Impact of Foreign Aid to Agriculture Sector on Agricultural Productivity in Developing Countries in the context of Second Goal of SDGs

By

Hussain, Nadia

THESIS

Submitted to

KDI School of Public Policy and Management

In partial fulfillment of the requirements

For the degree of

Master of Development Policy

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Committee in Charge

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ABSTRACT

In order to achieve the objectives of Sustainable Development Goals in the context of agriculture and food availability to everyone, the role of aid stands critical. The study will examine the impact of agriculture aid *on average* and at different quintiles of productivity level in low income and lower middle income countries (77 developing countries) during the period of 2002 to 2014. The agricultural productivity is taken as dependent variable and the explanatory variables include agricultural aid (main variable of interest), agricultural population, agricultural land, drought, primary gross enrolment, gross capital formation, gross fixed capital formation (in agriculture sector) and government's policy effectiveness during the period from 2002 to 2014. The estimated results show the positive and significant relationship between agriculture aid and productivity. However, the policy indicators have revealed negative but insignificant association with the dependent variable. The study suggests that the donor agencies have to increase the agricultural aid by 126 percent to get the double agricultural productivity by the year 2030 from the current average aid level of US$44.07 million per year.

Dedicated to my Beloved Mother, who brought me up as the only child among ten siblings

Acknowledgement

In the name of God, the Most Gracious, the most Merciful

I am very much grateful upon the support and guidance of many people in completion of my thesis. I would like to express my deepest gratitude to my research supervisor Prof. Lee, Kye Woo whose critical examination with clear directions made this work done. I am equally grateful to Prof. Paik, Sung-Joon for his unending encouragement and sincere advice not only for the thesis but also in carrying out my study objectives at KDI.

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Chapter One

Introduction

Purpose

The purpose of the study is to examine the impact of agricultural foreign aid on agricultural outputin the low income and lower middle income developing countries controlling for individual country's characteristics such as population, land, and government's policy effectiveness during the period from 2002 to 2014 in the aftermath of food crisis. The rationale to scrutinize the efficiency of aid and agriculture output in developing countries comes from the second goal of the Sustainable Development Goals. The second goal aims to "end hunger, achieve food security and improved nutrition and promote sustainable agriculture". The underlying objective for the sustainable agriculture development is the "*doubling of agricultural productivity"* and incomes of the small-scale farmers by 2030. The focus of this study will confine only to agricultural productivity (crop production) in each country.

Since most of the development activities in low and lower middle income countries are carried out by the foreign assistance due to the domestic resource constraints. And the development objectives are usually pursued by the international donor agencies and organizations through

Official Development Assistance (ODA)[1]. For that reason, examining the impact of *ODA disbursement to the agriculture sector*[2] is particularly intended in the study for its effective utilization for agriculture output.

The argument of ***Agriculture as the engine of the growth*** has now been widely accepted as it effectively reduces poverty in the developing countries depending upon their development stages (Kaya et al, 2008; Gollin, 2009; IDA, 2009). Kaya et al, is of the view that agriculture sector promotes growth at the early stages of development, thus it helps poverty reduction and pave the way of sustainable growth in low income countries. Similarly, aid to agriculture sector promotes agricultural growth in Nigeria but it was the largest recipient of aid in the region (Akpokodje and U. Omojimite, 2008). Empirically, it has also been found that agricultural growth reduces poverty more efficiently as compared to the aggregate GDP growth depending upon the level of and diversification of poverty in a country (Dewbre, et al 2011).

A number of studies have already been carried out on the subject matter. Most of them have examined the impact of agricultural aid on the agricultural growth, value addition, and aggregate growth of the economy. The few of them have used agricultural productivity to see the impact of ODA for this sector. A study by Alabi (2014) has recently analyzed the impact of sectoral aid on agriculture productivity and growth in 47 Sub-Sahara African (SSA) countries. The study found statistically significant and positive relationship between the sectoral disbursements and agriculture output in 47 (SSA) countries. The cross country analysis of his study focuses on only

[1]The official transfer of funds from donor to recipient country is called as Official Development Assistance (ODA) whose main objective is the recipient countries' development and welfare improvement. It has been undertaken through financial, technical, and food assistance which also constitutes 25 percent component of grant.

[2]According to the OECD distribution of aid to different sectors, agriculture aid comprises of agriculture policy and development, land resources, water resources, inputs, food crop production, livestock, agrarian reforms, education, research, and agriculture financial services.

Sub-Sahara Africa whereas the proposed study will include the sample 82 developing countries. In addition, it intends to calculate how much more aid is required to double the agricultural productivity by 2030 in order to meet the target of SDGs using the sample of developing countries.

Therefore, this study investigates the impact and magnitude of agriculture productivity in 82 developing countries depending upon their foreign aid disbursements to the sector. Based upon the findings of this empirical research the policy measures for aid disbursements,such as how much aid is required for a country to double its productivity level, would be suggested. Therefore, the target of doubling the agriculture productivity in developing countries could be achieved by 2030.

Statement of Problem

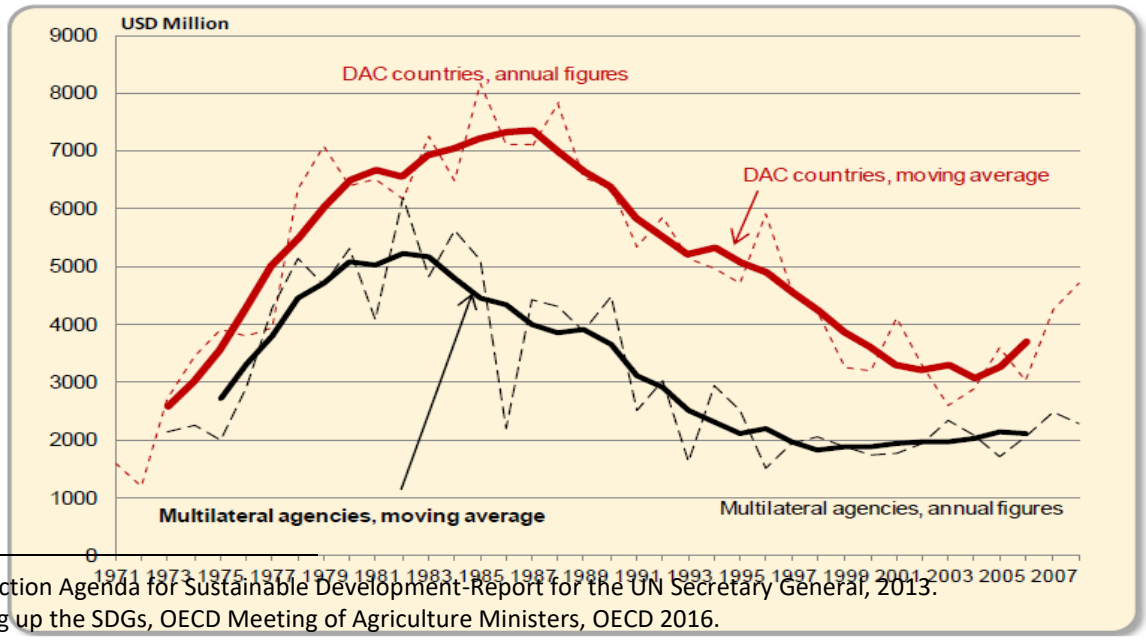
During the last two decades, the agriculture sector has observed declining trend in foreign aid allocations at one side and faced sectoral problems on the other. The food price hike during 2006-08 dragged almost 100 million of people into poverty trap (IFAD, 2010). The causes of food crisis as mentioned by IFAD report include negligence of investment in agriculture sector, inconsistent domestic and foreign expenditures, poor market regulations, poor infrastructure, low production levels, and less efficient agriculture sector may increase the poverty levels in low income countries. Consequently the food production has also declined in the affected countries owing to sector's issues. Moreover, by 2050 the world population will require 70 percent more food production than today, if the sector's issues left unattended will aggravate the hunger situation more than ever.[3]

[3] Rural Poverty Report, IFAD, 2010

It is widely accepted that in the developing countries agriculture is one of the major sources of income and will also continue to be the effective source of poverty reduction and sustainable development in this century (World Bank, 2015). Considering the combined impact of agricultural activities on poverty reduction as well as on agriculture sector development, it has always been kept at the core of the policy designs which is inevitable for sustainable development[4].

Specifically, "78% of the world's poor are heavily dependent on agriculture not only for their food, but also for their livelihoods, agricultural development, including the growth of agricultural productivity and incomes which represents (agriculture) the one of the most powerful tools" to end extreme poverty (OECD, 2016, 10:1)[5]. Despite this fact, the sector has faced declining fund allocations by the donors which have ultimately affected the poor masses of the developing countries.

As reported by Organization of Economic Cooperation and Development (OECD) (shown in figure 1), the annual average aid commitments to agriculture sector has declined by 43% from



[4] An Action Agenda for Sustainable Development-Report for the UN Secretary General, 2013.
[5] Sizing up the SDGs, OECD Meeting of Agriculture Ministers, OECD 2016.

Figure 3.1: Trends in Aid to Agriculture (Measuring Aid to Agriculture - OECD, 2010)

the high allocation of US$ 7.5 billion in 1980s to US$ 4.2 billion in 2008 per year. Recently, this decline has observed a slowdown and started to increase again. Moreover, negligence at the part of Development Assistance Committee (DAC) members' aid programmes has also been noticed as total commitments to the agriculture related programmes have decreased by 17% in mid 1980s to 6% recently by the DAC members[6].

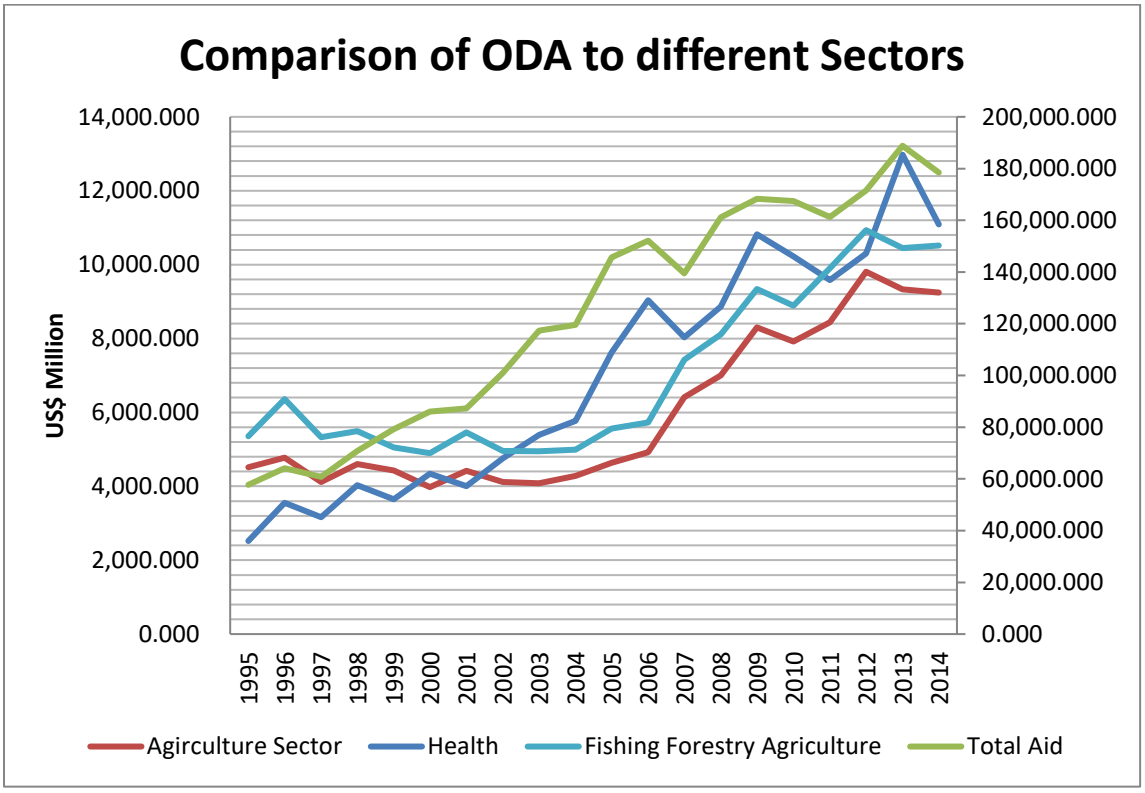


Figure 1.4: Comparison of Aid commitments*[7]

Consequently, while comparing the total ODA commitments with the other sectors, it has been observed that agriculture sector has seen declining trend in aid during the period 1999 to 2012. However, aid allocation to health sector has been increased during the same period. In this context, agriculture sector might have suffered with this declining trend in aid commitments.

[6] Measuring Aid to Agriculture, OECD-DAC, 2010.
[7] Total aid is at right axis and sectoral aid is at left axis.

The declining trend of agriculture aid has been suppressing the livelihoods of people living in extreme hunger and poverty. The needs of the sector are far more complex and diverse in nature wherein the principles of Paris Declaration seem not to bring out any desirable results. *A Progress Report on Implementing the Paris Declaration (2008)* mentions about the challenges faced by the agriculture sector in the perspective of Paris Declaration implementation. The role of agriculture in raising up the production level, food security and poverty reduction has not been exploited effectively. A gap of ownership exists among all the stakeholders of the sector such as smallholders, weak institutions, and least prioritization in resource allocation which have been observed in Poverty Reduction Strategy Papers (PRSP).

The efforts for domestic fund mobilization and development of policy frameworks in recipient countries are still underway. Funds and consistent policies are required to track the progress of *input* in the form of resource allocation, *output* as services supply and further investments, and *outcomes* in the form of agricultural income, production and productivity[8]. The inconsistency in funds provision (domestic and foreign aid) and inefficiency in service delivery, consequences of poverty reduction, and policy implementation have led the sector to face food shortage recently.

The problem of insufficient domestic expenditures allocated to the sector has also aggravated the situation. The public expenditures by the governments of each developing country have been on declining trend for the agriculture sector (Dewbre, et al 2011). Similarly, the low quality of spending in the sector is also below par in a way that the dominating head of amount allocated and spent to agricultural activities is wages in recurrent budget.

[8] World Agriculture, Towards 2015/2030

Empirically, ODA significantly enhanced agricultural productivity in Asia and relatively less but also in Sub-Saharan Africa during 1975-1985 (Norton, 1992). Due to constrained domestic resources most of the developing countries have to rely on foreign assistance in order to support sustainable development programmes. Therefore, the role of foreign aid in agriculture growth plays a pivotal role for the development of a country.

In view of the above scenario, many development forums such as Paris Declaration 2005, High-Level Forum on Aid Effectiveness Accra 2008, and the World Bank Group (WBG) Agriculture Action Plan FY2013-15 have revisited the sector's needs in response to the recipient's demands. Resultantly, the aid allocation due to recent food crisis has been increased by 70 percent to agricultural and other related sectors by the WBG in FY2010-12[9].

In the consequence of aid fluctuations to agriculture sector and recent food crisis, it is also feared that that the overall production level might have declined. Thereby, it is essential to examine the impact and magnitude of the foreign assistance on the agricultural productivity of the developing countries during the last decade.

Significance of study

Considering the significance of agriculture in eradication of poverty and hunger, the Food and Agriculture Organization (FAO) has provided a broad framework of policy guidelines in order to formulate development policies and plans at national level. FAO mentioned that to eradicate hunger and extreme poverty, the investment of US$ 265 billion per year is required from 2016 to 2030[10]. Major target areas should be social protection, pro-poor development and smallholders and family farmers which would have positive impact on food production. Given the current

[9] Agriculture Action Plan 2013-2015, World Bank Group.
[10] FAO, Achieving Zero Hunger , Brief (2016) (P: 2; 25)

level of disbursements, the study will be useful in assessing the requirement of foreign assistance only for the food production in pursuing the target of doubling the productivity by 2030.

In a FAO's Regional Conference for Europe, it is highlighted that Eastern Europe and Central Asia would require to increase the irrigation and nutrient application which will at least double the wheat production by 2030. Similarly, West Asia and North Africa requires sustainable use of natural resources particularly water resources as the region has already been constrained with water due to climate, development changes, and population (Muir, 2015).No study based upon latest available data has been carried out to identify the average level of agriculture aid required for all low income and lower middle income countries to achieve the SDGs target of doubling the productivity.

However, there is a plenty of research available supporting the interrelationship among economic growth, agriculture growth and poverty reduction but the literature on the subject matter is scanty. Most of the studies declare positive and significant relationship between agriculture growth/productivity and agriculture ODA (Norton et al, 1992; Kaya, et al 2008; Akpokodje and U. Omojimite, 2008; Alabi, 2014). Though they used agriculture growth and agriculture output as dependent variable but the independent variables, research technique, and time period under examination were different. The most commonly used research technique has been the cross country panel analysis with fixed effects model wherein the results have been presented on average for all developing countries.

This study seeks to contribute in the available literature by using quintile regression technique and will make a comparative analysis with fixed effects panel analysis. Moreover, the governance indicator will be used as instrumental variable following the Burnside and Dollar

(1997) and Hansen and Tarp (2000) in order to deal with the endongeneity problem of the agriculture aid. Hence, the study will estimate the impact of agriculture aid at different quintiles of productivity level in low income and lower middle income countries during the period of 2002 to 2014; i.e. how much aid is effective and varied among the countries at different quintiles of productivity.

The findings of our study will provide significant policy implications for resource allocation by the donors based upon the varying productivity level as well as the effective utilization of the funds by each country. The results will be helpful for the development and donor organizations to formulate plans/policies in order to achieve the targets of SDGs by 2030.

Hypothesis

The hypothesis of the study is that the agricultural productivity depends positively upon the foreign aid, countries' domestic resources (gross capital formation), government effective policies, and agricultural input such as land, labor, and natural resources. The agriculture productivity in the developing countries is heavily dependent upon foreign resources which may be disbursed uninterruptedly.

Research Questions:

Based upon the problem statement and purpose, the relevant questions are as follow:

- ✓ Does the agriculture aid significantly contribute to the agricultural productivity of the developing countries given their varied aid and productivity level?
- ✓ Does the government effectiveness (policy soundness) have any impact on the agricultural productivity?

Organization of the thesis

After giving background/introduction of the study in this chapter, the chapter two will review the existing literature both empirically and theoretically on the subject matter. Methodology and research technique will be discussed in the third chapter. Data analysis will be carried out in the third chapter. Chapter four will present the major findings and analysis. Policy recommendations and conclusion will be presented in the chapter five.

Chapter Two

Literature Review

This section will review the existing literature and discuss the findings of studies in the context of positive, negative, or significant impact of foreign assistance on agricultural output and growth in developing countries. It will discuss the theoretical context and empirical evidence on the subject matter.

Theoretical Review

Agriculture development has been a matter of concern since the primeval times not only for policy makers but also for a layman. A number of theories have been developed and followed by many economists based upon resource availability, environment, and institutional and financial capacities. Traditionally, the foundation of agriculture growth has been laid upon the intensive labour availability and scarce capital inputs (Lewis, 1954). Moreover, agriculture-sector-based farm inputs, cheap raw material, and lower transport cost provide a support mechanism to agriculture development; which resultantly assists other sectors and enhances aggregate growth in a country (Lewis 1954, Johnston and Mellor, 1961).

In addition it is also argued that the LDCs are constrained with scarce land due to population pressure and inequitable land distribution. Similarly, scarce capital, low income and low domestic savings, market imperfections, and risk to adapt latest technologies are some of the basic issues which keep the labour productivity and overall agriculture output very low (Ghatak, 1984).

Along with the abovementioned reasons, Hayami and Ruttan (1985) argued that despite of having abundant labour, the LDCs have been facing problem of lower agriculture productivity due to their high population growth, high agricultural dependent population, and unsupportive government policies. The parallel development of others sectors' in order to absorb the surplus labor; the promotion of technical and skilled education; research and development policies, and dissemination of technological innovation are the responsibilities of the government. In developing countries, the poor institutional capacities have restricted the high productivity, whereas the productivity level in LDCs was once higher than that of the developed countries during 1960 – 80 (Hayami and Ruttan, 1985).

Similarly, while discussing the agriculture development in developed countries, Hayami and Ruttan (1985) postulated a model of agriculture development and sustained productivity based upon the combination of two models as Kuznets'-Schultz perspective (Schultz's theory of agriculture development[11] and Simon Kuznets' theory of modern Economic Growth[12]). The Kuznets'-Schultz perspective presented by Hayami and Ruttan asserted that agriculture growth and the positive and increasing rate of agricultural productivity determines the economic development process of any country. They tested their hypothesis on United States and Japan by taking technical and institutional changes as endogenous factors. They found that both countries have achieved a sustained agriculture growth and productivity for a century. Although their resource endowments were different to each other yet the institutional development played a

[11] Theodore W. Schultz theorized that "Significant growth in productivity cannot be brought about by the reallocation of resources in traditional agriculture systems. Significant opportunities for growth will become available only through changes in technology – new husbandry techniques, better seed varieties more efficient sources of power, and cheaper plant nutrients." (Hayami and Ruttan, 1985, P, 2:26)

[12] Simon Kuznets "identified the development of economic and social institutions for the systematic application of scientific knowledge to economic activity as the primary source of sustained growth in productivity and in per capita income during the epoch of modern economic growth." (Hayami and Ruttan, 1985, P, 2:37)

significant role in diffusing the technological changes. [I add this para to emphasize the importance of institutions and governance]

Hence, it can be said that in developing countries the government policies (spread over whole government system) sector also a play a significant role in the sector's development which created difference in productivity among developed and developing countries. The farm inputs and resource supply can be covered under the auspices of agricultural aid (providing all inputs[13]), which would provide the base to this study's theoretical framework.

Empirical Review

The empirical evidence will be discussed in the following sequence as (i) mentioning about the aid ineffectiveness, (ii) positive role of aid in development, (iii) impact of foreign assistance in agricultural growth, (iv) link between economic growth, agricultural growth and poverty reduction, and (v) relationship between agriculture and poverty reduction through food aid, direct food security programmes etc.

i. Aid is ineffective in promoting growth

The consensus on the effectiveness of foreign aid to developing countries has still to be established as a number of divergent opinions are found on the aid effectiveness. The ***proponents of aid ineffectiveness*** are of the view that aid tends to alter and modify the recipients' government enticement as well as disturb the political environment. As recipient's government is not representative of public interests so aid helps promotes rent seeking, corruption and supports

[13] According to the OECD distribution of aid to agriculture sector, it comprises of agriculture policy and development, land resources, water resources, inputs, food crop production, livestock, agrarian reforms, education, research, and agriculture financial services.

interest groups (Boone 1996, Pederson 1995, Svensson 2000). Similarly, aid fungibility is also one of the outcomes of lobbying when funds are diverted from the intended projects which resultantly fail to achieve objectives. Generally, the main bottlenecks considered in aid ineffectiveness are principle-agent problem, ownership between donor and recipient, harmonization or conflicting view on objective of aid.

ii. Positive role of aid with sound policies

On the other hand, some of the studies are of the view that it is not the fact that all aid is ineffective, rather it plays ***positive role*** in improving welfare and development. It has been argued that aid becomes effective when is given to the countries with sound policies and institution, so aid should be given selectively to poor countries with good policy environment (World Bank, 1998). Another highly discussed study of Burnside and Dollar (2002) in this context emphasized the earlier opinion that aid becomes effective if impact is seen together with the policy index. The more the policies and institutions are better in a country the more strength-fully aid will have positive impact on growth. Collier and Dollar (2002) discussed that poverty reduction is the most common and important objective of foreign aid. For that reason the poverty-efficient aid allocation can double the impact of aid. The study found out that actual aid allocations are significant for poverty reduction; however while combining with the policy index (CPIA) it becomes insignificant. With the changing pattern of aid allocations and priorities, donors have become more policy selective and poverty focused in allocation of resources (Dollar and Levin, 2004).

iii. Sector-wise role of aid

Despite the fact that aid allocations and donors concerns for good policy environment it is important to enquire the outcome of aid by looking into different sectors. Unfortunately, not many studies are found on sectoral effectiveness of foreign assistance. Amongst a number of sectors, empirically ***health and education*** have been found to have positive impact of aid. In case of ***agriculture sector a very few studies are found***, thus no authentic paper has been found which could have examined the impact of aid on agriculture growth combined with associated sectors and policy index. There is a plenty of research available supporting the interrelationship among economic growth, agriculture growth and poverty reduction. Agriculture sector not only increases farmers' incomes but also enhances agricultural productivity which ultimately contributes to national income and reduces poverty (DFID, 2005). As this sector provides employment to around 81 percent of the labor force of the developing countries but the agricultural productivity and its contribution to GDP vary according to the structure of the economies.

iv. Role of aid in agriculture growth

The argument of ***agriculture as the engine of the growth*** has now been widely accepted as it effectively reduces poverty in the developing countries depending upon their development stages (Kaya et al, 2008; Gollin, 2009; IDA, 2009). Kaya et al, is of the view that agriculture sector promotes growth at the early stages of development, thus it helps poverty reduction and pave the way of sustainable growth in low income countries. But empirically, it has been found that agricultural growth reduces poverty more efficiently as compared to the aggregate GDP growth wherein the reason of diversified poverty level in an agricultural country is quoted.

Unfortunately, the literature on aid effectiveness to agriculture sector is very scarce. The few studies available on the subject matter establish a positive impact of aid in the agriculture sector. Norton, et al (1992) examined the impact of total aid on agricultural growth and found significantly positive relationship for less developed countries from 1970 to 1985. They asserted that segregation of aid into agricultural activities is very complicated as it is connected with several other sectors. For that reason, they examined the impact of total ODA on the agriculture output in 92 countries. They also incorporated other explanatory variables such as livestock, labor, machinery, land quality index, schooling, and higher education. All of the variables turned out to be significant with appropriate signs, such as schooling, better land quality, and higher education positively contribute to the agricultural growth. Foreign aid significantly enhanced agricultural productivity in Asia and relatively less in sub-Saharan Africa during 1975-1985. However, the foreign aid's impact in Middle East and Latin America was found out to be insignificant. In addition, it was also pointed out that due to external debt, the effects of agricultural output turned out to be negative in some countries. As well as countries with fiscal deficit less than 4% has positive significant impact of aid on agricultural output.

Similarly, Akpokodje and U. Omojimite (2008) studied the role of aid in agricultural output in Nigeria from 1970 to 2007. They established that foreign assistance to Nigeria has significantly contributed to the agricultural growth. The study mentioned that Africa has received the maximum foreign aid per capita and Nigeria has received less foreign aid as compared to other developing countries of Sub-Sahara Africa. The author used the simultaneous equation system wherein the endogenous variables included agricultural output, savings, agricultural imports and foreign aid. Exogenous variables were net agriculture exports, inflation, and per capita income. In case of Nigeria, domestic savings were not crowded out by the foreign

assistance as Nigeria is a low income country and so the imports were also not promoted. Agricultural growth in Nigeria is stimulated by foreign aid. The study argued that the effect of net exports on agricultural growth is positive but not significant.

Another research (Alabi, 2014) has studied the impact of aid to agriculture sector on the agricultural output in Sub-Saharan Africa during the period from 2002 to 2010 by using the Generalized Method of Moments. The results showed a positive impact of aid on agricultural GDP and productivity at 10% level of significance during the period under study. The author included other independent variables such as agriculture policy index, disaster or conflicts, rainfall, transparency, and governance index. Following the governance and policy variables of Burnside and Dollar (1997), the author found that policy variables have positive but insignificant relationship with agriculture aid to the recipient countries. In this way, policy variables seem not to be key determinants of agricultural aid. Further, the past agricultural productivity, current rainfall, and governance index also have positive impact on agriculture output. The author has also mentioned that landlocked countries received aid more than the average aid given to the other Sub-Saharan countries.

Kaya, et al (2008) have also examined the effects of agricultural aid on the agriculture sector growth of the developing countries ranging the period from 1974-2005. By using the fixed effects/times series model, their results showed positive and significant impact of agricultural assistance on agriculture output and growth. The dependent variable used in the study was agriculture value added and independent variables included aid to agriculture, GDP per capita, fertilizer consumption, irrigated land, land under cereal production, livestock production index, rural population, net exports, agriculture machinery, and crop production index. All of the independent variables do have appropriate signs.

v. The interconnection between agriculture and poverty reduction

In addition to above, some of the studies on the subject matter have been conducted in other dimensions highlighting the effect of foreign assistance on ***poverty reduction, direct food aid, food security*** etc. For example, Dewbre, et al (2011) discussed the agriculture progress and poverty reduction in developing countries by investigating the agricultural aid data from 1980 to 2005. The study used the cross section pooled time series fixed effects model. It was found out that the agricultural growth significantly reduces the poverty headcount more than that of the growth in non-agricultural sector. The public expenditures by the governments of each developing country have been on declining trend for the agriculture sector. Similarly, the low quality of spending in the sector is also below par in a way that the dominating head of amount allocated and spent to agricultural activities is wages in recurrent budget. However, the developmental activities are usually being financed by the donors.

Similarly, Mosley and Suleiman (2007) examined the connection among aid, agriculture and poverty in developing countries by using three stage least square technique. Their results showed that total agricultural productivity has a significant negative influence on incidence of poverty, particularly for infant mortality definition. Their proposition was that aid effectiveness depends upon "stability and inter-sectoral distribution" of resources. If more and more resources are utilized on public expenditures which are supportive to enhance agriculture growth, such as expenditures on education contributes positively to the agricultural productivity.

Dillon and Mussa (2010) used rural household surveys covering fifteen Ethiopian villages in order to see the food aid impact on the agricultural production and household supply in Ethiopia. The dependent variable was the number of days required for agricultural preparation

and types of crops whereas the food aid (received by household) was the independent variable controlling for household and ethnic characteristics. The survey results found out that receipt of food aid significantly decreases the household supply to agriculture as well as agricultural production. However, the effect of food aid disappears while controlling for household characteristics. Overall, food aid discourages the households to cultivate crops and take part in agricultural activities.

Likewise, Harita (2009) carried out the case study approach in Combodia to analyze the aid effectiveness in agriculture and education. The study found out that the decline in poverty incidence in Cambodia from 47% in 1994 to 30% in 2007 is associated with agricultural growth. Although a limited number of researches available on the subject matter yet a gap regarding investigating the impact of agricultural foreign aid on agricultural productivity in developing countries together with government effectiveness in policy implementation still exists.

Amongst the reviewed studies the most relevant to the proposed study are Norton (1992) and Alabi (2014). However, the results of Norton (1992) are based upon the data series of 1970-1985 using total ODA as well as are ***not jointly significant*** for agricultural growth. Similarly, the study of Alabi (2014) has been carried out only over ***Sub Sahara Region which has significant results*** for agricultural productivity but ***insignificant for the policy effectiveness***. Accordingly, it stands justified that this study will examine the impact of agricultural aid on productivity along with the governmental policy effectiveness for 82 developing countries on the data series of 2002-2014. As well as it will calculate how much aid would be required to double the agricultural productivity in developing countries by 2030 based upon the latest available data.

Summary of Existing Literature on the Impact of Agricultural Aid on Agricultural Productivity

S. No.	Study	Author	Country/ Data Set Year	Type of Study/ Dependent Variable	Conclusion/Results
1	Impact of Foreign Assistance on Agricultural Growth	George W. Norton, Jaime Ortiz and Philip G. Pardey (1992)	98 Developing Countries (1970 - 1985) OLS	Y (Agricultural output - real value of the agriculture GDP in US dollar) X (inputs) livestock, labor, machinery, land quality index, schooling, higher education, and Total ODA.	All non-aid variables are significant and had appropriate signs. *Coefficient of aid was positive but not significant* at 5% level for 98 countries. *Diversified results for different regions* Asia: Highly significant SSA: Less significant Middle East & Latin America: Non-Significant
2	Impact of Agricultural aid (for rural development) on agricultural sector growth in developing countries	Ozgar Kaya, Ilker Kaya and Lewell Gunter (2008)	Developing Countries 1974-2005 Cross Section Time Series Econometric Model Fixed effects to deal with omitted variable bias	Y: Agriculture value added X: Aid to agriculture, GDP per capita, fertilizer consumption, irrigated land, land under cereal production, livestock production index, rural population, net exports, agriculture machinery, crop production index	Positive and significant impact of agricultural assistance for rural development on agriculture output and growth
3	The Effect of aid flows on Nigeria's agricultural growth	Godwin Akpokodje and Ben U. Omojimite (2008)	Nigeria 1970 - 2007 Simultaneous Equation System	endogenous variables: Agricultural Output, savings (% of GDP), agri imports (% of GDP), and aid (% of GDP) exogenous variables: Net agri exports (% of GDP), inflation, per capita income	Agricultural growth in Nigeria is stimulated by foreign aid. The effect of net exports on agricultural growth is positive but not significant. Domestic savings are not crowded out by foreign assistance

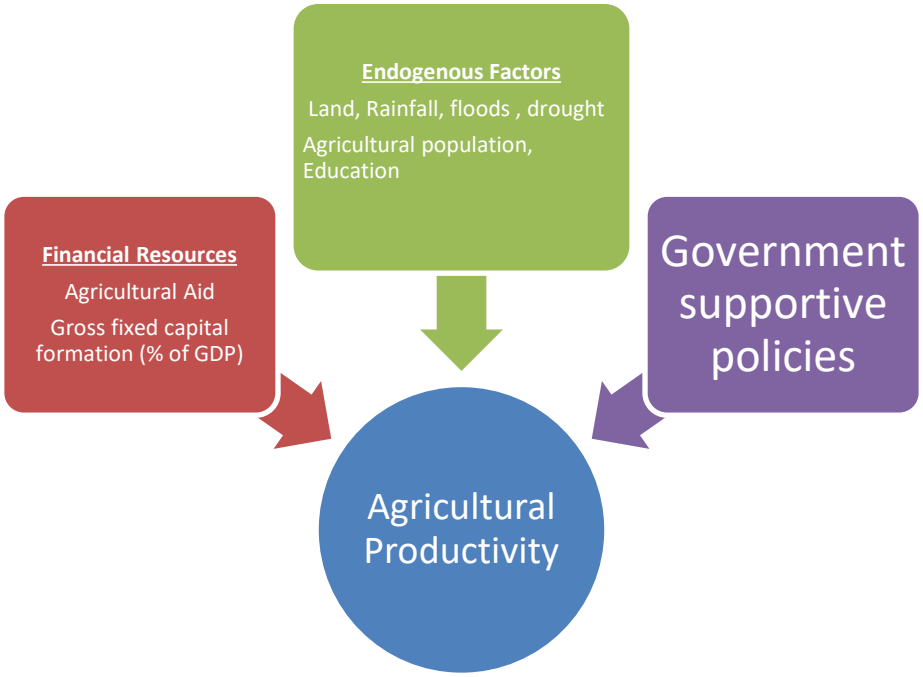
4	How does food aid impact agricultural production and household supply to agriculture in Ethiopia?	Andrew Dillon, Sofia Mussa, B.A (2010)	15 Ethiopian villages Panel Analysis of 4 rural household surveys	Y: Days for agricultural preparation and types of crops X: Food aid (received or not), household characteristics, ethnicity of households	Receipt of food aid significantly decreases household supply to agriculture as well as agricultural production.
5	Agriculture Progress and Poverty Reduction	Dewbre, J., D. Cervantes-Godoy, and S. Sorescu (2011)	Developing Countries1980-2005Cross section pooled Time Series Fixed effects model	Y: Povert headcount, and squared poverty gap X: Agriculture GDP per worker, non-agri GDP per worker, remittances per capita	The agricultural growth significantly reduces the poverty headcount more than that of the growth in non-agricultural sector.The public expenditures by the governments of each developing country have been on declining trend for the agriculture sector.
6	Impact of Agricultural foreign aid on agricultural growth in Sub Saharan Africa	Reuben Adeolu Alabi (2014)	Sub Sahara Africa 2002-2010 Generalized Methods Of Moments	Y: Agricultural GDP and productivity X: Agricultural aid, agri policy, disaster/conflicts, rainfall, transparency, governance index	Agricultural aid does have a positive impact on agricultural GDP and productivity at 10% significance 2002-2010. Governance indicators are positively correlated with aid but not significant.

Table 2.8: Summary of Literature Review

Theoretical Framework

In view of the above reviewed literature, the following framework can be developed to investigate the hypothesis of positive role of aid in the presence of good policies.

Figure 2.1: Theoretical Framework



Consistent financial resources whether domestic or foreign are significantly important to invest in the agriculture sector in order to increase the agricultural productivity. The foreign aid being the key variable of interest will cater for financial resources and other inputs[14]. Similarly, individual country's characteristics also important in developing the sector such as land, agricultural population, education, weather, and geographic location etc. These factors are additive to financial resources.

[14] According to the OECD distribution of aid to agriculture sector, it comprises of agriculture policy and development, land resources, water resources, inputs, food crop production, livestock, agrarian reforms, education, research, and agriculture financial services.

In addition to above, the role of governance is also taken in to account to know how much government is competent in implementing policies, delivering public services, and providing social welfare as well as how much government is accountable itself. The donors' commitment to the good governance has been evident after the formal endorsement of the connection between good governance and the allocation of resources by the DAC members in their High Level Meeting in 1993. Therefore, good governance and institutions of the developing countries have got certain attention as one of the criteria while designing the aid policy by the donors (Neumayer, 2005) which has later been endorsed by the World Bank also. For that reason, inclusion of government effectiveness (policy soundness) as a factor to determine the agricultural productivity has become a matter of concern for aid disbursements for the donors.

Chapter Three

Data and Methodology

As the study will examine the impact of agriculture aid on average and at different quintiles of productivity level in low income and lower middle income countries during the period of 2002 to 2014; i.e. how much aid is effective and varied among the countries at different quintiles of productivity. In order to carry out the empirical test, we identify the dependent and independent variables at macro-level where the unit of analysis is country. The agricultural productivity is taken as dependent variable and the explanatory variables include agricultural aid (main variable of interest), each country's rural population, agricultural land, drought, primary gross enrolment, gross capital formation, gross fixed capital formation (agriculture sector), and government's policy effectiveness during the period from 2002 to 2014.

Data and Methodology:

Based upon the theoretical framework mentioned in chapter two, the given below model is estimated by using quintile regression as well as through panel fixed effects regression.

$$logProductivity_{it} = \beta o + agri.aid_{it} + \beta_1 agri.population_{it} + \beta_2 agri.land_{it} + \beta_3 loggovt.eff t_{it} + \beta_4 (gcf)_{it} + \beta_5 (drought)_{it} + \beta_6 (primary.educ)_{it} + \beta_7 (gfcf)_{it} + u \ldots\ldots\ldots\ldots \textbf{(Eq. 1)}$$

Fixed Effects:

The above equation allows the country (indexed by *i*) fixed effects and time (indexed by *t*) fixed effects. The country fixed effects may capture the potential country heterogeneity biases like weather and geographic location etc. However, the heteroscedasticity test and Breauch-Pagan test to verify the basic assumptions of the regression are annexed. Similarly, the robust standard errors are used in the fixed effect model which are also compared with the OLS regression model in the table. In order to check the robustness of the results, we conduct the OLS regression analysis on the model in Eq.1. We use log-level variables for all models[15].

Quintile Regression:

Similarly, the above equation also allows us to discover the effects of aid on the entire distribution to check the robustness. The quintile regression summarizes the relationship between regressors and the dependent variable at different level of productivity (such as at Q=0.1, Q=0.25, Q=.5, Q=.75, and Q=.9). This type of distributional effect helps in determining the effectiveness of aid (magnitude) at different points. Moreover, the results of quintile regression are more robust against outliers as compared to OLS and panel analysis.

Variable and Data Description:

Data on sectoral aid disbursements has been obtained from OECD-DAC database from 2002 to 2014 for 82 developing countries. The government effectiveness will account for the institutional soundness of the recipient countries whose data has been obtained from the World Governance Indicators. The data for the rural population (proxy for agricultural labour force), agricultural

[15] To standardize the Productivity variable, we take log of the variable. The agricultural population, agricultural land, primary enrollment and gross capital formation variables are in percentage form. The variable of government policy effectiveness is in percentile rank and drought is given in number of occurrence per year. However, the aid variable is following the transformation function (Z normal distribution; $z=(X-\mu)/\sigma$) of the original variable to make it follows the normal distribution.

productivity, agricultural land, gross capital formation, gross primary enrolment, and average rainfall have been taken from the World Bank WDI's database. The statistics on the number of floods and droughts have been taken from the Centre for Research on Epidemiology of Disaster.

The description of variables used in the study is given below along with their unit of measure and data source.

Table 3.1: Variables Description

Variable	Description	Unit of Measure	Data Source
Agriculture Productivity	The statistics on Cereal Yield by Food and Agriculture Organization are taken in to account for agriculture productivity. It includes "wheat, rice, maize, barley, oats, rye, millet, sorghum, buckwheat, and mixed grains. Production data on cereals relate to crops harvested for dry grain only."(WDI)	Kg/hectare We use log of productivity.	World Development Indicators, World Bank Database
Agriculture Aid	Total foreign aid to agriculture sector including multilateral and bilateral aid	US$ Million Aid is standardized by using $Z = \frac{(X-\mu)}{\sigma}$ to standardize across large and small countries)	OECD database
Government Effectiveness	"Government Effectiveness captures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation	Percentile rank indicates the country's rank among all countries covered	Governance Indicators, World Bank Database

	and implementation, and the credibility of the government's commitment to such policies. Percentile ranks have been adjusted to correct for changes over time in the composition of the countries covered by the WGI." (WGI) (Burnside and Dollar, 2000; Hansen and Tarp, 2000)	by the aggregate indicator, with 0 corresponding to lowest rank, and 100 to highest rank.	
Agriculture-dependent population	Rural population whose livelihood is based on agriculture as well as agriculture based employment. (Schultz, 1954 – Alabi, 2014)	Percentage of total population	-do-
Gross Fixed capital formation (Agriculture Sector)	The total domestic expenditure in agriculture sector by the respective governments of each developing country	Percentage of GDP	-FAO-
Agricultural land	To examine the agriculture sector dependency and agriculture output (Schultz, 1954 – Alabi, 2014)	Percentage of total area of a country	-do-
Gross capital formation	"Gross capital formation (gross domestic investment) consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories." (WDI) (Hansen and Tarp, 2000)	Percentage of GDP	-do-
Primary Gross Enrolment	"Gross enrollment ratio is the ratio of total enrollment, regardless of age, to the population of the age group that officially corresponds to the level of education shown". (WDI) In order to consider the heterogeneity of education systems in developing countries, gross enrolment estimates are used.	Percentage	-do-

	(Mosley, 2007)		
Drought and Floods	To capture the variations of weather in different countries. (Alabi, 2014)	No. of floods and no. of droughts	Centre for Research on Epidemiology of Disaster

Table 3.1: Variables Description

Dealing with Endogeneity Problem

There can be number of econometric problems in such type of model. Since, it is pertinent to include all potential variables which could affect productivity. However, there may be the problem of omitted variable bias which could have correlation with the error term. In this case, results of Ordinary Least Square (OLS) can be biased. Therefore, we will investigate the real impact through Random Effect and Fixed Effects Model as these models estimate the impact of time-varying variables when time-constant variables are omitted.

As per the assumption of Random Effects that the error term does not correlate with the explanatory variables and it controls heterogeneity effects of all unobserved factors, so we can reduce the problem of omitted variable bias. Similarly, by using the Fixed Effects model we control the endogeneity problem if it exists in OLS though omitted variable bias. Since the Fixed Effects model eliminates the impact of time-invariant factors/variables, so the real impact of all available explanatory variables can be investigated on the dependent variable. Therefore, we will get the unbiased coefficients of Fixed Effect Model, which could have occurred due to time-invariant characteristics.

Hypothesis Testing for RE and FE

In order to know which model should be preferred; we carry out the Hausman Test

$H_0 : Cov(\mu_i, X'_{it}) = 0$ (RE)

$H_1 : Cov(\mu_i, X'_{it}) \neq 0$ (FE)

Table 3.2: Hausman Test

	Coefficients (b) FE	(B) RE	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
aid_z	.0180396	.0267516	-.0087121	.0016979
agri_land	.0049676	.0012552	.0037124	.0025096
agri_pop	.1093471	.0848066	.0245405	.0072926
gcf_prgdp	.0005813	.0009787	-.0003974	.0001049
gcf_agri	-.2437427	.0349824	-.2787251	.0513805
gov_rank	-.0001582	.0002748	-.000433	.0001829
prim_educ	.0031254	.0037779	-.0006525	.0001993
drought	-.0641024	-.0677241	.0036217	.
agri_pop2	-.0010207	-.000766	-.0002547	.0000633

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

```
Test:  Ho:  difference in coefficients not systematic

              chi2(9) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                      =       29.38
            Prob>chi2 =      0.0006
            (V_b-V_B is not positive definite)
```

The estimators of Fixed Effects and Random Effects are consistent under H_0 (null hypothesis). RE estimator is found inconsistent under H_1 (alternate hypothesis) but efficient under H_0.

Breusch Pagan Test

Table 3.3: Breusch Pagan Test

```
Breusch and Pagan Lagrangian multiplier test for random effects

        log_prod[Countries,t] = Xb + u[Countries] + e[Countries,t]

        Estimated results:
                         |       Var     sd = sqrt(Var)
                ---------+-----------------------------
                log_prod |    .4437437       .6661409
                       e |    .0384111       .1959876
                       u |    .3396822       .5828227

        Test:   Var(u) = 0
                                    chibar2(01) =  4265.88
                                Prob > chibar2 =   0.0000
```

Summary Statistics

The summary statistics of full model is given below:

Table 3.4 Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Year	1001	2008	3.743	2002	2014
Productivity	988	1974.42	1276.10	35.70	7556.20
Agriculture Aid(US$ Mln)	994	44.07	62.94	0.01	601.42
Agriculture (LF)	1001	62.41	15.73	22.74	91.32
Agriculture Land	1001	45.30	21.12	2.21	80.92
Govt. policy effectiveness	1001	27.09	16.64	0.00	75.12
Gross Fixed Capital Formation (Agri)	984	0.08	0.04	0.00	0.28
Gross Capital Formation (overall)	1001	23.48	9.61	1.53	67.91

Floods	1001	1.20	2.59	0.00	52.00
Drought	1001	0.12	0.33	0.00	2.00
Gross Primary Education Enrolment	1001	102.23	20.28	36.76	175.34
Aid (Transformed scale)	995	0.00	1.00	-0.70	8.86
Log of Prodductivity	988	7.39	0.67	3.58	8.93

Scatter Plots

Figure 3.1: Scatter Plot of Agriculture Aid and Productivity (Transformed scale)

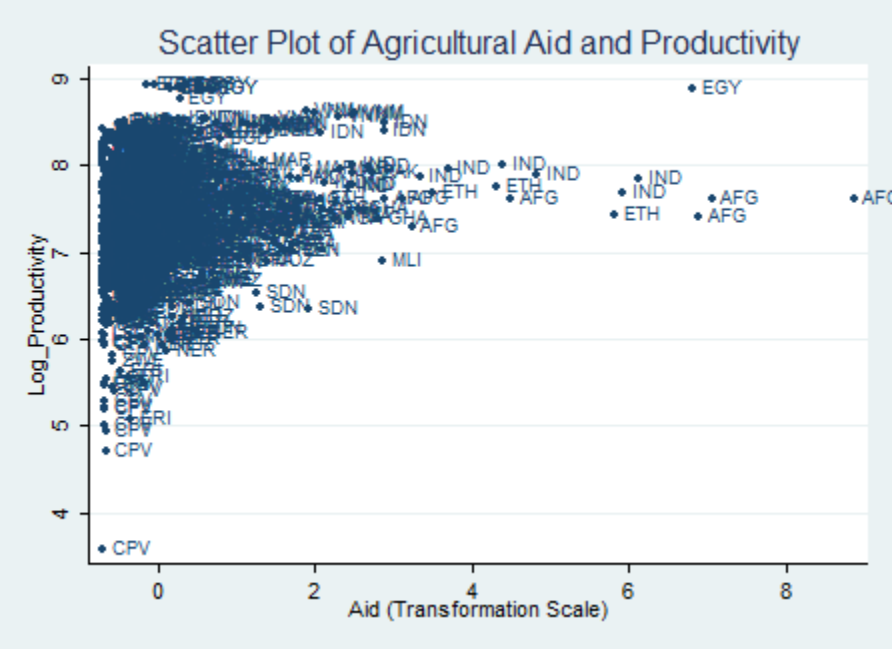


Figure 3.2: Scatter Plot of Agricultural Aid and Productivity (Real values)

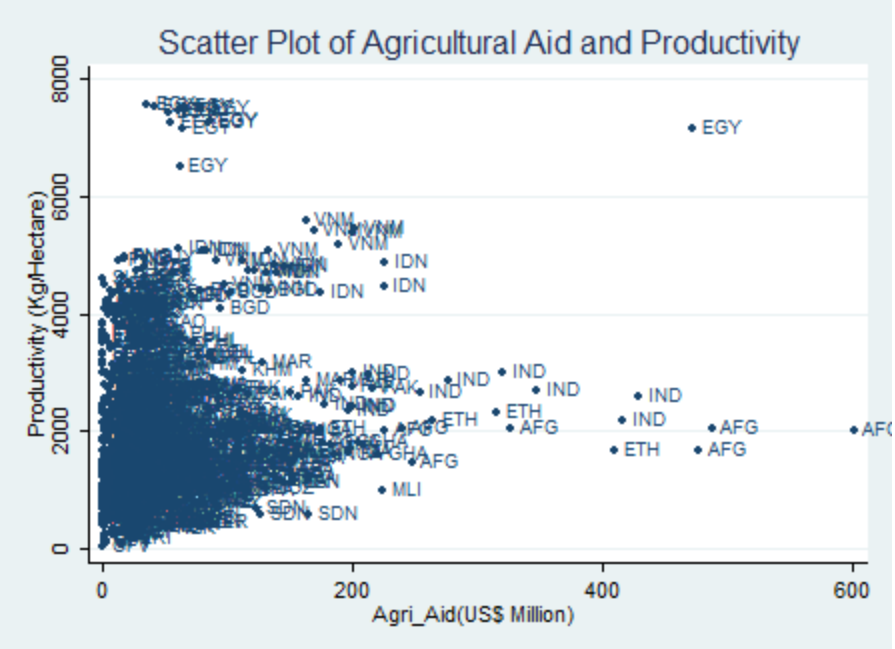


Figure 3.3: Average Agricultural Aid to 77 Developing Countries

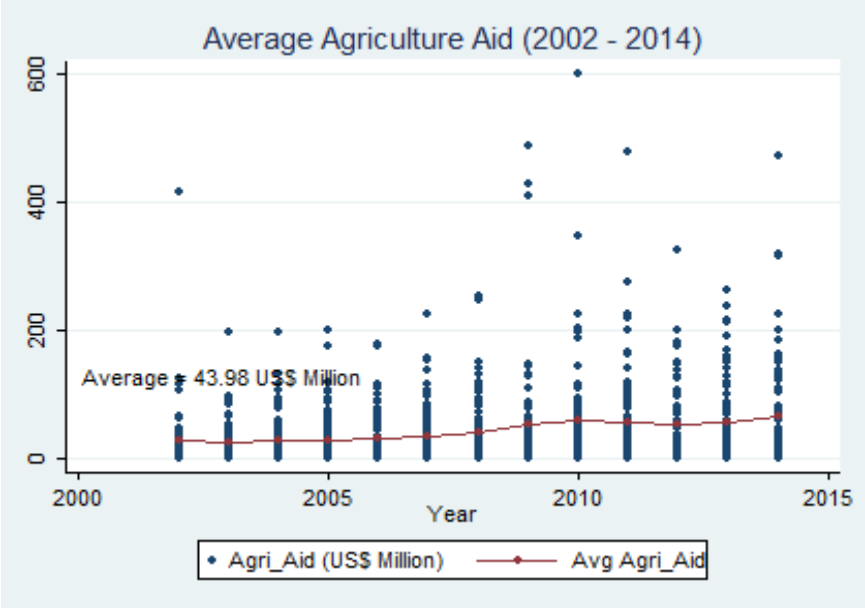


Figure 3.4: Average Productivity Level in 77 Developing Countries

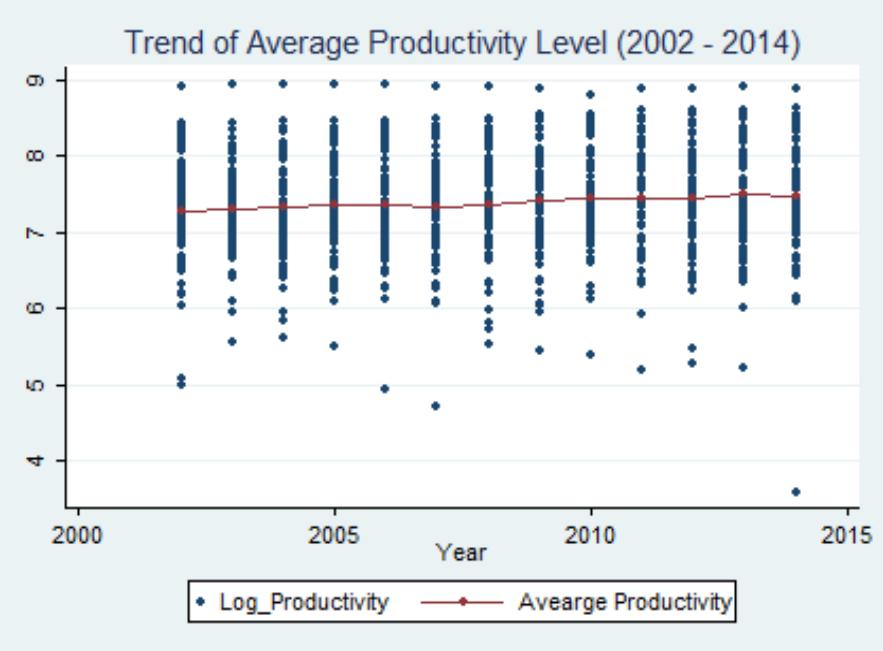
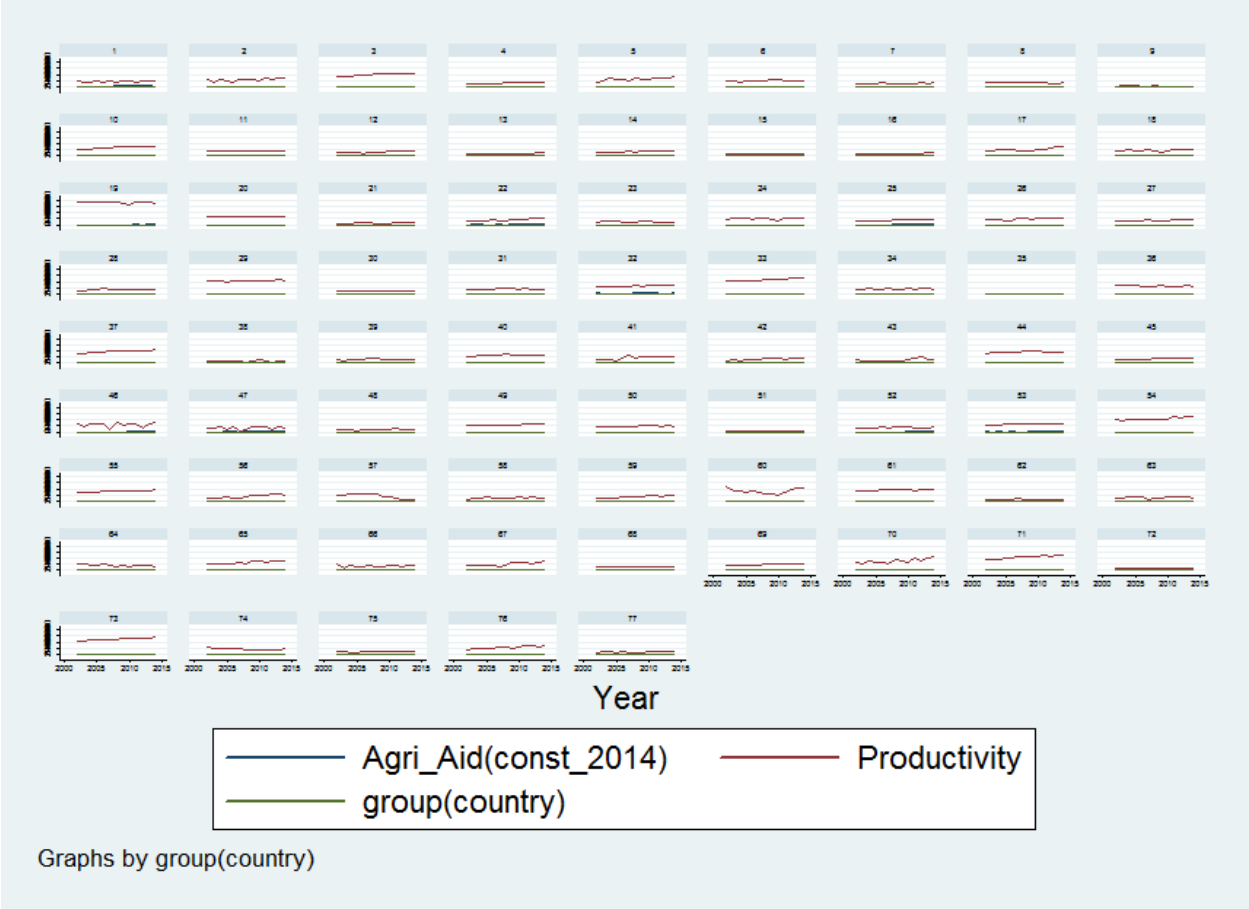


Figure 3.5: Aid and Productivity Trend in 77 countries



Challenges with Data

The summary statistics table () and scatter plots depict that there are some outliers which could distort the results. The outlier countries are Afghanistan, Egypt, Ethiopia, and India. For robustness check we also conduct quintile regression at different points of productivity level. The detailed description of variables productivity and agricultural aid is given in table 5 and table 6 respectively.

Table 3.5: Detailed Description of Productivity Level

Productivity				
	Percentiles	Smallest		
1%	230.8	35.7		
5%	546.7	110.1		
10%	742.8	140.7	Obs	988
25%	1075.6	148.5	Sum of Wgt.	988
50%	1646.5		Mean	1974.418
		Largest	Std. Dev.	1276.102
75%	2552.3	7500.2		
90%	3833.5	7515.4	Variance	1628436
95%	4405.8	7536.9	Skewness	1.498023
99%	7247	7556.2	Kurtosis	5.95863

Table 3.6: Detailed Description of Agricultural Aid

Agri_Aid(const_2014)				
	Percentiles	Smallest		
1%	.02	.006		
5%	.397	.009		
10%	1.282	.01	Obs	994
25%	6.14	.011	Sum of Wgt.	994
50%	21.0645		Mean	44.07137
		Largest	Std. Dev.	62.93503
75%	57.847	472.465		
90%	113.705	477.579	Variance	3960.818
95%	154.501	487.826	Skewness	3.442092
99%	320.69	601.418	Kurtosis	20.72089

Table 3.7: Correlation among all variables

Correlations	Log of Productivity	Agricultural Aid	Agricultural Population	Agricultural Land	Govt. Effectiveness	Gross Capital Formation	Drought	Primary Education	GFCF (Agri)
Log of Productivity	1.000								
Agricultural Aid	0.205	1.000							
Agricultural Population	0.013	0.136	1.000						
Agricultural Land	-0.113	0.080	-0.110	1.000					
Govt. Effectiveness	0.243	0.204	-0.124	-0.024	1.000				
GCF	0.021	0.115	-0.046	-0.115	0.396	1.000			
Drought	-0.074	0.151	0.085	0.075	0.034	-0.007	1.000		
Primary Education	0.207	0.042	-0.030	0.103	0.115	0.154	-0.002	1.000	
GFCF (Agri)	0.111	0.036	-0.141	-0.053	0.278	0.246	-0.095	0.178	1.000

Chapter Four

Results

The regression results obtained through OLS, Random Effects, and Fixed Effects panel analysis are given in Table - 4.1. All of the three regressions show that agricultural aid has a significant contribution in agricultural productivity during the period under study.

Pooled OLS

In Table 4.1, column 1, all estimates of pooled OLS are turned out to be significant except the agricultural dependent labor force. The coefficient of agricultural aid is significant at 10% level of confidence. By increasing one million US$ of agricultural aid, the productivity will increase by 0.13%. On the other hand, the GCF, agricultural land, and drought do have negative impact on the productivity. The reason to have negative impact of GCF might occur due to the investment activities financed and replaced by the ODA. However, the inverse relationship between land and productivity can be associated with the low soil quality, distribution of farm sizes, or omitted variable (Sial et al, 2012). According to Alabi, 2014, there has been deteriorating land (nutrient) quality in Africa, particularly in Nigeria, which causes low productivity.

Similarly, the inverse relationship of drought with the dependent variable is appropriate and obvious. In the same way, the government policy effectiveness turns out to be significant and positive. Specifically, increase of one percentile rank in the government policy effectiveness will

lead to increase the productivity by 0.009%. The role of primary education is positive and significant as expected in pooled OLS (column 1). The estimated results depict that the agriculture aid and governance indicators enhance the agricultural productivity significantly.

Fixed Effects and Random Effects

The estimates of FE and RE in column (2) and (3) respectively also determine the positive relationship between the agricultural ODA and the productivity. The FE estimates are significant at 5% level of significance and RE at 10% significance level. The coefficients depict that one million US$ increase in agriculture ODA increases the productivity by 0.018% in FE, column (2) and 0.0267% in RE, column (3). However, the coefficient of agricultural aid is slightly higher in pooled OLS estimates. The results are robust ("corrected for heteroscedasticity").

The estimates for GCF, government policy effectiveness, and agricultural land are determined insignificant though positive in FE and RE which are contrary to pooled OLS. The coefficient of governance effectiveness contributes positively to productivity as concurrent with that of Alabi (2014) findings. So we may infer that it may not be an important determinant along with agricultural ODA, and donors may not consider the effectiveness of government policies while disbursing the resources.

Theoretically, it is also maintained that disbursement of foreign resources depends upon the utilization of earlier amount which is consequent upon policy implementation and effectiveness (World Bank, 1998). So far, this variable (government policy effectiveness) may need to be explored with the timing of utilization of resources as empirically it turns out to be negative and insignificant. Similarly, the association of agricultural labor force with the productivity has been quadratic. It contributes positively as one percentage point increase in the labor force lead to

increase the productivity by 0.001%. The labor force after reaching to the maximum point decreases the dependent variable by 0.00095% which is aligned with the law of diminishing returns of labor productivity.

Further, the GCF (domestic investment) is also ascertained as insignificant which could be associated to the aid fungibility with domestic expenditures. We analyze the model without GCF in the Table 4.2 (columns 4, 5 & 6). The coefficient of agriculture aid does not deviate even after excluding the GCF from the model. We may infer that domestic investment by the governments do not contribute in increasing the level of productivity.

The Table 4.3, presents the same model by using the individual country effects under pooled OLS in column (3), which verifies the fixed effects estimates. The column 3 presents the similar results as already estimated under fixed effects column (1).

Quintile Regression

The scatter plot and detailed description of productivity and agriculture ODA depict that there is difference in productivity among some countries though their other characteristics are not much different. Similarly, some countries get more aid than others. In order to check the robustness of fixed effects results, we conduct quintile regression at Q = 0.1, 0.25, 0.5, 0.75, and 0.9 in Table 4.4. For the countries having productivity at quintile 0.5 (Median = 1646.5 kg/h) have the coefficient for aid is 0.05568, which means that one million US$ of aid will increase the productivity by 0.055% (column 5). Similarly, for countries at quintile 0.1, the coefficient of aid is even much higher.

Table 4.5 describes a comparison between all regression techniques. The quintile regression at Q = 0.1 and 0.25 (column 1 & 2) shows that the aid is much effective for the countries at these

point. In the same way, the government policy effectiveness is turned out to be positively significant but GCF become negatively significant. These estimates depict that there might be replacement of financial resources occurred as the ODA increases the domestic resources decline.

Further, in Table 4.6 we run the fixed effect model without outliers (who receive more aid; i.e. Afghanistan, Egypt, Ethiopia, and India**).** Our main variable of interest becomes insignificant by excluding these countries, though the value of coefficient does not fall. However, the other variables show the same impact and association with the dependent variable.

Chapter Five

Policy Implications and Conclusion:

Based on the estimated results, we found statistically significant and positive impact of agricultural aid, agricultural labor force, and gross primary enrolment, and negative impact of drought on the agricultural productivity in developing countries. Although the government effective policies do not have any statistically significant impact on the dependent variable yet it has turned out to have negative relationship with agriculture productivity. The results of the study are helpful for the donor agencies who are very much concerned about the aid effectiveness. In order to achieve the objectives of Sustainable Development Goals in the context of agriculture and food availability to everyone, the role of aid stands critical. By following simple calculations, the donor agencies have to increase the agricultural aid by 126 percent to get the double agricultural productivity by the year 2030 controlling for other variables. The current average aid is US$44.07 million and to reach the SDGs target the aid for this sector must be US$5555.5 million per year on average controlling for other variables.

This study has also highlighted the significant difference in aid effectiveness according to the income level of countries. It reveals that aid is relatively less effective in low income countries at GNI less than or equal to $1025 as compared to lower income countries with GNI less than or equal to $2000 (see Table: 4.7). The reasons need to be explored which could be associated with their socio-economic reasons, internal conflicts, or underdevelopment.

Appendix

Table 4.1: Panel Regression

Dependent Variable:	Log Productivity		
	Pooled OLS	Fixed Effects	Random Effects
	(1)	(2)	(3)
Agricultural Aid (US$ Million)	0.12998***	0.01804**	0.02675***
	(0.01843)	(0.00861)	(0.00884)
Agricultural Labor Force (% of total population)	-0.01461*	0.10935**	0.08481**
	(0.00849)	(0.04894)	(0.04114)
Agricultural Land (% of total land)	-0.00507***	0.00497	0.00126
	(0.00116)	(0.00439)	(0.00335)
Gross Primary Enrolment (% of enrolment)	0.00704***	0.00313**	0.00378***
	(0.00093)	(0.00150)	(0.00134)
Gross Capital Formation (% of GDP)	-0.01076***	0.00058	0.00098
	(0.00250)	(0.00190)	(0.00188)
GFC(agri)	0.38199	-0.24374	0.03498
	(0.54729)	(0.51958)	(0.52687)
Govt. policy effectiveness (Percentile Rank)	0.00921***	-0.00016	0.00027
	(0.00132)	(0.00149)	(0.00151)
Drought (Number of occurrence)	-0.20850***	-0.06410***	-0.06772***
	(0.05546)	(0.02285)	(0.02215)
Sq. Agricultural Labor Force (% of total population)	0.00013*	-0.00102***	-0.00077**
	(0.00007)	(0.00038)	(0.00032)
Constant	7.26160***	4.26844**	4.80143***
	(0.28459)	(1.63868)	(1.36674)
Observations	966	966	966
R-squared	0.164	0.151	

Standard errors in parentheses
* $p < .1$, ** $p < .05$, *** $p < .01$

Table 4.2: Fixed Effects Regression

Dependent Variable:	Log Productivity					
	Fixed Effects Regression					
	(1)	(2)	(3)	(4)	(5)	(6)
Agricultural Aid (US$ Million)	0.01857**	0.01640*	0.01639*	0.01804**	0.01690**	0.01809**
	(0.00916)	(0.00836)	(0.00850)	(0.00861)	(0.00820)	(0.00868)
Agricultural Labor Force (% of total population)	0.11168**	0.11096**	0.11101**	0.10935**	0.10034**	0.10946**
	(0.04863)	(0.04866)	(0.04860)	(0.04894)	(0.04711)	(0.04873)
Agricultural Land (% of total land)	0.00599	0.00558	0.00557	0.00497	0.00505	0.00516
	(0.00429)	(0.00425)	(0.00436)	(0.00439)	(0.00420)	(0.00431)
Gross Primary Enrolment (% of enrolment)		0.00304**	0.00304**	0.00313**	0.00338**	0.00320**
		(0.00150)	(0.00149)	(0.00150)	(0.00144)	(0.00150)
Gross Capital Formation (% of GDP)		0.00063	0.00063	0.00058		
		(0.00191)	(0.00191)	(0.00190)		
Gross Fixed Capital Formation (Agriculture)		-0.22263	-0.22212	-0.24374		-0.22923
		(0.50653)	(0.50808)	(0.51958)		(0.53497)
Govt. policy effectiveness (Percentile Rank)			-0.00006	-0.00016		-0.00011
			(0.00148)	(0.00149)		(0.00149)
Drought (Number of occurrence)				-0.06410***	-0.06380***	-0.06424***
				(0.02285)	(0.02258)	(0.02295)
Sq. Agricultural Labor Force (% of total population)	-0.00109***	-0.00104***	-0.00104***	-0.00102***	-0.00095***	-0.00102***
	(0.00037)	(0.00038)	(0.00038)	(0.00038)	(0.00035)	(0.00037)
Constant	4.67147***	4.20094**	4.20082**	4.26844**	4.50435***	4.26990**
	(1.57989)	(1.62334)	(1.62335)	(1.63868)	(1.60424)	(1.63767)
Observations	983	966	966	966	983	966
R-squared	0.125	0.142	0.142	0.151	0.150	0.151

Standard errors in parentheses * $p < .1$, ** $p < .05$, *** $p < .01$

Table 4.3: Panel Regression with Individual Country Effects (Pooled OLS)

Dependent Variable:	Log Productivity		
	Fixed Effects Regression	Pooled OLS	Pooled OLS with Individual Countries
	(1)	(2)	(3)
Agricultural Aid (US$ Million)	0.01804**	0.12998***	0.12998***
	(0.00861)	(0.01843)	(0.01843)
Agricultural Labor Force (% of total population)	0.10935**	-0.01461*	-0.01461*
	(0.04894)	(0.00849)	(0.00849)
Agricultural Land (% of total land)	0.00497	-0.00507***	-0.00507***
	(0.00439)	(0.00116)	(0.00116)
Gross Primary Enrolment (% of enrolment)	0.00313**	0.00704***	0.00313***
	(0.00150)	(0.00093)	(0.00082)
Gross Capital Formation (% of GDP)	0.00058	-0.01076***	0.00058
	(0.00190)	(0.00250)	(0.00163)
Gross Fixed Capital Formation (Agriculture)	-0.24374	0.38199	-0.24374
	(0.51958)	(0.54729)	(0.44422)
Govt. policy effectiveness (Percentile Rank)	-0.00016	0.00921***	-0.00016
	(0.00149)	(0.00132)	(0.00104)
Drought (Number of occurrence)	-0.06410***	-0.20850***	-0.06410***
	(0.02285)	(0.05546)	(0.02196)
Sq. Agricultural Labor Force (% of total population)	-0.00102***	0.00013*	-0.00102***
	(0.00038)	(0.00007)	(0.00023)
Constant	4.26844**	7.26160***	4.40595***
	(1.63868)	(0.28459)	(0.95646)
Observations	966	966	966
R-squared	0.151	0.164	0.922

Standard errors in parentheses
* $p < .1$, ** $p < .05$, *** $p < .01$

Table 4.4: Quintile Regression

Dependent Variable:	Log Productivity				
	Q=0.10	Q=0.25	Q=0.75	Q=0.9	Q=0.5
	(1)	(2)	(3)	(4)	(5)
Agricultural Aid (US$ Million)	0.18128***	0.12347***	0.05646**	0.07602**	0.05592**
	(0.04144)	(0.03148)	(0.02285)	(0.03676)	(0.02377)
Agricultural Labor Force (% of total population)	0.02899	-0.02016	-0.03235***	-0.01485	-0.03170***
	(0.01764)	(0.01340)	(0.00973)	(0.01565)	(0.01012)
Agricultural Land (% of total land)	0.00183	-0.00150	-0.00965***	-0.00996***	-0.00503***
	(0.00195)	(0.00148)	(0.00107)	(0.00173)	(0.00112)
Gross Primary Enrolment (% of enrolment)	0.00609***	0.00712***	0.00374***	0.00327*	0.00920***
	(0.00202)	(0.00154)	(0.00111)	(0.00179)	(0.00116)
Gross Capital Formation (% of GDP)	-0.02196***	-0.00839**	-0.00449*	0.00306	-0.00767***
	(0.00474)	(0.00360)	(0.00261)	(0.00421)	(0.00272)
Gross Fixed Capital Formation (Agriculture)	-0.53382	0.49138	1.46973**	-0.52238	2.14375***
	(1.07131)	(0.81377)	(0.59086)	(0.95050)	(0.61454)
Govt. policy effectiveness (Percentile Rank)	0.00638**	0.00974***	0.01175***	0.01191***	0.01075***
	(0.00269)	(0.00204)	(0.00148)	(0.00238)	(0.00154)
Drought (Number of occurrence)	-0.28100**	-0.18261**	-0.22070***	-0.20280*	-0.13822**
	(0.12196)	(0.09265)	(0.06727)	(0.10821)	(0.06996)
Sq. Agricultural Labor Force (% of total population)	-0.00031**	0.00014	0.00028***	0.00012	0.00026***
	(0.00015)	(0.00011)	(0.00008)	(0.00013)	(0.00008)
Constant	5.82691***	6.97535***	8.34800***	8.23743***	7.31578***
	(0.56335)	(0.42792)	(0.31070)	(0.49982)	(0.32315)
Observations	966	966	966	966	966

Standard errors in parentheses
* $p < .1$, ** $p < .05$, *** $p < .01$

Table 4.5: Robustness Check through Quintile and Panel Regressions

Dependent Variable:	Log Productivity						
	Q=0.10	Q=0.25	Q=0.75	Q=0.9	Q=0.5	FE	Pooled OLS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Agricultural Aid (US$ Million)	0.18128***	0.12347***	0.05646**	0.07602**	0.05592**	0.01804**	0.12998***
	(0.04144)	(0.03148)	(0.02285)	(0.03676)	(0.02377)	(0.00861)	(0.01843)
Agricultural Labor Force (% of total population)	0.02899	-0.02016	-0.03235***	-0.01485	-0.03170***	0.10935**	-0.01461*
	(0.01764)	(0.01340)	(0.00973)	(0.01565)	(0.01012)	(0.04894)	(0.00849)
Agricultural Land (% of total land)	0.00183	-0.00150	-0.00965***	-0.00996***	-0.00503***	0.00497	-0.00507***
	(0.00195)	(0.00148)	(0.00107)	(0.00173)	(0.00112)	(0.00439)	(0.00116)
Gross Primary Enrolment (% of enrolment)	0.00609***	0.00712***	0.00374***	0.00327*	0.00920***	0.00313**	0.00704***
	(0.00202)	(0.00154)	(0.00111)	(0.00179)	(0.00116)	(0.00150)	(0.00093)
Gross Capital Formation (% of GDP)	-0.02196***	-0.00839**	-0.00449*	0.00306	-0.00767***	0.00058	-0.01076***
	(0.00474)	(0.00360)	(0.00261)	(0.00421)	(0.00272)	(0.00190)	(0.00250)
Gross Fixed Capital Formation (Agriculture)	-0.53382	0.49138	1.46973**	-0.52238	2.14375***	-0.24374	0.38199
	(1.07131)	(0.81377)	(0.59086)	(0.95050)	(0.61454)	(0.51958)	(0.54729)
Govt. policy effectiveness (Percentile Rank)	0.00638**	0.00974***	0.01175***	0.01191***	0.01075***	-0.00016	0.00921***
	(0.00269)	(0.00204)	(0.00148)	(0.00238)	(0.00154)	(0.00149)	(0.00132)
Drought (Number of occurrence)	-0.28100**	-0.18261**	-0.22070***	-0.20280*	-0.13822**	-0.06410***	-0.20850***
	(0.12196)	(0.09265)	(0.06727)	(0.10821)	(0.06996)	(0.02285)	(0.05546)
Sq. Agricultural Labor Force (% of total population)	-0.00031**	0.00014	0.00028***	0.00012	0.00026***	-0.00102***	0.00013*
	(0.00015)	(0.00011)	(0.00008)	(0.00013)	(0.00008)	(0.00038)	(0.00007)
Constant	5.82691***	6.97535***	8.34800***	8.23743***	7.31578***	4.26844**	7.26160***
	(0.56335)	(0.42792)	(0.31070)	(0.49982)	(0.32315)	(1.63868)	(0.28459)
Observations	966	966	966	966	966	966	966
R-squared						0.151	0.164

Standard errors in parentheses * $p < .1$, ** $p < .05$, *** $p < .01$

Table 4.6: Fixed Effects Regression without Outlier

Dependent Variable:	Log Productivity	
	Fixed Effects Regression	
	Full Sample(1)	Without Outlier(2)
Agricultural Aid (US$ Million)	0.01804**	
	(0.00861)	
Agricultural Aid (W/o Outlier) (US$ Million)		0.00046
		(0.00027)
Agricultural Labor Force (% of total population)	0.10935**	0.10870**
	(0.04894)	(0.04887)
Agricultural Land (% of total land)	0.00497	0.00504
	(0.00439)	(0.00436)
Gross Primary Enrolment (% of enrolment)	0.00313**	0.00307**
	(0.00150)	(0.00150)
Gross Capital Formation (% of GDP)	0.00058	0.00049
	(0.00190)	(0.00192)
Gross Fixed Capital Formation (Agriculture)	-0.24374	-0.26180
	(0.51958)	(0.51670)
Govt. policy effectiveness (Percentile Rank)	-0.00016	-0.00026
	(0.00149)	(0.00148)
Drought (Number of occurrence)	-0.06410***	-0.06136**
	(0.02285)	(0.02354)
Sq. Agricultural Labor Force (% of total population)	-0.00102***	-0.00101***
	(0.00038)	(0.00037)
Constant	4.26844**	6.97535***
	(1.63868)	(0.42792)
Observations	966	954
R-squared	0.151	0.147

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4.7: Fixed Effects Regression for Low Income Countries

Dependent Variable:	Log Productivity		
	Fixed Effects	Low Income Counties	Random Effects
	(1)	(2)	(3)
Agricultural Aid (US$ Million)	0.01804**	0.01693*	0.01774**
	(0.00861)	(0.00853)	(0.00873)
Agricultural Labor Force (% of total population)	0.10935**	0.11131**	0.11896**
	(0.04894)	(0.04846)	(0.04895)
Agricultural Land (% of total land)	0.00497	0.00567	0.00629
	(0.00439)	(0.00430)	(0.00440)
Gross Primary Enrolment (% of enrolment)	0.00313**	0.00313**	0.00289**
	(0.00150)	(0.00150)	(0.00144)
Gross Capital Formation (% of GDP)	0.00058	0.00047	0.00043
	(0.00190)	(0.00188)	(0.00184)
GFC(agri)	-0.24374	-0.33458	-0.34484
	(0.51958)	(0.49713)	(0.51461)
Govt. policy effectiveness (Percentile Rank)	-0.00016	-0.00001	-0.00053
	(0.00149)	(0.00143)	(0.00150)
Drought (Number of occurrence)	-0.06410***	-0.06550***	-0.06540***
	(0.02285)	(0.02294)	(0.02258)
Sq. Agricultural Labor Force (% of total population)	-0.00102***	-0.00102***	-0.00109***
	(0.00038)	(0.00038)	(0.00037)
Low Income Countries (GNI<=$1025)		-0.04784	
		(0.03061)	
Low Income Countries (GNI<=$2000)			0.08171***
			(0.02934)
Constant	4.26844**	4.12645**	3.91161**
	(1.63868)	(1.60266)	(1.63131)
Observations	966	966	966
R-squared	0.151	0.151	0.162

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4.8: List of Countries

Afghanistan	Chad	Ghana	Laos	Nepal	Sri Lanka	Vietnam
Armenia	Comoros	Guatemala	Lesotho	Nicaragua	Sudan	West Bank, Gaza
Bangladesh	Congo	Guinea	Liberia	Niger	Swaziland	Yemen
Benin	Congo Republic	Guinea-Bissau	Madagascar	Nigeria	Syria	Zambia
Bhutan	Cote d'Iviore	Guyana	Malawi	Pakistan	Tajikistan	Zimbabwe
Bolivia	Djibouti	Haiti	Mali	Papua New Guinea	Tanzania	
Burkina Faso	Egypt	Honduras	Mauritania	Philippines	Timor Leste	
Burundi	El Salvador	India	Micronesia	Rwanda	Togo	
Cabo-Verde	Eritrea	Indonesia	Moldova	Sao Tome	Uganda	
Cambodia	Ethiopia	Kenya	Morocco	Senegal	Ukraine	
Cameroon	Gambia	Kiribati	Mozambique	Sierrra Leone	Uzbekistan	
Central African Republic	Georgia	Kyrgstan	Myanmar	Solomon Island	Vanuatu	

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