Arellano and Bond (1991) proposed a difference GMM estimation. Difference GMM corrects endogeneity by removing fixed effects and transforming regressors through differencing. The weakness of the Difference GMM is that it magnifies gaps in an unbalanced dynamic panel. The system GMM estimation, which was proposed by Arellano and Bover (1995) and Blundel and Bond (1998), corrects for endogeneity by introducing more instruments to improve efficiency and transforming the instruments to make them uncorrelated with fixed effects. In this study, both estimations will be used. The Sargan-Hansen test and the test for second order autocorrelation have been used to test the validity of each method.

3.6.2.2 Sargan–Hansen Test

The Sargan-Hansen test is used to test for overlying restrictions in a model. It tests “the null hypothesis for the validity of the instruments used. Failure to reject the null hypothesis” means that “the choice of instruments” used is valid. (Leonida, 2007)

3.6.2.3 Test for autocorrelation of the error term

In this test, the null “hypothesis that the differenced error term is first, and second order serially correlated” (Leonida, 2007). “Failure to reject the null hypothesis of no second order serial correlation” suggests that there is no serial correlation and there is correct specification of the moment conditions (Leonida, 2007).

3.7 Limitations

- i. Some variables in the WDI database have insufficient data points to give statistically reliable results. This forced the need for some empirical estimations which might deviate from the true values. This compromises the reliability of the data and hence the reliability of the whole study. For example, the most recent Gini estimate for Senegal was in 2011, hence the need to estimate it for the other years, thus exposing the investigation to gross inaccuracies.
- ii. The data extraction methods used for some variables are not as robust, and as result double counting is highly likely. For instance, the figures of spending on education usually use data are only from the ministry of education when, in fact, other ministries might also contribute towards educational spending.
- iii. When comparing educational outcomes between countries, it is important to take note that countries do not always classify qualifications at the same level, despite the same age or similar years of schooling. Some educational programmes are difficult to classify, thus creating some bias in the measurement of this variable. Definitions of measures also differ from country to country.
- iv. In many studies, GDP per capita has been used as an indicator for the average level of income. To an extent it is a good indicator, but it is just an average of the total production and the higher the income inequality, the less it indicates the average income level. In this investigation, we are dealing with sub-Saharan African countries which have relatively

high-income inequalities compared to the rest of the world, thus depriving the ability of the GDP per capita to reflect actual income.

- v. This study does not investigate the effect of educational inequality on income inequality and income.

CHAPTER 4: ANALYSIS

4.1 Introduction

This chapter describes the findings of the study. It includes an explanation of the descriptive statistics of the variables used, correlational analysis and panel data regression. The results from this chapter form a basis for the conclusion and policy recommendations in Chapter 5.

4.2 Descriptive statistics

The descriptive statistics in Table 4.1 show an average Gini index for the 18 selected sub-Saharan African countries, which is 46.8780%. This means that on average, these countries are of medium inequality classification. The variability in the Gini index is low as shown by the low standard deviation of 8.5559%. The average GDP per capita is \$4377.01. The variability in GDP per capita is high, as signified by the standard deviation of \$4347.10 which is almost equal to the mean, with values ranging from a minimum of \$518.16 (Rwanda, 1994) to a maximum of \$19897.47 (Mauritius, 2015).

The mean expenditure on primary education is 43.2152%, while secondary and tertiary education receive 29.6336% and 19.7370% respectively. This shows that, on average, most of the countries prioritised primary education over the 22-year period. The standard deviations of these measures show very low variability from their respective means. However, the ranges indicate the existence of outliers in the dataset as shown by the range of *pri_exp* being 60.9724%. The minimum value of *tert_exp* is 0% while the highest is 72.64554%. The mean for *edu_exp* is 4.6533%. This means that, on average, the percentage of government expenditure on education was just 4.6533%. There was very high variability in *edu_exp* as shown by the values ranging from a minimum of 1.0997% to a maximum of 44.3339%. The average literacy rate was 66.6994% per year. On average, the variability in literacy rate was relatively low as shown by the standard deviation of just 19.5229%. However, the range shows that there were some outliers at both extremes, as shown by a minimum of 14.3760 (Niger, 2001) and a maximum of 94.3679% (South Africa, 2015).

The mean pupil teacher ratios are 40.2821%, 24.7975%, 20.6649% for primary education, secondary education, and tertiary education, respectively. This suggests that on average, primary education had the lowest human capital input in relation to the size of the student population. Secondary education and tertiary education had lower pupil teacher ratios, due to fewer students

enrolling for higher levels of education. The variability in these measures for all the 18 countries over the 22-year period was low, as shown by their low standard deviations. The existence of outliers on both extremes is shown by the high ranges.

The average unemployment rate was 8.84871% per year. The variability in the unemployment rate was high, as shown by a relatively high standard deviation of 8.5287% and the unemployment values ranging from a minimum of 0.3170% to a maximum 33.4730%. The poverty headcount at \$1.90 per day had an average of 45.01419% and a standard deviation of 21.5640%. The inflation rate had an average of 9.0943% per year and a relatively high standard deviation of 9.2889%. The high variability in inflation is also shown by the inflation rates ranging from -27.7873% (Ethiopia, 2010) to 59.4615% (Ghana, 1995) during the period of investigation.

Table 4.1: Descriptive Statistics

Variable	Mean	Std. Dev	Min.	25%	Median	75%	Max.
<i>Gini</i>	46.878	8.5559	29.8	41.2	44.6	53.55	64.8
<i>gdppc</i>	4377.01	4347.1	518.16	1414.36	2677.48	6272.45	19897.47
<i>edu_att</i>	23.9636	20.4376	5.929	8.3652	12.5828	32.9115	77.1809
<i>pri_exp</i>	43.2152	11.673	16.8663	34.1616	42.3771	50.8889	72.6454
<i>sec_exp</i>	29.6336	8.7506	8.9296	24.2623	29.3998	35.0975	64.1404
<i>tert_exp</i>	19.737	9.0783	0	13.3097	18.3924	24.6014	50.6006
<i>Gov_spend</i>	18.6997	7.3435	7.6931	13.2315	16.2125	22.8228	38.6081
<i>gdp_growth</i>	4.2464	5.2976	-0.248	2.4767	4.4031	6.3391	35.224
<i>edu_exp</i>	4.6533	2.5521	1.0997	3.418	4.4322	5.4952	44.3339
<i>inflation</i>	9.0943	9.2889	-27.7873	3.5584	6.9274	10.7409	59.4615
<i>lit_rate</i>	66.6994	19.5229	14.376	52.0519	69.1492	83.0076	94.3679
<i>pov_hc</i>	45.0419	21.564	0.4	29.625	43.7	60.5	86
<i>ptr_pri</i>	40.2821	10.725	18.7328	32.2377	39.1394	47.9716	69.286
<i>ptr_sec</i>	24.7975	6.8284	12.875	18.7894	25.1169	29.3608	47.4135
<i>ptr_tert</i>	20.6649	8.6635	6.0668	14.6737	18.8881	26.2731	69.1531
<i>unempl</i>	8.84871	8.5287	0.317	2.8102	5.331	12.8722	33.473

Note: *Gini* = GINI index; *gdppc* = GDP per capita; *edu_att* = Educational attainment; *pri_exp* = Expenditure on primary education; *sec_exp* = Expenditure on secondary education; *tert_exp* = Expenditure on tertiary education; *Gov_spend* = Government expenditure; *gdp_growth* = GDP growth; *edu_exp* = Government expenditure on education as a % of total expenditure; *inflation* = Inflation, consumer prices; *lit_rate* = Adult Literacy rate; *pov_hc* = Poverty headcount; *ptr_pri* = Pupil-teacher ratio, primary; *ptr_sec* = Pupil-teacher ratio, secondary; *ptr_tert* = Pupil-teacher ratio, tertiary; *unempl* = Unemployment

Table 4.2: Correlation matrix

	<i>edu_att</i>	<i>pri_exp</i>	<i>sec_exp</i>	<i>tert_exp</i>	<i>Gov_spend</i>	<i>gdp_growth</i>	<i>gdp</i>	<i>Gini</i>	<i>edu_exp</i>	<i>inflation</i>	<i>lit_rate</i>	<i>pov_hc</i>	<i>ptr_pri</i>	<i>ptr_sec</i>	<i>ptr_tert</i>	<i>unempl</i>
<i>edu_att</i>	1															
<i>pri_exp</i>	-0.049	1														
<i>sec_exp</i>	0.069	-0.587***	1													
<i>tert_exp</i>	-0.062	-0.534***	-0.205***	1												
<i>Gov_spend</i>	0.315***	-0.094	0.285***	0.048	1											
<i>gdp_growth</i>	0.243***	-0.094	-0.037	0.225	-0.061	1										
<i>gdp</i>	0.516***	-0.421***	0.553***	-0.181***	0.689***	-0.0181	1									
<i>Gini</i>	0.144**	0.072	-0.038	-.210***	0.558***	-.424***	0.369***	1								
<i>edu_exp</i>	0.218***	-0.033	0.101**	-0.001	0.270***	0.119**	0.150***	0.201***	1							
<i>inflation</i>	-0.187***	0.009	-0.063	-0.042	-0.015	-0.135**	-0.147***	-0.001	-0.0107	1						
<i>lit_rate</i>	0.316***	0.251**	0.123**	-0.542***	0.418***	0.136**	0.39	0.201***	0.145***	0.220***	1					
<i>pov_hc</i>	-0.469***	0.119**	-0.223***	0.113**	0.418***	-0.136***	0.390***	0.047	-0.084*	0.097*	-0.193***	1				
<i>ptr_pri</i>	-0.105**	0.226***	-0.511***	0.314***	-0.520***	0.209***	-0.667***	-0.288***	-0.263***	0.036	-0.245***	0.318***	1			
<i>ptr_sec</i>	0.094*	0.338***	-0.507***	0.156**	-0.47***	-0.124*	-0.464	-0.141**	-0.077	-0.076	-0.356***	0.027	0.552	1		
<i>ptr_tert</i>	0.199***	-0.203***	0.086*	0.018	0.008	-0.072	0.016	-0.141***	0.047	-0.024	-0.085*	-0.121**	0.036	0.330***	1	
<i>unempl</i>	0.413***	-0.212***	0.191***	-0.04	0.826***	-0.059	0.670***	0.650***	0.174***	-0.026	0.307***	-0.364***	-0.483***	-0.483***	-0.275***	1

Note: *Gini* = GINI index; *gdppc* = GDP per capita; *edu_att* = Educational attainment; *pri_exp* = Expenditure on primary education; *sec_exp* = Expenditure on secondary education; *tert_exp* = Expenditure on tertiary education; *Gov_spend* = Government expenditure; *gdp_growth* = GDP growth; *edu_exp* = Government expenditure on education as a % of total expenditure; *inflation* = Inflation, consumer prices; *lit_rate* = Adult Literacy rate; *pov_hc* = Poverty headcount; *ptr_pri* = Pupil-teacher ratio, primary; *ptr_sec* = Pupil-teacher ratio, secondary; *ptr_tert* = Pupil-teacher ratio, tertiary; *unempl* = Unemployment ***, ** and * denotes significance at 1%, 5% and 10% respectively.

4.2 Correlational analysis

An assumption for the estimation of regression models is the independence of the regression covariates. To examine this independence assumption, correlation coefficients between pairs of regression variables were estimated and presented as a correlation matrix in Table 4.2. Correlation coefficients with absolute values greater than 0.7 are strong; between 0.35 and 0.7; fair; and below 0.35 weak. According to Kennedy (2008), strong correlation coefficients greater than 0.7 result in multicollinearity which results in biased regression estimates. In the correlation matrix in Table 5 there are no coefficients with absolute values greater than 0.7. This means that there are no problems associated with multicollinearity.

4.3 Regression results

This section presents and discusses the regression results. Section 4.3.1 discusses the regression results for the effect of education on income inequality, and section 4.3.2 discusses the regression results for the effect of education on income (proxied by GDP per capita).

4.3.1 Education and income inequality

As outlined in Chapter 3, the regression models used to analyse the effect of education on income inequality were a fixed effect model (FEM), a random effect model (REM), a Difference Generalised Method of Moments model (Diff-GMM) and a System Generalised Method of Moments model (Syst-GMM). The results of all estimations from the different estimation techniques are presented in Table 4.3. The choice between the fixed effects model and the random effects model was made using the Hausman test results shown in Table 4.3. The Hausman test results concluded that the fixed effects model was better than the random effects model. To test the validity of the System GMM model and the Difference GMM model, the Sargan test, the Hansen test and the test for autocorrelation of the error term were used. Neither the Hansen nor the Sargan tests reject the null hypothesis that instruments in the GMM estimators are valid. The test for auto-correlation of the error term fails to reject the null hypothesis of no second order auto-correlation, thereby suggesting that there is no second order auto-correlation and the GMM estimators are consistent.

All four models show that expenditure on primary education (*pri_exp*), expenditure on secondary education (*sec_exp*) and expenditure on tertiary education (*tert_exp*) have negative and significant effects on the Gini index. This suggests that increases in the percentages of primary, secondary,

and tertiary expenditures lead to a reduction in the level of income inequality. This suggests that whatever level of education is invested in, it leads to an increase in income equality, thus supporting Sylvester (2000). On the contrary, total expenditure on education (*edu_exp*) has a positive and significant effect on the Gini at 1% significance level. This implies that higher spending on education leads to greater income inequality. This supports the findings of Sylvester (2000) who demonstrates that countries with higher levels of inequality had higher educational spending percentages relative to GDP. This is likely to be due to inefficiencies in educational investments by sub-Saharan African governments. The contradiction with the separate components might have been due to the imputation procedure not producing consistent values for total educational expenditure and its individual components (primary, secondary and tertiary).

All the models also show that the adult literacy rate (*lit_rate*) has a negative and highly significant coefficient, implying that improving literacy reduces the level of income inequality. This is because highly literate populations are likely to have more educated people who will be able to work and provide incomes themselves. Low proportions of those populations receive no income. This finding is consistent with the findings of Rahman (2013).

All models show that pupil-teacher ratios in primary education (*ptr_pri*) and pupil-teacher ratio in secondary education (*ptr_sec*) have positive and significant coefficients, while the pupil-teacher ratio in tertiary education (*ptr_tert*) has negative and significant coefficients. This implies that the pupil-teacher ratios for lower levels of education move in the same direction as the Gini index and the pupil-teacher ratio for tertiary education moves in the opposite direction opposite to the Gini index. This means that for primary and secondary education, increasing the amount of educational labour resources per student leads to a lower Gini index value, which indicates lower income inequality. This contradicts Abdullah, Doucouliagos and Manning, (2015). However, increasing the amount of educational labour resources per student for tertiary education leads to an increase in the Gini index which indicates greater income inequality. This is likely to be attributed to the fact that the increased tertiary education resources only benefit a small percentage of the total population enrolled in tertiary education. This is consistent with the findings of Duman (2008).

The negative effect of educational attainment (*edu_att*) on income inequality is observed to be significant in the Difference GMM model at 5%. This implies that the educational attainment level has a negative effect on the Gini index. The higher the educational attainment, the more equal the

income distribution. This supports the empirical findings of Lee & Lee (2018), Ram (1984) and De Gregorio & Lee (2002) but contradicts Braun (1988).

Table 4.3: Income inequality and education regression results

Dependent variable: Gini Index					
	FEM	REM	Diff-GMM	Syst-GMM	Expected Sign
Gini Lag 1			-0.071***	-0.059***	
<i>edu_att</i>	-0.017	0.008	-0.031**	-0.011	-
<i>pri_exp</i>	-0.197***	-0.29***	-0.179***	-0.228***	-
<i>sec_exp</i>	-0.283***	-0.338***	-0.274***	-0.230***	-
<i>tert_exp</i>	-0.654***	-0.722***	-0.063***	-0.661***	-
<i>edu_exp</i>	0.568***	0.524***	1.024***	0.975***	-
<i>lit_rate</i>	-0.182***	-0.157***	-0.173***	-0.163***	-
<i>ptr_pri</i>	0.218***	0.162***	0.225***	0.187***	
<i>ptr_sec</i>	0.425***	0.454***	0.450***	0.449***	
<i>ptr_tert</i>	-0.255***	-0.298***	-0.277***	-0.302***	-
<i>pov_hc</i>	0.1842***	0.161***	0.190***	0.175***	
<i>Inflation</i>	0.018	-0.007	0.013	0.0003	+
<i>gov_spend</i>	0.989***	0.986***	0.907***	0.917***	-
<i>gdp_growth</i>	-0.450***	-0.480***	-0.511***	-0.563***	-
<i>Unempl</i>	0.008	0.296	-0.087	0.258***	+
Constant	47.428***	54.089***	49.074***	50.832***	
R-Squared	0.7792	0.8376			
Wald > χ^2/F (14)	91.76	1436.66	1218.51	1369.31	
Prob > χ^2/F	0.000	0.000	0.000	0.000	
Hausman χ^2 (p-value)	65.33 (0.000)				
Sargan Test p-value			0.197	0.218	
Hansen J-Test p-value			0.236	0.473	
AR(1):p-value			0.176	0.192	
Countries	18	18	18	18	
Observations	360	360	360	360	

Note: Gini = GINI index; *gdppc* = GDP per capita; *edu_att* = Educational attainment; *pri_exp* = Expenditure on primary education; *sec_exp* = Expenditure on secondary education; *tert_exp* = Expenditure on tertiary education; *Gov_spend* = Government expenditure; *gdp_growth* = GDP growth; *edu_exp* = Government expenditure on education as a % of total expenditure; *inflation* = Inflation, consumer prices; *lit_rate* = Adult Literacy rate; *pov_hc* = Poverty headcount; *ptr_pri* = Pupil-teacher ratio, primary; *ptr_sec* = Pupil-teacher ratio, secondary; *ptr_tert* = Pupil-teacher ratio, tertiary; *unempl* = Unemployment. ***, ** and * denotes significance at 1%, 5% and 10% respectively.

Inflation has a positive insignificant coefficient. The models do not provide any conclusive evidence regarding the effect of inflation on the Gini index. Government spending has a positive and highly significant effect on the Gini index. The higher the government spending as a percentage of GDP, the more unequal is the income distribution. This might be due to inefficient government spending and too much government expenditure being on projects that mainly benefit high income earners.

For all the models, the effect of GDP growth on the Gini index was negative and significant. This suggests that high economic growth is associated with reducing income inequality. Unemployment had a significant and positive effect on the Gini index under the system GMM model. This suggests that high unemployment rates lead to high income inequality. This supports the findings of Blejer and Guerrero (1990).

4.3.2 Results for the effect of education on income

A Difference Generalised Method of Moments model (Diff-GMM) and a System Generalised Method of Moments model (Syst-GMM) were used to analyse the effect of education on income. The GDP per capita has been used as a proxy for income as explained in Chapter 3. The panel regression results, found using the two different models, are shown in Table 4.4. The Hansen J-test and the Sargan test p-values show that the models have no overlying restrictions. The test for auto-correlation showed that there was no serial correlation. For most variables, the results from the two models were almost similar.

Under both models, the coefficient for educational attainment (*edu_att*) was significantly positive at 1% significance level. This implies that the greater the level of educational attainment, the greater the income. The coefficient for total expenditure on education (*edu_exp*) was negative and significant at 1% and 5% level for the Diff-GMM model and the Syst-GMM model, respectively. This implies that as government expenditure on education increases, the GDP per capita decreases. This is likely to be due to inefficient education spending which results in greater inequality and lower average income. This observation contradicts the findings of Ifa and Guedat (2018).

The results from both models show that literacy rate (*lit_rate*) “had a positive and significant effect” on the GDP per capita at 1% significance level. Thus, the higher the literacy rate the higher the GDP per capita. This is because literacy increases job opportunities and access to higher education (Rahman, 2013). This finding is consistent with the findings of Rahman (2013). The

pupil-teacher ratio for primary education (*Ptr_pri*) has a negative and insignificant effect on GDP per capita while pupil-teacher ratio for secondary education (*Ptr_sec*) has a positive and insignificant coefficient. Thus, there is not enough evidence to support the effect of the pupil-teacher ratios for primary and secondary education on GDP per capita. On the contrary, the Syst-GMM model show that pupil-teacher ratio for tertiary (*Ptr_tert*) has a negative and significant effect on GDP per capita at 10% level. This implies that the pupil teacher ratio for tertiary education moves in opposing directions with GDP per capita. An increase in the amount of educational labour resources per tertiary education student increases the GDP per capita. This supports the findings of Gyimah-Brempong, Paddison and Mitiku (2006), who concluded that increasing higher education human capital leads to an increase in income.

The three control variables—inflation, government expenditure as a percentage of GDP and poverty headcount—had no significant effects under both models. Unemployment had a negative and significant effect on the GDP per capita, which indicates that high unemployment is associated with low GDP per capita. This is because the total income generated by the few employed people will be spread across the total population, which is mostly unemployed. This finding supports Burgen, Meyer, and Tasci (2012).

Table 4.4: Regression Results

Dependent variable: GDP per capita			
	Diff-GMM	Syst-GMM	Expected sign
<i>gdp</i> Lag 1	1.019***	1.006	
<i>edu_att</i>	2.115***	2.432***	+
<i>pri_exp</i>	-2.140	-3.530	
<i>sec_exp</i>	0.008	-1.220	
<i>tert_exp</i>	-1.129	-2.856	
<i>edu_exp</i>	-18.516***	-16.224**	+
<i>lit_rate</i>	1.954**	2.112***	+
<i>ptr_pri</i>	-5.163	-4.976	
<i>ptr_sec</i>	0.927	0.542	
<i>ptr_tert</i>	-2.140	-2.635*	-
<i>pov_hc</i>	0.129	-0.129	
Inflation	0.356	0.3100	
<i>gov_spend</i>	-4.743	-4.365	
<i>gdp_growth</i>	31.176***	32.781***	+
Unempl	-14.581**	-10.467***	-
Constant	77.619	282.251	
Wald> χ^2	21873.681	233112.372	
Prob> χ^2	0.000	0.000	
Hansen J-Test p-value	0.263	0.412	
Sargan Test p-value	0.184	0.349	
AR(1):p-value	0.235	0.148	
Countries	18	18	
Observations	360	360	

Note: *Gini* = GINI index; *gdppc* = GDP per capita; *edu_att* = Educational attainment; *pri_exp* = Expenditure on primary education; *sec_exp* = Expenditure on secondary education; *tert_exp* = Expenditure on tertiary education; *Gov_spend* = Government expenditure; *gdp_growth* = GDP growth; *edu_exp* = Government expenditure on education as a % of total expenditure; *inflation* = Inflation, consumer prices; *lit_rate* = Adult Literacy rate; *pov_hc* = Poverty headcount; *ptr_pri* = Pupil-teacher ratio, primary; *ptr_sec* = Pupil-teacher ratio, secondary; *ptr_tert* = Pupil-teacher ratio, tertiary; *unempl* = Unemployment. ***, ** and * denotes significance at 1%, 5% and 10% respectively. ***, ** and * denotes significance at 1%, 5% and 10% respectively.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter details the conclusion and findings of this research into the relationship between education and income inequality, particularly focusing on sub-Saharan Africa. The chapter presents a summary of the study and brings together the theoretical and empirical findings discussed in Chapter 4. Further, this chapter presents policy recommendations arising from the conclusions and findings contained within the study. Finally, the chapter concludes with a view to highlighting avenues for future research.

5.2 Summary and conclusions

The study aimed to investigate the relationships between education and income inequality and between education and income. This has been done using a panel data fixed effects model, a random effects model and a dynamic panel estimation approach, using the System GMM model and the Difference GMM model. The Dynamic Panel estimation approaches reflected more robust results than provided by the other models, and were more robust since they accounted for endogeneity, omitted variable bias, unobserved panel heterogeneity and measurement errors. The data used related to 18 selected sub-Saharan African countries, all with sufficient data for credible analysis over a 20-year period, from 1995 to 2015. The data were sourced from the World Bank WDI database.

Most of the empirical results were in line with the findings in the literature. It was observed that higher literacy rates led to lower income inequality. This is because increasing literacy rates lead to more people having the opportunity to enhance their skills and earn relatively higher incomes, thus giving more people an opportunity to escape poverty. Educational attainment had a negative effect on income inequality, thus the higher the level of education attained, the lower the income inequality. This is because higher educational attainment is associated with lower educational inequality which, in-turn, leads to lower income inequality. However, total government expenditure on education was positively associated with increasing income inequality. This is evidence of inefficient resource allocation in educational investments by African governments.

Pupil teacher ratios for primary and secondary education were found to have a negative effect on the Gini index while pupil-teacher ratios for tertiary education had a positive effect. This is because only a small proportion of the population in Africa gets admitted into tertiary education. Hence

any initiatives to improve the educational labour resources in tertiary education, only benefit a small proportion of the total population, thus leading to greater educational inequality and consequent income inequality.

Similar to the literature findings, it was observed that educational attainment was positively related to national income per capita. Higher educational attainment means that more people reach relatively higher levels of education, thus equipping themselves with essential skills to obtain employment and earn higher incomes. Increase in government expenditure on education leads to lower income, due to inefficiency in the allocation of resources. Unemployment has a negative effect on income. However, the study could not find a relationship between inflation and income. This can be explored further in further research.

In conclusion, education does matter for income inequality. It is a clear pathway leading to decent paying jobs and careers that enable individuals to provide for themselves and their families.

5.3 Policy recommendations

The findings of this study have implications for sub-Saharan governments and policy makers with regards to their policies on education.

The findings show that it is vital for sub-Saharan countries to improve the educational attainment level. This may be achieved by implementing policies that encourage people to reach tertiary education. Access to tertiary education should be made easier for poor people. However, this is only possible if the quality of primary and secondary education is high. Improved primary and secondary education allow more people to qualify, be accepted and admitted into tertiary education. Educational labour resources should also be enhanced by improving training for teachers across all the three levels of education. However, in implementing these policies, the resources must be allocated efficiently. They should be allocated in such a way that all socio-economic sectors of the population benefit. If resource allocation is inefficient, then any efforts to improve the education system lead to greater educational inequality and income inequality.

A key policy recommendation is to increase government expenditure/budget allocation to improvement of quality education in early childhood and at the primary level of schooling. It is recommended that attention should focus on providing greater resources for teacher training, on

quality teacher-pupil support and access to classroom equipment and technology. Effective human capital policies should cover mass training and retraining of workers to enhance their skills.

5.4 Avenues for future research

This study investigated the relationship between educational variables and income inequality. However, educational inequality was not included as part of the independent variables due to insufficient data available for the 18 selected sub-Saharan countries. Equality of education opportunity, particularly for higher education, could be included in further research to investigate the relationship between education inequality and income inequality.

Qualitative factors other than education that contribute to income inequality could be assessed. The study may be extended further into the impact on income inequality of corruption, historical injustices, globalisation and technological changes.

Due to data constraints, only 18 sub-Saharan countries were used in the investigation. If more countries are included the study will be more comprehensive and more representative of the whole of sub-Saharan Africa. However, all countries used should have sufficient data to provide the variables used in analysis. The period of investigation may be extended to include years after 2015.

Further research should also include an investigation of the effect of cost on the accessibility of education for different socio-economic classes. There were some inconclusive results regarding the relationship between inflation and income inequality. This relationship may be explored in further research.

Efficiency of public spending on education should also be investigated, as it has a direct impact on the outcomes of education expenditure and therefore income inequality. This would involve further investigation of the quality of governance, corruption, and regulation.

References

- Abdullah, A., Doucouliagos, H. & Manning, E. (2015). Does education reduce income inequality? A meta-regression analysis. *Journal of Economic Surveys*, 29(2), 301–316.
- Manuel Arellano, Stephen Bond. The Review of Economic Studies, Volume 58, Issue 2 (April 1991)
- Manuel Arellano, Olympia Bover. Another Look at the Instrument Variable Estimation of Errors. *Journal of Econometrics*, (1995)
- Baltagi, B. (2005). *Econometric analysis of panel data (3rd edition)*. West Sussex: John Wiley & Sons.
- Barro, R. J. (1999). Determinants of democracy. *Journal of Political Economy*, 107, S158–S183.
Retrieved from
https://www.jstor.org/stable/10.1086/250107?seq=1#metadata_info_tab_contents
- Barro, R. J. & Lee, J–W. (2015). *Education matters: Global schooling gains from the 19th to the 21st century*. Oxford: Oxford University Press.
- Bipul. (2016). Retrieved from The world around us:
<https://uniconinc.blogspot./2016/05/differences-in-economic.html>
- Blejer, Mario & Guerrero, Isabel (1990). The Impact of Macroeconomic Policies on Income Distribution: An Empirical study of the Philippines. *The Review o Economics and Statistics*, 414-423
- Bourguignon, Francois & Morrison. (2002). *A Turning point in Global inequality and Beyond*. ias.edu. Presented at conference.
- Braun, D. (1988). Multiple measurements of US income inequality. *The Review of Economics and Statistics*, 398–405.

- Burgen, E., Meyer, B. & Tasci, M. (2012). An elusive relation between unemployment and GDP growth: Okun's law. *Economic Trends*.
- Checchi, D. (2003). Inequality in incomes and access to education: A cross-country analysis (1960–95). *Labour*, 17(2), 153-201. Retrieved from https://onlinelibrary.wiley.com/doi/abs/10.1111/1467-9914.00226?casa_token=VzyNPgv-eAEAAAAA:S2FsyG8zsVC-0fxbImdibrSELyx3vF0R1TSP0QlnAv6R0LvKRV9jszarmGQ1WkluGW3J8I2YBnpUPXk
- Chiswick, B. R. (1974). *Income inequality: Regional analyses within a human capital framework*. Washington, DC: National Bureau of Economic Research.
- Coady, David, Gupta, Sanjeev & Bastagli, Francesca, (2012). *Income Inequality and Fiscal Policy*. International Monetary Fund. SDN 12/8
- Coady, D. & Dizioli, A. (2017). *Income inequality and education revisited: Persistence, endogeneity, and heterogeneity*. New York: IMF.
- Coady, A. D. (May, 2017). *Income inequality and education revisited*. Washington, DC: IMF Working Paper WP/17/126.
- Dearden, L., Ferri, J. & Meghir, C. (2002). The effect of school quality on educational attainment and wages. *Review of Economics and Statistics*, 84(1), 1-20.
- Duman, A. (2008). Education and income inequality in Turkey: Does schooling matter? *Financial Theory and Practice*, 32.3, 369-385.
- Farris, F. A. (2010). The Gini index and measures of inequality. *The American Mathematical Monthly*, 851-864.
- Feketha, S. (2018, March 28). *The star*. Retrieved from IOL: <https://www.iol.co.za/news/south-africa/south-africa-worlds-most-unequal-society-report-14125145>
- Firebaugh, G. (2003). *The new geography of global income inequality*. Cambridge, MA: Harvard University Press.
- Freeman, R. B. (2002). *Inequality around the world*. London: Palgrave Macmillan.

- Glomm, G. & Ravikumar, B. (1992). Public versus private investment in human capital: Endogenous growth and income inequality. *Journal of Political Economy*, 100(4), 818–834.
- Gregorio, J. D. & Lee, J-W. (2003). Education and income inequality: New evidence from cross-country data. *The Review of Income and Wealth*, 395–416.
- Gyimah-Brempong, K., Paddison, O. & Mitiku, W. (2006). Higher education and economic growth in Africa. *The Journal of Development Studies*, 42(3), 509-529.
- Hanushek, A. E. & Wößmann, L. (2010). Education and economic growth. *Economics of Education*, 60–67.
- Hanushek, E. A. (2007). *Education quality and economic growth*. Washington, DC: The World Bank Group.
- Hausman, J. A. (1978). Specification tests in econometrics. *Econometrica: Journal of the Econometric Society*, 1251–1271.
- Herschbein, Brad, Kearney, Melissa & Summers, Lawrence (2015). *Increasing Education: What it will and will not do for earnings*. The Brookings Institution
- Honkkila, J. (1999). *Investment in education and income inequality*. Retrieved from <https://www.wider.unu.edu/sites/default/files/RIP21.pdf>
- Hurbert, W. (2017). *Income inequality trends in sub-Saharan Africa*. New York: UNDP Regional Bureau for Africa.
- Ifa, A., & Guetat, I. (2018). Does public expenditure on education promote Tunisian and Moroccan GDP per capita? ARDL approach. *The Journal of Finance and Data Science*, 234–246.
- OECD (2015). *In it together: Why less inequality benefits all*. Paris: OECD Publishing.
- Kuznets, S. (1955). Economic growth and income inequality. *American Economic Review*.
- Kweka, J. P. & Morrissey, O. (2000). Government spending and economic growth in Tanzania, . *CREDIT Research Paper, 1965-1996*(No. 00/6).

- Lam, D. F. (2015). *Schooling inequality, returns to schooling and earnings inequality: Evidence from Brazil and South Africa*. Helsinki: UNU-WIDER.
- Lee, J-W. & Lee, H. (2018). Human capital and income inequality. *Journal of the Asia Pacific Economy*, 23(4), 554–583.
- Lewin, K. M. (1993). Education and development the issues and the evidence: Education Research Paper No. 06, 61p. Retrieved from <https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.696.735&rep=rep1&type=pdf>
- Mellor, J. (1990). Dramatic poverty reduction in the third world: Prospects and needed action. *Agricultural Prospects and Challenges in Developing Countries*.
- Morris, P. (1996). Asia's four little tigers: A comparison of the role of education in their development. *Comparative Education*, 95–110.
- Mundi, I. (2011). Retrieved from Index Mundi: <https://www.indexmundi.com/facts/indicators/SI.POV.DDAY>
- Nielsen, Francois & Aldersen, Arthur S. (2002). Globalization & the Great U-Turn: Income Inequality Trends in 16 OECD Countries. *American Journal of Sociology*, 107(5), 1244-1299 *social statistics*. Paris: OECD Publishing.
- OECD Data Organization. (n.d.). *Inequality, Income Inequality*. Retrieved from O: <https://data.oecd.org/inequality/income-inequality.htm>
- Poves, O. (2018). *Overcoming poverty and inequality in S.A.: An assessment of drivers constraints and opportunities*. Washinton, DC: World Bank.
- Rahman, M. S. (2013). Relationship among GDP per capita, GDP literacy rate and unemployment rate. *British Journal of Arts and Social Sciences*, 14(2), 169–177.
- Ram, R. (1984). Population increase, economic growth, educational inequality and income distribution. *Journal of Development Economics*, 419 –428.
- Roy, P. & Husain, Z. (2019). *Education as a way to reducing inequality: Evidence from India*. Munich: MPRA.

- Saint-Paul, G. & Verdier, T. (1993). Education, democracy and growth. *Journal of development Economics*, 42(2), 399–407.
- Seefeldt, B. (2018, November 25). *The impact of education expenditures on income inequality: Evidence From US States*. Senior Capstone Project. Retrieved from www.fin24.com
- Shahabadi, A., Nemati, M. and Hosseinidoust, S.E. (2018). The effect of education on income inequality in selected Islamic Countries. *International Journal of Asia Pacific Studies*, 14(2), 61-78
- Sylwester, K. (2000). Income inequality, education expenditures, and growth. *Journal of Development Economics*, 63(2), 379–398.
- The World Bank Group. (n.d.). *Metadata glossary*. Retrieved from The World Bank Databank: <https://databank.worldbank.org/metadataglossary/world-development-indicators/series/SL.UEM.TOTL.NE.ZS#:~:text=Unemployment%20refers%20to%20the%20share,available%20for%20and%20seeking%20employment.&text=It%20is%20the%20labour%20force,indicator%20not%20t>
- World Development Indicators: Data Bank. <https://databank.worldbank.org>
- UNDP. (2017). *Income inequality: Trends in sub-Saharan Africa: Divergence, determinants and consequence*. New York: UNDP.
- UNESCO Institute of Statistics. (2009). *Education indicators: Technical guidelines*. UNESCO.
- Unesco Institute of Statistics. (n.d.). *Educational attainment*. Retrieved from UIS: <http://uis.unesco.org/en/topic/educational-attainment>
- Urquiola, M. & Verhoogen, E. (2009). Class-Size caps, sorting, and the regression-discontinuity design. *American Economic Review*, 179–215.
- Wahito, I. (2018). Effect of transaction costs on interational remittance flows from developed countries: A sub-Saharan context. Cape Town, South Africa: (Unpublished masters dissertation) University of Cape Town.
- Wells, R. (2016). *Education's effect on income inequality: An economic globalisation perspective*. Iowa City: University of Iowa. Retrieved from

https://www.researchgate.net/publication/44837944_Education's_effect_on_income_inequality_an_economic_globalisation_perspective

Willen, P. H. (2004). *Educational opportunity & income inequality*. NorthWestern University.

World Bank. (n.d.). *Inflation, consumer prices (Annual %)*. Retrieved from The World Bank Data Catalogue: <https://datacatalog.worldbank.org/inflation-consumer-prices-annual-0>

Yaffee, R. (2003). A primer for panel data analysis. *Social Sciences, Statistics and Mapping*, 10.

Zotou, N. B. (2013). *Education and economic growth*. Ioannina, Greece: MPRA.