The Impact of Aid on Human Development Indices in Sub-Saharan Africa

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by

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Abstract

This study investigates the relationship between official development assistance (ODA) and human development indicators (HDIs) in 49 sub-Saharan African countries over the period of 1995 to 2017 using 3-stage least squares (3SLS). The four key sub-classes of HDIs considered for this research include education, health, government and civic society, as well as environmental indicators. Of all these HDIs, the results of the analysis show that health aid is the most effective form of aid, significantly reducing the incidence of HIV, the infant mortality rate and the maternal mortality rate, as well as leading to improved life expectancy. Education aid has a significant effect on the progression to secondary school followed by adult literacy rates. Government and civil society aid significantly affects the ability of girls to access education at primary, secondary and tertiary levels while environmental aid is found to increase the carbon efficiency of production. Hence, this study demonstrates that aid is most effective on the health, education and environmental human development indicators.

Key words: official development assistance (ODA); human development indices (HDIs); aid effectiveness; OECD; sub-Saharan Africa (SSA); gender parity; education; health; environment.

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Abbreviations

AGOA	Africa Growth Opportunity Act
AIDS	Acquired Immuno Deficiency Syndrome
CO_2	Carbon Dioxide
CRS	Creditor Reporting System
DAC	Development Assistance Committee
DPT	Diphtheria
DV	Dependent Variable
EBA	Everything but Arms
ERP	European Recovery Programme
EU	European Union
FDI	Foreign Direct Investment
GCS	Government and Civil Society
GDP	Gross Domestic Product
GMM	Generalised Method of Moments
GNI	Gross National Income
GNP	Gross National Product
GPI	Gender Parity Index
HDI	Human Development Indicator
HIPC	Highly Indebted Poor Country
HIV	Human Immuno Virus
IMF	International Monetary Fund
INFMORT	Infant Mortality Rate
ISIC	International Standard Industrial Classification
IV	Independent Variable
MANOVA	Multi-variate Analysis of Variance
MDG	Millennium Development Goals
NGO	Non-governmental organisations
ODA	Official Development Assistance
OECD	Organisation of Economic Corporation and Development
OLS	Ordinary Least Squares
PPE	Pro-poor Expenditures
PPP	Purchasing Power Parity
RER	Real Exchange Rate
SD	Standard Deviation
SDG	Sustainable Development Goal(s)
SSA	Sub-Saharan Africa
UPE	Universal Primary Education
UN	United Nations
UNDP	United Nations Development Program
UNESCO	United Nations Educational, Scientific, and Cultural Organization
U.S/USA	United States of America
WASH	Water, Sanitation and Hygiene
WB	World Bank
WHO	World Health Organization
2SLS	2 Stage Least Squares
3SLS	3 Stage Least Squares

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I would like to extend a big thank you to my mother Margaret Tsokodayi for teaching me to believe and to dream. Thank you very much mum. I have the ability to dream and the energy to chase the dreams as evidenced by this completed dissertation which I dedicate to you. I would like to thank Shauna for affording me the time to study through her support and cooperation.

Chapter 1 : Introduction

1.1 Research area

According to Sachs (2005), Africa has no capacity to move out of poverty without international aid, and thus many United Nations programs are based on the premise that aid is an effective counter measure against poverty. Hence, increased aid has been promoted as a pre-requisite for Africa to achieve the Millennium Development Goals (MDGs) (Armah & Nelson, 2008). Despite this belief, Moyo (2010) argues that aid has been more detrimental than favourable in Africa. It is estimated that Africa has received aid equal to US$1.5 trillion since the 1970s (OECD, 2018), increasing from US$17 billion per annum in the 1970s to about US$48 billion from 2010 to present day. Despite this expenditure, Africa remains the most undeveloped and poverty-stricken region in the world (Siyum, 2018). According to Mills (2010), *"Africa is poor not because the world has denied the continent the market and financial means to compete. It is not because of aid per se nor is African poverty solely a consequence of poor infrastructure or trade access, or because the necessary development and technical expertise is unavailable internationally. Africa's people are poor because their leaders have made this choice."* This observation seems to justify the numerous studies on aid effectiveness given conditionalities such as good governance, political freedoms, rule of law and fiscial discipline.

1.2 Sub-Saharan Total Aid (1995-2017)

Table 1.1 summarises the descriptive statistics of aid by category to SSA. SSA received a total of US$494 billion from OECD countries over the course of 23 years between 1995 and 2017, which equates to an annual average of US$21 billion with a standard deviation of US$8 billion. Table 1.1 further shows that the majority of aid was distributed to the economic infrastructure and services sector (US$45 billion), followed by education (US$40 billion), and then health (US$35 billion). The final two categories comprise total government and civil society aid (US$30.91 billion) and lastly, environmental protection (US$9 billion).

The donor focus on economic infrastructure, education and health as evidenced by the high aid allocations to these sectors draws from the consensus of the MDGs that focus on "halving extreme poverty rates *(economic)*, halting the spread of HIV/AIDS *(health)* and providing universal primary education" (United Nations, 2001). This implies that donors consider

education, health and economic intervention to be the main instruments in poverty alleviation and development. Civil society issues such as gender equality and environmental issues were not topical until recently and this is reflected by lower aid allocations to these sectors. They were likely considered ancillary to the development process however, the new framework of SDGs emphasises on these matters and they have become central to assessing all-encompassing development (UNDP, 2019).

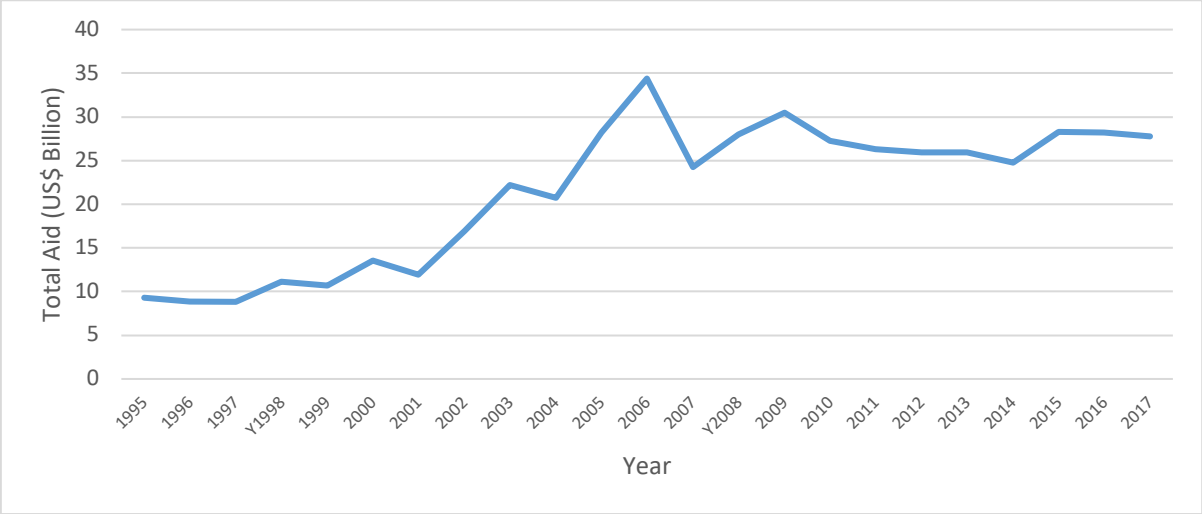
Table 1.1: Summary Statistics – Sub-Saharan Total Aid (1995-2017)

	Sum (US$'mil)	Mean (US$'mil)	Std. Dev.	Skewness	Kurtosis
Overall Development Assistance	493,918.94	21,474.74	8,115.09	-0.445	-1.290
Education	39,676.24	1,725.05	571.03	-0.393	-0.225
Health	35,026.52	1,522.89	739.49	0.430	-0.713
Economic Infrastructure & Services	45,002.09	1,956.61	1,012.67	0.601	-0.915
Government and Civil Society-	30,907.55	1,343.81	491.74	-0.321	-0.899
Environment Protection	8,675.22	377.18	226.99	1.524	3.114

Source: Based on data presented on (OECD, 2018)

Figure 1.1 below further shows that there was a material increase in the total aid from 1995 up to 2006, but a near-stationary distribution in the aid between 2007 and 2017. The increase in aid from around the year 2000 is a result of the adoption of MDGs and the advocacy by some global economists for the developed world to fund the achievement of these MDGs in Africa (Sachs, 2005). The increase is also attributed to the Enhanced HIPC initiatives of 1999 (Serieux, 2009). However, the trend was affected by the global credit crisis, which resulted in developed countries focusing their attention on bailing out financial institutions in their home countries rather than distributing aid capital abroad.

Figure 1.1: Distribution of Sub-Saharan Total Aid (1995-2017)

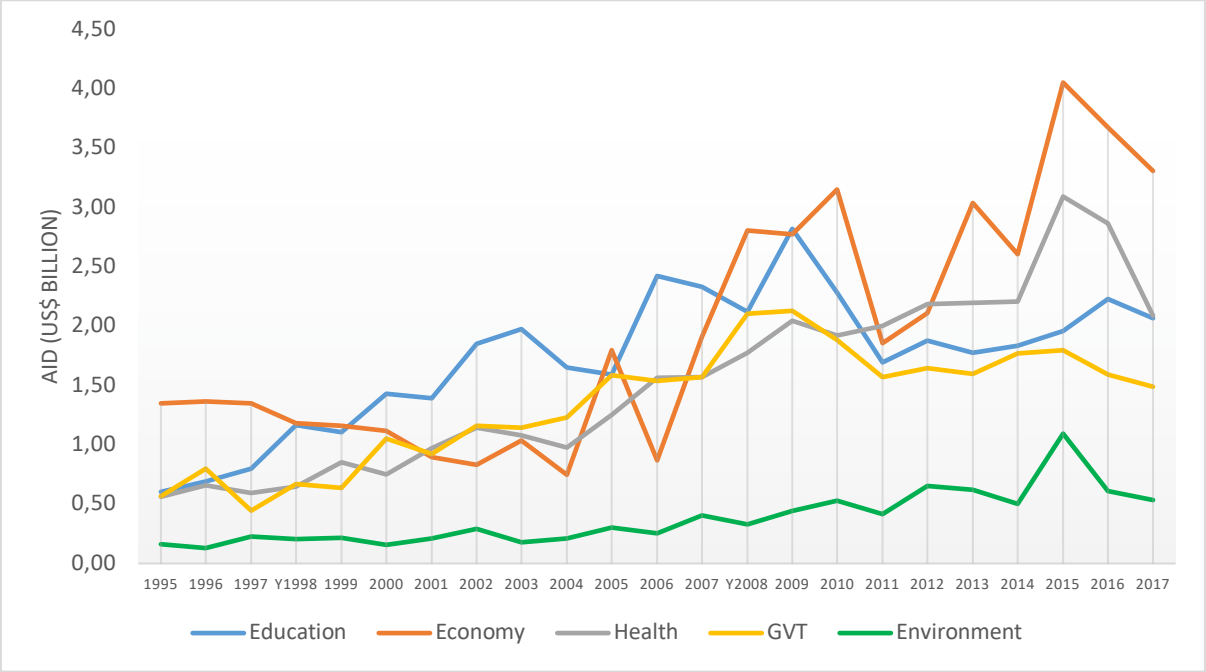


Source: Based on data presented on (OECD, 2018)

1.3 Sub-Saharan Aid by Sector (1995-2017)

To summarise the aid statistics provided in Table 1.1 and to demonstrate sector preference, Figure 1.2 shows the distribution of ODA to SSA by sector on a year-on-year basis from 1995 to 2017. There is a general increasing trend in all forms of aid from 1995 that slows during the period of the financial crisis and then recovers thereafter. Environment aid is the least preferred form of aid as evidenced by its perennially low trend line, possibly as a result of the lack of economic literature and general belief linking environmental sustainability to development (Arndt & Tarp, 2017). From 1995, economic and infrastructure aid was the highest form of aid but during the 10-year period from 1999 to 2008, education aid then became more dominant. After the financial crisis, economic and infrastructure aid emerged the most prevalent form as a means to counter the negative effects of the financial crisis. Health sector aid also increasingly became significant after 2000 as a result of the adoption of the Global Malaria Action Plan, which targeted countries in SSA that carry a significantly disproportionate share of the global malaria burden (WHO, 2019) and the fight against HIV/AIDS. Consequently, health sector aid became one of the three main forms of aid to SSA.

Figure 1.2: Sub-Saharan Africa Aid by Sector (1995-2017)



Source: Based on data presented on (OECD, 2018)

1.4 Problem Definition

A substantial volume of academic work exists that seeks to investigate the impact of aid on recipient countries, which includes economic growth effects (Chenery & Strout, 1966; Armah & Nelson, 2008), aid effectiveness (Bourguignon & Platteau, 2017), or the effects of aid volatility on growth (Museru, Toerien & Gossel, 2014). A common limitation among studies devoted to the topic is that most do not consider the effects of sectoral aid, such as health, welfare, gender parity, education and the environment. Of the sources reviewed in Chapter 2, less than 10% of the literature separated aid into its various sectoral components. Hence, although the objective of aid is human development, most studies only consider the effect of aid on economic growth (Williamson, 2008), and treat aid as a single homogeneous factor.

This study thus seeks to consider the broader socio-economic and cultural developmental effects of aid through splitting aid into its various sectoral components out of the realization that economic growth does not adequately measure human development, and studies based on aggregate aid flows potentially veil the impact of OAD on other sub-indices of human development. This will assist policy makers in long term aid planning and in targeting the aid to specific outcomes. This study thus investigates the relationship between official

development assistance (ODA) and human development indices (HDIs) in 49 sub-Saharan African countries over the period of 1995 to 2017 using 3-stage least squares (3SLS). The HDIs were categorised into four focal areas which are education, health, civil and social equality; and environmental sustainability.

1.5 Research questions and objectives

Pursuant to the problem statement and the background to the research, this study seeks to answer the following primary research question:

What is the relationship between the four sub-categories of official development assistance and the respective four categories of human development indicators?

The four sub-categories of ODA include health, education, government and civic society; and environment; while the four HDI categories include health, measured by child and maternal mortality, incidence and prevalence of HIV, and life expectancy; education, measured by adult literacy, progression to secondary school and pupil-teacher ratio; government and civic society, measured by gender parity in youth literacy, primary school enrolment, primary and secondary school enrolment, and tertiary education; and environmental sustainability, measured by CO_2 emission per dollar of GDP and per capita CO_2 emission.

In addition to the primary research question, the following sub-questions are also examined:

i. Is there a positive relationship between the ODA categories and the corresponding HDIs?
ii. Which HDIs are most significantly affected by aid?

The main aim of this study is to achieve a unique analysis on the effectiveness of aid in sub-Saharan Africa through stratifying aid into its various sectoral components and measuring effectiveness based on sector-specific development indicators. To achieve this, the study makes use of secondary aid data obtained from OECD and World Bank. The following is a list of research objectives:

1. *To understand the impact of aid on development indicators on a sector by sector basis.*
2. *To understand which development indicators per sector are the most responsive to sectoral aid.*

1.6 Structure of the study

The remainder of this research is structured as follows: Chapter 2 provides an overview of the theoretical and empirical studies on aid effectiveness. Chapter 3 discusses the data and data sources. Chapter 4 discusses the methodology used to conduct the empirical analysis. Chapter 5 discusses the results of the data analysis. Chapter 6 provides conclusions and recommendations.

Chapter 2 : Literature Review

This chapter is structured in five sub-sections. The first reviews the empirical studies devoted to the relationship between aid and economic growth, savings and investment. The second section focusses on the recent studies associated with conditionalities to the effectiveness of aid while the third section considers the studies that investigate the relationship between aid and human development. The chapter then concludes with a summary of the key themes.

2.1 Theory of aid and human development

Early economists, authors and their followers argued that the main hinderance to economic growth and development was lack of capital accumulation through savings (Kanbur, 2006). Consequently, early models on aid effectiveness were referred to as "gap" models as a result of their empirical analysis of the assumed financing constraints or "gaps" that aid was supposed to cover (Museru, Toerien, & Gossel, 2013). The initial gap model was performed by (Domar, 1947) who argues that to maintain full employment, savings should always equal investment. He argued that aid towards the industrialization of undeveloped countries had to take the form of goods and machinery to bridge the investment gap. This was informed by the arguments of Keynes (1936) who theorized that governments can intervene in markets to correct market failures such as the Great Depression through increased spending or taxation.

In the 1940s and 1950s, the US government through the Marshal plan, implemented "interventionist" measures towards the rebuilding of war-torn Europe as theorized by Keynes (1936). The Marshall Plan is considered to be the most effective and successful of US foreign aid programmes (Congressional Research Service, 1997). After the reconstruction of Europe in the 1960s, the US government continued with interventionist measures with the aim of helping aid-recipient countries to build savings for reinvestment (Kanbur, 2006). By this time, there were many advocates for aid as a means for fast-tracking the development of underdeveloped countries. One of them was Rostow (1960) who came up with the five stages of development.

Rostow (1960) argued that some of the pre-conditions necessary for nations to develop and transition from traditional societies could be external. In history, preconditions for take-off did not always arise endogenously but from some external intrusion in the form of conquest or aid from more advanced societies. Such literal or figurative invasions were assumed to have the potential to shock the traditional system and hasten its disintegration potentially leaving space for the development of new systems of doing things which are more productive as was observed during the industrial revolution (Rostow, 1960).

The theories of Rostow (1960) were closely followed by (Rosenstein-Rodan, 1961) who highlights that the purpose of international aid programmes is the development of underdeveloped countries to a point where a satisfactory rate of growth can be achieved on a self-sustaining basis. He draws parallels between investment and growth arguing that an aid absorptive capacity that is much higher than the average rate of saving was the main lever of a development programme and should be the main precondition to the granting of aid to underdeveloped regions.

Rosenstein-Rodan(1961)further argues that a minimum level of resources should be devoted to an aid programme for it to have chances of success. Using an analogy of an aeroplane, he argues that launching a country into self-sustaining growth and human development is similar to getting a plane off the ground. A certain minimum ground speed is a prerequisite for such an effort can be attempted. Likewise, to launch a society into continuous development, the giving of aid on bit by bit basis would not be sufficient to create the critical mass necessary to make aid effective. He therefore links the developmental effectiveness of aid to its quantum.

Beyond a certain critical mass, aid invested was assumed to have a one to one link with growth (Kanbur, 2006). This became known as the theory of the *"Big Push"* where according to the theory, growth is largely correlated to investment. In many ways, this together with the earlier gap model introduced by (Domar, 1947) set the stage for later aid studies that focused on the nexus between growth and investment/savings. Rosenstein-Rodan(1961) promote the big push for aid arguing that capital is the most mobile factor of production hence it should be much easier to move capital and machinery towards labour than performing the reverse which would be a mass migration from underdeveloped regions towards capital in the developed world.

Perhaps the most compelling and clear theoretical framework on aid was done by (Chenery & Strout, 1966). Building on the work of Rostow (1960), Rosenstein-Rodan(1961) and the earlier

Harod-Domar model, Chenery et al.(1960) theorize that a country setting out to transform its development level without external assistance must provide for all of the conditions precedent for accelerated growth from its own resources or from the imports of new technologies and resources acquired through export proceeds. To achieve this, a country had to simultaneously increase skills, domestic savings and export earnings whilst at the same time efficiently allocating these resources in such a way as to increase income.

In the mid-1960s, (Chenery & Strout, 1966) built on Chenery et al.(1960) and introduced the matter of import constraints as one of the main constraints to human development in the non-industrialized world resulting in the Harod-Domar model. Their argument is that these countries cannot import the technologies and the resources necessary for a modern economy and a modern level of development. Thus, their study focuses on the possibility of accelerating growth through concentrated amounts of external resources flows in a short timeframe.

The summarized early ideas from influential economists such as (Keynes, 2008), (Rostow, 1960) and (Domar, 1947) thus cement the theoretical framework that human development, whether defined by economic growth, the level of investment, employment, savings or any other measure, was possible of being catalyzed by external intervention in the form of aid. We may call this external intervention through aid the *"visible hand of international development."*

2.2 Empirical literature - Aid, savings, investment and growth

In the 1970s, aid-growth models came under greater scrutiny and studies such as (Griffin & Enos, 1970); (Papanek, 1972) , which conducted an empirical analyses on the relationship between aid and growth demonstrated that the relationship between aid and development was weak. (Griffin & Enos, 1970) found that aid had a negative correlation with savings because aid had become a substitute for tax reforms in developing countries and private entreprenuers who were finding cheap loans from abroad had no incentive to curtail their own consumption. This was also confirmed by (Papanek, 1972) who observed that the negative statistical relationship between savings and foreign aid could have been a result of an accounting convention used for recording financial flows and not an actual behavioral relationship.

In the 1990s and 1980s, the studies became increasingly non-conclusive. Emperical studies became increasingly concerned about explaining the reasons for the variation of aid across

countries i.e the reasons why aid results in a substantial developmental stimulus in some countries but in others, the results are neutral or even negative. (Mosley, Hudson, & Horrell, 1987) focused their study on this aspect but failed to establish any robust correlation between aid and the GDP growth rate in developing economies. However, their research laid the foundation for modern research which seeks to explain why aid effectiveness differs from one country to the other by considering other variables such as policy and political stability.

After the 1990s, studies increasingly identified a positive relationship between aid and growth in numerous developing territories. (Hansen & Tarp, 2000) performed a literature re-examination of the aid – investment, aid - savings and aid - growth relationships by considering 3 generations of empirical cross-country studies covering 131 countries from the period from the 1960s to the late 1990s. They find that there is a relatively consistent pattern that aid promotes aggregate savings, increases investment and growth.

(McGillivray, Feeny, Hermes, & Lensink, 2006) surveyed 50-years' worth of empirical studies on the macroeconomic effect of aid, focusing mostly on cross-country studies examining the aid/growth interaction. Of the 11 major studies surveyed which covered the period from 1968 to 1996, three studies highlighted that foreign capital flows negatively impact savings. These include Rahman (1968), Griffin (1970) and Weisskopf (1972). One study by Gupta (1970) concluded that foreign capital inflows have no impact on savings. Three out of the remaining seven studies found out that aid has a positive impact on growth. These include studies by Papanek (1973), Dowling and Hiemenz (1982); and Gupta and Islam (1983). The remaining four studies by Voivodas (1973), Mosley (1980), Mosley et al. (1987) and Boone (1996) concluded that aid has no impact on growth. (McGillivray, Feeny, Hermes, & Lensink, 2006) surveyed 18 empirical studies from 1996 to the time they perform their survey. Of the 18 studies surveyed 17 concluded that aid was indeed effective on growth with the exception of Jensen and Paldam (2003). Of the 17 pro-aid studies, eight concluded that aid effectiveness was either conditional on policy, good governance, democracy or institutional quality. These include Burnside and Dollar (2004b); Kosack (2003) and Collier & Dehn (2001). Seven studies highlighted that aid is effective however it has diminishing returns. Consequent to the results, (McGillivray, Feeny, Hermes, & Lensink, 2006), conclude that most of the literature for the last 50 years was ambiguous in its conclusions. They suggest the existence of what they called the "micro-macro paradox" because of the existence of evidence to suggest aid effectiveness at the micro level yet without corresponding evidence of the same at macro level. More recent

studies seemed to concur that aid works but they recommend further study in understanding the context within which aid works.

With regards to empirical studies devoted to SSA, (Gomanee, Girma, & Morrissey, 2002) use residual generated regressors to measure the impact of aid on growth accounting for the effect via investment using a sample of 24 SSA countries covering the period from 1970 to 1997. The results find that there is a significantly positive relationship between aid and growth whereby a 1% increase in the aid/GNP ratio increases the growth rate by about 33% of a percentage point. Hence, Gomanee *et al*. conclude that there is a positive relationship between aid and growth though it is very small because aid has to work through transfer mechanisms such as government spending and investment. They recommend that it is incorrect to take disappointing growth results in Sub-Saharan Africa as an indicator of the ineffectiveness of aid. They propose that it is more desirable to maintain aid to SSA whilst identifying, understanding and addressing factors that explain less than expected growth and performance.

(Ouattara, 2007) examines the impact of aid on public savings in Cote d'Ivoire during the period between 1975 to 1999 using the non-linear 3SLS technique, which is commonly used for fiscal response studies. The results show that an increase of a 1000 francs in both project and food aid reduces "public savings by 725 and 260 francs, respectively". A similar trend is observable for programme aid and technical assistance where an increase of 1000 francs induces a reduction in public savings by more than 1000 francs. Consequently, both programme aid and technical assistance had a higher public savings displacement effect compared to project aid and food aid. By further disaggregating the four types of aid into standalone variables, (Ouattara, 2007) observes that project aid flows decrease public savings, whilst the financial program aid has a zero-effect. On the contrary, food aid and technical assistance associated with increases in public savings. Project aid reduces public savings for a number of reasons but chiefly because recurrent project costs are often left to be financed by the recipient government from its own savings. For example, if donors build a hospital or a school, the government is left to finance the running expenditure of such infrastructure. As each type of aid has a different influence on the fiscal behaviour of the recipient government, (Ouattara, 2007) recommends that donors have to get the right balance on the composition and magnitude of aid flows to recipient countries. The solution is not to cut aid but to alter composition based on the needs of the recipient.

(Serieux, 2009) examines the impact of aid on domestic savings using a sample of 29 SSA countries over the period 1965 to 2006 by employing the pooled mean group (PMG) analysis. (Serieux, 2009)'s results show that "approximately 35% of each percentage point of aid relative to GNP was expended in financing reverse capital flows; 41% of the aid was consumed and the balance of 24% was investment." The consumed portion effectively displaced domestic savings. From the results, it is explicit that the predominantly aid is not utilized for investment but reverse capital flows hence more than 33% of aid did not trickle into the recipient economy. The long-run equation for the savings rate demonstrates a negative coefficient of -0.41 for the ODA to GDP ratio which demonstrates that as ODA increases, savings rates decrease. Hence, (Serieux, 2009) concludes that the anticipated periods of high aid to SSA during the first decade of the millennium to fund MDGs was likely to be accompanied by low rates of savings in the region.

(Ndambendia & Njoupouognigni, 2010) examine the relationship between foreign aid, FDI and economic growth using a sample 36 SSA countries over the 28 year period from 1980 to 2007. Employing dynamic panel data mean group (MG), pooled mean group (PMG) and dynamic fixed effect (DFE) estimators, the results show that although both foreign aid and FDI have a positive impact on economic growth, the effect of FDI is more significant than from aid. Using dynamic fixed effects (DFE), they derive significant positive evidence on the relationship between economic growth and internal factors of savings and human capital (labour) in as much as external factors of FDI and aid were important. Human capital remained a key factor of production in fostering economic growth. Hence, Ndambendia and Njoupouognigni recommend that it is much better to focus on internal factors such as human capital to boost economic growth because internal factors such as domestic savings and labour are more accessible compared to FDI and foreign. On human capital, they recommend higher investments in education but on domestic savings, they concede that this might be more difficult to boost considering the weak level of labour income in SSA.

(Baldé, 2011) studied the impact of foreign assistance and remittances on savings and investment in SSA using a sample of 37 SSA countries over the period 1980 to 2004. The study allowed for the performance of a comparative analysis on the effectiveness of aid and remittances in boosting savings and investment in the region. Ordinary least squares (OLS) and instrumental variables (2SLS) estimation methods were employed with country fixed effects. The results show that both remittances and official development assistance promote savings

and investment in SSA with remittance between more effective than aid despite being lesser in amount compared to ODA. Through a scenario analysis, the results show that a 10% increase in remittances increased savings by 7% and investment by 6.5%. However, a similar 10% increase in ODA increased savings by 1.6% and investment by 1%. Despite the findings which show higher effectiveness of foreign remittances over aid, the researcher recommends that the two inflows should never be seen as substitutes as suggested by (Grabel, 2009). They should be seen as complements because unlike foreign aid, remittances cannot fund large public infrastructure projects such as rail, roads and airports.

More recently, (Elbadawi, Kaltani, & Soto, 2012) study the relationship between foreign aid, exchange rate alignment and economic growth in 83 countries including 36 from SSA for the years 1980 to 2004. Based on the dynamic system GMM estimator, the empirical estimations on a cross-country sample of yearly data for 83 countries, show that increased long-term assistance and terms of trade contribute significantly to long-term real exchange rate (RER) appreciation. The results were tested for robustness using a sub-sample of SSA countries and they remained intact. The research provides evidence against an indirect negative impact of aid on growth via real exchange rate misalignment, demonstrating that little RER appreciation was attributable to large aid inflows in the short term. Consequently, they conclude that large aid inflows were not a major contributor to the "Dutch disease" type of RER fluctuation and did not have an impact of lowering growth.

Thus in summary, recent studies suggest that there is a significantly positive relationship between aid and growth, which contrasts with the studies conducted during the 1960s to 1990s, which tend to be less consistent.

2.3 Aid recipient-specific conditionalities to effectiveness

From the late 1990s, studies have increasingly focussed on whether aid effectiveness is impacted by conditionalities such as good policies, good goverance, political stability and tax efficiency. Burnside & Dollar (2000) examine the linkages among foreign assistance, economic policies, and GDP growth per capita using a panel of 56 countries covering 1970 to 1993. They find that bilateral aid strongly and positively influences government consumption in most of the sampled countries compared to multi-lateral aid. On the overall, they find that average aid (bilateral and multilateral) has little effect on growth consistent with the findings of a number of earlier studies. However, they made a statistically significant finding that aid was more

positively influential on growth in countries with good policy environments. In addition they find that aid has a positive effect on GDP growth in developing countries but is dependent on good fiscal discipline, monetary policies, and trade policies. They thus conclude that making good policies a condition to aid would increase its impact on growth.

(Bräutigam & Knack, 2004) argue that governance and institutions are a transfer mechanism in the aid-growth relationship. They argue that aid does have an impact on the quality of governance and institutions and by implication, on growth. Using a sample of 32 SSA countries with data from 1982 to 1990, they test the hypothesis that high aid levels affect the quality of governance and tax collections in Africa. For this study, they employed measures from the International Country Risk Guide (ICRG) as proxies for good governance and this formed the set of dependent variables whilst aid intensity was the independent variable measured as a ratio of aid to GNP or aid to government expenditure. Ordinary least squares regressions and 2SLS methods were used to perform the study. The results show a robust statistical relationship between high aid levels and declines in quality of governance and tax revenues as a percentage of GDP. However, improvements in GDP per capita tended to be closely associated with improvements in governance. They recommend that for aid to be effective, it needed to be more selective and *"delivered with few strings attached"* to governments with a developmental track record. Secondly, to promote growth and good governance, an aid "exit strategy" needed to exist. Just like the Marshall Plan which was temporary, large scale aid to SSA should be seen explicitly as a temporary developmental tool.

(Armah & Nelson, 2008) examine the effect of foreign aid on growth in 23 SSA countries covering the period from 1995 to 2003 on condition of good governance/political stability and policy. They argue that there is significant heterogeneity amongst SSA countries because of colonisation by different European powers and thus make use of instrumental variables analysis to account for policy, good governance/political stability, ODA and GDP growth. In the study, the instruments and proxies used to measure good governance or political stability are education (primary school enrolment as a percentage of GDP), democracy and good economic performance (proxied by positive growth rate in GDP). For the policy equation, they borrowed from the (Burnside & Dollar, 2000) linear combination of 3 main indicators which are macroeconomic policy (trade openness), budget surplus and inflation. Using a dynamic panel model, the results show that foreign aid promotes growth given good governance/political stability and using fixed effects in a static panel framework. However, because the aid-policy

interaction was insignificant, they could not prove (Burnside & Dollar, 2000) claim that the aid-growth relationship was conditional on good governance. The results further show that the political stability/good governance variable is positive and significant and similarly, the democracy variable is also significant and positive. More importantly, the aid variable has significant and positive results on growth and not seem to depend on policy because when policy is introduced, it becomes insignificant. They thus conclude that foreign promotes growth given good governance/political stability and suggest that increasing aid to SSA is one way of meeting the UN's MDGs because aid affects growth.

(Museru, Toerien, & Gossel, 2013) study the impact of aid and volatility in public investment on growth in 26 countries in SSA using GMM covering the period of 1992-2011. The study analyses the effect of 3 volatility variables - aid, government revenue and public investment on the aid-growth model and test the impacts on economic growth. As a proxy for institutional quality, the researchers employed the sum of 3 equally weighted measures which are law and order, bureaucratic quality and corruption. Earlier studies kept these fixed however (Museru, Toerien, & Gossel, 2013) update the institutional quality variable on a yearly basis to account for changes in the environments of countries in their sample. The results show that restrictions on freedom mostly had negative coefficients on growth indicating that growth is more probable in more democratic countries. Results further show that aid does have a statistically significant impact on growth. They observe that between 1992 and 2011, aid contributed between 0.09% and 0.14% of annual GDP per capita growth on a yearly basis. When public investment is accounted for, aid loses its significance to growth suggesting that in SSA, aid does not have an efficiency effect on growth rather a volume effect. When the volatilities of aid, government revenue and public investment are considered through 4-year rolling standard deviations, volatilities in all three factors are statistically significant at the 5% level but aid and revenue are more sensitive at the 1 - 5% level. Consequently, (Museru, Toerien, & Gossel, 2013) recommend that efforts should be directed towards reducing aid flow volatility and the associated volatility in government revenues. This could be done through multi-year aid agreements or securitisation of future aid commitments through sale of bonds.

Using cross-country data from 1990 to 2009 from 61 low income and middle income countries from Eastern Europe, Asia, Africa and South America, (Mosley, 2015) studies how the long-run tax effort affects aid effectiveness. This was a follow-up to the studies of (Bräutigam & Knack, 2004) who observed a link between tax effort and aid effectiveness. As a result of

numerous linkages between aid and tax (in both directions), the estimator involved instrumental variables methods using both the 3SLS method and GMM. The study also examines the effect between lagged aid and growth as well as current aid on growth. The result show that when aid is lagged, the positive correlation observed in the aid – growth interaction lost significance despite its continued existence. In the context of tax, the results show that the tax structure positively influence the tax effort which in turn exercised significant influence on the expenditure to GDP ratio. All the while, aid had a weak but positive influence on growth however it had a stronger positive influence on infant mortality as a measure of poverty. As a result of the modest results of aid on growth, (Mosley, 2015) suggests that aid effectiveness is better in cases where poverty is taken as the relevant factor of interest in measuring well-being as opposed to growth.

Thus, these studies indicate that it is potentially misleading to study the effectiveness of aid on economic growth without considering conditionalities such as policy, governance, political stability, and aid volatility.

2.4 Aid and human development

Aside from the impact of aid on economic growth, investment and savings, there is a body of studies that is increasingly considering the effects on human welfare, social development and institutional quality.

(Gomanee, Girma, & Morrissey, 2003), explore the interesting question of whether aid contributes anything more to human development except increasing growth? They investigate the existence of aggregated cross-country evidence of the effect of aid on welfare levels by testing the hypothesis that aid contributes to pro-poor expenditures (PPE) and hence contributes to welfare. They use a sample of 38 countries using two welfare indicators (INFMORT and HDI) from the period 1980 to 1998. By employing quantile regressions, (Gomanee, Girma, & Morrissey, 2003) obtain results that demonstrate that aid is associated with improved human development and reduced INFMORT. Welfare levels in lowly developed countries tend to be more responsive to aid than more developed regions. Consequently, Gomanee et, al recommend that instead of interpreting low values of welfare in poor countries as evidence of bad policies, thereby reducing entitlement to aid; the same welfare indicators may be a signal of the desirability to increase aid if the ultimate objective is reducing poverty and increasing human welfare.

(Williamson, 2008) peforms a cross-country investigation of the impact of foreign aid on the health sector using five primary indicators of health for the 208 countries listed in the World Bank 2006 report. The health indicators are infant mortality, life expectancy, death rate and immunisations of DPT and measles. The study involved a number of control variables such as GDP, Fraser freedom index and political freedom. The results of the fixed effects model show that health specific foreign aid does not improve the health situation in recipient countries despite controlling for quality of institutions and GDP. Health aid has a positive coeffient on life expectancy but the result is not statistically robust. Similar statistically insignificant results were observed for death rate and infant mortality (INFMORT). Hence, (Williamson, 2008) suggests highlights the lack of evidence supporting the prioritisation of health specific aid as a policy objective for the acceleration of human welfare development. The recommendation is that health aid should not be treated as "special" to other aid forms.

(Asiama & Quartey, 2009) study the welfare effects of aid among 49 countries in SSA, using data from the Human Development Report of 2005. To model welfare, they used reduced form specifications for welfare indicators such as INFMORT and other HDIs. The GMM analysis does not provide robust results on the interaction between aggregate bilateral aid and HDIs or other welfare variables. For independent variables, the study uses bilateral aid as a ratio of GDP, private consumption as a ratio of GDP, an index of good policies, adult life expectancy an index of financial development and population growth. Using dynamic panel models for non-overlapping 5-year periodic frequencies, the results show that aggregate bilateral aid has no impact on welfare and poverty variables in SSA. However, in its disaggregated form i.e. sector specific aid and programme assistance; aid has a significant influence on HDIs. Consequently, they concluded that not all types of bilateral aid are beneficial for poverty alleviation and welfare. Accordingly, they propose that sector specific aid and programme assistance should be scaled up.

(d'Aiglepierre & Wagner, 2010) investigate the impact of aid to access to universal primary education and educational achievements using data from the period 1999 to 2007 for 88 low to medium income countries. They employ fixed effects OLS and 2SLS on three-year averages from 1999 to 2007 to compensate for the long-run effects of aid on education. The results demonstrate a positive, developmental and robust influence of aid to primary education on the education achievements of recipient countries. Aid to primary education robustly improves

enrolment in primary education as well as gender parity in the enrolment. The repetition rate in schools also reduced though aid does not alter the pupil-teacher ratio. Consequently, (d'Aiglepierre & Wagner, 2010) recommend an increase in aid targeted for primary education. They warn that reductions in the allocation of such aid could have extreme negative effects on meeting universal primary education goals especially in developing countries.

(Young & Sheehan, 2014) examine the impact of aid on institutional quality using a panel of 116 countries and covering the period from 1970 to 2010. Using unbalanced panels of 5 -year periods, their analysis shows that aid is accompanied by a deterioration of both political and economic institutions. Aid significantly affects legal systems resulting in the deterioration of property rights and openness to international trade. They also find that economic institutions are positively related to economic growth and thus the negative impact of aid on economic institutions eventually affects growth in the long-run. After including aid as a control in their growth regressions, they find that foreign aid is statistically insignificant. They thus conclude that once the negative effects of institutional quality are controlled for, aid is not robustly related to growth.

(Pickbourn & Ndikumana, 2016) examine the impact of aid and its accompanying sectoral allocation on overall gender equality and gender equality in the health and education sectors using data from 76 countries from 1975 to 2010. The countries examined are SSA, South Asia and from Latin America. To account for the large sample size, the potential data imperfections and the potential number of outliers, researchers employ the iteratively reweighted least squares method. The results demonstrate that an increase in the allocation of foreign assistance to the health and education sectors improves gender-centric objectives in these sectors. More specific, significant reduction in maternal mortality is observed through the allocation of additional aid to the health sector. Moreover, increasing aid to education narrows the youth literacy gender gap. Consequently, they recommend targeted allocation of foreign assistance to health, education and social infrastructure, especially the provision of improved sanitation and clean drinking water.

(Ndikumana & Pickbourn, 2017) examine the impact of the allocation of foreign aid on access to social services in SSA using panel data estimation techniques controlling for potential endogeneity of regressors and country-specific effects using data from 1990 to 2010. They narrow down their study to investigating whether targeting ODA to the water, sanitation and

hygiene (WASH) sector can help expand access to WASH in SSA (SDG6) using an unbiased panel of data from a sample of 29 countries in SSA. They find that increased aid towards WASH is associated with improved access to this set of critical elements though the observed relationship is not linear. The results show that ODA is significantly material in meeting social development goals. Consequently, (Ndikumana & Pickbourn, 2017) recommend that targeted aid is important in accelerating human development.

In summary, over the last couple of decades the debate regarding the efficacy of aid has moved from the effect on growth to societal welfare, poverty alleviation and social development.

2.5 Conclusion

Modern literature on aid effectiveness has been progressively moving away from the traditional aid-savings-growth models such as the Harod-Domar model to more robust and dynamic models that include conditionalities such as good policy, political stability and government investment expenditure. However, recent studies suggest that there is a significantly positive relationship between aid and growth, which contrasts with the studies conducted during the 1960s to 1990s, which tend to be less consistent. It has thus also become increasingly apparent that it is potentially misleading to study the effectiveness of aid on economic growth without considering the effects of conditionalities such as policy, governance, political stability, and aid volatility. Of the sources reviewed, less than 10% of the literature separated aid into its various sectoral components and assessed its effectiveness on sector-based measures. Hence, this study attempts to contribute to the less studied broader socio-economic and cultural developmental effects of aid through splitting aid into its various sectoral components out of the realization that economic growth does not adequately measure human development, and studies based on aggregate aid flows potentially veil the impact of OAD on other sub-indices of human development.

Chapter 3 : Data

The purpose of the research is to investigate the relationship between aid and human development in 49 sub-Saharan African countries over the 23-year period from 1995 to 2017 using 3-stage least squares (3SLS). To achieve this, the analysis makes use of 14 dependent factors, four independent factors of interest, and one control factor to account for other macroeconomic effects. The list of the 49 sub-Saharan African countries is provided in Annexure 1. The OECD uses the term "South of Sahara" to refer to this group of countries whilst the World Bank uses the commonly used "sub-Saharan Africa." For the purposes of this study, the 49 countries were chosen purely on geographical location and should be distinguished from North African countries whose geographic territories encompass and/or are north of the Sahara Desert. These countries are part of the Arab League and are culturally closer to the Middle Eastern region. The excluded countries are Algeria, Morocco, Tunisia, Egypt and Libya.

3.1 Dependent variables

The dependent variables comprise education, health and wellness, environmental sustainability, gender parity and economic growth. Each category comprises the sub-HDI variables discussed below. The HDI data was obtained from the World Bank (WB).

Education HDIs

In this research, the education HDI includes three sub-factors that consist of:

- Adult literacy rate is "the percentage of people from the age of 15 and above who can both read and write a short simple statement about their everyday life" (World Bank Group, 2019).
- Progression to secondary school (%) which is defined by the World Bank as "the number of new entrants to the first grade of secondary school in a given year as a percentage of the number of students enrolled in the final grade of primary school in the previous year (minus the number of repeaters from the last grade of primary education in the given year)" (World Bank Group, 2019).
- Pupil-teacher ratio in secondary schools which is the "average number of pupils per teacher in secondary school" (World Bank Group, 2019).

Environment Sustainability HDIs

Carbon emission are central to climate change discussions consequently environment protection HDIs focus more on carbon emissions. The environmental protection HDI thus consists of the following two sub-components which correspond to SDG 12:

- CO_2 emissions (kg per PPP US$ of GDP) which measures the amount of carbon dioxide produced per US$ of GDP adjusted for purchasing power parity (PPP). "Carbon dioxide emissions are those arising from the utilisation of fossil fuels and the manufacture of cement. They include carbon dioxide produced during consumption of solid, liquid, and gas fuels and gas flaring" (World Bank Group, 2019).
- CO_2 emissions (metric tons per capita) which are measures the "total carbon dioxide emitted in a given year divided by the total population" (World Bank Group, 2019).

Gender Parity HDIs

Gender parity is represented by the following four factors which relate to SDG 5 and 10:

- School enrolment, tertiary (gross), gender parity index (GPI) which the World Bank defines as the "ratio of women to men enrolled at tertiary level in public and private schools" (World Bank Group, 2019).
- School enrolment, primary and secondary (gross), gender parity index (GPI) which is the "ratio girls to boys enrolled in primary and secondary level in public and private schools" (World Bank Group, 2019).
- School enrolment, primary (gross), gender parity index (GPI) which is "the ratio of girls to boys enrolled at primary level in public and private schools" (World Bank Group, 2019).
- Literacy rate, youth (ages 15-24), gender parity index (GPI) which is "the ratio of females to males ages 15-24 who can both read and write with understanding a short simple statement about their everyday life" (World Bank Group, 2019).

Health and Wellness HDIs

The last class of HDIs measures health and wellness within the society which corresponds to SDG 3. The following five HDI's are used to capture the effect of health related aid on society:

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- Incidence of HIV (% of uninfected population ages 15-49) which measures "the number of new HIV infections among uninfected populations ages 15-49 expressed per 100 uninfected population in the year before the period" (World Bank Group, 2019);
- Mortality rate, under-5 (per 1,000 live births) which is "the probability per 1,000 that a new-born baby will die before reaching age five, if subject to age-specific mortality rates of the specified year" (World Bank Group, 2019).
- Prevalence of HIV, total (% of population ages 15-49) which refers to "the percentage of people ages 15-49 who are infected with HIV" (World Bank Group, 2019).
- Maternal mortality ratio (modelled estimate, per 100,000 live births) which is "the number of women who die from pregnancy-related causes while pregnant or within 42 days of pregnancy termination per 100,000 live births" (World Bank Group, 2019).
- Life expectancy at birth, total (years) which indicates "the number of years a new-born infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life" (World Bank Group, 2019).

3.2 Independent variables of interest

Official development assistance can be categorized into multiple classes depending on the purpose for which the aid was given. The aid data was obtained from the OECD Creditor Reporting System which is freely accessible on the OECD website. For this study, four classes of aid were considered:

- Education aid - includes all aid that focuses on basic life skills for youths and adults; teacher training; educational research; vocational training, early childhood development and education policy and administrative aid (OECD, 2018).
- Health aid – includes all aid targeting health policy and administration; basic health infrastructure, malaria control, health personnel development and tuberculosis control. Both health and education aid collectively form the social infrastructure and services aid category (OECD, 2018).
- Government and Civil Society aid – includes all aid towards conflict, peace and security; ending violence against women and girls; women equality organisations and institutions; prevention of child soldiers and demobilisation as well as human rights and free flow of information (OECD, 2018).

- General Environment Protection – this class of aid includes “environmental education and training; environmental policy and administrative management; bio-diversity and site preservation” (OECD, 2018).

3.3 Control factors

This study measures the extent of impact of the amount of aid allocated to selected subsets of dependent development indicators. To ensure that the year-on-year variability in the sector-specific aid is controlled for, gross national income per capita (GNI) is used as a control variable. Studies by (Glennie, 2008); (Deaton, 2013); (Kharas, Jung, & Makino, 2011) and (UNDP, 2015) confirm that the extent of impact of aid on the human development indicators are influenced by the level of economic development in the country, and GNI per capita is one of the principal measures of economic development. This control factor is used as a control variable to standardise the aid allocated for a particular year relative to the population dynamics and total gross national income in accordance with the related studies of (Gani, Azmat, Prasad, & Biman, 2008), (Raghupathi & Wu, 2011) , (Aysen & Darja, 2012), (Ge, 2017) as well as (Kaminsky & Kumpel, 2018).

3.4 Data Manipulation

Normalisation of the data was achieved by logarithmic transformations of the primary data to stabilise the variance and to standardize the scale (Field, 2016).

3.5 Data Summary

The table below summarises the nature, unit of measurement and designation of the variables used in this study.

Table 3.1: Data Summary and Sources

Statistic/Metric	Applicable SDG	Unit of Measurement
AID CATEGORIES		
Total Aid	N/A	US$
Education Aid	N/A	US$
Environmental Sustainability Aid	N/A	US$
Government and civic society Aid	N/A	US$
Health sector aid	N/A	US$
EDUCATION HDIs		
Progression to secondary school (%)	SDG4	%
Pupil-teacher ratio, secondary	SDG4	%
Literacy rate, adult total (% of people ages 15 and above)	SDG4	%
GENERAL ENVIRONMENT HDIs		
CO2 emissions (kg per PPP US$ of GDP)	SDG3, 7,11,12,13, 14, 15	Kg
CO2 emissions (metric tons per capita)	SDG3, 7,11,12,13, 14, 15	Tons
GENDER PARITY HDIs		
School enrolment, tertiary (gross), gender parity index (GPI)	SDG5	GPI
School enrolment, primary and secondary (gross), GPI	SDG5	GPI
School enrolment, primary (gross), gender parity index (GPI)	SDG5	GPI
Literacy rate, youth (ages 15-24), gender parity index (GPI)	SDG5	GPI
HEALTH AND WELLNESS HDIs		
Incidence of HIV (% of uninfected population ages 15-49)	SDG 3	%
Mortality rate, under-5 (per 1,000 live births)	SDG 3	% of live births
Prevalence of HIV, total (% of population ages 15-49)	SDG 3	%
Maternal mortality ratio (modelled estimate, per 100,000 live births)	SDG 3	%
Life expectancy at birth, total (years)	SDG 3	Years

Chapter 4 : Methodology

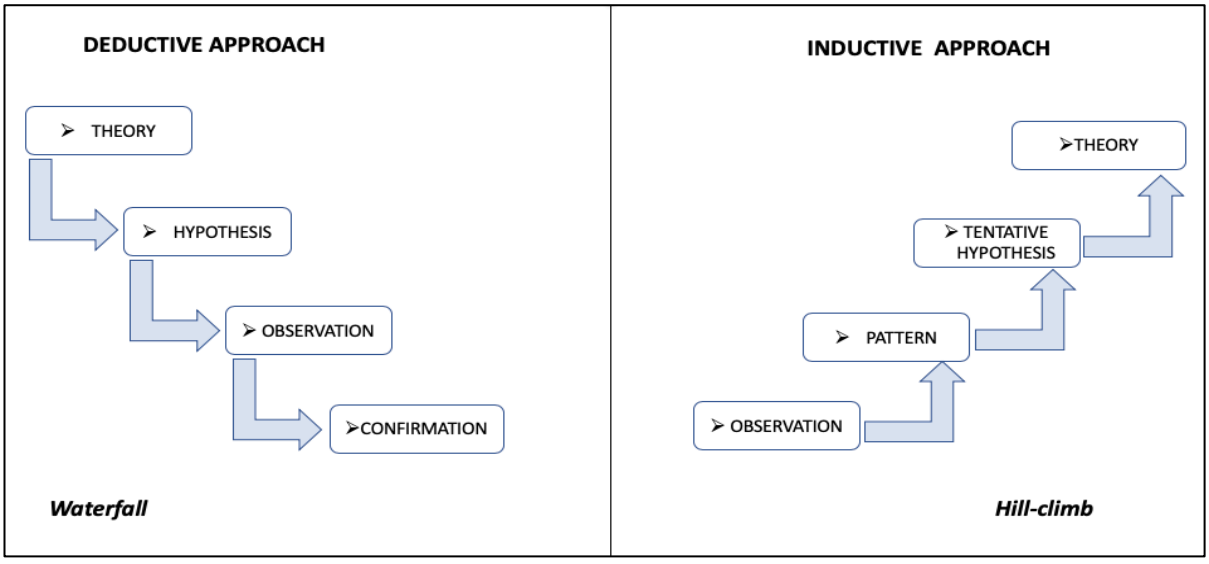
This chapter describes the methodology used to conduct the empirical analysis.

4.1 Research Design

Building on the previous chapter, this chapter outlines the research techniques employed to investigate the research questions. In addition, the chapter provides justifications for the research strategy employed as well as highlighting the advantages and the limitations. A research methodology should be responsive to the research questions and the objectives and scope of the research (Williams, 2007). The chapter also explains the selection of the estimator and provides the reasons supporting the estimator and the associated limitations.

The primary purpose of this study is to establish the impact of ODA on human development indicators. To aid this analysis, the focus is on the four broad categories of HDIs which are education, health, gender equality and environment sustainability. The research is deductive in nature as it seeks to prove the theories advanced on aid effectiveness (Burney, 2008). The study is a top-down approach as opposed to a bottom-up approach as shown in Figure 4.1 below. In contrast to inductive approaches, this research does not result in the formulation of new theories on aid effectiveness but quantitatively explores whether aid has an impact on human development indices in Sub-Saharan Africa.

Figure 4.1: Deductive versus Inductive Approach



Source: (Burney, 2008)

4.2 Estimator Selection

This study investigates the relationship between ODA and development indicators in 49 sub-Saharan African countries over the period of 1995 to 2017. The literature review summarized in Table 4.1 below demonstrates that related studies have tended to use a variety of empirical methods that include generalized method of moments (GMM), two-stage least squares (2SLS), and three-stage least squares (3SLS). This study makes use of 3SLS because it is able to estimate a system of simultaneous equations for each of the development indicators (Greene, 2002; Denbee *et al*., 2014) and takes account of endogeneity in a more efficient manner than both GMM and 2SLS (McEvoy, 2018); (Akinkunmi, 2019).

3SLS, 2SLS and GMM estimations are used to deal with endogeneity and the correlation of the lagged values on the contemporaneous values. The state of human development in the current year is dependent on the state of human development in prior years in as much as it is dependent on the exogenous variables which, in the circumstances of this study, are the various forms of sectoral aid. To be able to study the impact of aid on various human development variables, there is need to isolate the endogeneity of human development variables.

GMM employs instrumentation to deal with endogeneity. (Dhrymes, 2014) views GMM as an OLS procedure applied to a suitably transformed variant of the model whose parameters we intend to estimate. With OLS, moment restrictions equal the number of unknown parameters i.e. $E(X_e) = 0$. An exactly identified 2SLS model where the number of endogenous variables is similar to the number of instruments is another example of an exactly identified GMM estimator (Dunn, 2014). Under these circumstances, GMM, OLS and 2SLS give similar results. However, an over-identified GMM estimator does not give materially different results to those of a 2SLS (Researchers' Hub, 2019). This research does not use GMM because the quality of this type of estimation is dependent on many factors beyond the control of the researcher such as the magnitude of the time-dimension sample size, speed of dynamic adjustment and relative influence of individual effects and stationarity of the effect impact on any of the explanatory variables (Kiviet, Pleus, & Poldermans, 2017).

2SLS and 3SLS methodologies specify the endogenous variables in a simultaneous equation model however, 3SLS's performance always bests that of 2SLS when there is stronger intercorrelation among errors which is the norm when dealing with macro-economic variables (Belsley, 1988). 3SLS is therefore more statistically efficient than 2SLS (Belsley, 1988).

Hence, this study utilizes 3SLS. The table below highlights the methodologies used for related studies.

Table 4.1: Estimation methodologies used in related studies

Literature Source	Estimation Method	Objective of Study
(Hansen & Tarp, 2000)	OLS	"To examine the relationship between aid and savings; aid and investment; aid and growth."
(Burnside & Dollar, 2000)	OLS and 2SLS	"To examine the impact of aid on growth in good policy environments."
(Gomanee, Girma, & Morrissey, 2002)	OLS	"To study the impact of aid on growth via the investment transfer mechanism."
(Ouattara, 2007)	3SLS	"To study the impact of foreign aid on public savings and aid dependency in SSA."
(Asiama & Quartey, 2009)	OLS and GMM	"To explore the impact of foreign aid on Human Development Indicators in SSA"
(Museru, Toerien, & Gossel, 2013)	GMM	"To investigate the effects of aid inflows and the volatility of public investment on economic growth in SSA"
(Menarda & Weillb, 2016)	GMM	To address the direction of causality between aid and corruption
(Pickbourn & Ndikumana, 2016)	IRLS (Iteratively reweighted least squares) and GMM	"To examine the impact of aid and its sectoral allocation on gender equality in the health and education sectors."
(Ndikumana & Pickbourn, 2017)	GMM	"To examine the impact of foreign aid allocation on access to social services in SSA."

4.3 Estimation Strategy

The discussion of the estimation strategy used to conduct the empirical analysis consists of a summary of the 3SLS estimation methodology and model specification; followed by a commentary on statistical assumptions underpinning 3SLS, and ends with a consideration of the applicable methodological limitations.

4.3.1 Overview of 3SLS

According to (Beaver & Harbertson, 2016), the three stage least squares regression (3SLS) methodology refers to a simultaneous equation estimation strategy that integrates both the seemingly unrelated equation (SUR) and 2SLS. The 3SLS is applied in systems of equations that are endogenous, which means the 2SLS component and the SUR component are correlated to the error terms (Gujarati, 2003); (Maddala, 2001). However, it differs from 2SLS, in that while 2SLS estimates the coefficients of each structural equation one by one, with 3SLS, these are computed simultaneously (Norman, 2009). The standard equation for 3SLS for a general linear model is as follows:

$$y_i = y'_{-i,t}\gamma_i + x'_{i,t}\beta_i + U_{it}; \qquad i = 1, \ldots\ldots\ldots, m \tag{4.1}$$

where y_i is a matrix of dependent variables; y_{-i} is a matrix of endogenous regressors; X_i is a matrix of exogeneous regressors; β and γ are coefficients of the exogeneous and the endogenous regressors respectively.

The key assumptions for the use of 3SLS which will be tested as part of the empirical analysis are that the residuals are homoscedastistic and normally distributed. Homoscedasticity implies that each of the structural equations should have a homoscedastic error term that is not auto-correlated to the other error terms (Baltagi, 1998; Li *et al.,* 2014) while multivariate normality implies that the residuals have a multivariate normal distribution and that they are asymptotically normal and more efficient than single equation estimates (Wonnacott & Wonnacott, 1996); (Hidalgo & Goodman, 2013).

4.3.2 Model Specification

When the 3SLS estimation model is applied in the context of this study, welfare or human development is estimated to be a factor of the exogeneous aid variable taking into account the endogeneity of welfare before considering the error term. This relationship can be estimated in algebraic format as demonstrated below:

$$Y_{(n\times p)} = \hat{Y}_{(-i,t)}\gamma_{(n\times q+1)} + X_{(n\times q+1)}\beta_{(q+1\times p)} + E_{(n\times p)} \tag{4.2}$$

Or

$$WELFARE(HDI)_{(n\times p)} = \widehat{W}ELFARE_{(-i,t)}\gamma_{(n\times q+1)} + ODA_{(n\times q+1)}\beta_{(q+1\times p)} + E_{(n\times p)} \quad (4.3)$$

where:

$n = number\ of\ observations$

$p = number\ of\ Y\ variables$

$q = number\ of\ X\ observations$

$(n \times p), (n \times q + 1), (q + 1 \times p) = row\ by\ column\ matrix\ subscripts$

$Y\ or\ WELFARE\ or\ (HDI) = a\ matrix\ of\ human\ development\ indices$

$X\ or\ ODA = design\ matrix\ for\ aid$

$E\ or\ \epsilon = error\ matrix\ which\ captures\ all\ the\ other$

$disturbances\ in\ HDIs\ and\ all\ sources\ of\ variability, both\ systematic\ and\ random$

The expanded version of the dependent variable matrix $[Y_{(n\times p)}]$ is a matrix with n rows and p columns where $n = 23\ and\ \ p = 14$. The dependent HDI variables have the following matrix in the order shown above.

$$Y_{(n\times p)} = \begin{bmatrix} Y_{11} & Y_{12} & \cdots & Y_{18} \\ Y_{12} & Y_{22} & \dots & Y_{2p} \\ \vdots & \vdots & \ddots & \vdots \\ Y_{231} & Y_{232} & \cdots & Y_{238} \end{bmatrix}$$

The explanatory variable of the model (ODA) is contained in a design matrix $[X_{(n\times q+1)}]$ in which the order of the matrix is defined by the 23 rows ($n\ rows$) which are the 23 years from 1995 to 2017. It also consists of the $q + 1$ column vector consisting of the q predictor measures $(X_1, X_2, \dots X_q)$ and the unit column vector $X_0 \equiv 1$ for estimating the model intercept. The design matrix takes the following form:

$$X_{(n\times p)} = \begin{bmatrix} 1 & X_{11} \\ 1 & X_{12} \\ \vdots & \vdots \\ 1 & X_{231} \end{bmatrix}$$

The error matrix which captures all other variability in HDIs, both systematic and random variability is as follows:

$$E_{(n\times p)} = \begin{bmatrix} \epsilon_{11} & \epsilon_{12} & \cdots & \epsilon_{18} \\ \epsilon_{12} & \epsilon_{22} & \dots & \epsilon_{2p} \\ \vdots & \vdots & \ddots & \vdots \\ \epsilon_{231} & \epsilon_{232} & \cdots & \epsilon_{238} \end{bmatrix}$$

$$[\text{HDI}]\begin{bmatrix} Y_{11} & Y_{12} & \cdots & Y_{18} \\ Y_{12} & Y_{22} & \dots & Y_{2p} \\ \vdots & \vdots & \ddots & \vdots \\ Y_{231} & Y_{232} & \cdots & Y_{238} \end{bmatrix} = [OAD]\begin{bmatrix} 1 & X_{11} \\ 1 & X_{12} \\ \vdots & \vdots \\ 1 & X_{231} \end{bmatrix}[BETA]\begin{bmatrix} \beta_{01} & \beta_{02} & \cdots & \beta_{0p} \\ \beta_{11} & \beta_{12} & \dots & \beta_{1p} \\ \vdots & \vdots & \ddots & \vdots \\ \beta_{q1} & \beta_{q2} & \cdots & \beta_{qp} \end{bmatrix} + [\text{ERROR}]\begin{bmatrix} \epsilon_{11} & \epsilon_{12} & \cdots & \epsilon_{18} \\ \epsilon_{12} & \epsilon_{22} & \dots & \epsilon_{2p} \\ \vdots & \vdots & \ddots & \vdots \\ \epsilon_{231} & \epsilon_{232} & \cdots & \epsilon_{238} \end{bmatrix} \quad (4.4)$$

The effect of each sub-class of ODA on a series of response welfare variables is analyzed individually, focusing on health, education, economic progression, environment and gender parity. Each sub-model incorporates dependent variables that are best related to the reason for which the ODA was provided (for example, carbon emissions HDIs correspond to general environment protection goals whilst infant mortality HDIs correspond to health-related goals).

If *EDU*, *HLT*, *GPI* and *ENV* represent education, health, gender parity and environmental welfare respectively, then the welfare equations for each of the sub-sectors of the development indices can be presented algebraically as follows:

$$EDU_{(n\times p)} = \hat{E}DU_{(-i,t)}\gamma_{(n\times q+1)} + EDUCATION\ OAD_{(n\times q+1)}\beta_{(q+1\times p)} + E_{(n\times p)} \quad (4.5)$$

$$HLT_{(n\times p)} = \hat{H}LT_{(-i,t)}\gamma_{(n\times q+1)} + HEALTH\ OAD_{(n\times q+1)}\beta_{(q+1\times p)} + E_{(n\times p)} \quad (4.6)$$

$$GPI_{(n\times p)} = \hat{G}PI_{(-i,t)}\gamma_{(n\times q+1)} + CIVIC\ OAD_{(n\times q+1)}\beta_{(q+1\times p)} + E_{(n\times p)} \quad (4.7)$$

$$ENV_{(n\times p)} = \hat{E}NV_{(-i,t)}\gamma_{(n\times q+1)} + ENVIRONMENT\ OAD_{(n\times q+1)}\beta_{(q+1\times p)} + E_{(n\times p)} \quad (4.8)$$

The corresponding hypotheses being tested are thus as follows:

Education Aid:

H_1: Education aid influences the percentage progression to secondary school

H_2: Education aid influences the secondary school pupil-teacher ratio

H_3: Education aid influences the percentage adult literacy rate

Health Aid:

H_4: Health aid influences the incidence of HIV

H_5: Health aid influences the under 5 mortality rates

H_6: Health aid influences the prevalence of HIV

H_7: Health aid influences the maternal mortality ratio

H_8: Health aid influences the life expectancy at birth

Government and Civil Society Aid:

H_9: GCS aid influences the tertiary school enrolment GPI

H_{10}: GCS aid influences the primary and secondary school enrolment GPI

H_{11}: GCS aid influences the primary school enrolment GPI

H_{12}: GCS aid influences the youth literacy rate GPI

Environment Aid:

H_{13}: Environment protection aid influences CO_2 emissions per GDP PPP

H_{14}: Environment protection aid influences CO_2 emissions per capita

4.4 Limitations

Model Limitations

- The main limitation associated with 3SLS is that the parameters and covariance matrices tend to be highly inconsistent and inaccurate in cases of heteroscedasticity (Wijekularathna, Yi, & Roka, 2019); (Wooldridge, 2010) and thus it is crucial to establish that there is no heteroscedasticity before considering the results.

Data Limitations

- This study examines a panel of 49 countries in sub-Saharan Africa and thus does not consider individual country effects such as culture, colonial history, and governance.
- The country-level data contains a number of gaps on a year-to-year basis as there is lack of consistency in data collection. Consequently, any similar study at country-level will only focus on those countries for which data is available. The model does not account for the heterogeneity contained in the aggregated SSA data.

- The aid figures used are those provided on the OECD creditor reporting system. These figures are not all encompassing as they cannot account for all aid granted by non-OECD countries.
- The selected human development indicators are not all encompassing as a description of the welfare of sub-Saharan Africa. Some of them may not be completely representative of the status of a particular sector or area of human development.

Chapter 5 : Results and Discussion

This study sought to determine whether aid has a positive association with the selected human development indices in 49 countries in sub-Saharan Africa over the period of 1995-2017. The dependent variables comprise the human welfare indicators (education indicators, health indicators, gender parity indicators, and environmental indicators) while the key independent variables are the applicable aid factors (education specific aid, health specific aid, government and civil society aid; and environmental aid). This chapter commences with a presentation of the diagnostic test results, and thereafter, the results of the estimations are presented and discussed.

5.1 Diagnostic Test Results

As mentioned in section 4.3.1, prior to formulating any conclusions from 3SLS estimation it is necessary to ensure that the residuals do not suffer from heteroscedasticity or non-normality. Hence, the section below presents the results of the diagnostic tests of the 3SLS estimations.

As can be seen from Tables 5.1(a) – (d), none of the estimations exhibit significant heteroscedasticity or non-normality of the residuals at a 5% significance level.

Table 5.1 (a): Education

```
. mvtest normality log_progression_sec log_pteacher_ratio log_literacy_adult

Test for multivariate normality

    Doornik-Hansen                  chi2(6) =    3.498   Prob>chi2 =  0.7443

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance

         chi2(6)      =     0.79
         Prob > chi2  =   0.3726
```

Table 5.1(b): Health

```
. mvtest normality log_incidence_hiv log_mortality_5yrs log_prevalence_hiv
log_mat_mortality log_life_expectancy

Test for multivariate normality

    Doornik-Hansen                  chi2(10) =    3.882    Prob>chi2 =  0.9525

Breusch-Pagan / Cook-Weisberg test for h
> eteroskedasticity
         Ho: Constant variance

         chi2(10)      =     0.70
         Prob > chi2   =   0.4024
```

Table 5.1(c): Government/Civil Society

```
. mvtest normality log_enrol_tertiary log_enrol_prisec log_enrol_primary log_literacy_youth

Test for multivariate normality

    Doornik-Hansen                  chi2(8) =    7.201    Prob>chi2 =  0.5151

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance

         chi2(8)       =     3.04
         Prob > chi2   =   0.0810
```

Table 5.1(d): Environment

```
. mvtest normality log_co2_gdp log_co2_capita

Test for multivariate normality

    Doornik-Hansen                  chi2(4) =    4.836    Prob>chi2 =  0.3045

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance

         chi2(4)       =     0.40
         Prob > chi2   =   0.5252
```

5.2 3SLS Results

5.2.1 Relationship between Education Aid and Education Indicators

The first estimation investigates the associations between ODA and human development in order to investigate the following hypotheses:

H_1: Education aid influences the percentage progression to secondary school

H_2: Education aid influences the secondary school pupil-teacher ratio

H_3: Education aid influences the percentage adult literacy rate

The results of the 3SLS estimations are presented in Tab1e 5.2. The coefficients demonstrate the direction and the strength of the relationship between aid and the dependent variables. Earlier studies such as (d'Aiglepierre & Wagner, 2010) concluded that aid to education has a strong influence on school enrolment. The same research argues that aid has no impact on the pupil to teacher ratio. The results in Table 5.2 below show that education aid is significantly associated with variance in the progression to secondary schooling and adult literacy rate. The results further show that education aid is mostly effective in increasing the rate of progression to secondary school followed by the adult literacy rate.

Table 5.2: 3SLS of Education Aid and Education Indicators

Three-stage least-squares regression

Equation	Obs	Parms	RMSE	"R-sq"	chi2	P
log_progre~c	23	1	.0215763	0.7182	58.61	0.0000
log_pteach~o	23	1	.0302814	0.1178	3.07	0.0797
log_litera~t	23	1	.0157308	0.3808	14.15	0.0002

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
log_progression_sec						
log_aid_education	.2007365	.0262208	7.66	0.000	.1493447	.2521283
_cons	-.0025634	.2414711	-0.01	0.992	-.4758381	.4707112
log_pteacher_ratio						
log_aid_education	-.0644875	.0367998	-1.75	0.080	-.1366138	.0076387
_cons	1.972118	.3388944	5.82	0.000	1.307897	2.636338
log_literacy_adult						
log_aid_education	.0718992	.019117	3.76	0.000	.0344306	.1093678
_cons	1.109342	.1760509	6.30	0.000	.7642883	1.454395

Endogenous variables: log_progression_sec log_pteacher_ratio log_literacy_adult log_gni
Exogenous variables: log_aid_education

log_aid_education	Education Aid
Log_gni	GNI per capita
log_progression_sec	Progression to secondary school (%)
log_pteacher_ratio	Pupil-teacher ratio, secondary
log_literacy_adult	Literacy rate, adult total (% of people ages 15 and above)

5.2.2 Relationship between Health Aid and Health Indicators

The second 3SLS model examines the relationship between aid allocated to the health sector and the corresponding health development indicators in order to test the following hypotheses:

H_4: Health aid influences the incidence of HIV

H_5: Health aid influences the under 5 mortality rates

H_6: Health aid influences the prevalence of HIV

H_7: Health aid influences the maternal mortality ratio

H_8: Health aid influences the life expectancy at birth

Researchers such as Gomanee, Girma, and Morrissey (2003), Pickbourn and Ndikumana (2016) and Loots (2006) have argued that health aid is beneficial in the context of SSA by reducing factors such as infant mortality rates. Other researchers such as (Williamson, 2008) argue that aid is not related to increasing overall health. However, the results of the 3SLS estimations presented in Table 5.3 show that health aid is significantly associated with all of the health-related factors and thus that health sector aid significantly benefits human development in SSA.

Based on the coefficients in Table 5.3, aid has the greatest impact on incidence of HIV, under 5 mortality rates, maternal mortality ratio, life expectancy and prevalence of HIV respectively. The lesser impact on life expectancy is likely indicative of how there is a natural limit on how much any initiative can increase life expectancy while the lesser HIV prevalence coefficient is possibly a result of prevention rather than cure. Hence, the percentage of the population already infected will continue to influence the long-run prevalence rate for the duration of their life-time.

Table 5.3: 3SLS of Health Aid and Health Indicators

Three-stage least-squares regression

Equation	Obs	Parms	RMSE	"R-sq"	chi2	P
log_incide~v	23	1	.0444819	0.9330	320.47	0.0000
log_mortal~s	23	1	.0318673	0.9239	279.11	0.0000
log_preval~v	23	1	.0274689	0.5343	26.38	0.0000
log_mat_mo~y	23	1	.0252044	0.9129	241.20	0.0000
log_life_e~y	23	1	.0092419	0.9058	221.15	0.0000

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
log_incidence_hiv						
log_aid_health	-.7447767	.0416038	-17.90	0.000	-.8263186	-.6632347
_cons	6.410688	.3799075	16.87	0.000	5.666083	7.155293
log_mortality_5yrs						
log_aid_health	-.497946	.0298054	-16.71	0.000	-.5563635	-.4395284
_cons	6.618865	.2721697	24.32	0.000	6.085422	7.152308
log_prevalence_hiv						
log_aid_health	-.131968	.0256916	-5.14	0.000	-.1823226	-.0816135
_cons	1.892592	.2346041	8.07	0.000	1.432776	2.352407
log_mat_mortality						
log_aid_health	-.3661142	.0235736	-15.53	0.000	-.4123176	-.3199107
_cons	6.185275	.2152638	28.73	0.000	5.763365	6.607184
log_life_expectancy						
log_aid_health	.1285467	.008644	14.87	0.000	.1116049	.1454886
_cons	.5616477	.0789328	7.12	0.000	.4069423	.7163532

Endogenous variables: log_incidence_hiv log_mortality_5yrs log_prevalence_hiv log_mat_mortality log_life_expectancy log_gni
Exogenous variables: log_aid_health

log_aid_healthsky	Health, Total
Log_gni	GNI per capita
log_incidence_hiv	Incidence of HIV (% of uninfected population ages 15-49)
log_mortality_5yrs	Mortality rate, under-5 (per 1,000 live births)
log_prevalence_hiv	Prevalence of HIV, total (% of population ages 15-49)
log_mat_mortality	Maternal mortality ratio (modelled estimate, per 100,000 live births)
log_life_expectancy	Life expectancy at birth, total (years)

5.2.3 Relationship between Government/Civil Society (GCS) Aid and gender parity

The third set of estimations investigates the relationship between government and civil society aid and the government and civil society indicators. The corresponding hypotheses being tested are thus:

H_9: GCS aid influences the tertiary school enrolment GPI

H_{10}: GCS aid influences the primary and secondary school enrolment GPI

H_{11}: GCS aid influences the primary school enrolment GPI

H_{12}: GCS aid influences the youth literacy rate GPI

The 3SLS results are presented in Table 5.4. (Pickbourn & Ndikumana, 2016) argued that increased allocation of foreign assistance to the education and health sectors improves gender-specific objectives in these sectors. The results in Table 5.4 similarly show that aid is significantly associated with the gender parity index for primary, secondary and tertiary school enrolment; but not with the youth literacy rate gender parity index. Thus, with the exception of the youth literacy rate gender parity index, the results confirm the arguments of (Pickbourn & Ndikumana, 2016).

The results thus demonstrate that aid is helping increasing the number of female students attending primary, secondary and tertiary education. However, the access to education is not translating into an equitable youth literacy gender parity index as this development indicator did not have a significant relationship with the same class of aid ($p = 0.158$). This might be a consequence of the time lag between attendance of school and the time one meets the criteria of being considered literate as adult literacy reflects the cumulative effects of formal schooling (Park & Kyei, 2011). Moreover, there might be a number of other factors such as repressive societal expectations on female students which may be depressing the literacy rate even though they are having access to education. These may include factors which were observed by (Unesco, 2012) such as early marriages, restrictions to movement, non-ownership of assets and poverty. African societies are mostly patriarchal therefore female students may have other disadvantages affecting their literacy rate (Sathiparsad, Taylor, & Dlamini, 2008).

Based on the coefficients presented in Table 5.4, government and civil society aid has a greater impact on the primary school enrolment gender parity index followed by the combined primary and secondary school enrolment gender parity index. Aid moderately impacts the tertiary enrolment gender parity index. At tertiary level, a number of factors influence enrolment and these include the natural drop-out rate across all stages from primary, secondary to tertiary.

Table 5.4: 3SLS of Government and Civil Society (GCS) Aid and GCS Indicators

Three-stage least-squares regression

Equation	Obs	Parms	RMSE	"R-sq"	chi2	P
log_enr~iary	23	1	.0124078	0.5144	24.36	0.0000
log_enrol_~c	23	1	.0118405	0.5675	30.18	0.0000
log_enr~mary	23	1	.011512	0.6851	50.03	0.0000
log_litera~h	23	1	.0111009	0.0798	1.99	0.1578

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
log_enrol_tertiary						
log_aid_government	.0682506	.0138271	4.94	0.000	.0411501	.0953512
_cons	-.7773555	.1257571	-6.18	0.000	-1.023835	-.5308762
log_enrol_prisec						
log_aid_government	.0724874	.0131949	5.49	0.000	.0466259	.0983489
_cons	-.7180181	.1200074	-5.98	0.000	-.9532282	-.482808
log_enrol_primary						
log_aid_government	.0907429	.0128287	7.07	0.000	.065599	.1158867
_cons	-.8743417	.1166771	-7.49	0.000	-1.103025	-.6456587
log_literacy_youth						
log_aid_government	.0174727	.0123706	1.41	0.158	-.0067733	.0417187
_cons	-.2264566	.1125107	-2.01	0.044	-.4469736	-.0059396

Endogenous variables: log_enrol_tertiary log_enrol_prisec log_enrol_primary log_literacy_youth log_gni
Exogenous variables: log_aid_government

log_aid_government	Government & Civil Society-general, Total
log_gni	GNI per capita
log_enrol_tertiary	School enrolment, tertiary (gross), gender parity index (GPI)
log_enrol_prisec	School enrolment, primary and secondary (gross), gender parity index (GPI)
log_enrol_primary	School enrolment, primary (gross), gender parity index (GPI)
log_literacy_youth	Literacy rate, youth (ages 15-24), gender parity index (GPI)

5.2.4 Relationship between Environment Aid and Environment Indicators

The final set of 3SLS estimations investigates the relationships between aid allocated to environment protection and environment development indicators. Thus, the corresponding hypotheses being tested are:

H_{13}: Environment protection aid influences CO_2 emissions per GDP PPP

H_{14}: Environment protection aid influences CO_2 emissions per capita

The results of the estimations are presented in Table 5.5 and show that environmental protection ODA is significantly associated with carbon dioxide emissions per purchasing power parity of the GDP but is insignificantly associated with carbon dioxide emissions per capita. In addition, the negative coefficient of aid on CO_2 emissions per PPP of GDP suggests that carbon dioxide emissions are negatively related to aid as hypothesized. These results thus suggest that environmental aid is making production in SSA more carbon efficient as each dollar of GDP being produced in SSA is gradually using lower carbon emissions on a year on year basis.

Table 5.5: 3SLS of Environment Protection Aid and Environment Indicators

Three-stage least-squares regression

Equation	Obs	Parms	RMSE	"R-sq"	chi2	P
log_co2_gdp	23	1	.0532593	0.8414	122.06	0.0000
log_co2_ca~a	23	1	.0149418	0.0003	0.01	0.9376

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
log_co2_gdp						
log_aid_environment	-.518361	.0469191	-11.05	0.000	-.6103208	-.4264012
_cons	3.913223	.3994504	9.80	0.000	3.130314	4.696131
log_co2_capita						
log_aid_environment	.0010312	.0131631	0.08	0.938	-.024768	.0268304
_cons	-.0777442	.1120653	-0.69	0.488	-.2973881	.1418997

Endogenous variables: log_co2_gdp log_co2_capita log_gni
Exogenous variables: log_aid_environment

log_aid_environment	General Environment Protection, Total
log_gni	GNI per capita
log_co2_gdp	CO_2 emissions per Purchasing Power Parity of GDP (kg per PPP US$ of GDP)
log_co2_capita	CO_2 emissions per capita (metric tons per capita)

Chapter 6 :Recommendations and Conclusions

6.1 Introduction

This chapter summarises the key findings of the analysis, and presents the recommendations for future studies. The research questions sought to determine whether the four sub-categories of official development assistance (health, education, government and civic society, and environment aid) are significantly associated with the four related indicators of human development (health, education, gender equality and environmental sustainability).

6.2 Summary and conclusions of the research

The discussion below seeks to explicitly answer the research questions posed by this study.

What is the relationship between the four sub-categories of official development assistance and the respective four categories of human development indicators?

The findings of the empirical analysis show that all forms of aid have a significant relationship with the majority of development indicators applicable to a specific target sector. The study thus demonstrated that all forms of aid have statistically significant relationships with their corresponding health welfare, gender parity, education and environmental welfare indicators during the period from 1995 to 2017.

Is there a positive relationship between the ODA categories and the corresponding HDIs?

The study finds that health aid significantly improves infant and maternal mortality rates as well as HIV prevalence and incidence rates while educations aid is associated with higher rates of progression from primary school to secondary school, and literacy rates. In the case of government and civil society aid, the results show that this form of aid improves gender parity at all education levels ranging from primary, secondary to tertiary level. Environmental aid is found to reduce carbon emissions.

Which HDIs are most significantly affected by aid?

Of the development indicators tested in this study, health aid influenced all of the selected health variables in a beneficial manner. This is likely because it is much easier to target health aid to achieve specific outcomes compared to other forms of aid. The coefficients are also larger for health aid compared to the other aid estimations and thus it is possible to conclude that this research finds that health development indicators are the most positively influenced by health related aid.

Education aid influenced two of the three selected education specific development indicators, the exception being the pupil-teacher ratio which was statistically insignificant. Government and civil society aid had a statistically significant and beneficial relationship with three of the four gender parity development indicators tested but the coefficients are significantly smaller than those of the education and health aid estimations. Lastly, the effects of environmental aid was found to improve productivity based carbon emission levels.

Thus in summary, the results of the analysis show that health aid is the most effective form of aid, significantly reducing the incidence of HIV, the infant mortality rate and the maternal mortality rate, as well as leading to improved life expectancy. Education aid has a significant effect on the progression to secondary school followed by adult literacy rates. Government and civil society aid significantly affects the ability of girls to access education at primary, secondary and tertiary levels while environmental aid is found to increase the carbon efficiency of production. Hence, this study demonstrates that aid is most effective on the health, education and environmental human development indicators.

6.3 Policy Recommendations

In order to take advantage of the results above, donors should target their aid to specific development indicators that are found to be most sensitive to the aid rather than using aid as merely generic capital in the hope that it will actuate governments to spend towards developmental objectives. In the context of SSA, aid should thus be targeted towards high impact sectors such as health and education, as well as addressing historical and cultural stereotypes that hamper access to education and employment among the female populations.

Addressing the health of the sub-Saharan African society and its education standards can also have significant knock-on effects on economic growth and socio-economic development.

Pursuant to the favourable impact of aid on education, donors should consider making more investments in the education sector to consolidate the gains made thus far. Universal primary education was one of the key focal areas of the MDGs (United Nations, 2001) and is also reflected in the SDGs. Despite the increasing levels of education and literacy as a result of education specific aid, it is important for OECD countries to realise that many SSA countries remain pre-dominantly commodity-based economies and thus most graduates will be employed in these primary sectors. Hence, in order to complement aid, OECD countries should lower subsidies in their home primary sectors to allow SSA countries to fully develop their comparative advantage. If this is achieved, education aid together with health aid may indirectly contribute to economic growth via the increased supply of healthy, literate and skilled labour to the productive sector.

6.4 Recommendations for Future Research

There are three areas that are recommended for future research.

Consequent to the lack of statistically significant results between government and civil society aid and the youth literacy rate gender parity index, the research could investigate the gender imbalances in SSA. Gender parity is one of the key areas where SSA is lagging behind and this has been blamed on discriminatory family codes, son preference, restricted physical integrity (restriction of a woman's control over her body), restricted civil liberties and restricted control of resources and assets (OECD, 2015).

Further research could examine the aid impacts at an industry level so as to identify the areas of economic activity where SSA economies should develop a trade advantage. Such an understanding may help craft future preferential trade agreements such as USA's AGOA and EU's EBA by directing preference to the areas where SSA may have a future long-term comparative advantage.

The research could be further segregated to examine the regional, resource dependence, and colonial heritages of sub-Saharan Africa using sub-samples to take into account of the regions varied history and levels of economic development.

Annexure 1: List of 49 countries in Sub-Saharan Africa

1	Angola
2	Benin
3	Botswana
4	Burkina Faso
5	Burundi
6	Cabo Verde
7	Cameroon
8	Central African Republic
9	Chad
10	Comoros
11	Congo
12	Côte d'Ivoire
13	Democratic Republic of the Congo
14	Djibouti
15	Equatorial Guinea
16	Eritrea
17	Eswatini
18	Ethiopia
19	Gabon
20	Gambia
21	Ghana
22	Guinea
23	Guinea-Bissau
24	Kenya
25	Lesotho
26	Liberia
27	Madagascar
28	Malawi
29	Mali
30	Mauritania
31	Mauritius
32	Mozambique
33	Namibia
34	Niger
35	Nigeria
36	Rwanda
37	Sao Tome and Principe
38	Senegal
39	Seychelles
40	Sierra Leone
41	Somalia
42	South Africa
43	South Sudan
44	Sudan
45	Tanzania
46	Togo
47	Uganda
48	Zambia
49	Zimbabwe

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