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University of Pavia

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Betlehem Hailmariyam Bekele

Supervisor: Professor Jaromír Harmáček

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Effectiveness of Foreign Aid on Poverty Reduction in Sub-Saharan African Countries

Betlehem Hailmariyam Bekele

Supervisor: Professor Jaromír Harmáček

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Declaration

I declare that this master thesis entitled 'Effectiveness of Foreign Aid on Poverty Reduction in Sub-Saharan African Countries' submitted to the GLODEP Consortium 2020 is my original work, carried out under supervision of Professor Jaromír Harmáček, Palacký University Olomouc. It has not been submitted to any other institution before. All the literature and datasets used in the analysis of this thesis properly cited and referenced.

Betlehem

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Jméno a příjmení: **Betlehem Hailmariyam BEKELE**
Osobní číslo: **R180101**
Studijní program: **N1301 Geography**
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Zásady pro vypracování

Poverty is pronounced deprivation in well-being of individuals (World Bank, 2000). Even though poverty is declining in international level, the number of poor people in Africa has increased from 278 million in 1990 to 413 million in 2015. 45 percent of the population earn less than 1.9 dollar a day, and 54 percent of the population lives under multidimensional poverty (World Bank Group, 2019). Alleviating global poverty needs huge finance. Foreign aid would fill gaps to break out of the poverty trap and make countries growing on their own (Easterly, 2006). Despite the decrease in the amount of ODA globally, it still has a high share of GDP to sub Saharan African economies. It contributes 3.013 percent of 2017 GNI. Net ODA increased from 2.64 percent of GNI 2014 to 3.013 percent of GNI in 2017 which is 2.811 percent higher than the global average (world bank, 2017). There are two contrasting views about usefulness and potential contribution of aid to growth and poverty reduction. On one extreme there are aid skeptics like Dambisa Moyo argued, official aid is easy money that fosters corruption and distorts economies, creating a culture of dependency and economic laziness (Moyo, 2009). Supported by Gafar T Ijaiya and Muftau A Ijaiya (2004), Foreign aid does not have significant contribution to poverty reduction because of weak economic management and misuse of foreign aid in sub Saharan Africa. On the contrary, Jeffrey Sacs argued that injections of aid are needed to break the poverty trap because there is nowhere else money is going to come from when there is insufficient domestic income (Sacs, 2005). In between these two extremes, there are scholars like, Burnside and Dollar (1997) who found that aid has a positive effect on the country's economy, but only when policy is good. Also, white (1996) contend, aid can contribute toward poverty reduction either directly or indirectly. The indirect channel is through the trickle down or multiplier effects from aid's contribution to overall growth. Accordingly, this paper will examine the effectiveness of aid on the reduction of poverty by analyzing both non-monetary and money-metric poverty indicators using country level measures. It will question how greatly aid is contributing to eradicate poverty in selected African countries. General Objective of the study is to analyze how aid is affecting poverty in sub Saharan African countries. Specifically, it aims to examine the potential contribution of aid to eradicate non-monetary and monetary poverty and to compare different poverty indicators to understand the real effect of aid on poverty and its consistency among different indicators over time. Cross sectional data will be observed for this study. It will consider multidimensional poverty index and percentage of population living under the international poverty line (1.9 dollar a day) as dependent variable to analyze the effect of aid on non-monetary and monetary-metric poverty of nations respectively. Other control variables that can determine countries' poverty level will be selected based on theoretical literature and availability of data for the proxy. Regarding sampling, the study will select sub Saharan African countries that have the most updated data for both dependent and independent variables in need. Methodologically, Cross country econometrics regression will be done. To evaluate the improvement over time, it will analyze the variation of poverty and amount of aid flow through time by classifying time as initial and end periods.

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Vedoucí diplomové práce: **Ing. Mgr. Jaromír Harmáček, Ph.D.**
Katedra rozvojových a environmentálních studií

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L.S.

doc. RNDr. Martin Kubala, Ph.D.
děkan

doc. RNDr. Pavel Nováček, CSc.
vedoucí katedry

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Abstract

The paradox of the high volume of assistance inflow and high percentage of poor population in SSA countries triggered this research to investigate the direct effects of foreign aid on poverty reduction in SSA countries. The study intended to examine the role of foreign aid in alleviating income poverty and multidimensional deprivations over a short and relatively long period of time. The analysis of this study added to the existing literature by inspecting the role of assistance to mitigate poverty and contrasting the contribution of aid to the reduction of income and multidimensional poverty across SSA countries.

Due to unavailability of poverty data, the cross-sectional approach proposed in the proposal modified to "pseudo" cross-section approach. To fill the gap in the data "pseudo" cross-sectional data designed for different countries at different but comparable periods of time. For the empirical investigation beta regression model applied.

Results of the analysis indicate that ODA does not tend to reduce income poverty in the region irrespective of the duration. Moreover, ODA is significant to mitigate multidimensional poverty only over a relatively long period. Comparing results, ODA has made a relatively better contribution to alleviate multidimensional poverty in long period of time.

Key words: Aid effectiveness, Beta regression, Foreign aid, Income Poverty, Multidimensional poverty, Sub-Saharan Africa

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Acronyms

DAC	Development Assistance Committee
FDI	Foreign Direct investment
GDP	Gross Domestic Product
GNI	Gross National Income
GNP	Gross National Product
HDI	Human Development Index
HPI	Human Poverty Index
ILO	International Labour Organization
MDG	Millennium Development Goal
MPI	Multidimensional Poverty Index
NGO	Non-Governmental Organization
ODA	Official Development Assistance
OECD	Organization of Economic Co-operation and Development
OPHI	Oxford Poverty and Human Development Institute
PPP	Purchasing Power Parity
SDG	Sustainable Development Goals
SSA	Sub-Saharan Africa
UN	United Nations
UNDP	United Nations Development Programme
USA	United States of America
WDI	World Development Indicator

Chapter one

1. Introduction

1.1. Background

Eradication of global poverty has remained concerning subject and common global policy priority of the international development community for the past three decades. World Bank has been advocating sustainable poverty reduction as one of its development trajectories since 1990. The Bank suggested broadening global development initiatives aimed at alleviating extreme poverty globally (World Bank, 1990). Poverty reduction also emerged as a focal point of international and regional development goals. Both MDGs and SDGs concentrate on eradicating global poverty in one way or another. MDGs targeted to 'reduce global poverty and hunger by half by 2015'. Likewise, Agenda 2030 also calls for 'eradicating poverty in all forms and dimensions globally' (UNDP, 2016). Multilateral organizations also extensively focus on alleviating various forms of global poverty.

In order to combat global poverty, foreign aid has considered to be a vital source of finance for underdeveloped countries. Policy proposals by multilateral organizations and donor countries emphasize the importance of international assistance to reduce poverty and foster economic development around the world. MDGs proposed to double aid flow to reduce global poverty by half in 2015¹. SDGs also stress about transfer of resources to developing countries to facilitate the poverty alleviation process² (UN, 2016). The notion of massively increasing international assistance to combat poverty is centred on the implicit premise that aid is an indispensable tool for relieving global poverty. However, the effectiveness of this massive influx of assistance remained questionable in aid effectiveness literature.

The volume of aid flow to developing countries has begun to decline since the beginning of the new millennium. Remittances and FDI overcame foreign aid in most of the developing countries, but in SSA. SSA countries remained the largest recipient of international assistance over the last two decades. In per capita terms, net ODA received increased from \$19.626 in 2000 to \$49.921 in 2006, hitting \$52.846 in 2017. Net ODA received as a percentage of GNI, has risen from 2.64 percent in 2014 to 3.044 percent in 2018 (World Bank, 2019).

Despite the large volume of international assistance to the SSA, extreme poverty has remained singularity of the region. 56 percent of the world's severely poor population live in SSA. Even though Africa has achieved rapid economic growth and a decline in the proportion of the poor population, the total number of poor people in the region has increased from 278 million in 1990 to 422 million in 2019 due to rapid population growth. 70 percent of the poorest countries in the world are in Africa (World Bank, 2019).

¹ Target 8.B of MDGs call for 'more generous ODA for countries committed to poverty reduction'.

² Target 17.2, 17.3 and 17.4 of SDGs

1.2. Statement of the problem

Since the 1990s, more consideration has been devoted to effectiveness of foreign aid in academic papers. Although most of the studies in the field focus on either its direct impact on economic growth or indirect effects on poverty reduction through economic growth. Defining the performance of aid as a function of its effects on GDP and other macroeconomic variables, such as saving and public investment commonly used as a default description of aid effectiveness.

Aid effectiveness studies have generalized the concept of poverty reduction into a one-dimensional approach of rising of GDP per capita or reduction in income poverty. Studies by Burnside and Dollar (2000); Dalgaard and Hansen (2001); Collier and Dollar (2002); Easterly et al. (2004); Morrissey (2004); Easterly and Pfutze (2008); Ogundipe et al. (2014), focused on the direct interaction of foreign aid with GDP. To research the contribution to poverty reduction, primarily they investigate the impact of aid on economic growth then on poverty through presumed income elasticity of poverty. This creates limitation of publication bias. If aid programs had been successful in reducing poverty and improving the lives of the poor at household level but did not affect GDP per capita, according to those measures of aid effectiveness foreign aid would be considered unsuccessful.

Other studies conducted by Ijaiya and Ijaiya (2004); Arimah (2004); Mosley et al. (2004) focus on the direct impact of aid on income poverty. These kinds of analysis often have limitation of generalization. Poverty headcount does not address income distribution among household size and structure. Nor does it consider the depth of poverty below the poverty line (Ravallion, 2016). Moreover, poverty cannot be defined simply as a lack of money or consumption. Individuals may earn more than \$1.90 a day and still have no access to health care, education, or safe living environment. Consequently, even if a study conducts the direct relationship between aid and poverty, it is still problematic if the money-metric indicator is the only measure of poverty.

The effectiveness of the assistance needs to be seen beyond economic growth, investment, and income poverty, to understand the impact on people's livelihood. Therefore, this research investigates the direct effects of foreign aid on both monetary and non-monetary indicators of poverty in SSA countries. It will contribute to existing literature mainly by examining the contribution of foreign aid for alleviation of income and multidimensional deprivation over short and relatively long period of time, particularly in the case of SSA.

1.3. Objectives of the study

This study aims to examine the potential contribution of foreign aid to the reduction of poverty in SSA. The study intends to compare different poverty indicators to observe the actual effects of the aid on poverty and its continuity among those different measures. It also aims to compare the effects of net ODA per capita on income and multidimensional poverty through time.

General question

How greatly is foreign aid contributing to alleviate poverty in SSA?

Sub-questions

- i. Does ODA contribute to reduce the percentage of population lives below \$1.90 a day in SSA?
- ii. Does ODA benefit SSA countries to lift their population out of multidimensional poverty?
- iii. Is there any variation between income and multidimensional poverty regarding the effectiveness of ODA?
- iv. Does ODA have comparable result over short and relatively long period of time?

1.4. Significance of the study

As it is discussed in the statement of the problem, most of the studies in this field examine either the indirect effects of aid on poverty through economic growth and other macroeconomic variables, or directly via income poverty using headcount rate based on national or international poverty lines. Only the handful of them are conducted about multidimensional poverty indicators. Accordingly, this paper examines aid effectiveness on the reduction of poverty using both income and multidimensional poverty indicators.

This research elaborates on previous studies using the latest updated dataset available and examines the relationship between net ODA inflows to SSA countries vis-à-vis national poverty status. It compares the effects of foreign aid on income and multidimensional poverty indicators in order to comprehend the actual contribution of international assistance to the region. Moreover, the study analyzes the impact of foreign aid received during different periods of time on the current poverty level using beta regression analysis. Generally, this study will fill the literature gap regarding the assessment of multidimensional poverty and comparison between monetary and non-monetary indicators poverty in relation to aid inflows.

1.5. Scope and limitations of the study

This study analyze "pseudo" cross-sectional data for selected SSA countries. Due to unavailability of longitudinal poverty data across countries, it is not possible to conduct panel, pseudo-panel, or cross-sectional studies on African countries. It is also challenging to compare the contribution of foreign aid using a specific duration of time as initial and end period as proposed at the outset of this study. To solve this problem of data unavailability, "pseudo" cross-section approach designed based on available data for different time periods for each country. The statistics across countries are for different years based on the available poverty data. Explanatory variables calculated as an average of four years data for the same time span within a country, and different but comparable time period across countries.

Percentage of the population lives in multidimensional poverty, and percentage of the population lives under the international poverty line (\$1.90 a day, 2011 PPP) considered to be a proxy for non-monetary and monetary poverty, respectively. Selected countries for both poverty indicators are from different sub-regions (South, Central, East, and West African countries) with different level of economic growth, geographical area, and population size. 26 countries designated for income poverty, with data available for the period 2011-2015. For multidimensional poverty, 33 countries selected with the available data for the period 2013-2017.

All forms of poverty indicators face data limitation and incomparable diversity during surveys. This study faces additional limitations due to data unavailability and the design of "pseudo" cross-sectional data. Since the data is analyzed for different countries over different years, conclusions of the study are subject to a susceptible bias. Besides, the study contrasts different number of countries for income and multidimensional poverty that could possibly limit the comparison results. Furthermore, it is also not feasible to study the causal relationship between aid and poverty due to cross-sectional data limitations.

1.6. Organization of the study

This study is organized in five chapters. Following the introductory chapter written above, chapter two reviewed theoretical and empirical literature related to the subject. Research framework and methodology of the study presented and discussed in the third chapter. Research findings and interpretation of results are presented in the fourth chapter. In chapter five overall conclusion of the study and potential policy implications are addressed.

Chapter two

2. Literature review

In this chapter, theoretical and empirical literature related to aid and poverty are reviewed in two sections. Theoretical concepts of aid and poverty discussed in the first section. Within this section concepts and indicators of poverty; concepts and classifications of aid; the history of aid effectiveness; thoughts and debates about aid effectiveness are overviewed. Review of empirical studies discussed different studies conducted about the direct and indirect effects of foreign aid on poverty presented in the second section. The direct effects sub-section sets out literature about the role of aid in the reduction of monetary and non-monetary indicators of poverty separately. The indirect effects sub-section mainly focuses on the impact of aid channelled through economic growth. In the third sub-section, different empirical studies conducted in specific countries about the direct or indirect effects of aid on poverty are reviewed.

2.1. Theoretical literature

2.1.1. Poverty concepts and indicators

According to World Bank (1990), poverty defined as being unable to earn or consume minimum level of income, nutrition, and other daily necessities. The UN also states poverty as the lack of necessary economic capital or basic human needs to ensure healthy livelihood of individuals. In more comprehensive terms, poverty does not only depend on daily income or consumption, it also encompasses health, education, sanitation, ability to exercise human rights, the power of decision-making, social participation, and inclusion (UN, 2015).

In the year 1979, World Bank started measuring extreme global poverty, and it became more systematic after 1990 when the international poverty line was established. The aim of calculating international poverty line was to quantify economic poverty based on a certain threshold that defines the level of total destitution in the most vulnerable areas in the world. When it commenced for the first time in 1990, it was \$1 per day using the 1985 PPP. This was followed by \$1.08 per day in 2000/1 based upon the 1993 PPP. In 2008, it became \$1.25 per day, basing it upon the 2005 PPP. The latest updated one became \$1.90 a day in October 2015 using 2011 PPP (Ferreira, 2015). World Bank has also launched other quantitative tools to measure poverty, such as the poverty gap and the square poverty gap.

Different scholars give different descriptions of poverty, either unidimensionally, based on income/consumption, or multidimensionally, with combinations of multiple indicators.

Unidimensionally focused scholars interpret poverty as not being able to meet minimum requirements of income or consumption that enable them to meet their needs in their day-to-day activities regarding the standards of the economy they are living in (Gordon, 2019).

There are two basic approaches to measure and interpret the unidimensional indicators of poverty. Those are income approach and basic needs approach. Income approach of poverty can also be explained in absolute or relative terms. Absolute poverty refers to daily income below the minimum subsistence threshold. Relative poverty is defined as the number of people who earn an income below a certain percentage of national or regional median income (World Bank, 1990). European Union and OECD measure poverty relatively as living below 60 percent and 50 percent of the median income, respectively (OECD, 2012).

ILO introduced the concept of the basic needs approach in the 1970s. It describes poverty as a scarcity of resources and opportunities to meet basic human needs. The concept also takes into account the provision of public goods and services in society while identifying and evaluating poverty (Watson, 2014).

Poverty indicators are usually driven by money-metric factors. Indeed, relying exclusively on consumption or expenditure is not enough to grasp the true essence of poverty. It is also essential to understand the non-monetary perspective of the problem. Multidimensional indicators usually represent the non-monetary side of poverty.

Sen launched a comprehensive approach of understanding poverty as a deprivation of human capabilities in the 1980s. This approach explains poverty as a lack of necessary human capabilities to live at a minimally acceptable level within a society (Sugden and Sen, 1986)

HPI and MPI are the most widely used multidimensional approaches of calculating poverty. UN has been calculating HPI since 1997. HPI is a statistical mixture of scores that represent life expectancy, literacy, and quality of life. Calculation of HPI varies according to countries economic performance. For instance, Shorter life expectancy is expected in developing countries than in developed countries. In contrast, in wealthier countries, the calculation provides a measure of social exclusion usually proxied using national unemployment rates. Subsequently, HPI was replaced by MPI, which was developed in 2010 by the UNDP and the OPHI. MPI intended to measure acute poverty in terms of both the proportion of people experiencing multiple deprivations and the intensity of such deprivations. MPI assesses individuals' experiences regarding health, education, and standard of living through various indicators (OPHI, 2011).

2.1.2. Foreign aid and aid effectiveness concepts

Foreign aid is a voluntary oversea transfer of resources from governments or organizations to another country or region. Assistance could be offered bilaterally, directly from Government to Government, or multilaterally, redirected through international organizations (OECD, 2012).

Depending on the intent of the transfer, aid classified into humanitarian and development blocks. Humanitarian aid is provided as short-term emergency relief or technical support in reaction to humanitarian disasters such as natural catastrophes, refugee crises, or civil wars.

The main goal of humanitarian is sustaining human life. On the contrary, development aid is offered by governments or international agencies to promote socio-economic development in underdeveloped countries. Development aid is usually planned for long term progress of developing countries (OECD, 2012)

The most common form of development aid is Official Development Assistance (ODA). The primary objective of ODA is the advancement of economic development and welfare in developing countries. Transfers could be in the form of concessional loans, grants, technical assistance, debt cancellation, or commodities. To classify foreign aid as ODA, flows must be rendered by official bodies. Moreover, Concessional transfers should include a grant element of at least 25 percent with 10 percent discount rate (OECD, 2019).

Aid effectiveness is the real impact of assistance on reducing deprivation, narrowing inequality, rising productivity, building capacity, and promoting development in underdeveloped nations (World Bank, 2019). Effectiveness could be evaluated on project-level, sector-level, or country-level. It could also be measured from both donor's and recipient's perspective. From a donor's point of view, efficacy measured either in absolute terms of how much money was granted or in relative terms as the amount of money granted as percentage of donor country's GDP or GNI. From the recipient's point of view, assistance could be measured in three ways: the total amount received in dollars (net ODA); the amount as a percentage of GDP or GNI of the receiving country (net ODA per recipient GDP or GNI); average amount aid received per person (net ODA per capita) (OECD, 2012).

2.1.3. Evolution of Aid effectiveness

Foreign aid became development remedy for developing nations after the Second World War. In 1948, Marshall plan proposed financial assistance for the reconstruction of European economy, which was devastated during the Second World War. After implementation of Marshall plan, foreign aid turned out to be an instrument to establish international development and form a political and economic alliance between donor and receipt countries (Magid, 2012).

Until the early 1970s, there was a high expectation that the granting of aid would be crucial, assuming foreign aid as an extra reward which could inevitably make remarkable differences. Although the development community in the 1980s claimed that wealth creation and technological progress relied not only on the level of international assistance but also on better economic policy. In beginning of 1990s, imperialism thoughts used international assistance as a weapon of neo-imperialism (Pankaj, 2005). Eventually, the combination of policies that were considered adequate was implemented by the Washington Consensus in the 1990s. The debt relief action of World Bank demonstrated the need for a more comprehensive solution to aid distribution that had to be under the jurisdiction of the national governments (Glennie and Sumner, 2016).

Following 'aid fatigue' during late 1990s, there were a growing emphasis upon on effectiveness of the aid programmes. The debate has been more steadfast since then. Funding programs of

the World Bank at the end of 1990s focused on providing aid with particular emphasis on beneficiary countries with the highest incidence of absolute poverty. A decade later, the focus shifted to the underlying causes of poverty such as violence, drought, and lack of political stability (Donaubauer et al. 2016).

Global concerns about successful development assistance and cooperation have continued to be addressed extensively following the report presented at Monterrey, Mexico, during the UN conference of 'Financing for Development' in March 2002. It has been argued that the effectiveness of financial assistance could be improved by redirecting funding to developing countries that pursue sound economic policies (UN, 2002).

After the Monterrey conference, four consecutive global events highlighted the ongoing efforts to modern and strong development cooperation and the distribution of aid. The first 'High-Level Aid Effectiveness Forum' happened in Rome, 2003, which focused primarily on reaffirming the donor's dedication to eradicate poverty, foster sustainable development, and establish inclusive global economic system. It was followed by 'Paris Declaration on Aid Effectiveness' in 2005. Which was mainly articulated around the five main pillars of global aid effectiveness: ownership, alignment, harmonization, managing for results, and mutual accountability. In 2008, the 'Third High-Level Forum on Aid Effectiveness' was the 'Accra Agenda for Action' which took place in Ghana. It called for a strong partnership between the different parties involved in aid and development. The fourth conference took place in 2011, 'Busan High-Level Forum on Aid Effectiveness.' For the first time it announces the negotiated structure for development cooperation that include conventional donors, South-South co-operators, BRICS³, civil societies, and private donors (UN, 2018).

2.1.4. Thoughts and debates about aid effectiveness

There have always been two radical thoughts in the literature about the success of international assistance. Before half a century, economists such as Nurkse (1953); Lewis (1954) argue that foreign aid generates required resources to fuel growth in emerging that, even though the extent of the result varies among nations, regions, the amount of assistance, and economic policies of recipient countries, the rise in foreign aid has an encouraging contribution for investment and economic growth.

The two-gaps model of Chenery and Strout (1966) demonstrate foreign aid as a bridge for the gap between national expenditure and income. Developing economies have small amount of savings and export earnings that limit national consumption and growth of the economy. Therefore, foreign aid would help them to bridge the discrepancy between investment needs and domestic savings that could direct to higher growth rates.

The idealistic school of thought by Holyoke et al. (1983) and Davies (1969) argues that the influx of foreign assistance from industrialized to underdeveloped countries is essential to the

³ Brazil, Russia, India, China and South Africa

preserve global peace and prosperity. They claimed that developed countries have a moral duty to provide assistance to developing countries.

On the contrary, economists such as Friedman (1958) and Bauer (1977) called for an end to aid, claiming that aid is not a prerequisite for a country's economic growth. They emphasize that foreign assistance to economically weak countries is risky because it raises elite power in recipient states, which leads to corruption, maladministration, and impedes economic development. Specifically, Bauer noted that aid discouraged private investment and promotes growth which relies on public sector. Because assistance is actual money applied to state coffers and thus slows down growth and hinder progress in developing countries.

Significance of foreign aid continued to be a debatable topic among researchers and policy circles for a long time. More recently, there are also two drastic thoughts about the success of aid. The first group constitutes foreign aid supporters who are optimistic about the success of foreign aid. Experts like Arndt et al. (2010, 2015); Sachs (2005); and Stiglitz (2007) support the thought that aid is successful in eradication of poverty and promotion of economic growth in underdeveloped countries.

Sachs (2005) suggest foreign aid as an essential tool to achieve global development goals. Sachs explains that, if there would be sufficient amount of capital transferred to developing countries along with necessary socio-economic planning, it would be possible to reduce global poverty in a significant amount. Assistance is needed during early phases of development for underdeveloped countries. If capital stock is financed with a considerable amount of money in initial stages of development, in the long run, the economy will become self-sustaining utilizing domestic private and public investment funded by local taxation. Which later help each household to escape from extreme poverty.

Conversely, there are scholars like Alesina and Weder (2002); Easterly (2003, 2006); Moyo (2009); Doucouliagos and Paldam (2011); Acemoglu and Robinson (2012); who are pessimistic about the positive contribution of aid. They believe that assistance is inadequate solution to reduce poverty and to promote economic growth in underdeveloped countries.

Alesina and Weder (2002) clarify that increasing aid is an opportunity for rent-seekers and corrupted elites because it is an unexpected transfer that encourages bribery in underdeveloped countries. Easterly (2003) also confirm the assumption that assistance leads to development along with reducing poverty is unfounded.

Moyo (2009) also asserts in her book called 'Dead Aid' that assistance has less to do with saving people from poverty. Instead, aid makes people poorer and weaker. She argues that aid disseminates the cycle of poverty and derails economic performance by encouraging dependency and corruption in developing countries, particularly in Africa.

Acemoglu and Robinson, the authors of 'Why Nations Fail' (2012), suggest that pouring millions directly into economically weak societies would not eradicate poverty, instead it could lead to a structural inequality within the society.

Between these two extremes, there are other scholars who assert that assistance could be successful under certain circumstances. This argument is endorsed by Burnside and Dollar (2000); Collier and Dollar (2001, 2002); Gomanee et al. (2003, 5005a, 2005b); Mosley et al. (2004). This group of scholars insists that the success of the assistance is conditioned on the donation system, domestic policy, institutional quality of the recipient country, and the amount of aid flow. They find a positive impact of aid in developing countries with sound trade, monetary, and fiscal policies, while aid has less contribution in the presence of poor domestic policies.

Another known thought is the micro-macro paradox of aid by Mosley (1986). Mosley claims that aid has different level of effectiveness in macro and micro levels. According to him, the outcome of the assistance at the macro level is uncertain due to data availability and interpretation of the results. Even if there are macro level improvements, there is possibility to be offset by market crises and other external factors. In the reverse, micro level contributions might not be notified at national level. Consequently, it is ambiguous to measure and confirm the results of assistance in macro level.

2.2. Empirical literature review

Empirical studies related to the success of foreign aid to eradicate poverty grouped into the following two categories.

I. Direct effects of foreign aid on poverty

This group of studies discuss the immediate effects of foreign aid on the level of poverty. The studies in this group also categorized and reviewed in two groups. Some of them analyzed the direct impact of aid on the monetary indicators of poverty, the others research about the effects of aid on non-monetary indicators of poverty.

I. Indirect effects of foreign aid on poverty

Studies reviewed in this sub-section investigate about the indirect effects of assistance on countries' poverty level through various economic channels. Foreign aid could affect poverty through economic growth, investment, saving, fiscal policy, and other macroeconomic instruments. Most of the studies reviewed under this sub-section focus on the indirect contribution of aid channelled through economic growth.

2.2.1. Review of Studies investigating the direct effects of foreign aid on poverty

I. Effects of aid on monetary indicators of poverty

Research by Arimah (2004) analyze the relationship between ODA and percentage of the population lives below the national and international poverty lines. The study found that per capita ODA in underdeveloped countries does not substantially help to reduce the proportion of the population lives below both poverty lines. The study concludes that overflow of aid does not contribute to solve the problem of income poverty in underdeveloped countries.

Ijaiya and Ijaiya (2004) carried out an empirical study about the effects of foreign assistance on poverty reduction in SSA. This research analyzes cross-country data using multiple linear regression model. The results show that there is insignificant association between foreign assistance and poverty reduction in the SSA due to weak economic management, high levels of corruption, bad governance, institutional failure, political instability, and macro-economic instability. They conclude that foreign aid is not fruitful in terms of poverty reduction in SSA.

Mosley et al. (2004) examined the direct effects of aid on poverty reduction applying GMM (Generalized method of moments) in a simultaneous equation set-up for poverty, foreign aid, and policy. The researchers further launch PPE (Pro-Poor Public Expenditure) measure, called the PPE index. The study found that corruption, inequality, and the composition of public expenditure, are strongly associated with the efficiency of aid. The ultimate remark of the study is that in order to make aid more efficient in terms of poverty alleviation, aid ought to be transferred to countries which has better micro and macro economic policies, fair income distribution, and growing per capita GDP.

A study by Alvi and Senbeta (2012) examines the effects of bilateral and multilateral assistance on income poverty. They inspect the direct impact of aid on poverty using three poverty indicators: headcount poverty index, poverty gap index, and square poverty gap for bilateral and multilateral sources for assistance comparing grants and concessionary loans. They measure the impact using complex panel assessment methods and SGMM (Simultaneous Generalized Method of Moments) estimation approach that enable the authors to monitor time-invariant country specific effects of aid. They found that foreign assistance has a significant poverty reduction impact after adjusting average income. They also acknowledge that the effectiveness of international assistance depends on the composition of aid. Grant and multilateral aid are more successful in terms of poverty alleviation than bilateral aid and loans.

McGillivray and Feeny (2016) study the relationship between international assistance and poverty in developing countries based on international data since 1980s. The authors claim that ODA has positive marginal impact on poverty reduction in underdeveloped countries, and there would be higher number of poor peoples without ODA.

Study about aid targeting investigate the scale to which international assistance reach the poor in 17 African countries using household surveys. The number of aid projects per country is the

exogenous variable in the model which measured by the total number of regional projects per country, the weight of the projects by their costs, and natural logarithm of the total dollar value projects in each country. Comparing national poverty rates with geographically distributed aid projects, the study indicate that assistance does not reach to the poorest in African countries. Instead, aid is flowing to countries that have relatively small numbers of poor citizens and benefit economically well-off nationals (Briggs, 2016).

I. Effects of aid on non-monetary indicators of poverty

The most cited paper by Boone (1996) is one of the earliest studies to empirically test the effectiveness of aid on some indicators of HDI using data from 97 developing countries. Boone found that aid in those countries mainly spent for consumption purposes which tend to benefit the political elite, but not the poor. According to this study, aid has no significant impact on infant mortality, primary schooling ratio, or life expectancy. He concludes that aid does not improve economic development for two basic explanations. First, the lack of financial capital does not necessarily cause poverty; second, it is not rationally justified to adjust domestic policies with the interest of the donor during each aid inflow.

Arvin and Barillas (2002) employ the GCM (Granger causality model) to investigate the causality between aid and poverty in a bivariate framework, tested on annual data from 1975 to 1998 for a sample of 118 aid-receiving countries. The study categorized countries into two broad groups based on their geographical location and levels of income. For all 118 countries, there is no causal relationship between aid and poverty either ways. However, comparing the results among sub-samples, aid reduces poverty in East Asia and the Pacific more than it reduces poverty in SSA. And comparing the result among the income groups, foreign aid has a relatively significant contribution in low-income countries than middle-income countries.

Kosack, (2003) scrutinize cross-country examination of the impact of foreign aid on quality of life using the HDI as a proxy. The study used the OLS (Ordinary Least Square) and 2SLS (Two-Stage Least Square) estimation techniques on a sample of 49 developing countries over the period 1974–1985. The analysis shows that the impact of aid depends on the quality of the institutions in the recipient countries. It also indicates that aid is relatively successful in terms of improving the quality of life in democratic countries rather than in autocratic states. Furthermore, the paper provides strong evidence that foreign aid has indirect contribution for poverty reduction and well-being improvement if it is spent for the interest of economically disadvantaged segments of the population.

Another study by Morrissey (2004) checked the hypothesis that aid improves aggregate welfare using a fixed-effect data panel estimation approach for a survey of 104 countries for the duration 1980–2000. Infant mortality and HDI have been used as indicators for welfare. The main finding of the research is that assistance explicitly increases welfare indicators, and the result is more significant in low-income countries compared to middle-income countries. The study also found that economic growth is one of the channels through which aid has indirectly

influenced welfare. However, the study could not find evidence about the positive contribution of aid channelled through public expenditure.

Gomanee et al. (2003) use quantile regressions to analyze the effects of international assistance on human welfare. The researchers found evidence that assistance can have an impact on welfare through public spending, and the outcomes are more valuable in countries with comparatively lower welfare levels. The researchers have also found that the marginal success of assistance in alleviating poverty is higher in poorer countries than in wealthier countries.

Panel study about the effects of the aid on infant mortality and illiteracy rate have been investigated by Masud and Yontcheva (2005) using data for 58 countries from 1990 to 2001. This research assesses the impact of official bilateral aid that has been directly transferred from a donor government to a recipient country and aid for specific projects that have been disbursed through international NGOs. They apply 2SLS (Two-Stage Least Square) regression and the SGMM (System Generalized-Method of Moments) approach. Their results indicate that NGO aid significantly reduces infant mortality compared to bilateral aid. Nonetheless, the impact of both types of aid on illiteracy is less significant.

Mosley and Suleiman (2007) study the effects of foreign aid on agriculture and poverty in developing countries followed up on their previous paper Mosley et al. (2004). The latest study used panel data econometric analysis covering all developing countries and four case studies of heavily aid-dependent African countries. Estimation of the poverty equation incorporates the effects of aid through growth, macroeconomic policy, pro-poor expenditures, and instability in aid levels. Proof has been found that the level, composition, and stability of foreign assistance matter contribution of assistance to poverty reduction. The study also reiterates the preceding findings that assistance is more effective in reducing poverty if it is spent on pro-poor projects, such as agriculture, education, and infrastructure.

Research by Asiana and Quartey (2009) analyze the effects of foreign assistance on HDI using data for 39 SSA countries. The study noted that the aggregate bilateral assistance flows to the SSA do not have direct significant impact on the poverty and welfare indicators in the region. However, disaggregated aid in the form of sector-specific project funding and program assistance has a positive impact on HDIs. This indicates that not all forms of bilateral aid have the same result on poverty and welfare in the region. Bilateral assistance as ratio GNP does not have a significant impact on HDIs in SSA but, has some positive marginal effect if it is studied in each specific sector.

Milovich (2017) compared 64 developing countries to check the association between the higher levels of aid provided by USA between 1946 and 1999 and the lower MPI between 2000 and 2014 using 2SLS and OLS models. The study found that 1 percent rise in the total amount of assistance received contributes to a 0.61 percent decrease in MPI across countries. However, the relationship between aid and money-metric indicators of poverty, measured by headcount ratio of \$1.90 and \$3.10 per day, does not appear statistically significant.

Table 1. Summary of empirical studies conducted about the direct effects of aid on monetary and non-monetary indicators of poverty

Author	Variables studied in relation to foreign aid	Sample	Result
Ijaiya and Ijaiya (2004)	Income poverty	SSA	Negative association between foreign aid and poverty reduction.
Mosley et al. (2004)	Income poverty	Developing countries	Aid is not effective due to strong corruption and inequality.
Alvi, Senbeta (2012)	Income poverty	79 countries	Multilateral aid and grants reduce poverty, but not bilateral aid and loans.
McGillivray and Feeny (2016)	Income poverty	Developing countries	Foreign aid has marginally positive result on poverty reduction.
Briggs (2016)	Aid targeting the poor	17 African countries	Aid does not reach the poor. Foreign aid disproportionately flows to countries that have relatively high numbers of rich population.
Boone (1996)	Infant mortality, primary education, and life expectancy	97 developing countries	Aid is mainly used for consumption purposes in developing countries. It has no significant impact on infant mortality, primary schooling ratio or life expectancy.
Arvin and Barillas (2002)	Causality between aid and poverty	118 countries	Aid does not affect poverty and vice versa
Kosack (2003)	Quality of life	49 developing countries	The success of aid depends on the quality of institutions in recipient countries.

**continued to the next page*

Gomanee et al. (2003)	Welfare	38 countries	Foreign aid indirectly contribute to welfare when aid is associated with higher social sector spending.
Morrissey (2004)	Child mortality and HDI	104 countries	Marginal success of aid in alleviating poverty is greater in poorer countries than in rich countries.
Masud and Yontcheva (2005)	Literacy rate and infant mortality	58 countries	NGO aid significantly reduces infant mortality. Impact of all types of aid on illiteracy is less significant.
Mosley and Suleiman (2007)	Economic growth and pro-poor expenditure	39 countries	Level, composition, and the stability of foreign aid have an impact on poverty reduction.
Asiama and Quartey, (2009)	Human development	SSA	No direct outcome of aid on poverty and welfare.
Milovich, (2017)	The effects of Aid from USA on MPI	64 developing countries	1 percent increases of assistance from united states lead to 0.61 percent decrease in MPI.

Source: Author

2.2.2 Review of studies investigating indirect effects of foreign aid on poverty

Forging aid could contribute to poverty mitigation via different macro-economic instruments and policies. Burnside and Dollar (2000) found that assistance is effective in reducing infant mortality rates, only in countries with stable policy environments. In the same vein, Collier and Dollar (1999, 2001) found that aid could accelerate the poverty reduction process to developing countries with good policy and institutional environments. The results of assistance on poverty depends on its impact on per capita income growth, which could later facilitate the alleviation of poverty.

Another related research by Collier and Dollar (2002) found that the efficacy of the assistance determined by the 'poverty-efficient distribution' of foreign aid. 'Poverty-efficient allocation' means the distribution of aid based on policy performance of developing countries. They predict that assistance provided from the 1990s until 2002 effectively lift about 30 million people out of extreme poverty each year. They acknowledge if 'poverty-efficient reallocation' applied properly, assistance would boost out additional 40 million people out of poverty globally.

The growing body of empirical evidence is reinvigorating the policy conditionality of aid performance. Burnside and Dollar (2000); Lensink and Morrissey (2000); Collier and Dollar (2001); Dalggaard and Hansen (2001); Guillaumont and Chauvet (2001); Hansen and Tarp (2001); Addison et al. (2005, 20017) confirm that aid is successful in reducing poverty through economic growth conditioned on economic policy and institutional quality. They found positive effects of aid on growth which later leads to poverty reduction directed through average income and employment benefits.

Gomanee et al. (2005b) employed a quantile regression analysis for a sample of 38 countries working through social expenditures and sector-specific interventions. The study reported the indirect outcome of aid on welfare is effective when aid is associated with higher social sector spending. According to the study, the relationship between aid, welfare and social spending is circular.

Guillaumont (2011) study how foreign aid can be more beneficial to least developed countries. The study describes some of the potential macro-economic channels through which aid could contribute to poverty reduction. According to the study, assistance could be redirected through economic growth, public finance, and financial stabilization factors. Nonetheless, the connection between foreign aid and poverty reduction depends on the particular circumstances of recipient countries.

Kaya, Kaya, and Gunter (2013) investigate the effectiveness of aid given to the agricultural sector. The study disaggregated total aid into subcategories and focused on agricultural aid. The empirical analysis used four years averaged cross-country data for a panel of 46 aid recipient countries in the period 1980–2003. The study analyzes poverty headcount ratio below \$1 per day as the main dependent variable. Using fixed-effects panel estimator, the study found 1 percent increase in agricultural aid reduces the headcount poverty ratio by 0.2 percent. The study concluded that agricultural aid contributes directly to headcount poverty reduction or indirectly through economic growth.

The study by Hirano and Otsubo (2014) examine benefit of foreign aid to the poor segment of the population in underdeveloped countries. The finding shows that aid for education, health, water, and sanitation projects benefit the poorest in society significantly and directly, and assistance for transport, electricity, communication, financial, and infrastructure projects increases per capita income of the poor indirectly through economic growth.

Empirical research by Ogundipe et al. (2014) examined the relationship between foreign aid and economic development in SSA. The study applies GMM (Generalized method of moments) estimation technique for the period of 1996-2010 covering 40 SSA countries. The study noted that foreign aid does not significantly affect real GDP per capita in SSA. But the relation reverses after controlling for the role of economic policy. This implies that foreign aid became more significant after interacting with economic policy.

Most recently Mahembe and Odhiambo (2019) conducted a study about the causal relationship between foreign aid, poverty, and economic growth in 82 underdeveloped countries for the period 1981-2013. They used VCEM (Vector Error Correction Model) and panel vector Granger causality test. The main findings are that, in the short term, there is two-way causal relationship between economic growth and poverty and a one-way causal relationship between economic growth and foreign aid. In the long term, foreign aid tends to converge to its equilibrium path in response to changes in economic growth and poverty and both economic growth and poverty are jointly triggered by foreign aid.

Table 2. Summary of empirical studies conducted about the indirect effects of aid on monetary and non-monetary indicators of poverty

Author	Variables studied in relation to foreign aid	Sample	Result
Burnside and Dollar (2000)	Economic growth	Developing countries	Aid is effective with good fiscal, monetary, and trade policies
Collier and Dollar (1999, 2000)	Policy environment	Developing countries	Aid reduce poverty only in countries with good policy environments.
Gomanee et al. (2005b)	Welfare	36 countries	Aid effective to improve it is associated with higher social sector spending
Kaya and Gunter (2013)	Agricultural poverty	46 countries	1 percent increase in agricultural aid reduces headcount poverty ratio by 0.2 percent
Hirano and Otsubo (2014)	Globalization and the poverty-growth-inequality (P-G-I) nexus	Developing countries	Social aid directly benefits the poor, while economic aid contributes to poverty through economic growth.
Ogundipe et al. (2014)	GDP per capita	SSA	Foreign aid has significant result combining with sound economic policy
Mahembe and Odhiambo (2019)	Causal relationship between foreign aid, poverty, and economic growth	82 underdeveloped	In the long term, both economic growth and poverty are affected jointly by foreign aid.

Source: Author

2.2.3. Country specific studies

Research by Feeny (2004) conducted about the contribution of international assistance to human well-being in Papua New Guinea. The study analyzed the combination of donor aid programs aimed at fostering economic development and safety net programs designed to enhance individual well-being. The study found out that sector-specific allocation of development aid in Papua New Guinea support the strategic objectives of poverty reduction and well-being improvement in the country. Specifically, assistance invested in infrastructure, water supply, and rural development projects, could reflect the tangible result of aid on people's well-being.

Research conducted about the impact of foreign aid on economic development of Pakistan 1960-2002 found that international aid contributes to economic development only with the presence of better monetary, fiscal, and trade policies in Pakistan (Mohey-ud-din, 2005).

Another study conducted in 69 districts of Kenya investigates monthly data from July 2003 to December 2008. The research shows that ODA has substantially contributed to poverty alleviation in Kenya, with a higher result for the 'poorest of the poor' and less for those who earn slightly less below the poverty line. The contribution of ODA is more noticeable on household poverty than national poverty (Oduor and Khainga, 2009).

Longitudinal study about the relationship between aid, economic growth, and poverty reduction in the Dominican Republic for the period 1970-2007 found insignificant relationship between foreign aid and economic growth, along with the pre-existing fiscal policy. Moreover, it found positive and statistically significant correlation between foreign aid and poverty reduction. The positive correlation coefficient between foreign aid and poverty reduction is due to lack of institutional quality and accountability in the country (Lamb, 2010).

Mohapatra et al. (2016) examines the effectiveness of foreign aid on the growth of Indian economy using annual data from 1970 to 2014. The study found a statistically significant positive impact of foreign aid on economic growth in India both in the short and long term. In the long term positive impact of assistance extends to poverty and average income via economic growth.

The study by Shitile and Sule (2019) re-asses the effectiveness of foreign aid on poverty alleviation process in Nigeria using longitudinal data from 1999 to 2017. They analyze the average impact of technical assistance, ODA, and other grants, on the level of poverty using ARDL (Autoregressive Distributed Lag) and bound testing approach. The researchers found in the short term, technical assistance and ODA have a positive but not significant contribution to national poverty. But, in the long term, technical assistance and ODA have a negative association with the level of poverty. Yet other forms of grants and loans moderately contribute to poverty alleviation in Nigeria.

Table 3. Summary of empirical studies conducted about the effects of aid in different countries

Author	Variables studied in relation to foreign aid	Specific country	Result
Shitile and sule (2019)	Income poverty	Nigeria	Technical assistance and ODA do not have significant impact on poverty reduction Other kind of grants and external loans have significant association with poverty reduction.
Mohapatra et al. (2016)	Economic growth	India	Foreign aid has positive and significant impact of on economic growth in both in the long run and in short run. Aid has significant contribution to poverty mitigation in long run.
Lamb (2010)	Economic growth, poverty, and fiscal policy	Dominican Republic	There is no significant relationship between foreign aid and economic growth or pre-existing fiscal policy. There is negative relationship between and foreign aid poverty.
Oduor and Khainga (2009)	Income poverty	Kenya	ODA has significantly reduced poverty in Kenya with higher outcome for the 'poorest of the poor'.
Mohey-uddin (2005)	Economic development	Pakistan	Aid helps to improve economic development only under the presence of sound economic policy.
Feeny (2004)	Human well-being	Papua New Guinea	Aid would be more successful to improve well-being if it is invested on the demanding sectors.

Source: Author

Chapter three

3. Research framework and methodology

3.1. Research framework

As it is discussed in the literature review, various studies have drawn different conclusions about the contribution of foreign aid for poverty mitigation via direct or indirect channels. This research investigates the direct effects of foreign aid on the reduction of income and multidimensional poverty in SSA. The framework of the study build upon the inquiries about the amount of foreign aid inflow to the SSA versus the extent of poverty in the region. Despite the higher inflow of assistance, development remained sluggish in SSA countries. Besides the economic hardships, political, social, and institutional development of the region is still less efficient.

To combat these economic, social, and institutional failures, various global and regional goals have been proposed since 1990. Those international goals and strategies have aimed at combating poverty in the region in one way or another. In addition to those strategies tremendous amount of resource has been poured to the region in order to alleviate poverty and ensure prosperity. Development initiatives and projects are still overflowing across the region.

Regardless of the higher inflow of international assistance, the standard of people's livelihood is lower in many respects. Even though there are improvements in in terms of growth and proportion of poor population, the region still has the most overlapping MPI deprivations. An estimate of one in three people living in SSA are undernourished. Concerning access to basic services, approximately 589 million people live without electricity, 37 percent of the world population with no access to clean water lives in SSA. Regarding health services, 1 out of 16 women living in SSA dies during childbirth or pregnancy (UNDP, 2018). According to the UNDP, Human Development Report (2019), SSA is the only region that remained stagnant below 0.55 HDI for decades.

Those socio-economic challenges will not be solved in the near future, either. For instance, MDGs poverty reduction target will not be reached in SSA until 2147, decreasing child mortality by two thirds, and the achievement of universal primary education will not be achieved before 2165 and 2129, respectively. If the population continues to grow at the current rate, by 2030, about 9 out of 10 impoverished people will live in SSA (UNDP, 2015). This spurred to uncertainties about the success of aid and development projects in the region.

Following those concerns about assistance versus development, this study scrutinizes the direct effects of foreign aid inflows to SSA countries in terms of enhancing people's livelihood in respect to income and multidimensional poverty over short and relatively long period of time.

3.2. Data description and source

For the analysis of this study, SSA countries selected based on the available data for selected dependent and independent parameters. Unfortunately, there is a considerable gap in the availability of longitudinal data across SSA countries. In particular, data poverty indicators are rarely available across countries for similar periods of time. For the purpose of this research, an approach called "pseudo" cross-section is designed to address this gap in cross-country analysis. This "pseudo" cross-sectional data is a quasi cross-sectional approach designed for many countries over different (but comparable) timeframes.

The study encompasses 26 countries for headcount poverty and 33 countries for multidimensional poverty. This number of countries represent more than 50 percent of the SSA countries for both poverty indicators. These are all SSA countries for which the data are available for the years that range in between 2011-2015 in terms of headcount poverty and for 2013-2017⁴ in terms of multidimensional poverty. To minimize bias due to time variation across countries, average of four years data for each independent variable computed. These four years average data for each independent variable used as one year data for each country. The calculation includes the year of available poverty data and the previous three years (Appendix 1).

$$X_t = \frac{(Xh + Xh-1 + Xh-2 + Xh-3)}{4}$$

Where x , represent independent variables, t is the period of data for independent variable (four years average), and h is the year of available data for poverty.

The Proxies for both dependent and independent variables are country level secondary data. Most of them retrieved from the World Bank archive (WDI, 2019). Except for MPI, sourced from OPHI (2019) database; state fragility, traced from Fund For Peace database (FFP, 2019); average annual rate of population change, retrieved form UN, World Population Prospects (2019) revised database.

3.3. Description of variables

To examine the role of foreign aid in poverty reduction, poverty has considered to be an endogenous variable in the model. Percentage of population live under the international poverty line (\$1.90 a day) is used as a proxy for monetary poverty, and percentage of the population live in multidimensional poverty is used as a proxy for non-monetary poverty.

⁴ Exception of Central African Republic (2010), Mozambique (2011), and Niger (2012) due to unavailability of MPI data afterwards

I. Poverty headcount ratio at \$1.90 a day (2011 PPP) (percentage of population)

Poverty headcount rate of \$1.90 a day explains the percentage of the population lives below \$1.90 per day per person based on 2011 PPP. Data for the proportion of the population lives below \$1.90 per day tracked from WDI (2019). The Bank calculates the data based on primary household survey data collected from national government statistical agencies and World Bank country departments.

Headcount poverty computed by dividing the total number of population earn below \$1.90 per day by the total number of households surveyed.

Total number of people earn below \$1.90 per day, G calculated as,

$$G = \sum_{i=1}^m I(y, z) n_i$$

The index I , is designed by comparing the income, y of each household to the poverty line, z . And n_i represents the number of people in each household.

Total number of households surveyed, N measured as,

$$N = \sum_{i=1}^m n_i,$$

Where n_i is again the number of people in each household.

II. Multidimensional poverty (percentage of population)

MPI was launched for the first time in 2010 by UNDP, Human Development Reporting Office (HDRO), and OPHI at Oxford University. The MPI was first published in 2010 during the twentieth anniversary of the Human Development Report (HDR). The calculation amended each year by adding additional indicators and countries (Alkire and Robles, 2016).

MPI reflect multiple deprivations that people face in the areas of education, health, and living standards. MPI has 3 dimensions and 10 indicators. Each of the 3 dimensions has the same weight of 1/3. All the indicators within the health and education dimensions have a weight of 1/6 each. And each indicator within the standard of living dimension has 1/18 weight each (Appendix, 2). Individuals who encounter deprivation in at least one-third of these weighted indicators are categorized as multidimensionally poor (Alkire and Robles, 2016).

$$MPI = W_1 D_1 + W_2 D_2 + \dots + W_i D_i$$

W is the weight attached to each indicator i , where $\sum W_i = 1$

D is the score of an individual for each indicator i

$D_i = 1$ if the person is deprived in indicator i , and $D_i = 0$ otherwise.

Independent variables are chosen based on empirical evidence that has been verified in other studies. Quantitative values for independent variables have translated into per capita terms to demonstrate the disaggregated value of each variable at individual level.

The primary interest of this study is to inspect the direct effects of aid on poverty, thus independent variables other than net ODA per capita and its lag value examined as control variables in the model exclusively due to their association with poverty. The aim of adding those covariates to the model is to find robust result about the relationship between aid and poverty by controlling other external factors which could determine poverty in SSA countries.

Therefore, for the purpose of this study poverty in SSA estimated as the function of net ODA per capita, one period lag net ODA per capita, and other empirically selected control variables.

Poverty = f (net ODA per capita, one period lag net ODA per capita, GNI per capita, employment-to-population ratio, state fragility, natural resource as percentage of GDP, average annual rate of population change)

- i. Net ODA received in current US dollar (per capita)

Net ODA is composed of net resource transferred from the developed world to developing countries. The transfer should obey DAC conditionalities and received by countries and regions on the DAC list of beneficiaries of funding. ODA could be transferred in the form of financial flows, technical assistance, or commodities, which intended to promote economic development and welfare improvement as its primary objective. To be classified as ODA, transfers must be provided by the official authorities, not by any private entities. If resources transferred in the form of loan, it must have a grant element of at least 25 percent with 10 percent discount rate (OECD, 2019). DAC compute per capita ODA annually as ratio of net ODA received and mid-year projected population. Data for net ODA per capita retrieved from World Bank (2019).

- ii. Lag value of net ODA in current US dollar (per capita)

The analysis of the study considers one period lag of net ODA per capita in the model. This includes ODA received from 2004-2013 for both indicators of poverty for all SSA countries included in this study⁵ (Appendix 1). The efficacy of the aid may not be demonstrated simply by analysing the current flow of aid. The sum of the distribution of assistance in previous periods could have an impact on the countries' current level of poverty.

One-year lag value of net ODA per capita calculated as,

$$Ad_{t-1} = \frac{(Ad_{t-5} + Ad_{t-6} + Ad_{t-7} + Ad_{t-8})}{4}$$

⁵ Exception of Central African Republic (2010-2001), Mozambique (2011-2002) and Niger (2012-2005) due to unavailability of MPI data afterwards

Where Ad is the amount of net ODA per capita received by each country, $(t-1)$ is one period lag (four years average) value of net ODA per capita, and h is the year for available poverty data.

iii. State fragility index

Conflict and instability of countries represented by state fragility index in this study. The Fragile States index provides an analysis about tensions in states and their exposure to internal strife. Country rating for the index is based on the total scores of 12 indicators, classified under cohesion, social, economic, and political dimensions. There are 3 indicators under each aspect, and each of the indicators has a value between 0 and 10. Total state fragility index evaluated out of 120. The lower is the more stable and vice versa (Appendix 2). For each of the indicators annual data collected from sources such as UN, World Health Organization (WHO), World Factbook, Transparency international, and World Bank, and Freedom House. The final quantitative value of the index calculated and presented on Fund For Peace (FFP) public database (FFP, 2019).

iv. GNI in US dollar (per capita)

GNI is the market value of final goods and services produced by the citizens of a country regardless of their place of residence, which includes taxation on items and factor income. GNI is GDP less domestic product by foreign nationals, plus income earned from foreign sources by nationals of the country. The per capita value calculated by dividing market value of total production by citizens of the country in US dollars by the total population of the country (World Bank, 2019).

v. Employment-to-population ratio

Employment-to-population ratio is the percentage of the country's population actively engaged in the labour market. This describes how effective an economy is to create jobs for people who want to work. The ratio calculated as currently working population age greater than 15 divided by the total population of the country. High proportion of employment-to-population ratio means significant proportion of the workforce is currently hired and vice versa (World Bank, 2019). The data retrieved from World Bank archive.

vi. Average annual rate of population change

The data for the average annual rate of population change retrieved from UN, World Population Prospects (2019) revised database. Rate of population change estimated based on all available sources of yearly data on population size, fertility rate, mortality rate and net migration for all the countries in the world.

vii. Total natural resources rent as percentage of GDP

Total rent for natural resources is the amount of rent from oil, natural gas, hard and soft energy, for minerals and woods. Estimates of rentals for natural resources measured as the discrepancy between the market price of the resource and the actual cost of extracting it (including the usual return on capital). Annual estimation of rents from natural presented in World Bank data base by computing annual income from natural resource for give country as percentage of annual GDP (World Bank, 2011).

Independent variables analyzed in the final model are presented in the table below, along with available empirical evidence regarding their relationship with poverty. The selected independent variables have ample relationship with poverty, particularly in SSA. This support the econometric analysis of the study to find a robust result by controlling other external factors which could affect poverty in SSA. Empirical evidence about net ODA per capita and its lag value is widely described in chapter two. The reason why it is not included in the table below is to lessen redundancy.

Table 4. selected independent variables along with empirical evidence about their correlation with poverty.

Variables	Empirical evidence
Employment	Karnani (2009); Page and Shimeles (2015); Adelowokan et al. (2019); Thompson and Dahling (2019)
GNI Per capita	Moser and ichida (2001); Son and Kakwani (2004); Sembene (2015)
State fragility	Goodhand, (2001); Luckham et al. (2001); Penh (2009); Aremu (2011)
Average annual rate of population change	Ahlburg (1996); Merrick (2002); Chakravarty et al. (2006); Sinding (2009); Gupta et al. (2011)
Natural resource as a percentage of GDP	Heady (2000); Bravo-Ortega and Gregorio. (2002); Barbier (2005); Ploeg and Poelhekke (2009)

Source: Author

3.4. Econometric framework

In this sub-section, the discussion is about econometric model specification and implementation. To evaluate direct effects of aid on both income and multidimensional poverty two separate beta regression equations are analyzed separately for two dependent variables with similar set of independent variables.

3.4.1. Model specification.

Econometric model for given research has to be specified on the basis of data distribution and characteristics of the dependent variables. For this study proxies for dependent variables are both percentages of the total population, which are inherently proportional and distributed in the interval of 0 and 1.

Beta regression model developed by Ferrari and Caribari-Neto (2004) suits well for this sort of exogenous variables. Beta regression is usually appropriate for modeling of continuous random variables with values between 0 and 1. Beta distribution is flexible distribution commonly used to model data that is limited to a certain open range. Beta regression model is naturally heteroskedastic and easily accommodates asymmetry (Cribari-Neto and Zeileis, 2010).

Beta regression model is presented as,

$$g(\mu) = B_0 + B_1 X_1 + B_2 X_2 + \dots + B_k X_k$$

B_0 is constant

B_i are regression coefficients

X_i are explanatory variables

μ is mean of independent variable

$$\mu(y; p, q), \quad 0 < y < 1$$

where p and $q > 0$

$$\text{Mean of } y \text{ is, } E(y) = \frac{p}{p+q}$$

$$\text{Variance of } y \text{ is, } V(y) = \frac{pq}{(p+q)^2 (p+q+1)}$$

Key assumptions of Beta regression

- i. Dependent variable has beta distribution, $y \sim (0,1)$
- ii. Mean of the dependent variable is related to a set of regressors through a linear predictor with a link function.
- iii. Distribution for the dependent variable is conditional on the covariates.
- iv. Parameters are interpreted using maximum likelihood, or odds ratio depend on the link function.

Beta regression parameters are linked with different functions with nonlinear predictors. Beta regression link functions are nonlinear, smooth, and monotonous mapping of infinite space of the linear predictor into the proper sample space of observations (Ferrari and Caribari-Neto, 2004).

Accordingly, the beta regression equations for this study presented as,

$$g(\mu P_i) = B_0 + B_1 \text{Ad}(t) P_i + B_2 \text{Ad}(t-1) P_i + B_i X_i P_i \dots\dots\dots(I)$$

However, ODA received in the recent period is statistically correlated with ODA received during one period lag for both poverty indicators (Appendix 5). Moreover, it is statistically recommended to do separate regression for lag variables to minimize multicollinearity among independent variable. Therefore, separate beta regression equations analysed for net ODA per capita received in different time periods.

$$g(\mu P_i) = B_0 + B_1 \text{Ad}(t) P_i + B_2 X_i P_i \dots\dots\dots(i)$$

$$g(\mu P_i) = B_0 + B_1 \text{Ad}(t-1) P_i + B_2 X_i P_i \dots\dots\dots(ii)$$

where P is poverty, and i=hp, mp, (Description of variables presented in Table 5)

Ad (t) is the amount of net ODA per capita received in period t or “recent period”

Ad (t-1) is the amount of net ODA per capita received in period t-1 or “one period lag”

μ is mean of poverty

B0 is constant

Bi regression coefficients.

X independent variables, i= sf, emp ,nr, gni , pop, (description of variables presented in Table 5)

For this analysis, beta regression models are evaluated using the logit link function with log slink function.

Link function $g(u) = \log(u/(1-u))$ [Logit]

Slink function $g(u) = \log(u)$ [Log]

Interpretation of beta regressions results depends on the link and slink functions applied. If the link function is logit, results interpreted as odds-ratio (Ferrari and Caribari-Neto, 2004). As it is explained above this study is analysed based on logit link with log slink function. So, beta regression results could be interpreted either using odds-ratio or average marginal effect. For

the purpose of this study, beta regression results interpreted as average marginal effect. Result from the marginal effect interpreted as, holding the other control covariates constant, beta regression coefficients explain the average change in the dependent variable due to one unit of change in the particular explanatory variable (Williams, 2012).

Table 5. Description of independent variables and symbolic representation in the model

Variable name	Type	Variable representation in the model
Inocme Poverty	Percentage	hp
Multidimensional poverty	Percentage	mp
GNI per capita	Continues	gni
Employment to population ratio	Percentage	emp
Net ODA per capita	Continues	Ad(t)
One period lag net ODA per capita	Continues	Ad(t-1)
State fragility	Continues	sf
Natural resource as per centage of GDP	percentage	nr
Average annual rate of population change	Percentage	pop

Source: Author

3.4.2. Stata implementation

Econometric analysis for this study conducted on Stata 15.1. While specifying which model to use to address research questions, different models with similar assumptions have been compared. Linear regression with log-transformed dependent variable, fractional regression, inflated beta regression, and beta regression models examined. And beta regressing model specified as final model with better precision than the other tantamount models (Appendix, 3).

Beta regression (betareg) Stata command launched by Ferrari and Caribari-Neto (2004). The first result after 'betareg' Stata cannot be interpreted as the average marginal effect. So, 'margins, dydx(_all)' command implemented in Stata afterwards to interpret the results as average change. Beta regression model combined with different functions of standard error for better precision. For this study, after testing four other functions interchangeably, 'vce (robust)' standard error chosen as better precise function. Further detail tests and results of the econometric analysis presented in the Appendix.

Chapter four

4. Result and discussion

Results of descriptive statistics and empirical analysis of the study are discussed in two sub-sections of this chapter. In the first sub-section, descriptive statistics results presented using summary statistics, distribution, and correlation results. Graphical analysis of net ODA per capita and poverty in SSA and cross-country comparison of "pseudo" cross-sectional data discussed in the first sub-section. Findings of the empirical examination using beta regression analysis are presented and interpreted in the second sub-section according to Ferrari and Caribari-Neto (2004) beta regression assumptions and tests.

4.1. Descriptive Statistics

4.1.1. Poverty in SSA

Summary of descriptive statistics for “pseudo” cross-sectional poverty data are presented in Table 6. On average, 43 percent of the population in SSA lives below \$1.90 per day. Of the 26 SSA countries studied for income poverty, the share of the population that lives under \$1.90 a day ranges from 10 to 77 percent across countries. Yet multidimensional poverty for SSA countries ranges from 24 percent to 90 percent of the countries’ population. On average, about 57 percent of the population in SSA live in multifaceted deprivation.

According to the descriptive summary, more people experience multidimensional poverty than income poverty in the region. Average multidimensional poverty is 14 percent higher than average income poverty. Poverty in SSA is more profound than lack of daily income or consumption.

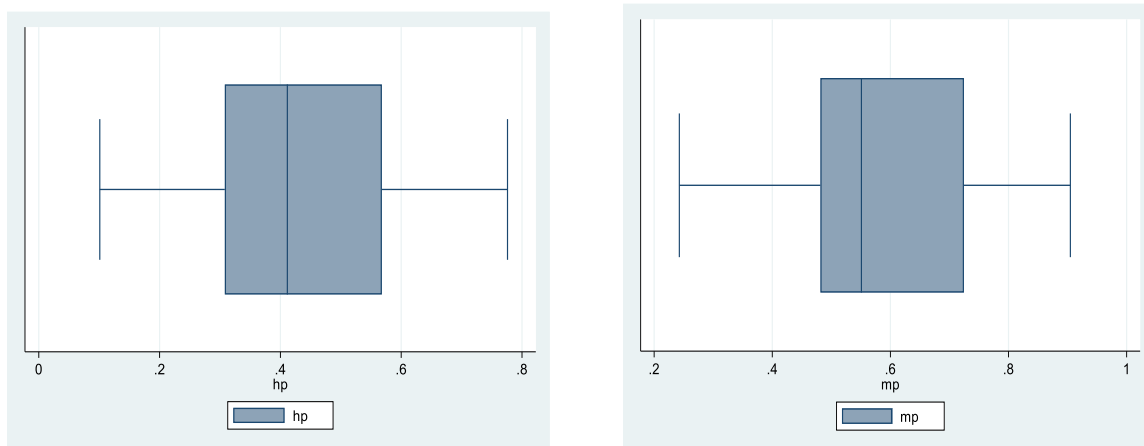
Table 5. Descriptive summary of headcount and multidimensional poverty in SSA

	SD	Mean	max	min	Q1	Q2	Q3	Q4
hp	0.188	0.434	0.776	0.101	0.308	0.4115	0.568	0.776
mp	0.173	0.577	0.904	0.242	0.481	0.550	0.724	0.904
SD; Standard Deviation			Q; Quartile					

Source: Stata 15.1 result

Box plot presented in Figure 1 provide further clarification about the distribution of income and multidimensional poverty in SSA. The box plots show the median, approximate quartile values, and the lowest and highest data points to map the pattern and range of poverty in the region.

Figure 1. Distribution of income and multidimensional poverty in SSA presented in box plots



Source: Stata 15.1 result

Quartiles designate the percentage of countries which have certain proportion of poor population under each quartile. 25 percent of the countries have less than 30.8 percent their population living below \$1.90 a day, whereas 75 percent of the countries have under 56.8 percent of their population residing in income poverty. All 26 countries have under 77 percent of their population living below \$1.90 per day.

Comparing the two forms of poverty, there are more countries with a higher proportion of multidimensionally poor population following each quartile than countries with a percentage of the population who only earn \$1.90 a day. Of the 33 countries analyzed for multidimensional poverty, 25 percent of countries have less than 48 percent of their population living in multidimensional poverty. This is 18 percent higher than that of income poverty in the same quartile. Besides, 75 percent of countries have under 72 percent of their population living in multidimensional deprivation. All of the countries have under 90 percent multidimensionally poor population. These statistics shows that deprivation in the region is more encompassing than earning daily necessities.

The median for countries in income poverty analysis is 41 percent, and 55 percent for countries in the analysis of multidimensional poverty. Percentage of the population encounter poverty in each country lied in a comparable range. There is no country which has an outlier percentage of population for both income and multidimensional poverty.

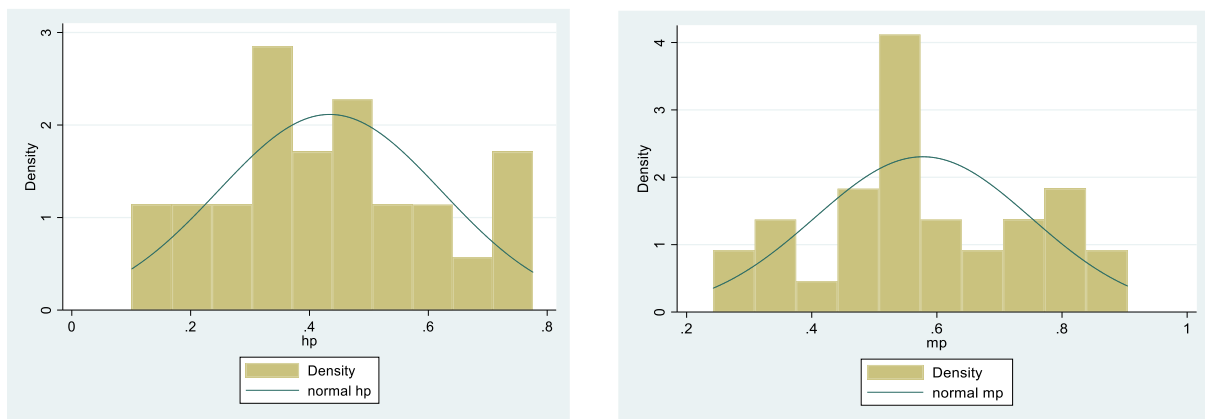
More detailed explanation of the above results of approximate distribution, peak, frequency, and symmetry of both poverty indicators are presented in the histogram below. From Figure 2, it is visible that out of the 26 countries in income poverty analysis, most countries have from 30 to 50 percent of their population living below \$1.90 per day. There are also considerable number of countries, with more than 70 percent of poor population lives in income poverty.

Regarding the distribution of multidimensional poverty in the 33 SSA countries, majority of the countries have about 50 percent of multidimensionally poor population. Unlike headcount poverty, there are fewer countries which have 30 to 40 percent of the multidimensionally poor

population. Hence, there is a considerable number of countries with 70 to 90 percent of their population living in multidimensional poverty.

Although the distribution of both poverty measures is less symmetrically distributed, beta regression is compatible with all left- or right-skewed distributions as well as with J-shaped and inverted J-shaped distributions (Ferrari and Cribari-Neto, 2004). Thus, the distribution of poverty indicators reflects just the spread and frequency of poverty rates across countries, but the distribution does not matter procedure of the regression.

Figure 2. Distribution of income and multidimensional poverty in SSA presented in Histogram



Source: Stata 15.1 result

4.1.2. Poverty and ODA in SSA

Graphical analysis of net ODA per capita and poverty rates in SSA summarized in four categories of countries based on comparison of volume of net ODA per capita received with the percentage of the population living in each form of poverty. The assessment is based on the performance of other countries within the same category. Low or high poverty means smaller or higher percentage of poor people relative to other countries in the same group. The analogy continues in the same manner with the volume of per capita ODA received.

The first group of countries those who received higher amount of net ODA per capita compared to other countries and have high percentage of population encounter form of poverty. The second group of countries received higher foreign assistance than others and have a smaller percentage population in each type of poverty. The third group of countries are those that receive less net ODA per capita than other countries, while a higher percentage of their population live in poverty. The fourth group of countries in the region have a small proportion of their population experience poverty, even though they receive less net ODA per capita than other countries.

I. Income poverty and ODA

Figure 4 presented the cross-country comparison of net ODA per capita received and the rate of income poverty in each country. The 26 countries summarized in the four categories and discussed below.

The first group of countries include Burundi, Mozambique, Malawi, Rwanda, and Zambia, those earn comparatively higher amount of net ODA per capita, while more than 50 percent of their population lives below \$1.90 a day. Liberia also belongs to this group; the volume of assistance to Liberia increased instantly during those two periods following the outbreak of the civil war in 1999 and the war with Sierra Leone and Guinea. This led the country to economic and refugee crises in the 2000s. The net ODA per capita for Liberia increased spontaneously from \$78.4 in 2006 to \$324.4 in 2007 and hit \$346.5 in 2008. Although the net ODA for Liberia decreased to \$130.06 per capita in 2012, Liberia is still the highest recipient of assistance than any other country in the group, while 38.6 percent of Liberians still lives below the international poverty line.

Countries such as Congo Republic, The Gambia, and Ghana classified into the second group. They received higher foreign assistance than others and have a lower percentage of the population live in income poverty. Comoros is also grouped to this category, that has received \$65.17 per capita during the recent period and has only 23 percent of the population living in income poverty.

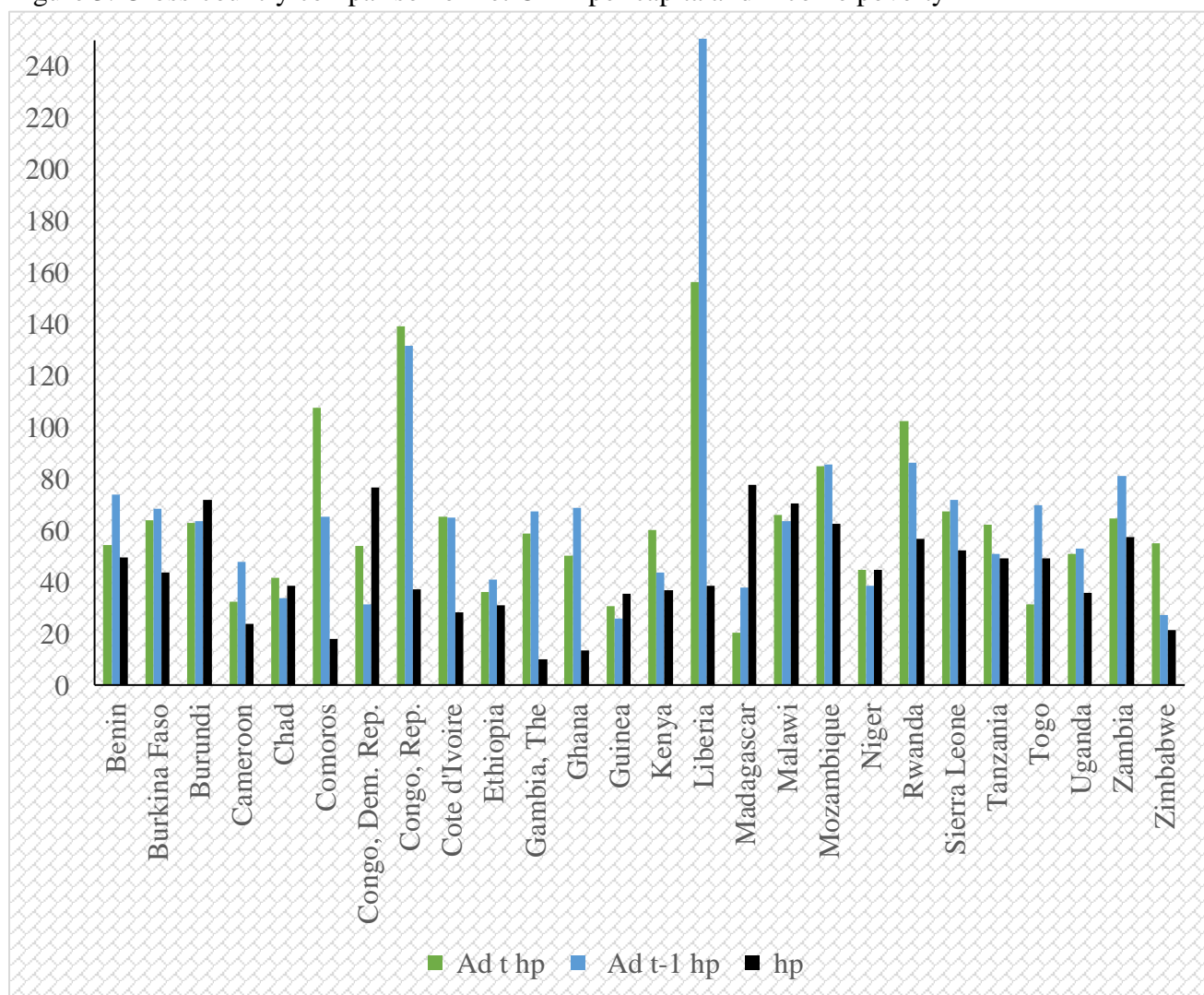
Chad, Democratic Republic of Congo, Madagascar, and Malawi are categorized in the third group, receiving less net ODA per capita than other countries, at the same time, a higher share of their population encounter income poverty. 76 percent of Democratic Republic of Congo population lives below \$1.90 a day, while the country received \$31.37 net ODA per person in the recent period. Madagascar and Malawi received \$37 and \$63 net ODA per capita during the recent period, while 77.7 and 70.3 percent of their population lives in income poverty, respectively.

On the contrast, countries in the fourth group have a lower proportion of their population live below \$1.90 per day, even though they receive low net ODA per capita than other countries. Taking Zimbabwe as an instance, only 21.4 percent of the population subsists below \$1.90 a day, while they receive \$27.07 net ODA per person in recent period. Likewise, other countries like Cameroon, Ethiopia, and Guinea, have relatively low percentage of poor population, while receiving less aid than other countries.

Income Poverty and ODA received during the lag period doesn't seem linked to each other as well. Countries received high assistance, such as Burundi, Guinea, Liberia, Mozambique, Zambia, but also record a higher percentage of poor population. In reverse, Cameroon, Niger, and Zimbabwe received less ODA and have smaller percentage population living below \$1.90 a day. Yet, Comoros, Gambia, and Ghana, receive considerable amount of assistance and have less percentage poor population compared to the other countries in the group.

As it is seen in the graph, the net ODA per capita does not have a comparable sequence with income poverty across SSA countries. Countries have a different percentage of poor population, irrespective of the amount of aid they have received. Receiving larger or smaller amount of assistance relative to other countries in the group does not seem to have relation with having higher or lower percentage of population lives below \$1.90 per day.

Figure 3. Cross-country comparison of net ODA per capita and income poverty



Source: Author

I. Multidimensional poverty and ODA

Cross-country comparison of net ODA per capita and multidimensional poverty presented in Figure 5. Countries classified and compared in the four groups.

Benin, Burundi, Guinea-Bissau, Mali, Mozambique, and Rwanda are classified in the first category. Even though there is a considerable amount of ODA inflow to these countries, more than 65 percent of their population encounter multi-faceted deprivation. The same is true for

Liberia, which received \$221.24 and \$204.20 of net ODA per capita for each period, but 62.93 of Liberians remained multidimensionally poor.

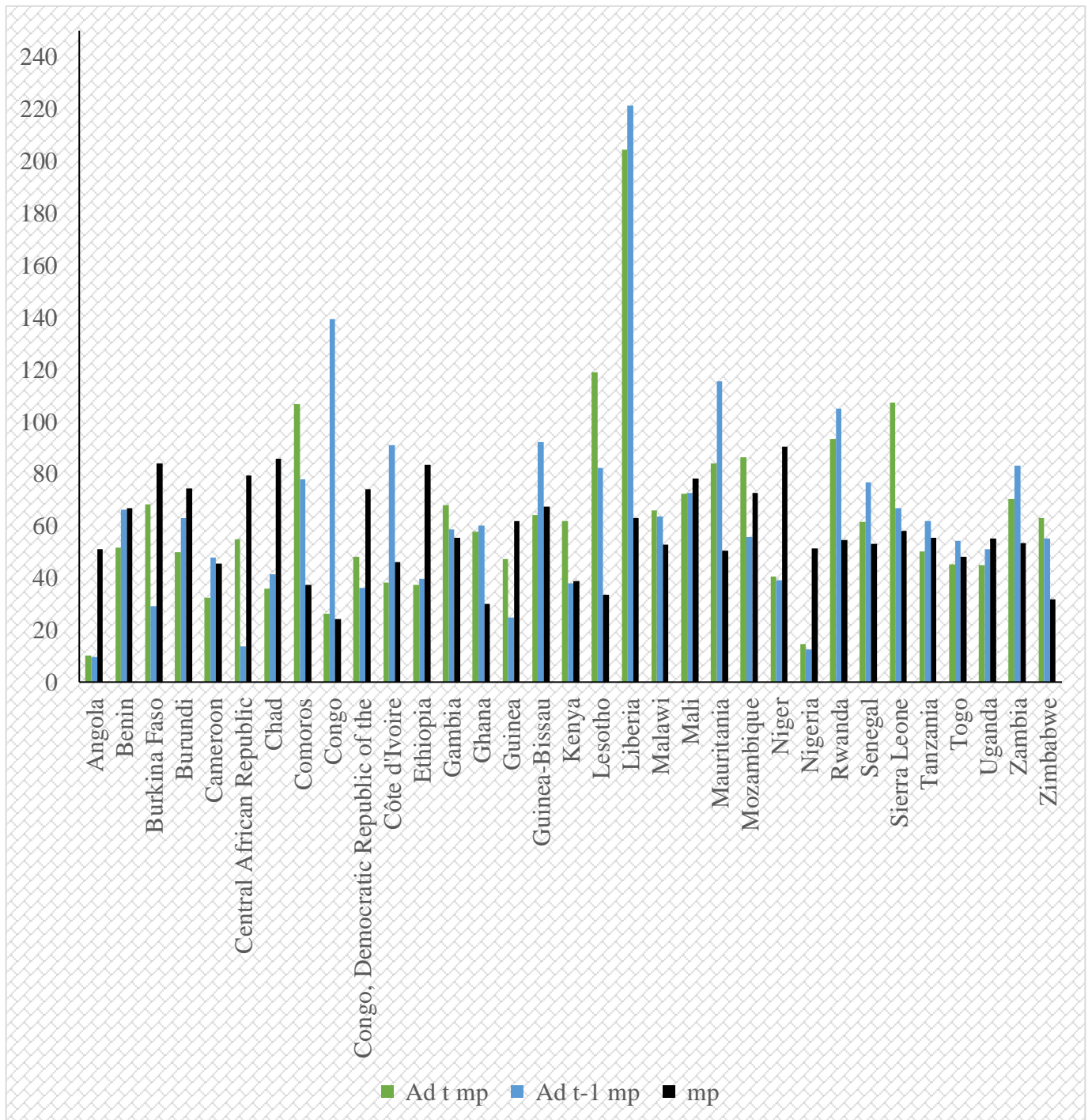
In the Second group, Comoros and Lesotho managed to lift out more than 60 percent of their population from multidimensional poverty, receiving comparably higher amount of net ODA per capita than other countries in the group. Likewise, Mauritania and Ghana have lower percentage of multidimensionally poor population, while receiving \$100 and \$58.2 of net ODA per capita on average for the two periods, respectively.

In the third group countries such as Angola, Central African Republic, Chad, and Democratic Republic of Congo have received less ODA per capita than other countries. However, they have higher percentage of their population living in multidimensional poverty. Similarly, Burkina Faso, Niger, Nigeria, and Tanzania are earning less and achieving less than the rest.

The fourth group comprises countries like Cameroon, Togo, and Zimbabwe that receive low ODA per capita and have low percentage of multidimensionally poor population compared to others. Congo Republic is also classified in this group by comparing ODA received in the recent period and percentage of multidimensionally poor population. However, ODA received by Congo Republic during the lag period is the second highest ODA per capita in the group.

Similarly to income poverty, the graph reveals that receiving high or low ODA per capita does not seem to have to do with the low or high percentage of multidimensional poverty. Countries have high or low percentage of the poor population, irrespective of the amount of ODA they have received during both periods.

Figure 4. Cross-country comparison of net ODA per capita and income poverty



Source: Author

4.1.4. Statistical correlation between ODA and poverty in SSA

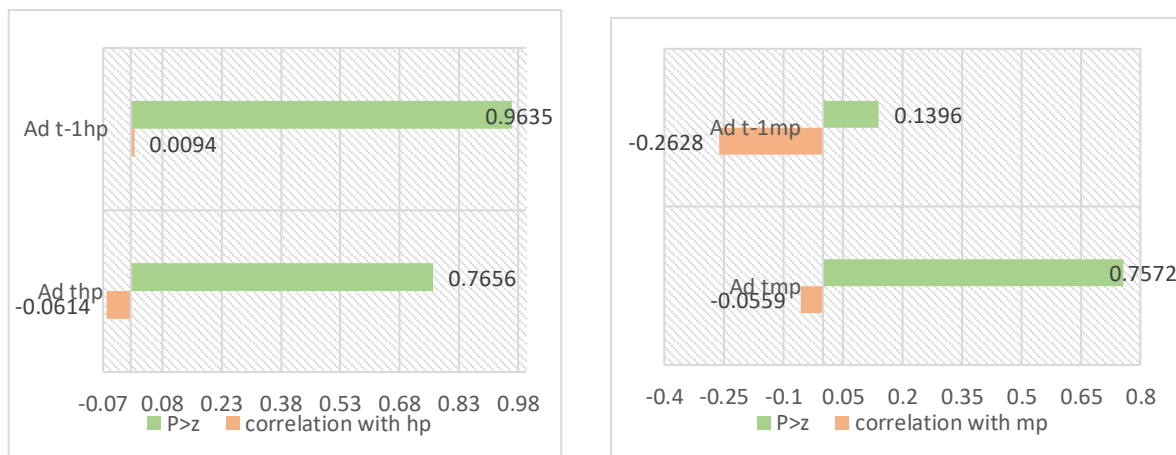
The statistical correlation between assistance and poverty rates is presented in this subsection. The command “pwcrr” in Stata used to demonstrate the strength and direction of the statistical relationship between net ODA per capita and each form of poverty in SSA.

According to the result of correlation that presented in Figure 6, income poverty is negatively correlated with ODA received in the recent period and has a positive correlation with ODA received in the lag period. However, the correlation is not strong enough for both periods. Moreover, the high p-value results of the correlation indicate that the association between assistance and income poverty is not statistically significant. Based on the correlation results, it seems that the amount of ODA flow to SSA does not have a substantial role on the reduction of income poverty.

As it is shown in the figure, ODA received during both periods has a negative correlation with multidimensional poverty. The negative correlation result of ODA received during the recent period is not sufficiently robust. However, assistance received during the lag period has a weak correlation with multidimensional poverty ($r < \pm 0.1$)⁶. Furthermore, looking at p-value results, correlation results of multidimensional poverty and net ODA per capita are not statistically significant for both periods.

According to result of the correlation statistics, aid inflow to SSA countries appears to be less likely to reduce multidimensional poverty in the short or long period of time.

Figure 5. Results of correlation between net ODA per capita and poverty



Source: Stata 15.1 result

significant at * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

4.2. Quantitative analysis

4.2.1. Beta regression results

The regression analysis enables to elaborate on the results from the descriptive statistics. Further discussions about the direct contributions of foreign aid to alleviate income and

⁶ $\pm 0.1 < |r| < \pm 0.3$ weak correlation, $\pm 0.3 < |r| < \pm 0.5$ medium/moderate correlation, $|r| > \pm 0.5$ strong correlation

multidimensional poverty are examined using beta regression analysis and presented in this section.

In order to elucidate the research questions about the direct effects of foreign aid on alleviation of poverty in SSA countries, econometric analysis has been done using two independent beta regression equations separately for income poverty and multidimensional poverty. The data for both dependent variables is inherently proportional ($0 < y < 1$) and the distributed less symmetrically. Therefore, beta regression model fits for this analysis precisely due to the flexible characteristics of beta distribution for modeling and distribution of proportions. Results of beta regression model interpreted using marginal effect of each independent variable. In beta regression model average marginal effect result is equal to average change in the dependent variable due to the change in exogenous variables (Williams, 2012).

I. Income poverty

As it is presented in Table 7, beta regression coefficients for net ODA per capita and income poverty are positive for both periods. However, the results are not statically significant. On 90 percent confidence level, the inflow of ODA per capita to SSA countries does not appear to have a significant effect on the reduction of the percentage of people living below \$1.90 per day over in short or relatively long period of time.

Based on the results of beta regression, the cross-country analysis does not confirm the anticipated outcomes of ODA in terms of mitigating income poverty in SSA. International assistance received from 2004-2015 (include the period for the recent and lag period) does not enable the region to overcome the problem of income poverty in the period 2011-2015.

The primary objective of this study is to examine the direct effects of aid on poverty alleviation, but it is also deserving of having a brief discussion on the results of other control variables.

Of the five variables analysed in the model as external factors, GNI per capita, natural resource as percentage GDP, and employment-to population ratio, are significantly linked to income poverty. The relationship between employment and income poverty appears peculiar than expected. One percent rise in employment-to-population ratio contributes to 0.0076 percent increase in the percentage of population lives income poverty on average. According to the results, natural resources tend to be a curse for the region. One percent increase in natural resource percent of GDP results in an increase of percentage of poor population by 0.005 on average. Improving annual GNI per capita reduces income poverty in the region. One dollar increase in per capita GNI has led to the reduce in the percentage of population lives in income poverty by 0.0000345 on average, although the value is quite small. The average annual rate of population change and state fragility does not have a statistically significant relationship with income poverty.

Table 6. Beta regression results of income poverty and net ODA per capita (After ‘margins, dydx_all’, command)

	dy/dx	P>z		dy/dx	P>z
Adthp	0.00055	0.499	Adt1hp	0.00043	0.232
sfhp	-0.005	0.129	sfhp	-0.00493	0.118
emphp	0.007637	0.005**	emphp	0.007652	0.005***
nrhp	0.005461	0.069*	nrhp	0.005828	0.064*
gnihp	-3.4E-05	0.034**	gnihp	-3.5E-05	0.027**
pop	0.046484	0.459	pop	0.040795	0.511

Source: Stata 15.1 results

Significant at * $p < 0.1$, $p < **0.05$, and $p < ***0.01$

II. Multidimensional poverty

Controlling other independent variables, net ODA per capita has negative regression coefficients with multidimensional poverty during both periods. But, the negative association between ODA received during the recent period and multidimensional poverty is not statistically significant. Foreign assistance received during the recent period does not seem having potential contribution to lifting peoples out of multidimensional poverty in SSA. However, ODA received during the one period lag contributes to the alleviation of current multidimensional poverty in the SSA. With 90 percent confidence, additional one dollar net ODA per capita received during the lag period boosted 0.00101 percent of the population from multidimensional poverty on average. Foreign assistance has encouraging result in alleviating non-monetary indicator of poverty in SSA in a relatively long period of time.

Concerning the results of the other control variables, GNI per capita and state fragility have statically significant association with multidimensional poverty. One dollar increase in annual GNI per capita lifts out 0.00027 percentage of the population from multidimensional deprivation on average. And, One percent increase in the average annual rate of population change corresponds to a 0.11 increase in the percentage of the population living in multidimensional poverty on average.

Also, one unit increase in state fragility index increase percentage of multidimensionally poor population almost by 0.004 percent on average. Natural resource as a proportion of GDP and employment-to-population ratio does not have significant association with multidimensional poverty rate.

Table 7. Beta regression results of multidimensional poverty and net ODA per capita (After ‘margins, dydx_all’, command)

	dy/dx	P>z		dy/dx	P>z
Adtmp	-0.00026	0.665	Adt1mp	-0.00101	0.054*
sfmp	0.004342	0.05**	sfmp	0.003716	0.059*
empmp	0.000665	0.63	empmp	-0.0006	0.625
nrmp	-0.00077	0.566	nrmp	0.000385	0.74
gnimp	-6.2E-05	0.001***	gnimp	-6.6E-05	0.000***
pop	0.110971	0.014**	pop	0.111223	0.004***

Source: Stata 15.1 results

Significant at *p<0.1. p<**0.05, and p<***0.01

III. Result comparison

Despite the flooding of assistance to SSA, its direct outcome to mitigate both forms of poverty in the region is different from the pre-conceived outcome. The results of both descriptive and econometric analysis of this study demonstrated that the direct impact of foreign aid to enhance the livelihood of the population does not seem consistently successful.

Comparing the result of the two forms of poverty, foreign aid contributes better to the reduction of multidimensional poverty than income poverty. In addition, the result of foreign aid is more noticeable in a relatively long period than the short period.

For the 26 countries analyzed for income poverty, aid during neither of the periods is significant for alleviating income poverty in the region. This empirical finding is comparable to that of Arimah, (2004) which also found that increasing ODA per capita in developing countries does not enable them to reduce the proportion of the population living below the national or international poverty line. It is also akin to another study by Oyolola (2007) that found no direct impact of foreign aid on income poverty alleviation.

The study also found comparable results with by Ugwuanyi et al. (2017) about the short and long term effects of foreign aid. Both long-term and short-term regression estimates revealed that official aid has a no substantial impact on income poverty reduction during both periods.

Concerning multidimensional poverty, based on an analysis of 33 SSA countries, foreign assistance received during the lag period helped the region to reduce multidimensionally poor population in the period 2013-2017. However, the outcome of ODA is not noticeable in the recent period.

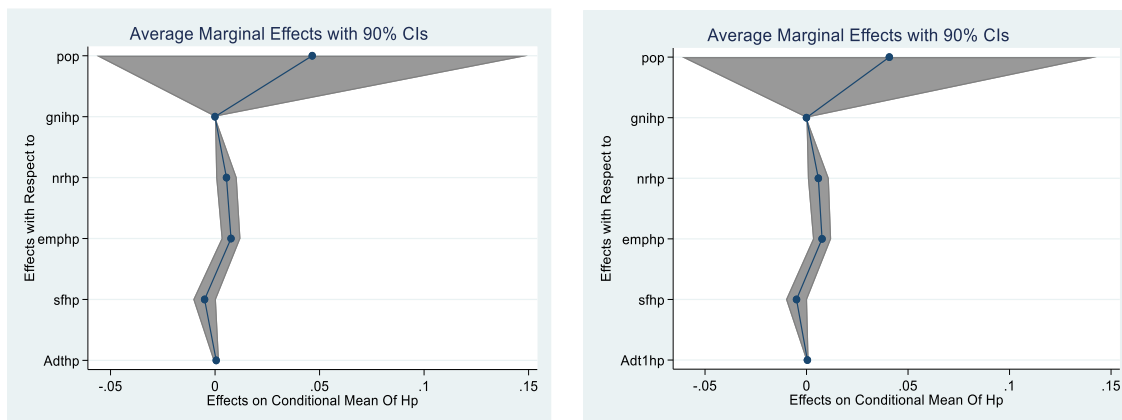
Results for aid contribution for multidimensional poverty in short period of time is comparable with findings by Asiana and Quartey (2009), which reported that aid inflow to SSA does not

have a significant direct effect on the non-monetary welfare indicators in the region. Multidimensional poverty finding for the relatively long time period is somehow analogous with the research by Milovich (2017), which pronounced that a 1 percent rise in the overall amount of assistance received corresponds to a 0.61 percent decrease in MPI across countries.

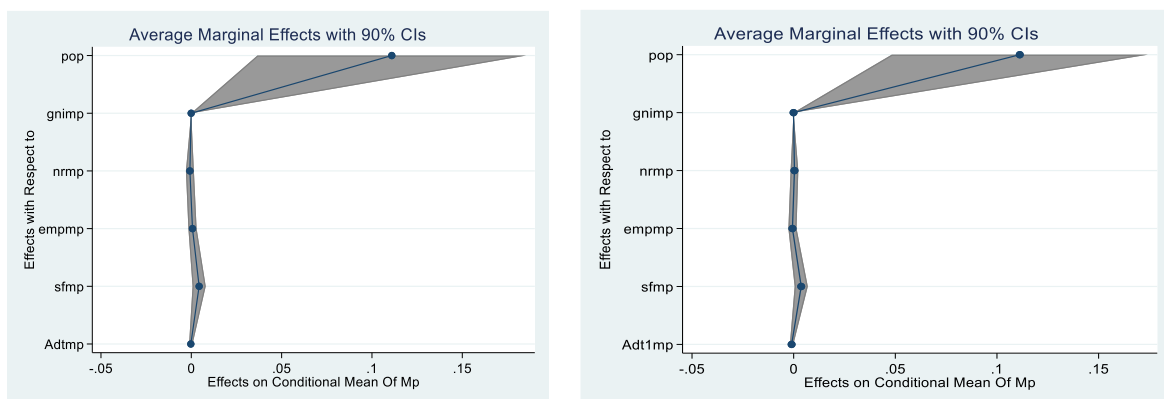
Figure 7 present the comparison among the average marginal effect results of income and multidimensional poverty ratios for short and long period of time distinctly. Average marginal effects plot shows the regression coefficient for each variable and its significance in 90 percent confidence interval. The blue dots connected with the line inside indicates the regression coefficient results for each independent variable. And the grey shade around the line represent the confidence interval for each of the results.

Employment-to-population ratio and natural resource as percentage of GDP, have significant association with income poverty but not with multidimensional poverty. On the reverse, fragility of state and annual rate of population change has significant link with multidimensional poverty but not with income poverty. GNI per capita has significant role in lessening both forms of deprivation in SSA.

Figure 6. Marginal plots of beta regression results



a) Marginal plots of income regression



b) Marginal plots multidimensional poverty regression

Source: Stata 15.1 results

4.2.2. Robustness checks

Diagnosis tests for the model and the results of the analysis are evaluated based on Ferrari and Cribari-Neto (2004). Statistical diagnostic evidence, tests, and steps are presented in Appendix 2-4 and some of the robustness results briefly discussed in this sub-section.

According to Arellano-Valle et al. (2014), the correlation between explanatory variables might cause bias in the model. So VIF (variance inflation factor) is tested to evaluate the correlation between the variables. All the variables have low VIF and mean of total VIF for regression of income poverty. In multidimensional poverty regression multicollinearity detected between employment-to-population ratio and natural resource as percentage of GDP. But similar results found after correcting the error (Appendix 5).

Moreover, VCE (variance-covariance matrix of estimation) and 'betafit' are also checked to test the correlation among explanatory variables and goodness fit of the model, respectively. All the tests confirm that the model fits the data precisely. 'vce (robust)' is also applied to find a robust standard error. Standard error correction combined with 'log link' function gives an intact result of the model.

Beta regression model has been extended to include either boundary or both boundary values [0,1] by adding additional distribution of probability volumes to boundary values (Arellano-Valle et al, 2014). Thus, findings of beta regression are comparable with and log-transformed linear model, Fractional regression model and inflated beta regression model. Comparing the findings of those models, even though there is no significant discrepancy among regression coefficients of each model, beta regression results are better in terms of precision and robustness.

The AIC (Akaike information Criterion) or the BIC (Bayesian information Criterion) tests also compared among those models, and beta regression scores better results for both. Not only BIC and AIC but also maximum likelihood and maximum pseudo-likelihood tests compared among the models. PRE (Proportional Reduction of Error) statistic based on log-likelihoods tests found that beta regression model minimizes errors in the prediction of both headcount and multidimensional poverty better than other models with similar assumptions.

Chapter five

5. Conclusion and Recommendation

5.1. Conclusion

This study aims to investigate the direct impact of foreign assistance on poverty alleviation in SSA countries. The region receives substantial amount of international assistance each year, although significant proportion of the population is still economically marginalized. The paradox of receiving a high amount of resources and having a large number of economically disadvantaged people leads to questioning the effectiveness of international assistance in the region. The analysis for this research is intended to address these effectiveness concerns regarding direct effects of assistance on income and multidimensional poverty separately.

After beta regressions analysis, the research reaches a conclusion that international assistance is not consistently successful in terms of improving the livelihoods of the poverty-stricken population in the SSA. Despite the influx of international assistance to SSA, its direct role to mitigate poverty in the region is less significant than expected. Given all the constraints that the study has encountered, considering data unavailability in particular, the results of both descriptive and econometric analysis of this study indicate that the direct impact of foreign aid to enhance the livelihood of the population does not appear successful in SSA.

Foreign assistance does not have a direct contribution to the reduction of income poverty in the 26 SSA countries for the period 2011-2015. The amount of assistance provided to SSA does not address the problem of income poverty in short or relatively extended period of time. Concerning multidimensional poverty, based on the analysis of 33 SSA countries, foreign assistance is helping the region to reduce multidimensional poverty over a relatively long period of time. However, the result is not noticeable in a short period of time.

Comparing result of the two forms of poverty, foreign aid contributes better to reduction of multidimensional poverty than income poverty. In addition, the outcome of foreign aid is more noticeable in a relatively long period than in a short period of time.

Taking in to account the volume of assistance, foreign aid does not appear to have potential benefit to lift out the population from income poverty in SSA. But, this less effective outcome of assistance in this research could be attributed to the gaps in the data. The study conducted for various countries over different periods of time. This may lead to variation in the amount of assistance and the degree of poverty due to external circumstances in each country. In addition, the study compares different number of countries for income and multidimensional poverty, which could have possible gap in the comparison results. Regarding source of the data, the study investigates macro level secondary data. At the macro level, the effects of the assistance might be offset by various socio-economic factors. The analysis of secondary data could also induce bias due to estimation and calculation errors. Such limitations of this analysis are open to further research based on primary micro level longitudinal data. Moreover, future

research work about the role of aid for household poverty will add alternative policy recourses to the conclusions made in this research.

5.2. Policy implication

1. Selectivity

Aid contribution to the poor could be more enhanced if the resources from assistance invested in long term development projects. According to the empirical results discussed above, ODA tends to be relatively plausible in reducing poverty over extended period of time. Therefore, spending aid resources on long-term projects would bring the desired improvement in the region. It is also found that assistance has relatively significant contribution to multidimensional poverty than income poverty. So, it would be reasonable to spend aid resources on multifaceted long term projects like education and health. This could also make aid more successful in terms of combating both monetary and non-monetary poverty at household and national level simultaneously. Moreover, the finding indicates that assistance is less successful in a shorter period regardless of the type of poverty. So, incentivising long-term projects could make aid more constructive for the economically disadvantaged segment of the population. Therefore, the policy of financing development via foreign aid should be reconsidered based on selected long term inclusive development projects.

2. Result based aid

To achieve constructive results out of assistance, new creative funding strategies should be revised. Aid would be more vital to overcome poverty if it is provided on the grounds of pre-agreed accomplishment in poverty reduction. Transferring resources based on verified improvements would help to develop accountability among authorities and better aid management system. Thus, foreign assistance programs for SSA countries should be revised based on advance targets and achievements to enhance the livelihood of individuals.

3. Alternative sources of finance

While foreign aid funding has begun to decline globally, other alternative sources of financing have become more lucrative for developing countries. FDI and remittances are becoming more imperative to trigger the development sector. Likewise, SSA countries should turn their attention to alternative sources of financing.

As it is indicated in the results of this study, foreign assistance is not a sustainable solution to alleviate poverty in SSA. To build strong self-sustain development in SSA investment and trade should also be reconsidered as an alternative source of finance. Governments should also promote new and growing sources of financing. Portfolio investment, private investment, and personal transfer should be encouraged to reduce the long term reliance on foreign aid.

4. Domestic Resource Mobilization (DRM)

All varieties of external sources of financing have certain disadvantages. Foreign aid comes with a particular policy pre-requisite and conditionalities, FDI and other forms of funding are also linked to specific profit-generating sectors. There is also the issue of the Dutch Diseases and volatility due to external circumstances. In order to minimize these drawbacks, it would be more efficient for SSA countries to re-examine their institutional and economic policies and give priority to domestic resources and experience.

While SSA receives the highest amount of international assistance, there is also high-level of pecuniary outflow in the form of debt repayment, illicit logging, multinational profit for international companies, illicit financial flows, fishing, mining, and hunting. In 2014, \$191.9 billion was extracted from the region, which was \$58.2 billion more than the overall inflow for the same year (Firoze, 2018). This indicates that the region is giving more of its domestic wealth than it receives. Inflow and outflow of resources are more of a cyclical phenomenon in SSA countries. Further improvements can be made if countries in the region begin to curb illegal resource outflows and utilize it in to finance local development instead of seeking international assistance. In this way, SSA can prosper more from locally synthesized resources by overcoming the limitations of other types of foreign financing and heading towards the desired stage of development.

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Appendix one

1. “pseudo” cross-sectional data design

I. Countries studied for income poverty

Country	Sub-region	Year of survey	Independent variables	
			‘Recent period’ (Divided by four)	‘Lag period’ (divided by four)
Benin	West Africa	2015	(2015+2014+2013+2012)	(2011+2010+2009+2008)
Burkina Faso	West Africa	2014	(2014+2013+2012+2011)	(2010+2009+2008+2007)
Burundi	East Africa	2013	(2013+2012+2011+2010)	(2009+2008+2007+2006)
Cameroon	Central Africa	2014	(2014+2013+2012+2011)	(2010+2009+2008+2007)
Chad	Central Africa	2011	(2011+2010+2009+2008)	(2007+2006+2005+2004)
Comoros	East Africa	2013	(2013+2012+2011+2010)	(2009+2008+2007+2006)
Democratic Republic of Congo	Central Africa	2012	(2012+2011+2010+2009)	(2007+2006+2005+2004)
Congo, Rep.	Central Africa	2011	(2011+2010+2009+2008)	(2007+2006+2005+2004)
Cote d'Ivoire	West Africa	2015	(2015+2014+2013+2012)	(2011+2010+2009+2008)
Ethiopia	East Africa	2015	(2015+2014+2013+2012)	(2011+2010+2009+2008)

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Gambia	West Africa	2015	(2015+2014+2013+2012)	(2011+2010+2009+2008)
Ghana	West Africa	2016	(2014+2013+2012+2011)	(2010+2009+2008+2007)
Guinea	West Africa	2012	(2012+2011+2010+2009)	(2007+2006+2005+2004)
Kenya	East Africa	2015	(2015+2014+2013+2012)	(2011+2010+2009+2008)
Liberia	West Africa	2014	(2014+2013+2012+2011)	(2010+2009+2008+2007)
Madagascar	East Africa	2013	(2013+2012+2011+2010)	(2009+2008+2007+2006)
Malawi	East Africa	2016	(2014+2013+2012+2011)	(2010+2009+2008+2007)
Mozambique	East Africa	2014	(2014+2013+2012+2011)	(2010+2009+2008+2007)
Niger	West Africa	2014	(2014+2013+2012+2011)	(2010+2009+2008+2007)
Rwanda	East Africa	2013	(2013+2012+2011+2010)	(2009+2008+2007+2006)
Sierra Leone	West Africa	2011	(2011+2010+2009+2008)	(2007+2006+2005+2004)
Tanzania	East Africa	2011	(2011+2010+2009+2008)	(2007+2006+2005+2004)
Togo	West Africa	2015	(2015+2014+2013+2012)	(2011+2010+2009+2008)
Uganda	East Africa	2012	(2012+2011+2010+2009)	(2007+2006+2005+2004)
Zambia	East Africa	2015	(2015+2014+2013+2012)	(2011+2010+2009+2008)
Zimbabwe	East Africa	2011	(2011+2010+2009+2008)	(2007+2006+2005+2004)

Source: World Bank (2019)

II. Countries studied for multidimensional poverty

Country	sub-region	Year of survey	Independent variables	
			'Recent period' (Divided by four)	'Lag period' (Divided by four)
Angola	Central Africa	2015-2016	(2015+2014+2013+2012)	(2011+2010+2009+2008)
Benin	West Africa	2017-2018	(2017+2016+2015+2014)	(2013+2012+2011+2010)
Burkina Faso	West Africa	2010	(2009+2008+2007+2006)	(2005+2004+2003+2002)
Burundi	East Africa	2016-2017	(2016+2015+2014+2013)	(2012+2011+2010+2009)
Cameroon	Central Africa	2014	(2014+2013+2012+2011)	(2010+2009+2008+2007)
Central African Republic	Central Africa	2010	(2010+2009+2008+2007)	(2007+2006+2005+2004)
Chad	Central Africa	2014-2015	(2014+2013+2012+2011)	(2010+2009+2008+2007)
Comoros	East Africa	2015	(2015+2014+2013+2012)	(2011+2010+2009+2008)
Congo	Central Africa	2014-2015	(2014+2013+2012+2011)	(2010+2009+2008+2007)
Democratic Republic of Congo	Central Africa	2013-2014	(2013+2012+2011+2010)	(2009+2008+2007+2006)
Côte d'Ivoire	West Africa	2016	(2016+2015+2014+2013)	(2012+2011+2010+2009)
Ethiopia	East Africa	2016	(2016+2015+2014+2013)	(2013+2012+2011+2010)
Gambia	West Africa	2013	(2013+2012+2011+2012)	(2011+2010+2009+2008)
Ghana	West Africa	2014	(2014+2013+2012+2011)	(2010+2009+2008+2007)
Guinea	West Africa	2016	(2016+2015+2014+2013)	(2012+2011+2010+2009)
Guinea-Bissau	West Africa	2014	(2014+2013+2012+2011)	(2010+2011+2010+2009)

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Kenya	East Africa	2014	(2014+2013+2012+2011)	(2010+2009+2008+2007)
Lesotho	South Africa	2014	(2014+2013+2012+2011)	(2010+2009+2008+2007)
Liberia	West Africa	2013	(2013+2012+2011+2010)	(2009+2008+2007+2006)
Malawi	East Africa	2015-2016	(2015+2014+2013+2012)	(2011+2010+2009+2008)
Mali	West Africa	2015	(2015+2014+2013+2012)	(2011+2010+2009+2008)
Mauritania	West Africa	2015	(2015+2014+2013+2012)	(2011+2010+2009+2008)
Mozambique	East Africa	2011	(2011+2010+2009+2008)	(2007+2006+2005+2004)
Niger	West Africa	2012	(2012+2011+2010+2009)	(2008+2007+2006+2007)
Nigeria	West Africa	2016-2017	(2016+2015+2014+2013)	(2012+2011+2010+2009)
Rwanda	East Africa	2014-2015	(2014+2013+2012+2011)	(2010+2009+2008+2007)
Senegal	West Africa	2017	(2017+2016+2015+2014)	(2013+2012+2011+2010)
Sierra Leone	West Africa	2017	(2017+2016+2015+2014)	(2013+2012+2011+2012)
Tanzania	East Africa	2015-2016	(2015+2014+2013+2012)	(2011+2010+2009+2008)
Togo	West Africa	2013-2014	(2014+2013+2012+2011)	(2010+2009+2008+2007)
Uganda	East Africa	2016	(2011+2015+2014+2013)	(2012+2011+2010+2009)
Zambia	East Africa	2013-2014	(2014+2013+2012+2011)	(2010+2009+2008+2007)
Zimbabwe	East Africa	2015	(2015+2014+2013+2012)	(2011+2010+2009+2008)

Source: World Bank (2019)

Appendix two

2. Variables

I. Multidimensional poverty indicators

Dimensions of poverty	Indicator	Weight
Health	Nutrition	1/6
	Child mortality	1/6
Education	Years of schooling	1/6
	School attendance	1/6
Standard of living	Cooking fuel	1/18
	Sanitation	1/18
	Drinking water	1/18
	Electricity	1/18
	Housing	1/18
	Assets	1/18

Source: OPHI (2019)

II. State fragility indicators

Dimensions of fragility	Indicator	Weight
Cohesion	Security apparatus	1/4
	Factionalized elites	
	Group grievance	
Economic	Economic decline	1/4
	Uneven economic development	
	Human flight and brain drain	
Political	State legitimacy	1/4
	Public services	
	Human rights and rule of law	
Social	Demographic pressures	1/4
	Refugees and iDPs	
	External intervention	

Source: Fund For Peace (FFP,2019)

Appendix three

3. Model specification

3.1. Comparing beta regression results with other models which have similar assumptions

I. Income poverty

a. Regression results with recent ODA per capita

Parameters	betareg			zoib			fracreg			Log transformed linear model (reg)		
	Coef.	Std. Err.	P> z	Coef.	Std. Err.	P> z	Coef.	Std. Err.	P> z	Coef.	Std. Err.	P> z
Ad_t hp	.0005501	.0008138	0.499	.0005501	.0008138	0.499	.0004922	.0007874	0.532	.0024856	.0028019	0.386
sf_t hp	-.0050035	.0032969	0.129	-.0050035	.0032969	0.129	-.0056986	.003277	0.182	-.010952	.0116076	0.357
emp_t hp	.0076365	.0027486	0.005	.0076365	.0027486	0.005	.007491	.0027892	0.007	.023062	.0110854	0.051
nr_t hp	.0054614	.0030004	0.069	.0054614	.0030004	0.069	.0054919	.002908	0.059	.0151045	.008488	0.091
gni_t hp	-.0000342	.0000161	0.034	-.0000342	.0000161	0.034	-.0000353	.0000107	0.001	-.000086	.0000271	0.005

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Pop_t hp	.0464836	.0627169	0.459	.0464836	.046483	0.459	.049202	.064166	0.443	.1195785	.2060533	0.569
					6		4	4				
Wald chi2(10)	32.06			32.06			41.53			Root MSE	.40137	
Prob > chi2	0.0000			0.0000			0.0000			Prob > F	0.0000	
Log pseudolikelihood	17.000692			17.000692			-16.821854			F(6, 19)	14.64	
AIC	-18.00138			-18.00138			47.64371				32.1603	
BIC	-7.936612			-7.936612			56.45038				40.96698	
Pre.	51.96%			51.96%			51.96%				55.10%	
Significant at *p<0.1. p<**0.05, and p<***0.01												

Source: Stata 15.1 result

b. Regression results with lag ODA per capita

Parameters	betareg			zoib			fracreg			Log transformed linear model (reg)		
	Coef.	Std. Err.	P> z	Coef.	Std. Err.	P> z	Coef.	Std. Err.	P> z	Coef.	Std. Err.	P> z
Ad t-1 hp	.0029321	.0003595	0.232	.0004299	.0003595	0.232	.0003992	.0003362	1.19	.0018514	.0011541	0.125
sft hp	-.0049303	.0031571	0.118	-.0063919	.0031571	0.118	-.005619	.0026806	0.171	-.010905	.0106947	0.321
emp_t hp	.007652	.0027173	0.005	.007652	.0027173	0.005	.007537	.0020579	0.005	.0227816	.0099176	0.033
nr_t hp	.0058275	.0031475	0.064	.0058275	.0031475	0.064	.0058256	.0030599	0.057	.0167232	.0089301	0.077
gni_t hp	-.0000345	.0000156	0.027	-.0000345	.0000156	0.027	-.0000356	.0000102	0.000	-.0000886	.0000238	0.001
Pop_t hp	.0407947	.0621048	0.511	.0407947	.0621048	0.511	.044381	.0640778	0.489	.0931489	.2056296	0.656
Wald chi2(10)	33.09			33.09			43.24			Root MSE .39659		
Prob > chi2	0.0000			0.0000			0.0000			Prob > F 0.0000		
Log pseudolikelihood	17.119107			17.119107			-16.812918			F(6, 19) 16.06		

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AIC	-18.23821	-18.23821	47.62584	31.53757
BIC	-8.173441	-8.173441	56.43251	40.34424
Pre.	52.31%	52.31%	52.29%	56.16%
Significant at *p<0.1. p<**0.05, and p<***0.01				

Source: Stata 15.1 result

III. Multidimensional poverty

a. Regression results with recent ODA per capita

Parameters	betareg			zoib			fracreg			Log transformed linear model (reg)		
	Coef.	Std. Err.	P> z	Coef.	Std. Err.	P> z	Coef.	Std. Err.	P> z	Coef.	Std. Err.	P> z
Ad t-1 mp	-0.0010139	.0005252	0.054	-0.0010139	.0005252	0.054	-0.0009657	.0005405	0.074	-0.0009506	.0006222	0.139
sft mp	.0037158	.0019656	0.059	.0037158	.0019656	0.059	.0036756	.0021198	0.083	.0035975	.002434	0.151
emp_t mp	-0.0005965	.0012189	0.625	-0.0005965	.0012189	0.625	-0.0004413	.0011435	0.700	-0.0003536	.001322	0.791

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nr_t mp	.00038 5	.00115 8	0.740	.000385	.001158	0.740	.0002595	.001096 6	0.813	.0001898	.0012704	0.8 82
gni_t mp	- .00006 57	.00001 27	0.000	- .000065 7	.0000127	0.000	- .0000656 6	- .000065	0.000	- .0000668	.0000152	0.0 00
Pop_t mp	.11122 31	.03828 88	0.004	.111223 1	.0382888	0.004	.1090436	.109043 6	0.003	.1078699	.0397472	0.0 12
Wald chi2(10)	69.68		69.68		71.55		Root		.11998		MSE	
Prob > chi2	0.0000		0.0000		0.0000		Prob > F		0.0000			
Log pseudolikelihood	27.936068		27.936068		-21.236002		F(6, 26)		11.32			
AIC	-39.87214		-39.87214		56.472		-40.16518					
BIC	-27.90007		-27.90007		66.94756		-29.68963					
Pre.	61.32%		61.32%		61.26%		60.97%					

Significant at *p<0.1, p<0.05, and p<***0.01**

Source: Stata 15.1 result

b. Regression results with lag ODA per capita

Parameters	betareg			zoib			fracreg			Log transformed linear model (reg)		
	Coef.	Std. Err.	P> z	Coef.	Std. Err.	P> z	Coef.	Std. Err.	P> z	Coef.	Std. Err.	P> z
Ad t mp	- .00025 53	.0005 894	0.665	- .0002553	.0005894	0.665	-.0001712 2	.000586	0.770	-.000134 26	.00066	0.841
sft mp	.00434 17	.0022 141	0.050	.0043417	.0022141	0.050	.0043968 8	.002299	0.056	.0043706 42	.00264	0.110
emp_t mp	.00066 53	.0013 809	0.630	.0006653	.0013809	0.630	.0007102 5	.001306	0.587	.0007854 63	.00148	0.602
nr_t mp	- .00077 13	.0013 424	0.566	- .0007713	.0013424	0.566	-.0007936 5	.001276	0.534	-.0008537 42	.00145	0.562
gni_t mp	- .00006 18	.0000 194	0.001	- .0000618	.0000194	0.001	-.0000609 4	.000018	0.001	-.000062 14	.00002	0.007
Pop_t mp	.11097 14	.0452 208	0.014	.1109714	.0452208	0.014	.1123122 2	.043579	0.010	.111586 21	.04769	0.027
Wald chi2(10)	54.25			54.25			59.82			Root MSE	.12504	
Prob > chi2	0.0000			0.0000			0.0000			Prob > F	0.0000	

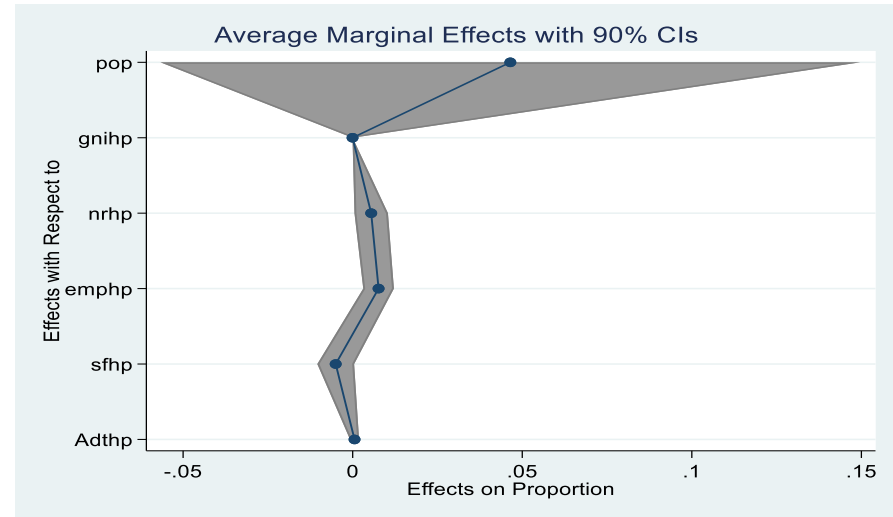
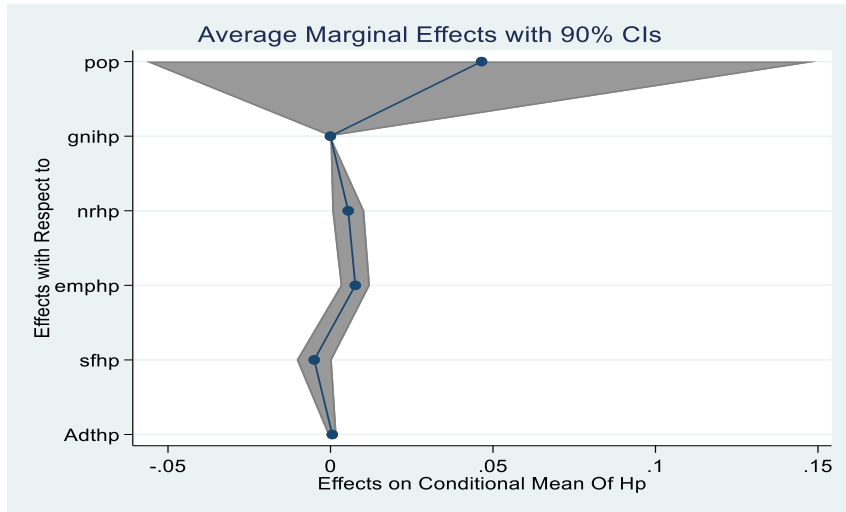
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Log pseudolikelihood	26.343828	26.343828	-21.309907	F(6, 26)	9.59
AIC	-36.68766	-36.68766	56.61981	-37.43901	
BIC	-24.7156	-24.7156	67.09537	-26.96346	
Pre.	57.63%	57.63%	57.67%	57.61%	
Significant at *p<0.1. p<**0.05, and p<***0.01					

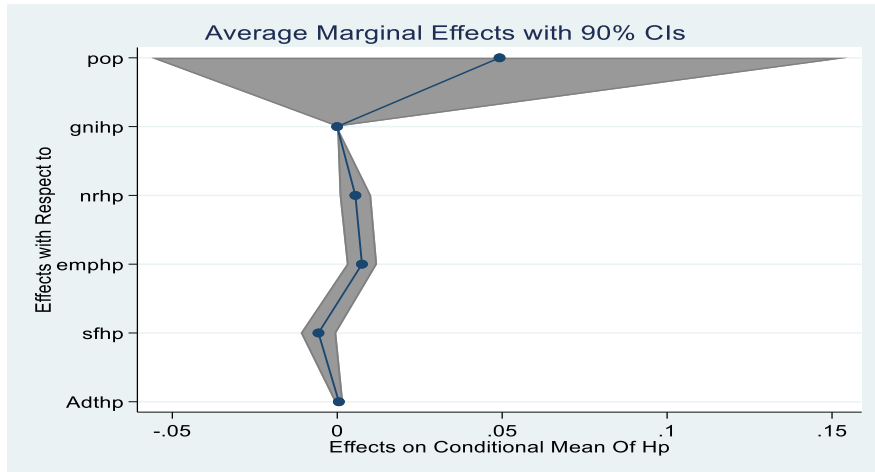
Source: Stata 15.1 result

I. Income poverty

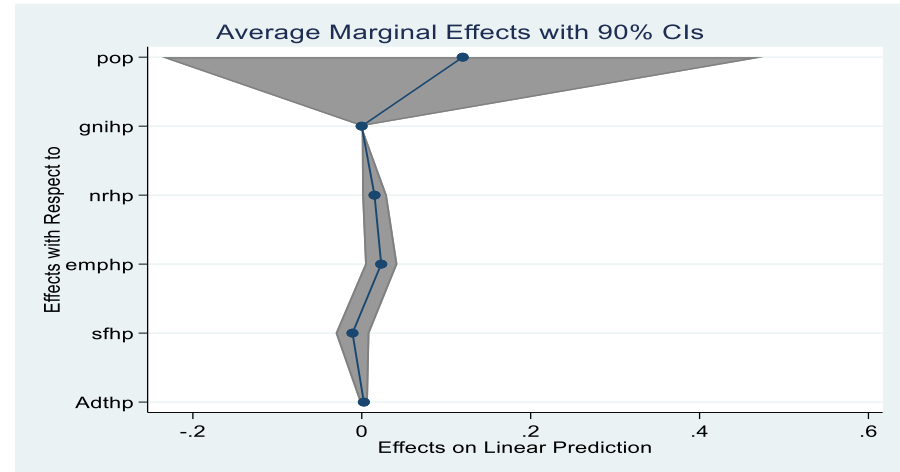
a. Regression results with recent ODA per capita



Beta regression



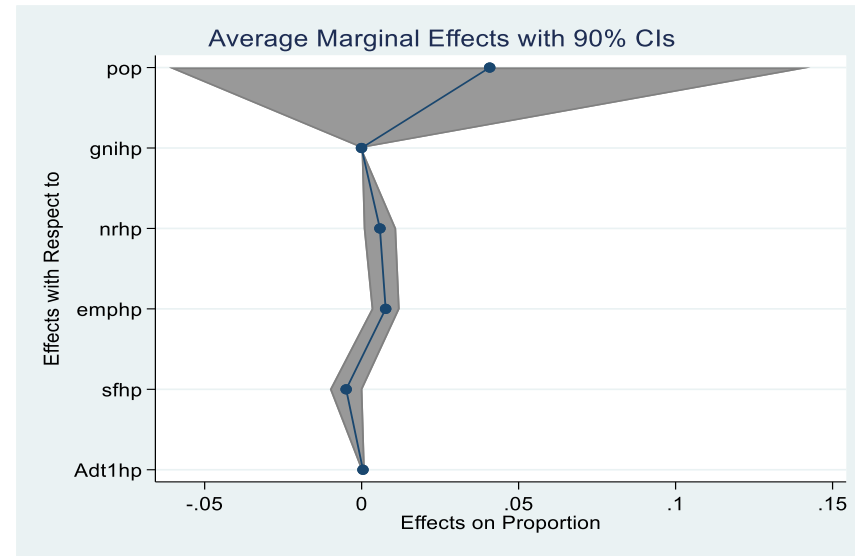
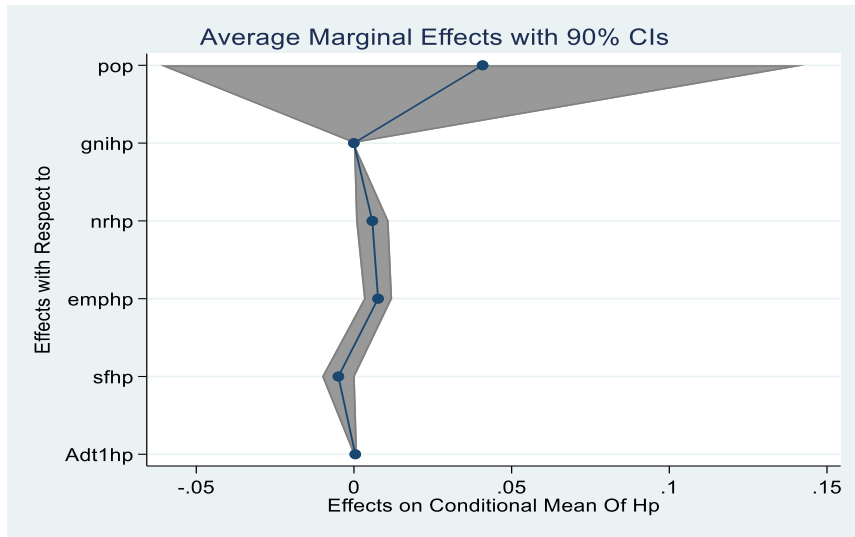
Inflated beta regression



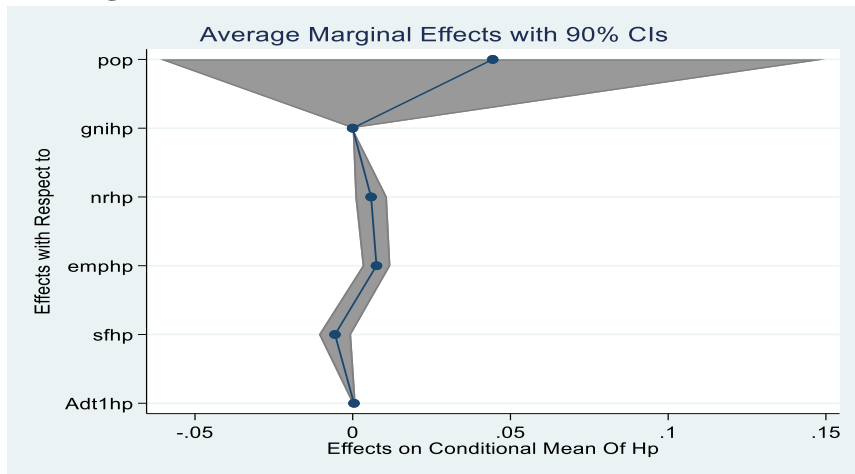
Fractional regression

Log transformed linear model (reg)

b. Regression results with lag ODA per capita

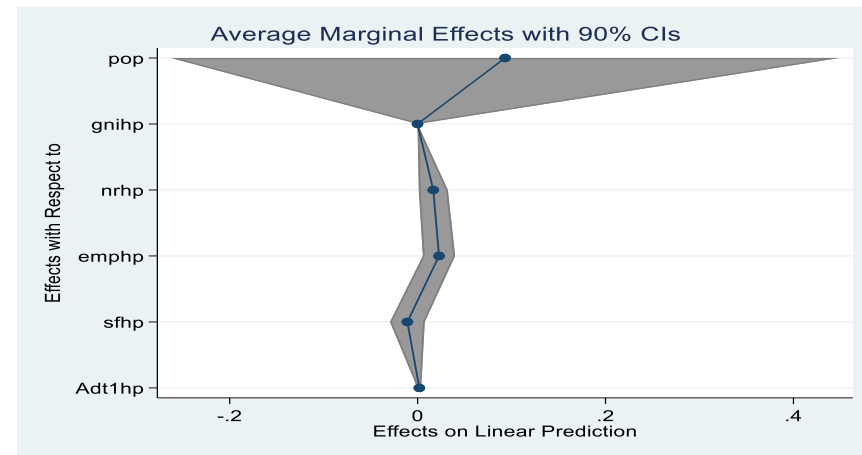


Beta regression



Fractional regression

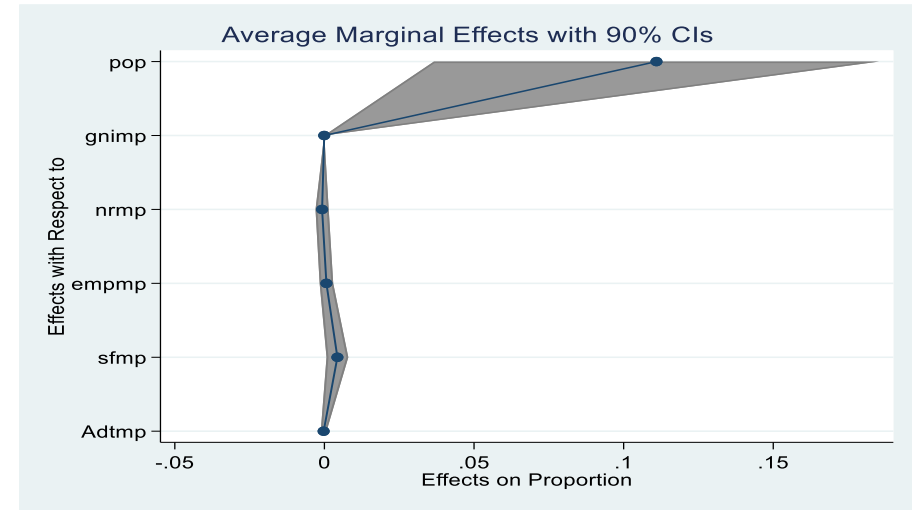
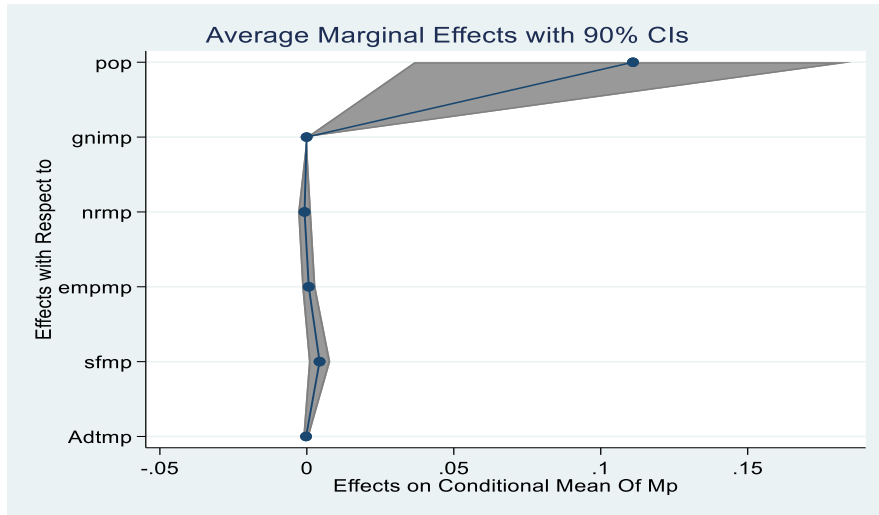
Inflated beta regression



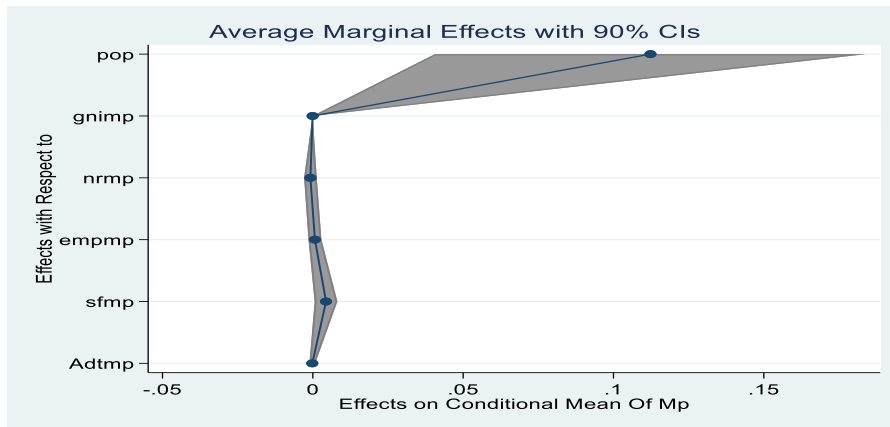
Log transformed linear model (reg)

II. Multidimensional poverty

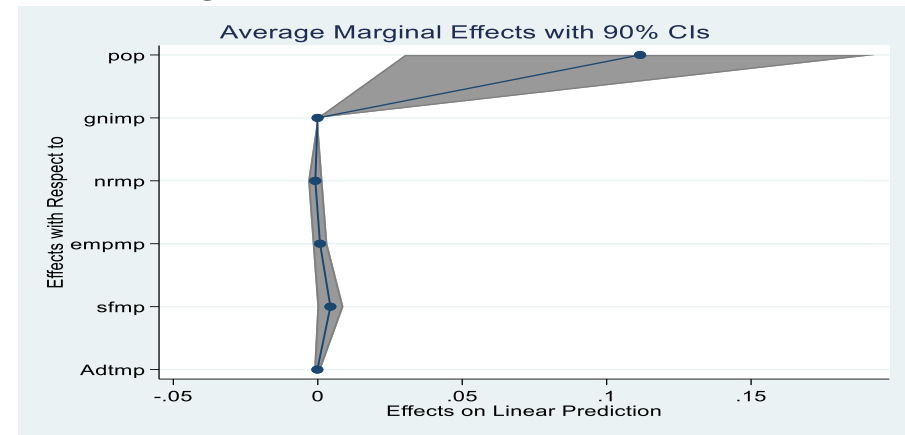
a. Regression results with recent ODA per capita



Beta regression



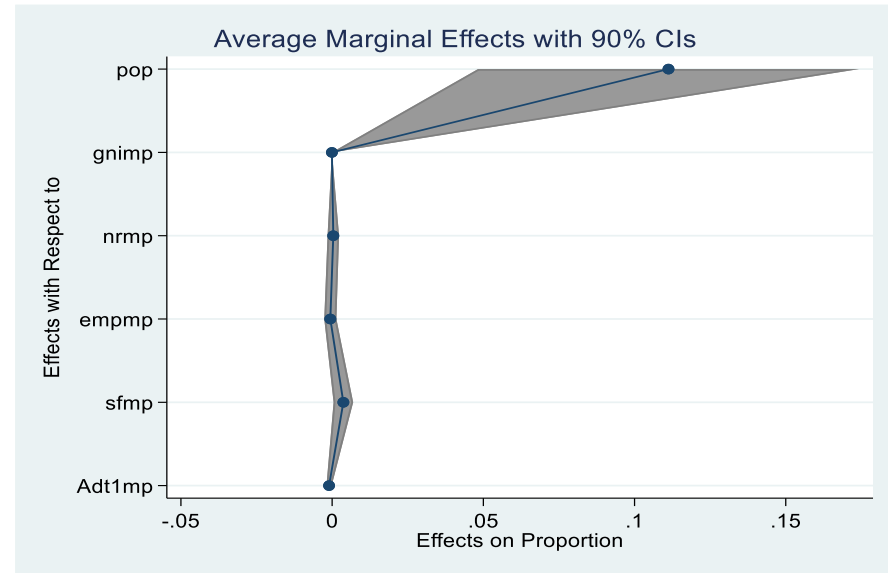
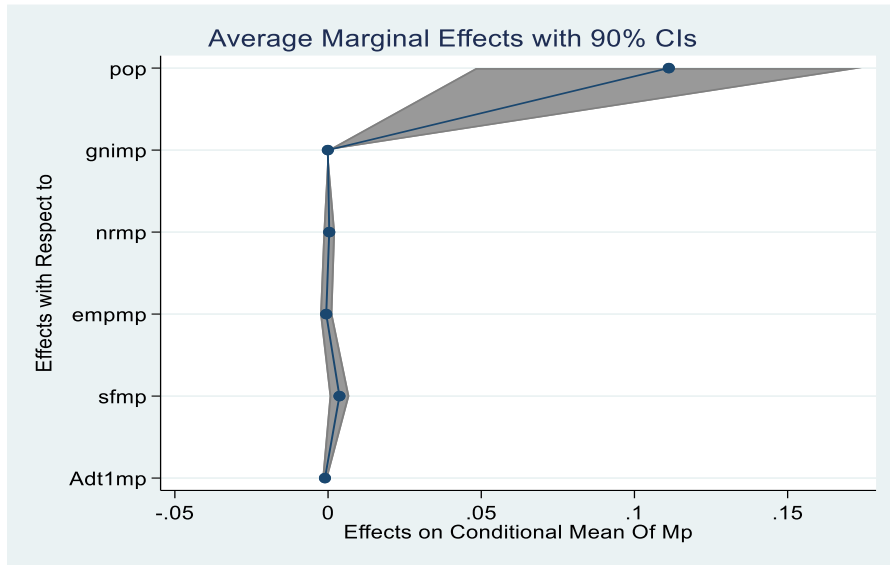
Inflated beta regress



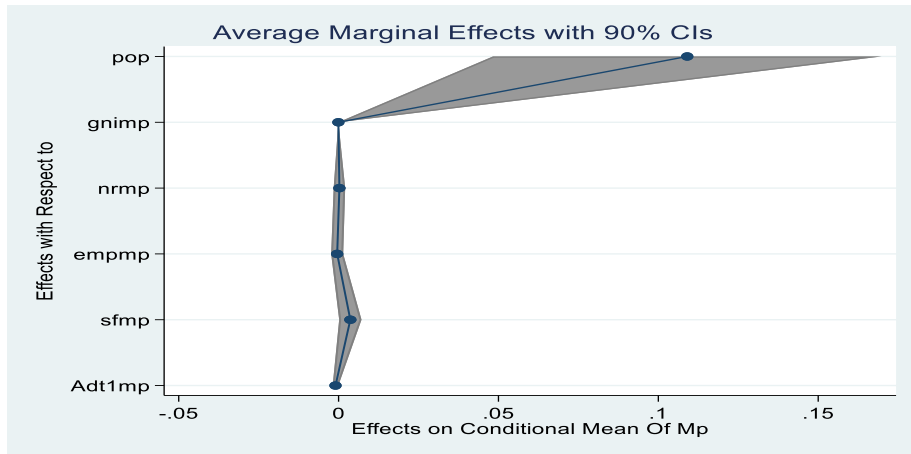
Fractional regression

Log transformed linear model (reg)

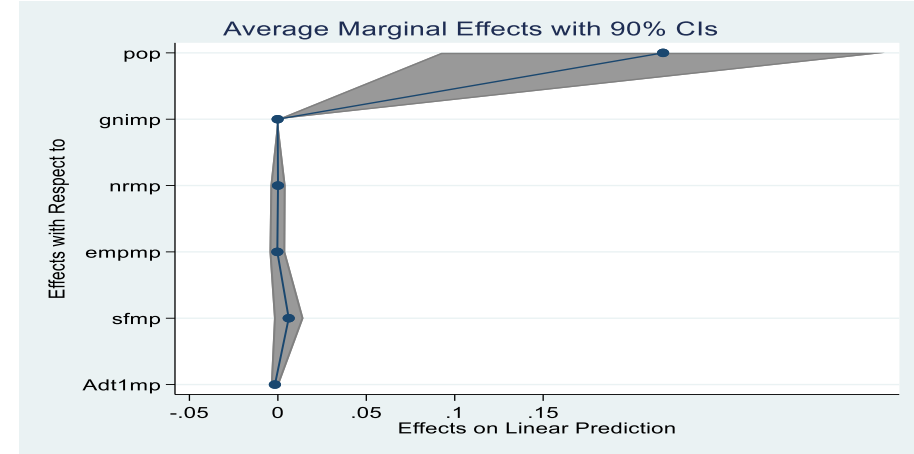
b. Regression results with lag ODA per capita



Beta regression



Inflated beta regression



Fractional regression

Log transformed linear model (reg)

Appendix four

4. Comparison of beta regression results with different link functions

Model one; beta regression using scale of net ODA per capita for each period

Model two; beta regression with scale of net ODA per capita during each period and, link(cloglog)

Model three; beta regression with scale of net ODA per capita during each period and, slink(root)

Model four; beta regression with scale of net ODA per capita during each period and both, link(cloglog) and ,slink(root)

Model five; beta regression with vce(robust)

Model six; beta regression with vce(robust), and link(cloglog)

Model seven; beta regression without any function

After comparing the result and precision for each model, the analysis done based on five model. Stata 15.1 results for each model presented below⁷.

⁷ Model represent as mode Stata

I. Income poverty

a. Income poverty with ODA received during recent period

Variable	model	mode2	mode3	mode4	mode5	mode6	mode7
Ad(t)	0.00165	0.00193	0.00257	0.00187	0.00239	0.00145	0.00239
P> z	0.00147	0.00103	0.00278	0.00219	0.00356	0.00254	0.00409
sfhp	-0.0015	-0.0009	-0.0103	-0.0094	-0.0218	-0.0169	-0.0218
P> z	0.01034	0.00749	0.01431	0.01082	0.01438	0.01037	0.01402
emphp	0.03684	0.02841	0.03521	0.02592	0.03325	0.02497	0.03325
P> z	0.00334	0.00246	0.00957	0.00717	0.01239	0.00932	0.0114
nrhp	0.00837	0.00875	0.01085	0.01047	0.02378	0.01864	0.02378
P> z	0.00546	0.00414	0.00845	0.00699	0.01318	0.00861	0.01212
gnihp	-0.0002	-0.0002	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001
P> z	0.00012	8.9E-05	8.1E-05	8.2E-05	7.1E-05	8.8E-05	7.4E-05
pop	0.70724	0.51645	0.36924	0.2426	0.20238	0.14302	0.20238
P> z	0.22426	0.1755	0.28612	0.2073	0.27318	0.19642	0.2716
_cons	-4.361	-3.7212	-2.7919	-2.1616	-1.2841	-1.2033	-1.2841
P> z	1.27174	0.97782	2.02892	1.56235	2.12663	1.58544	2.03119
scale							
Adthp	0.10343	0.10192	0.043	0.04022			

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P> z 	0.03095	0.03079	0.02816	0.02877			
_cons	-3.3501	-3.257	1.20114	1.38862	2.56351	2.58838	2.56351
P> z 	1.81384	1.81291	1.51126	1.56652	0.24254	0.24009	0.26959
Statistics							
bic	-15.842	-15.074	-6.7218	-7.0406	-7.9366	-8.4603	-7.9366
aic	-27.165	-26.397	-18.045	-18.363	-18.001	-18.525	-18.001

Significant at *p<0.1, p<**0.05, and p<***0.01

Source: Stata 15.1 result

b. Income poverty with ODA received during one lag period

Variable	model	mode2	mode3	mode4	mode5	mode6	mode7
Ad(t-1)	0.00127	0.00101	0.00185	0.00146	0.00187	0.00135	0.00187
P> z 	0.00093	0.00075	0.00106	0.00087	0.00159	0.00125	0.00239
sfhp	-0.0028	-0.0034	-0.0093	-0.008	-0.0215	-0.0163	-0.0215
P> z 	0.01447	0.0105	0.01455	0.01066	0.01378	0.00994	0.01384
emphp	0.0444	0.03226	0.04318	0.03154	0.03332	0.02542	0.03332
P> z 	0.00819	0.00623	0.01048	0.00782	0.01226	0.00958	0.01108
nrhp	0.00451	0.00421	0.00961	0.00866	0.02538	0.0193	0.02538
P> z 	0.00321	0.00268	0.00683	0.00552	0.01385	0.00866	0.01181
gnihp	-9E-05	-8E-05	-0.0001	-0.0001	-0.0002	-0.0001	-0.0002
P> z 	4E-05	3.5E-05	5.2E-05	4.8E-05	6.9E-05	8.5E-05	7.3E-05
pop	0.23726	0.22735	0.06759	0.08738	0.17764	0.13448	0.17764

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P> z 	0.30189	0.22591	0.30609	0.21633	0.27021	0.19161	0.26501
_cons	-3.568	-3.0126	-2.5655	-2.2503	-1.2447	-1.2854	-1.2447
P> z 	1.83406	1.35347	1.79148	1.36012	1.92721	1.47692	1.88955
scale							
Ad(t-1)hp	0.07822	0.07681	0.06102	0.05634			
P> z 	0.01861	0.02069	0.02665	0.02641			
_cons	-2.0565	-1.9878	0.34009	0.59331	2.57281	2.59716	2.57281
P> z 	1.22166	1.34957	1.33626	1.35961	0.24637	0.24366	0.26966
Statistics							
bic	-21.35	-20.627	-9.8051	-9.8599	-8.1734	-8.6976	-8.1734
aic	-32.673	-31.95	-21.128	-21.183	-18.238	-18.762	-18.238
Significant at *p<0.1. p<**0.05, and p<***0.01							

Source: Stata 15.1 result

II. Multidimensional poverty

a. multidimensional poverty with ODA received during one lag period

Variable	model	mode2	mode3	mode4	mode5	mode6	mode7
Adtmp	-0.0017269	-0.0010839	-0.0020923	-0.0011744	-0.0011252	-0.0006526	- 0.0011252
P> z 	0.0018051	0.0011172	0.0023182	0.0014505	0.0026038	0.0016842	0.0034088
sfmp	0.0099331	0.0068589	0.0104115	0.0074715	0.0191333	0.0129033	0.0191333

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P> z 	0.0101788	0.0067811	0.0108486	0.0072079	0.0098466	0.0069589	0.0106129
empmp	-0.0023726	-0.0013983	-0.0025351	-0.0010444	0.0029317	0.0024144	0.0029317
P> z 	0.0059871	0.0038263	0.0066107	0.0042344	0.0060881	0.0038316	0.0068594
nrmp	0.0020509	0.0012121	0.0021014	0.000805	-0.0033992	-0.0026626	-0.0033992
P> z 	0.0058208	0.0037282	0.0064181	0.0041144	0.0059222	0.0037348	0.0065873
gnimp	-0.0003639	-0.0002587	-0.0003711	-0.000254	-0.0002724	-0.000187	-0.0002724
P> z 	0.0001023	0.0000696	0.0001136	7.492E-05	8.858E-05	6.281E-05	8.408E-05
pop	0.3706524	0.2605256	0.394425	0.2692165	0.4890358	0.307577	0.4890358
P> z 	0.1223061	0.0810102	0.1375041	0.0915001	0.2021721	0.1320051	0.1616746
_cons	-0.494301	-0.7451346	-0.5399272	-0.8386823	-2.133059	-1.7852915	-2.133059
P> z 	1.3874125	0.9205559	1.59601	1.0461783	1.4228817	1.0122672	1.5486696
scale							
Adtmp	0.027228	0.0291523	0.0464589	0.0470049			
P> z 	0.0106702	0.0107294	0.0233306	0.0232426			
_cons	1.3123712	1.2366471	1.739155	1.7661989	2.8627469	2.8813906	2.8627469
P> z 	0.7007675	0.7025172	1.1966824	1.1938952	0.1643925	0.1708656	0.2401532
Statistics							
bic	-26.421473	-27.617274	-24.791334	-25.526252	-24.715596	-25.296236	-24.715596
aic	-39.890041	-41.085842	-38.259903	-38.99482	-36.687656	-37.268297	-36.687656
Significant at *p<0.1. p<**0.05, and p<***0.01							

Source: Stata 15.1 result

b. Multidimensional poverty with ODA received during one lag period

Variable	model	mode2	mode3	mode4	mode5	mode6	mode7
Ad(t-1)	-0.003239	-0.001489	-0.002053	-0.001087	-0.004491	-0.002733	-0.004491
P> z 	0.001299	0.000942	0.001489	0.000993	0.002369	0.001751	0.002422
sfmp	0.005509	0.005151	0.008405	0.006377	0.016458	0.011088	0.016458
P> z 	0.008349	0.006404	0.008879	0.006279	0.008804	0.006148	0.009413
empmp	-0.00889	-0.003659	-0.004166	-0.001821	-0.002642	-0.00025	-0.002642
P> z 	0.004523	0.003684	0.005152	0.003562	0.005417	0.003713	0.006744
nrmp	0.00756	0.00307	0.003469	0.001446	0.001705	-0.000248	0.001705
P> z 	0.004234	0.003463	0.004929	0.003409	0.005138	0.003545	0.006411
gnimp	-0.000493	-0.000314	-0.0004	-0.000269	-0.000291	-0.000192	-0.000291
P> z 	5.59E-05	5.17E-05	6.7E-05	4.89E-05	6.04E-05	4.27E-05	6.57E-05
pop	0.469009	0.310956	0.488624	0.322791	0.492623	0.301025	0.492623
P> z 	0.128979	0.095332	0.135195	0.093835	0.174837	0.106668	0.144486
_cons	0.396153	-0.466858	-0.48379	-0.836709	-1.328196	-1.308855	-1.328196
P> z 	1.01305	0.81612	1.072671	0.770184	1.053373	0.731658	1.2096
scale							
Adt1mp	0.041551	0.030445	0.060526	0.05536			
P> z 	0.012302	0.010244	0.02048	0.020687			
_cons	0.623186	1.224455	1.353701	1.559757	2.960834	2.960645	2.960834
P> z 	0.785237	0.671351	0.93855	0.988903	0.165841	0.168928	0.240759
Statistics							
bic	-33.68563	-30.68913	-29.94246	-29.13	-27.90008	-27.89365	-27.90008
aic	-47.15419	-44.1577	-43.41103	-42.59857	-39.87214	-39.86571	-39.87214
Significant at *p<0.1, p<**0.05, and p<***0.01							

Source: Stata 15.1 result

Appendix five

5. Tests of precession for beta regression results

I. Income poverty

. betafit hp

Iteration 0: log likelihood = 7.8359273
 Iteration 1: log likelihood = 7.873416
 Iteration 2: log likelihood = 7.8734862
 Iteration 3: log likelihood = 7.8734862

ML fit of beta (alpha, beta)	Number of obs	=	26
	Wald chi2(0)	=	.
Log likelihood = 7.8734862	Prob > chi2	=	.

hp	Coef.	Std. Err.	z	P> z	[95% Conf. interval]
alpha					
_cons	2.748726	.7288802	3.77	0.000	1.320147 4.177305
beta					
_cons	3.588581	.9718258	3.69	0.000	1.683837 5.4933

. test	. test
(1) [hp]Ad(t)hp = 0	[hp]Ad(t-1)hp = 0
(2) [hp]sfhp = 0	[hp]sfhp = 0
(3) [hp]emphp = 0	[hp]emphp = 0
(4) [hp]nrhp = 0	[hp]nrhp = 0
(5) [hp]gnihp = 0	[hp]gnihp = 0
(6) [hp]pop = 0	[hp]pop = 0
chi2(6) = 32.06	chi2(6) = 33.09
Prob > chi2 = 0.0000	Prob > chi2 = 0.0000

Source: Stata 15.1 result

II. Multidimensional poverty

. betafit mp

Iteration 0: log likelihood = 12.229492

Iteration 1: log likelihood = 12.243694

Iteration 2: log likelihood = 12.243721

Iteration 3: log likelihood = 12.243721

ML fit of beta (alpha, beta)

Number of obs = 33

Wald chi2(0) = .

Prob > chi2 = .

Log likelihood = 12.243721

mp	Coef.	Std. Err.	z	P> z	[95% Conf. interval]	
-----+-----						
alpha						
_cons	4.295159	1.037328	4.14	0.000	2.262034	6.328285
-----+-----						
beta						
_cons	3.1124	.7353163	.23	0.000	1.671206	4.553593
-----+-----						

. test

. test

(1) [hp]Ad(t)mp = 0		[hp]Ad(t-1)mp = 0
(2) [hp]sfmp = 0		[hp]sfmp = 0
(3) [hp]empmp = 0		[hp]empmp = 0
(4) [hp]nrmp = 0		[hp]nrmp = 0
(5) [hp]gnihp = 0		[hp]gnimp = 0
(6) [hp]popmp = 0		[hp]popmp = 0
chi2(6) = 54.25		chi2(6) = 69.68
Prob > chi2 = 0.0000		Prob > chi2 = 0.0000

Source: Stata 15.1 result

I. Correlation between variables in income poverty regression

. pwcorr

	hp	Ad(t)hp	Ad(t-1)hp	sfhp	emphp	nrhp	gnihp	pop
hp	1.0000							
Adthp	-0.0614	1.0000						
Ad(t-1)hp	-0.0298	0.8058 ⁸	1.0000					
sfhp	0.0136	-0.1129	-0.1971	1.0000				
emphp	0.4949	-0.4315	-0.3141	-0.0131	1.0000			
nrhp	0.2026	0.0260	-0.1403	0.3613	-0.0096	1.0000		
gnihp	-0.3970	-0.0417	0.0095	-0.4838	-0.1310	0.0270	1.0000	
pop	0.3379	-0.1514	-0.0503	0.0670	0.1871	0.1788	-0.2374	1.000

Source: Stata 15.1 result

II. Correlation between variables in multidimensional poverty regression

. pwcorr

	mp	Ad(t)mp	Ad(t-1)mp	sfmp	empmp	nrmp	gnimp	pop
mp	1.0000							
Ad(t)mp	-0.0559	1.0000						
Ad(t-1)mp	-0.2628	0.6999	1.0000					
sfmp	0.3565	-0.2546	-0.2082	1.0000				
empmp	0.0901	-0.1244	-0.2158	0.2315	1.0000			
nrmp	0.0476	-0.0763	-0.1388	0.2349	0.9838 ⁹	1.0000		
gnimp	-0.5883	-0.3546	-0.0462	-0.2112	-0.0950	-0.0457	1.0000	
pop	0.4478	-0.3362	-0.1304	0.0463	0.0633	0.0540	-0.059	1.000

Source: Stata 15.1 result

⁸ This is the reason why separate beta regressions applied for net ODA received during the two periods.

⁹ After correcting this multicollinearity error between natural resources as percentage of GDP and employment-to-population ratio, the result for both beta regressions are analogous.