

**IMPACT OF TYPE OF AGRICULTURAL ODA ON POVERTY
REDUCTION**

By

WON, Jiyeon

THESIS

Submitted to

KDI School of Public Policy and Management

In Partial Fulfillment of the Requirements

For the Degree of

MASTER OF DEVELOPMENT POLICY

2018

Professor Kye Woo LEE

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Committee in charge:

Professor Kye Woo LEE, Supervisor



Professor ChangYong CHOI


Changyong Choi

Professor Chrysostomos TABAKIS



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Jiyeon Won

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Abstract

Impact of Type of Agricultural ODA on Poverty Reduction

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Jiyeon Won

The purpose of this study is to identify and analyze the relationships between agricultural ODA and poverty reduction in developing countries. In this paper, empirical study is conducted to identify the impact of agricultural ODA by types. According to the regression result estimated by the fixed effect model, agricultural development ODA is negatively significant. In short, if a particular agricultural ODA increases, the child mortality rate decreases, which is the proxy indicator of poverty rate in this paper.

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1. Introduction

The purpose of this thesis is to analyze which type of agriculture ODA projects decrease child mortality rate, which is one of the indicators of poverty rate. Since most of least developed countries, where poverty rate is high, regard the development of agricultural sector as an engine of economic growth, analyzing the significance between agricultural ODA projects and economic growth rates. There have been many studies that proved the hypothesis that agriculture development leadsto the economic development through the agricultural sector. However, the premise that a specific type of agriculture ODA has significant relationship with the poverty reduction has never been proved in a scientific manner. Therefore, this study focus on the question whether ODA for agriculture really improves child mortality rate in rural areas, and which type of ODA among the agriculture ODA has the most significant effects on poverty.

In 2000, the Millennium Development Goals (MDGs) was adopted to reduce extreme poverty. Through MDGs, the important framework for development and significant progress has been made in various countries. Despite huge progress have been made, about 800 million people still live in extreme poverty and suffer from hunger. Besides, about 16,000 children die each day before celebrating their fifth birthday, which means the maternal mortality ratio in the developing countries is 14 times higher than in the developed countries. On 1st of January 2016, the world then began to have a new 2030 agenda, called Sustainable Development Goals (SDGs) for inclusive and sustainable development. 17 of aspirational objectives and 169 of targets were set for guide actions of governments, civil society, and international organizations. Among the SDGs, poverty eradication was settled as the first goal to make all people everywhere, including the most vulnerable, should be assure of a basic standard of living and social protection benefits (United Nations, 2016). Before implementing this strategy in rural areas of the least developing countries, we have to make sure the premise that certain type of agriculture ODA improve the child mortality which represents the poverty reduction.

Therefore, this study deals with a research question of the relationship between ODA for agricultural sectors and the impact to the child mortality in rural areas. For this purpose, this study aims to test the following two hypotheses: the ODA for agriculture reduces child mortality in rural areas; Second, certain agriculture ODA has the most significant correlation with the child mortality rate reduction . For this test, we use the methodology of fixed-effect model with Hausman-test. The model will be estimated with data collected from World Bank data, OECD CRS, and FAO. The empirical test proved that the relationship between various types of agricultural ODA and poverty reduction is statistically significant in low and middle income developing countries.

The rest of this paper is structured as follows. The next section deals with a review of literature related to the impact of ODA, The third section deals with the overall current situation of poverty and child mortality. The fourth section explains methodology and variable settings. The fifth section identifies the findings of the study. Finally, the last section concludes the result of the study with policy suggestion.

2. Literature Review

2.1. Impact of ODA on Growth of Developing Countries

According to the OECD, Official Development Assistance(ODA) is defined as government aid designed to promote the economic development and welfare of developing countries. The empirical studies regarding the impact of foreign aid on economic growth have been conducted by the numerous researchers.

Harrod-Domar's growth model (Harrod, 1948; Domar, 1947) is the most well-known formulation of the gap theory. This model presumes that there is an excess supply of labor and that growth is constrained only by the availability and productivity of capital. However, since savings in developing countries are likely to be too low to achieve a target growth rate. In other

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words, foreign aid was needed in order to relieve the savings constraint and increase investment thus leading to economic growth.

Many empirical studies about the impact of foreign aid on economic development was conducted based on the gap theory. However, there have been debate that the connection between aid and savings is not as clear cut as had been analyzed earlier. Griffin and Enos (1970) expressed that the declaration from claiming gap models that foreign aid leads to a one-to-one increase in savings, arguing that unless an aid recipients' marginal propensity to save is equal to 1, a part of foreign aid will be allocated to consumption rather than savings. During the 1980s, Mosley *et al.*(1987) made a significant work to the literature by incorporating lagged aid variables into his model and by accounting for the potential endogeneity of aid. In the paper, they found that there is no statistically significance between aid and growth, using various sub-periods and samples of developing countries.

However, since the late 1990s, analyzing the “effectiveness” of aid has been important to donor countries in order to shape their donor policy. Later, in 2000, Burnside and Dollar founded that aid had a positive impact on growth for developing countries with good fiscal, monetary and trade policies in place, but had little impact for those countries with poor policies. This paper, therefore, can explains the reason of aid which had been found to have little positive impact on growth in past empirical studies.

Since agriculture is the major industry in the most of developing countries, there also have been theoretical and empirical discussions about the relationship between agriculture ODA and the economic growth in developing countries. However, the point of view that since the population in rural area is high and the agricultural sector a large part of shares to the total GDP, the precondition of the economic development is the agricultural development (Meuerink & Roza, 2007; Awokuse 2009) was suggested.

2.2. Impact of Agriculture ODA on poverty reduction in Developing Countries

Based upon the studies on agriculture ODA's impact on economic growth, Addison *et al.* (2005) suggested that aid will reduce poverty through growth when aid itself used for investment to raise the livelihood of the poor through the poverty-elasticity of growth.

Schneider & Gugerty (2011) claimed that the comprehensive development method for poverty reduction is agricultural development. They argued that agriculture-led economic growth is more effective by 20% on income increase and welfare improvement than non-agriculture-led economic growth. Furthermore, development in agriculture sector generally led great impact to reduce the poverty rate. According to Delgado (2010), he founded that 1% of increase in agricultural sector in GDP improves 30% of poor's income. In World Bank Report (2007), they concluded that the poverty reduction in developing countries' rural residents by agriculture development has two-fold to forth-fold effect than the development of non-agricultural sector. Similarly, Dewbre (2010) also claimed that the country where experienced poverty reduction and economic growth faster than other countries, had been bigger income increase of rural people than non-rural people.

Moreover, in the paper produced by DFID(2004), they highlighted the close correlation between different rates of poverty alleviation over the past 50 years and the rate of agricultural productivity growth. The authors find links between agriculture and poverty reduction as being forged through several transmission instruments that are change of income level, food price, and the generation of economic opportunity. In addition, Bresciani and Valdes (2007) frame their analysis in terms of three key channels they say links agricultural growth to poverty: 1) labor market, 2) farm income, and 3) food prices. They provide a theoretical framework for examining the quantitative importance of the various channels and then present findings from six country

case studies. They concluded that when both the direct and indirect effects of agricultural growth are taken into account after the agricultural productivity grew; such growth is more poverty reducing than growth in nonagricultural sectors.

While most empirical studies show that the agricultural aid for the growth is relatively more important, there are exceptions, underscoring the existence of potentially important differences in the sectoral GDP growth elasticities of poverty across countries, depending on the structure and institutional organization of their economies (Loayza and Raddatz, 2006). A common finding is that the poverty reducing powers of agriculture declines as countries get richer (Christiansen and Demery, 2007; Ligon and Sadoulet, 2008). Also, according to the Gardner (2000), for example, found that earnings in income from off-farm sources was the main reason rural poverty declined in the US from the 1960s. From the paper, the author argued that the export market is important for the prosperity of US farm income.

However, since the incidence of poverty tends to be higher in agricultural and rural population than elsewhere, and most of poor live in rural areas that a large share of them depend on agriculture for living, which type of agriculture ODA impacts on the poverty reduction most should be analyzed. Although there have been number of empirical studies to figure out the relationship between agriculture aid and the economic growth, most of studies conducted before the SDGs declaration. Since the SDGs were set for follow-up the MDGs, there should have been assessment to estimate the impact of agriculture ODA on poverty reduction directly. Since the poverty rate is not measured annually, there is limitation to estimate the exact poverty reduction. However, since the mortality rate, which is measured every year, closely linked with the poverty rate (OECD, 2016), the mortality rate can be used for analyzing the relationship between agriculture ODA and the poverty reduction in developing countries. Therefore, this study proposes that the direct relationship should be investigated between various types of agriculture ODA and poverty reduction. Although in this paper, there is still a limitation that the poverty rate

is not indicated clearly, however, since the data of this paper is used latest, the current state of the ODA and developing countries is more well applied. Furthermore, in the past literature, they try to link agricultural ODA and poverty through analysis of the relationship between agricultural ODA and growth and then through the analysis of growth elasticity of poverty, however, in this paper, I tried to analyze the impact of agricultural ODA on poverty reduction directly.

3. Recent Trends of Developing Countries

The World Bank classified the overall countries by region, income level and lending. The most used classification is the income level which have four level, that are: 1) High-income, 2) Upper-middle, 3) Lower-middle, 4) Low income economies. To see the recent trends of developing countries', low income countries and lower-middle income countries will be compared by the world recent trends.

Table 2. World Classification by Income Level

Income Level	Country
Low income (34)	Afghanistan, Benin, Burkina Faso, Burundi, Central African Republic, Chad, Comoros, Congo, Dem. Rep, Eritrea, Ethiopia, Gambia, The, Guinea, Guinea-Bissau, Haiti, Korea Dem. People's Rep., Liberia, Madagascar, Malawi, Mozambique, Nepal, Niger, Rwanda, Senegal, Sierra Leone, Somalia, South Sudan, Syrian Arab Republic, Tajikistan, Tanzania, Togo, Uganda, Yemen, Rep., Zimbabwe
Lower-middle income (47)	Angola, Bangladesh, Bhutan, Bolivia, Cabo Verde, Cambodia, Cameroon, Congo, Rep., Côte d'Ivoire, Djibouti, Egypt, Arab Rep., El Salvador, Georgia, Ghana, Honduras, India, Indonesia, Kenya, Kiribati, Kosovo, Kyrgyz Republic, Lao PDR, Lesotho, Mauritania, Micronesia, Fed. Sts., Moldova, Mongolia, Morocco, Myanmar, Nicaragua, Nigeria , Pakistan, Papua New Guinea, Philippines, São Tomé and Príncipe, Solomon Islands, Sri Lanka, Sudan, Swaziland, Timor-Leste, Tunisia, Ukraine, Uzbekistan, Vanuatu, Vietnam, West Bank and Gaza, Zambia

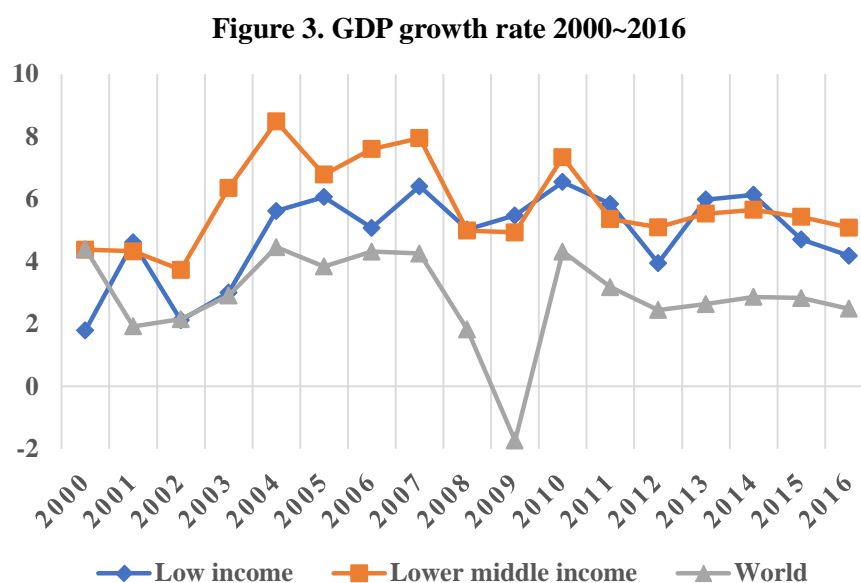
Source: World Bank Data

3.1. Overall Economy Trend

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GDP growth all over the world in 2016 was 2.5%, where low income countries grew by 4.2%. As the figure 1 shows below, economic growth trend of low-income countries, lower middle income countries and the overall world is slightly different. In the early 2000s, the trends of gdp growth rates of low income countries, lower middle income countries and the world showing similar upward. After the financial crisis in 2008, the growth rate of the world dropped rapidly the most, however, even the growth rate in low income countries also reduces, it shows stable trend. Although there has been much economic recovery from 2010, growth rate slowed down again since 2012.

However, when we look at the low income countries' GDP growth rate and other economic indicator such as production indices and population growth, it is found that there were increases steadily with the economy in the low income countries. In particular, compared to the 2000, the production indices which illustrates the relative level of the aggregate volume of agricultural production based on the sum of price-weighted quantities of different agricultural commodities each year, increased by 58% in 2016.



Source: World Bank Data

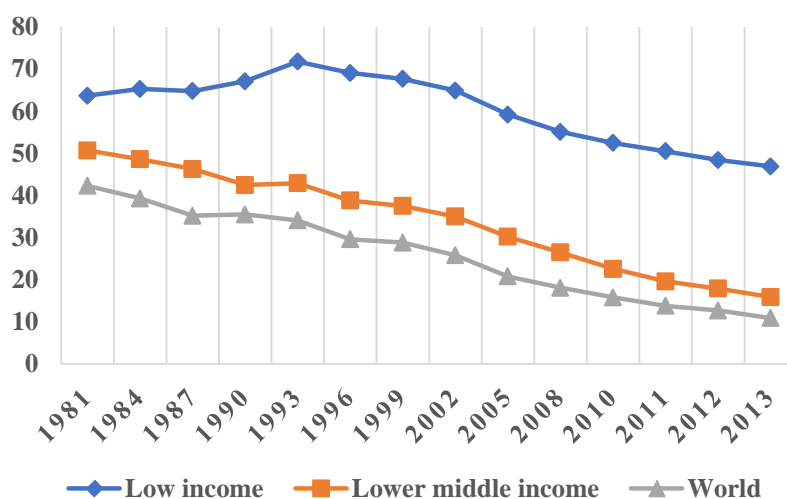
3.2. Changes in Poverty Reduction

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According to the World Bank, poverty headcount ratio at \$1.90 a day has fallen down from 42.3% to 10.9% from 1981 to 2013. This data shows the percentage of the population living on less than \$1.90 a day at 2011 international prices. There were 42 people out of 100 around the world who live on less than \$1.90 in 1981, and the number of poor reduced to 11% for the past 20 years. The achievement of poverty reduction is notable and valuable throughout the world, however, when we divide by income level, the poverty ratio reduction shows slightly different trend.

Figure 2 presents the poverty reduction by the different income levels. Poverty ratio of the countries where included in low income level, reduces slowly than lower middle income level countries and the world. The poverty ratio of low income countries has been reduced by 26% in comparison with 1981. Although, there was 26% of decrease in poverty reduction among the low income countries for about 20 years, the reduction in lower middle income countries and overall world is more dramatic.

Figure 2. Poverty headcount ratio 1981~2013



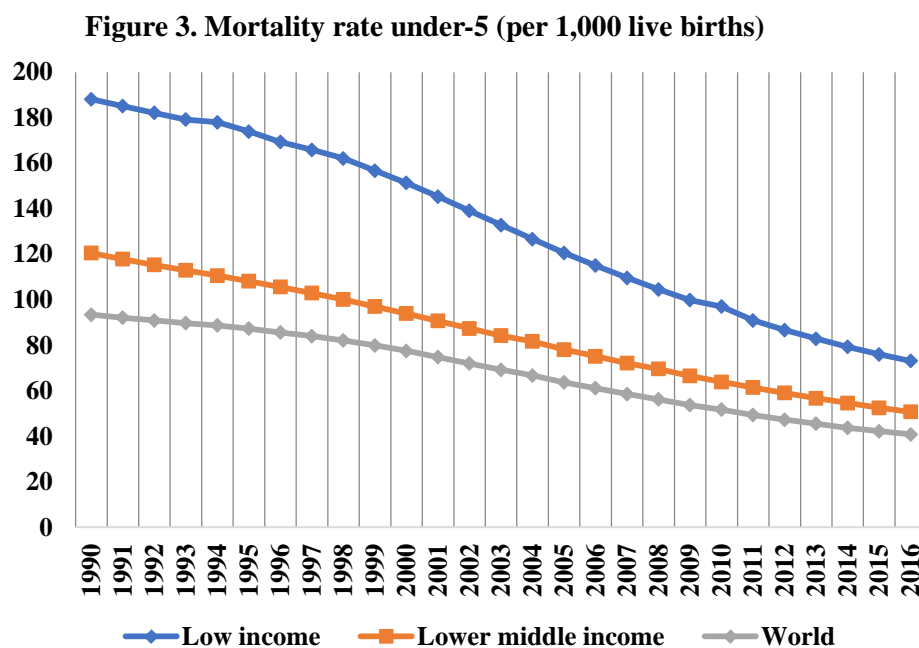
Source: World Bank Data

The reduction of poverty ratio is the great significance to the world for achieving the SDGs. To accomplish the “No poverty” and “Zero hunger”, which is one of the goals of SDGs, continuous studies should be conducted to analyze the cause and effect to find the better way for

poverty reduction of the developing countries. In spite of the progress on the poverty reduction, since there still number of poor live in low income countries, the empirical analysis about the poverty reduction in low income countries should be proceeded.

However, by using the mortality rate which is measured annually and closely related to the poverty rate, the continous vulnerable people trend can be assumed. According to the figure 3, mortality rate in low income countries shows more dramatic result than poverty headcount ratio. It is because of that the the poverty headcount ratio represents only the numerical result which means that the poverty reduction during 20 years of low income countries-where occupied 0.5% of total GDP over the world in 2016-cannot help but low.

According to the World Bank Data, in contrast with the poverty rate, child mortality rate not only represents the trend of vulnerable population but represents the progress of socioeconomic development across countries. As the graph shows below, there was huge child mortality rate reduction in the low income countries from 1990 to 2016. From 1990, the mortality rate of low income countries has reduced from 188 to 73.1. The average annual reduction of child mortality rate in low income countries is 4% and has reduced about 61% for 26 years.

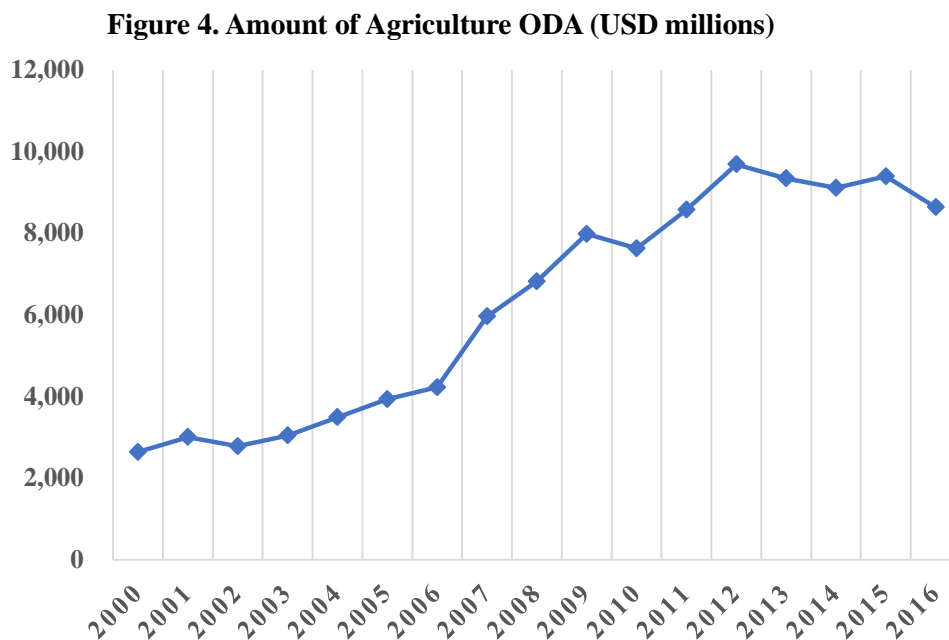


Source: World Bank Data

As stated above, child mortality rate represents both vulnerable population and the progress of socioeconomic development. According to the UNICEF, child mortality rate is influenced by various reasons that are : 1) improved family care, 2) increased access to improved water and sanitation, 3) responded rapidly to emergencies (UNICEF, 2015). It means that there was an economic growth, as well as the well-being promoted around the developing countries.

3.3. Agricultural ODA Trend

In terms of low income countries, 69% of people live in rural areas. Most of them depend on the agriculture for their livelihood, and many live in extreme poverty (World Bank, 2007). In order to alleviate the poverty across the countries, there have been sustained aid to agricultural sector. The total amount of agricultural ODA to the developing countries has increased as the figure 4 shows as below. As the graph shows, since 2006, the amount of total agricultural ODA increases rapidly. In comparison with 2000, during 16 years, there was over 227% of increases in agricultural ODA to the developing countries. Among the agricultural ODA, 52% amount of aid inflows to the Africa, and 24% amount of aid inflows to the Asia.

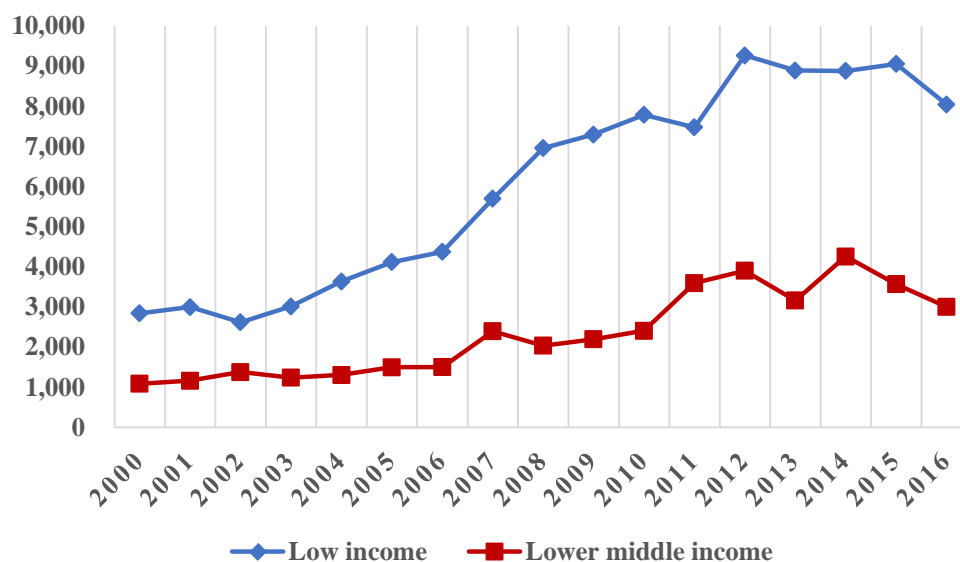


Source: OECD CRS

Figure 5 shows the agriculture ODA to the developing countries by income group.

Agriculture ODA progressively increases from the early 2000's among the low income countries. Similarly, agriculture ODA trends to the lower middle income countries increases progressively however, compare to the low income countries, there was stable increases to the lower middle income countries.

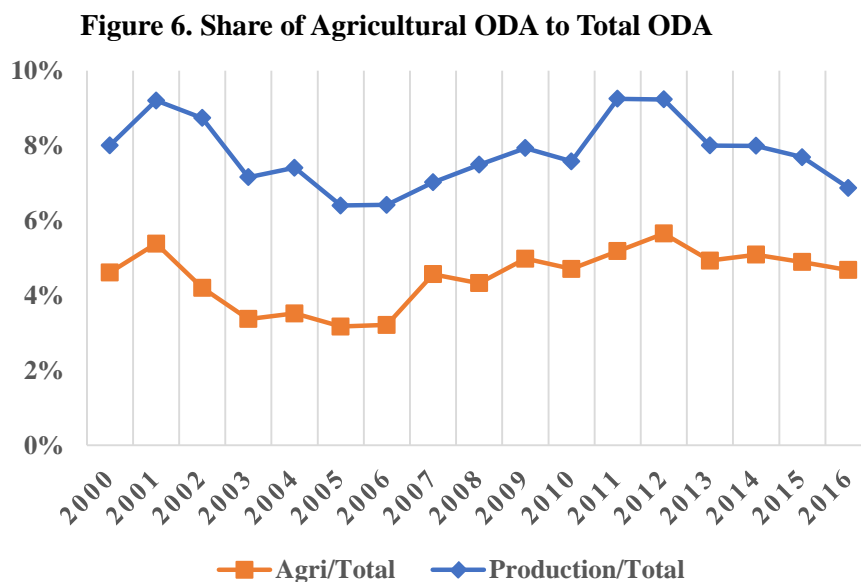
Figure 5. Agriculture ODA Trend by Income group (USD millions)



However, if we compare the amount of agricultural ODA with the total amount of ODA, it is found that there was stable aid to agricultural sector. The average of agricultural ODA to the total ODA is 4.5% during 2000 to 2016. Although the share of agricultural sector has decreased rapidly from 2001 to 2005, however, the share of the ODA has recovered the average in 2006, which is 4 to 5%, until now. The agricultural ODA ratio has been stable for a long time, which means that agricultural ODA has been in competition with other subsectors.

Moreover, when we compare to the other sector of ODAs, the share of agricultural ODA highly regarded as one of the significant subsectors. In OECD Creditor Reporting System (OECD CRS), they categorized all the ODA as a code by sectors such as education, health, governance, and agriculture et al. According to the CRS code, the agricultural ODA is composed of one of the broad sector called production sector. The production sector annually occupied about 8% of total ODA, and agricultural ODA occupied about 67% of production sector. Figure 5 represents that

the competition with other subsectors is so keen that the share of agriculture in the total production sector has not been changed much in recent years.



Source: OECD CRS

Over all, while the agricultural ODA increases and maintain stable share of total ODA, poverty rate and child mortality rate reduce simultaneously. In fact, there will be various reasons of poverty/child mortality rate reduction, however, if the hypothesis that “agricultural ODA is negatively significant to the poverty” is true, agricultural ODA could be one of the significant variables for poverty reduction.

4. Empirical Evaluation Method and Data

4.1. Modelling and Variable Setting

This paper will use Panel data analysis based on the “2014-2016 Recipient countries list” from OECD/DAC. The recipient countries list will be divided by income level. Panel data analysis has several advantages: (1) while the cross-sectional model estimates only static relationship, panel data analysis estimates dynamic relationship, (2) panel data analysis considers the unobserved heterogeneity which decreases model misspecification, (3) provide variability that

will give an efficient estimator ultimately, (4) in linear regression model, the problem of multi-collinearity is alleviate. However, there also limitations with the panel data analysis that are: (1) inefficiency caused by omitted variables brings identification problem with the parameter, (2) group-wise correlation between panel groups, (3) if the panel group is individual, the length of time variable is short.

Panel data analysis is composed of “Random-effect model” and “Fixed-effect model”. For the empirical study, fixed-effect model will be used to clarify the heterogeneity of income characteristics across the developing countries. Also, the decision whether random-effect model used or fixed-effect model for the empirical study is made through the Hausman-test. After examine the Hausman-test, it is found that fixed-effect model is more proper than random-effect model for this study.

However, before making the equation of the analysis, the type of agricultural ODA should be identified. There are 18 of subsectors in total agricultural ODA. According to the OECD CRS, the details about the descriptions are explained as the table 1. Agricultural ODA is provided to the developing countries in variety of types for different situations. As the table 1 shows below, the range of using agricultural ODA is wide and specific, that can be used for the inclusive agricultural development.

Table 2. Agricultural ODA Classification

CRS code	Description	Clarifications
31110	Agricultural policy and administrative management	Agricultural sector policy, planning and programmes; aid to agricultural ministries; institution capacity building and advice; unspecified agriculture.
31120	Agricultural development	Integrated projects; farm development.
31130	Agricultural land resources	Including soil degradation control; soil improvement; drainage of water logged areas; soil desalination; agricultural land surveys; land reclamation; erosion control, desertification control.
31140	Agricultural water resources	Irrigation, reservoirs, hydraulic structures, ground water exploitation for agricultural use.
31150	Agricultural inputs	Supply of seeds, fertilizers, agricultural machinery/equipment.

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31161	Food crop production	Including grains (wheat, rice, barley, maize, rye, oats, millet, sorghum); horticulture; vegetables; fruit and berries; other annual and perennial crops. [Use code 32161 for agro-industries.]
31162	Industrial crops/export crops	Including sugar; coffee, cocoa, tea; oil seeds, nuts, kernels; fibre crops; tobacco; rubber. [Use code 32161 for agro-industries.]
31163	Livestock	Animal husbandry; animal feed aid.
31164	Agrarian reform	Including agricultural sector adjustment.
31165	Agricultural alternative development	Projects to reduce illicit drug cultivation through other agricultural marketing and production opportunities (see code 43050 for non-agricultural alternative development).
31166	Agricultural extension	Non-formal training in agriculture.
31181	Agricultural education/training	
31182	Agricultural research	Plant breeding, physiology, genetic resources, ecology, taxonomy, disease control, agricultural bio-technology; including livestock research (animal health, breeding and genetics, nutrition, physiology).
31191	Agricultural services	Marketing policies & organisation; storage and transportation, creation of strategic reserves.
31192	Plant and post-harvest protection and pest control	Including integrated plant protection, biological plant protection activities, supply and management of agrochemicals, supply of pesticides, plant protection policy and legislation.
31193	Agricultural financial services	Financial intermediaries for the agricultural sector including credit schemes; crop insurance.
31194	Agricultural co-operatives	Including farmers' organisations.
31195	Livestock/veterinary services	Animal health and management, genetic resources, feed resources.

Source: OECD CRSad

Among those type of agricultural ODAs, 5 types of the major agricultural ODAs will be used for analysis. The major agricultural ODAs are decided in order of volume in 2016. First variable of the study will be “Agricultural development” which shares 34% to the total agricultural ODA. Second variable will be “Agricultural policy and administrative management”, which shares 24%. Third variable will be “Agricultural water resource”, which shares 9%. Fourth variable will be will be “Agricultural research”, which shares 6%, Finally, “Agricultural financial services” which shares 6% of the total agricultural ODA will be used.

The basic equation used in this paper is as follows:

$$\text{chilmort}_{it} = \alpha + \beta_1 \text{gdp} + \beta_2 \text{agripolad} + \beta_3 \text{agridev} + \beta_4 \text{agriwat} + \beta_5 \text{agriresear} + \beta_6 \text{agrifinserv} + \varepsilon_i$$

.....(1)

where

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i and t: country and year (during 2000~2016)

chilmort: child mortality rate(under 5)

gdp: GDP

agripoladgdp: ODA for agriculture policy and administrative management/GDP

agridevgdp: ODA for agriculture development /GDP

agriwatgdp: ODA for agricultural water resource/GDP

agrireseargdp: ODA for agricultural research/GDP

agrifinservgdp: ODA for agricultural financial services/GDP

In this paper, I will conduct the empirical study to identify the effect of agricultural ODAs to the child mortality rate, which reduces poverty rate ultimately. The dependent variable of the equation will be child mortality rate collected from World Bank. Child mortality rate that used in this paper is the probability per 1,000 that a newborn baby will die before reaching age five.

4.3 Expected Results and the Limitation of the Study

Nevertheless, since analysis about the impact of agricultural ODA on poverty reduction by its types have not been conducted much before, this paper can be one of the guidelines for agricultural ODA policy making. By the empirical study, it is expected that all the independent variables have negative relationship with the dependent variable. Which means that if the major agricultural ODA increases, the child mortality rate decreases across the countries. Also, it is expected that the larger volume of ODA, the much greater significance to the dependent variable. Since “agriculture development” shares 34% of the total agricultural ODA, the variable will be

the most significant.

Since, the poverty rate data in low income countries and other developing countries is not measured every year, child mortality rate-closely related to poverty rate-will be used as an indicator. However, child mortality rate is more closely related to the health, it can be the limitation of this paper. The main issue-which is lack of direct data such as poverty rate-will be reinforce further soon after the data updated.

5. Empirical Test Findings

The number of observed countries is 78 where randomly chosen among the low income countries and lower middle income countries. For the regression analysis, 5 variables have regarded as indicators that are: 'agricultural development', 'agricultural policy and administrative management', 'agricultural water resources', 'agricultural research', and 'agricultural financial services' from 2000 to 2016. Since these 5 out of 18 types agricultural ODA share almost whole amount of agricultural ODA, the analysis conducted with these variables.

5.1. Overall Regression Result

The estimation result by using the fixed-effect model is as below. As expected, all the variables have negative relationship with child mortality rate. According to the result, 'GDP' and 'agricultural development' are statistically significant to the child mortality reduction at the 5 percent level. However, 'agricultural policy and administrative management', 'agricultural research', and 'agricultural financial services' are statistically insignificant.

Figure 7. Fixed-effect Model

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Fixed-effects (within) regression		Number of obs =		1,326		
Group variable: countrysna-de		Number of groups =		78		
R-sq:		within =		0.0558		
		between =		0.0024		
		overall =		0.0084		
corr(u_i, Xb) =		-0.1161		F(6,1242) =		
				12.22		
				Prob > F =		
				0.0000		
chilmort	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
gdpmillion	-.0000487	6.68e-06	-7.30	0.000	-.0000618	-.0000356
agripoladgdp	2.142256	1.979768	1.08	0.279	-1.741804	6.026315
agrdevgdp	-7.833783	1.915729	-4.09	0.000	-11.5922	-4.075361
agriwatgdp	-5.289659	3.211733	-1.65	0.100	-11.59068	1.011363
agrifireseargdp	1.188061	7.755547	0.15	0.878	-14.02736	16.40348
agrifinservgdp	-5.608322	9.086756	-0.62	0.537	-23.43541	12.21877
_cons	79.6559	.7764033	102.60	0.000	78.1327	81.17911
sigma_u	41.351387					
sigma_e	19.981365					
rho	.81070717	(fraction of variance due to u_i)				
F test that all u_i=0: F(77, 1242) =				68.73		Prob > F =
						0.0000

Specifically, if 1 percentage point of agricultural development is provided to the developing countries, there will be 7.8% of child mortality rate reduction. Among the independent variables, GDP and agricultural development has the strong relationship with the child mortality rate, while, agricultural policy and administrative management, agricultural water resource, agricultural research, and financial services have no significance with the child mortality rate.

Figure 8. Random-effect Model

Random-effects GLS regression		Number of obs =		1,326		
Group variable: countrysna-de		Number of groups =		78		
R-sq:		within =		0.0557		
		between =		0.0029		
		overall =		0.0091		
corr(u_i, X) =		0 (assumed)		Wald chi2(6) =		
				71.46		
				Prob > chi2 =		
				0.0000		
chilmort	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
gdpmillion	-.0000474	6.52e-06	-7.28	0.000	-.0000602	-.0000347
agripoladgdp	2.460603	1.984611	1.24	0.215	-1.429162	6.350369
agrdevgdp	-7.513274	1.918684	-3.92	0.000	-11.27383	-3.752722
agriwatgdp	-5.035664	3.219053	-1.56	0.118	-11.34489	1.273564
agrifireseargdp	2.303235	7.777829	0.30	0.767	-12.94103	17.5475
agrifinservgdp	-5.409325	9.114316	-0.59	0.553	-23.27306	12.45441
_cons	79.46278	4.436583	17.91	0.000	70.76724	88.15833
sigma_u	38.424783					
sigma_e	19.981365					
rho	.78714564	(fraction of variance due to u_i)				

The result of random-effect model is similar with the fixed-effect model. GDP and

agricultural development type of ODA has the negative relationship with the child mortality rate. Also, agricultural policy and administrative management, agricultural water resource, agricultural land resource, agricultural research, and financial services, have no significant relationship. Although there is no much difference between two models, Hausman test should be conducted for unbiased estimation. Since Hausman test considers in time invariant variables and estimates the coefficient of such variables efficiently, as well as controls potentially endogenous variables, Hausman test should be followed up to decide either fixed or random effect model will be used.

According to the Hausman-test result, as shown below, since the p-value under 0.05, which means $cov(X_{it}, \mu_i) \neq 0$, the null hypothesis can be rejected, and fixed-effect model is more appropriate for the estimation.

Figure 9. Hausman-test

	Coefficients		(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
	(b) FE	(B) RE		
gdpmillion	- .0000487	- .0000474	-1.30e-06	1.58e-06
agripoladgdp	2.142256	2.460603	-.3183476	.1115525
agrdevgdp	-7.833783	-7.513274	-.3205089	.1352581
agriwatgdp	-5.289659	-5.035664	-.2539945	.1902579
agriresear~p	1.188061	2.303235	-1.115174	.3734373
agrifinser~p	-5.608322	-5.409325	-.1989966	.4061301

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

 $chi2(5) = (b-B)' [(V_b-V_B)^{-1}] (b-B)$
 $= 13.59$
 Prob>chi2 = 0.0184

In compliance with the result Hausman-test, this study should be conducted by the fixed-effect model. However, figure 9 shows the summarized result of the study GDP and agricultural development type of ODA are statically significant. Although, agricultural water resource, agricultural financial service type of ODA is also negatively significant, it is not strong than other variables.

Figure 10. Regression Result

Variable	FE	RE
gdpmillion	-0.000***	-0.000***
agripoladgdp	2.142	2.461
agrdevgdp	-7.834***	-7.513***
agriwatgdp	-5.290	-5.036
agriresear~p	1.188	2.303
agrifinser~p	-5.608	-5.409
_cons	79.656***	79.463***

legend: * p<.05; ** p<.01; *** p<.001

5.2. Regression Result by Income Level

However, when the analysis conduct by income levels, different result is founded. Figure 11 represents the regression result by income level across the countries. The left one is the result of ‘Low Income Countries’ and the right one is the result of ‘Lower Middle Income Countries’. As the figure shows, GDP and agricultural development ODA are more significant across the low income countries, however, it seems there is no significant relationship with agricultural ODAs and poverty reduction to the lower middle income countries.

In case of low income countries, it is found that there is negative relationship between the agricultural ODAs and the mortality rate except the ‘agricultural policy & administrative management’ and ‘agricultural research’. It supports the claim that there is no positive and negative impact of agricultural policy and administrative ODA to the development countries, which has regarded as the essential element for combating income inequality in the rural area(Khuhro at al. 2012). However, the table represents the GDP and ‘agricultural development’ is significant among the 6 variables. On the contrary, with the lower middle income countries, it is found that the changes of GDP is the most significantly related to the child mortality rate reduction. The table of lower middle income countries represents that agricultural ODA is less important than low income countries.

¹ “FE” and “RE” in the figure 10 means fixed-effect model and random-effect model respectively.

Figure 11. Regression Result by Income Level(low income countries(L) lower middle income countries(R))

Variable	FE	RE	Variable	FE	RE
gdpmillion	-0.003***	-0.002***	gdpmillion	-0.000***	-0.000***
agripoladgdp	1.013	1.228	agripoladgdp	0.946	0.934
agrdevgdp	-11.284***	-11.747***	agrdevgdp	5.551*	5.513*
agriwatgdp	-7.303	-7.046	agriwatgdp	0.192	0.098
agriresear~p	-6.713	-6.002	agriresear~p	12.417	12.415
agrifinser~p	-8.414	-7.560	agrifinser~p	-8.871	-9.105
_cons	135.514***	134.605***	_cons	59.888***	59.786***
legend: * p<.05; ** p<.01; *** p<.001			legend: * p<.05; ** p<.01; *** p<.001		

Through the separated analysis, several findings identified: 1) agricultural ODA has negative impact to the low income countries except agriculture policy & administrative management, 2) among agricultural ODAs, ‘agricultural development’ is strongly related to the child mortality rate, 3) GDP growth is important to both group of countries.

6. Conclusion and Recommendation

6.1. Summary of the Study

Although agricultural improvement in developing countries has been considered as one of the most important tools for economic growth and poverty reduction, analysis on the agriculture in developing countries has been challenged. However, ever since the MDGs and SDGs adopted in 2000 and 2016 respectively, it has been such a great duty for the developed countries even for the developing countries to achieve the world’s common purpose. Since the MDGs has adopted, studies to estimate how the poverty reduced effectively. However, due to the lack of statistics data in developing countries such as Africa and South Asia, estimation was insufficient. Moreover, since the health and education sector were more intensively studied than agriculture, there has been no specific analysis on the agriculture.

By using the developing countries data collected from the WB, OECD, and FAO, over the period 2000~2016, this paper has estimated the agricultural ODA impacts on the poverty

reduction by different type of ODA. Overall, according to the result of fixed effect model, the expansion of agricultural ODA would lead to the decline of poverty rate. Particularly, 'agricultural development', which is the integrated projects and farm development is significantly negatively related to the child mortality rate of developing countries. However, when the analysis was conducted by income level, the priority is identified. In low income countries, 'agricultural development' ODA is the most significant and has largest impact on the dependent variable. Besides, in lower middle countries, among the agricultural ODAs, only the 'agricultural financial service' has the negative impact but not significant, however, GDP has the significant impact on the dependent variable.

6.2. Policy Recommendation

The ultimate purpose of the ODA is to build the capacity of various categories of developing countries for independent from the help. In other words, even the aid or international cooperation ended, whether the developing countries can maintain the development or not is the important for the economical independent from other countries or organizations. Since agriculture and rural development is the fundamental factor for ending poverty across the developing countries.

From the early 2000, the amount of agricultural ODA has been increased and the type of agricultural ODA has been diversified. Especially, there are major type of agricultural ODAs that are : 1) 'agricultural development', 2) 'agricultural policy and administrative management', 3) 'agricultural water resource', 4) 'agricultural research', 5) 'agricultural financial services'. Among the ODA types, 'agricultural development' type of ODA shares 34% to the total agricultural ODA. In this paper, it is found that agricultural development defined as the accumulation of knowledge and availability of technology as well as the allocation of inputs and outputs(Juan R. de Laiglesia, 2006) is the most significant variable to the dependent variable among the low income countries. In short, it can be said that there has been appropriate allocation with the agricultural development ODA, however, other types of agricultural ODA need to be

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managed. Especially, since the governance is not well organized in developing countries, support for systemize the structure of agricultural policy and administrative. However, even ‘agricultural policy and administrative management’ shares 24% to the total agricultural ODA, it has no significant result. Although further study should be conducted to figure out the problem of the agricultural and administrative ODA, it is assumed that this type of ODA has been allocated in a wrong way in the developing countries.

For world common purpose, “No Poverty” and “Zero hunger”, proper policy should be made and enforce appropriately. By apply the result of the empirical analysis, it can be representing into three steps. Firstly, since ‘agricultural development’ ODA is the most important factor among the agricultural ODAs, it should be maintained or increased for the poverty reduction. Secondly, other types of agricultural ODA should be reformed to maximize the impact of agricultural ODA, especially in low income countries, where most of agricultural ODA has negative relationships. Since except ‘agricultural development’, other types of ODAs have no significance, there should be a additional study to figure out the problem. Then, according to the current state of the ODAs, restructuring task should be considered. Finally, after the reforming of agricultural ODA, prioritizing should be followed up, so that the ODA can be fully utilize across the developing countries.

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