RESULT OF AID ALLOCATION IN DIFFERENT SECTORS- ECONOMIC GROWTH AND HUMAN DEVELOPMENT

By

JANG, Yunjeong

THESIS

Submitted to

KDI School of Public Policy and Management

In Partial Fulfillment of the Requirements

For the Degree of

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Approval as of December, 2016

ABSTRACT

RESULT OF AID ALLOCATION TO DIFFERENT SECTORS - ECONOMIC GROWTH AND HUMAN DEVELOPMENT

By

Yunjeong Jang

Regarding the effectiveness of aid allocation, this paper examines the aid effectiveness from the perspective of aid allocation to different sectors. The basic hypothesis of this paper is that aid allocation to economic secotrs can promote economic growth more in developing countries compared to aid allocation to other sectors. In this regard, this paper tried to prove that aid allocation to economic sectors shows the better performance in economic growth with three (3) different timing methodologies: short-term, medium-term and long-term. Also, to overcome a criticism that economic growth itself is too narrow to define the development of each country, this paper tried to broaden the concept of development into human development measured by Human Development Index (HDI).

The result of this paper indicates that the disaggregated aid allocation shows the different impact on both economic growth and HDI. Aid allocation to economic infrastructure and services showed the positive and significant impact on economic growth and human welfare in the overall period, while aid allocation to social infrastructure and services showed the negative impact on economic growth in the short term and the medium term. Social aid showed even ineffectiveness on HDI in the short run and the long run. Therefore, this paper strongly proved that aid allocation to economic infrastructure and services is essential for both economic growth and human development in developing countries.

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I. Introduction

1. Purpose of Study

The purpose of this thesis is to find out the most effective sector for aid allocation in promoting economic growth and welfare of recipient countries. In this paper, aid effectiveness on economic growth and welfare of developing countries will be analyzed with cross-country panel data based on the aid allocation trend to (i) social infrastructure & services and (ii) economic infrastructure & services. The main purpose of this thesis will be to show a causal effect of aid allocation to economic infrastructure & services and social infrastructure & services on economic growth and welfare of developing countries with the recent data set of countries. With the disaggregated data and diverse analysis, this thesis aims to show that aid allocation to investment sector such as economic infrastructure or direct support for transportation, communications, and energy brings the larger impact on economic development and the improvement of welfare in developing countries compared to aid allocation to social sectors.

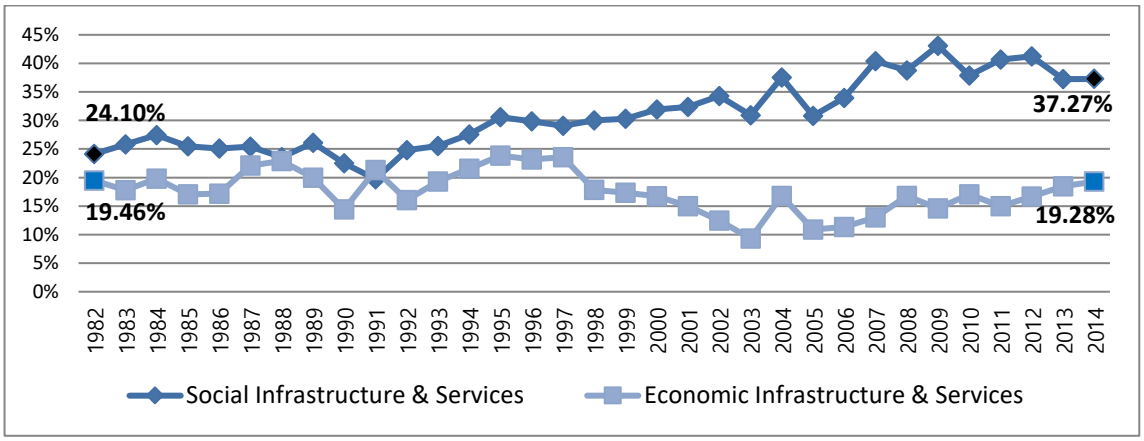
2. Problems and Issues

From the beginning of the official development assistance (ODA), the amount of aid has become larger and larger every year. With the growing amount of ODA, one of the most important concerns has been ‘aid effectiveness’. Considering that there is a clear change in the trend of aid allocation such as movement of ODA from economic infrastructure sectors to social aid sectors, there should be a reasonable and acceptable ground to justify the sustainability of this trend.

For example, according to OECD data analysis, the proportion of aid allocation to social sectors is growing rapidly and continuously from 24% of total ODA in 1990 to 37% in

2014 while the aid allocation to economic infrastructure sector remains at the similar level, from 19% of total ODA in 1982 to 19% in 2014.

[Figure 1: Aid Allocation by Sectors]



Under this situation, aid effectiveness should be closely reviewed based on the different objectives of aid, which are differently determined according to the definition of 'development'. Considering that there have been lots of debates regarding the definition of development, aid effectiveness measured by the different indices of development is very significant and meaningful. If the economic growth, which is represented as GDP per capita growth, is taken as the 'development' of developing countries, aid allocation should be discussed with whether this sectoral aid allocation contributes to the economic growth or not. On the other hand, if the development is defined with another concept such as welfare of developing countries, aid effectiveness should be handled with the index of the welfare of countries such as HDI.

Based on the criticism that economic growth is too narrow to define the development of developing countries, there have been a number of researches to broaden and diversify the scope of 'development'. Regarding this issue, 'definition of development and aid effectiveness', there have been different layers of debates and projections as well that

the aid effectiveness from the perspective of human development may show the opposite result to the one from the perspective of economic growth.

Therefore, this study tries to understand two questions: i) which sectoral aid is more effective to economic growth in developing countries? and ii) which sectoral aid is more effective to improvement of welfare of developing countries? With the comparison of two different analysis, this study aims to check if the aid allocation to different sectors shows the dissimilar result on economic growth and HDI.

3. Importance of Issue

Aid effectiveness regarding economic growth of recipient countries has been very important issue of debates for decades. Considering that economic growth of developing countries has been stagnant even though huge amount of aid has been provided to those countries, there should be a clear direction for donor and recipient countries so that aid allocation can be made in more effective way rather than wasting time and resources of both countries. Since there are diverse sectors where aid allocation can be made, there should be enough analysis on which sector is more effective in promoting development of recipient countries to solve the stagnant economic growth problem of developing countries.

Also, if the development is reviewed from the perspective of welfare of developing countries, the diverse sectors should be closely analyzed with the question, whether which sectoral aid allocation can contribute more to the improvement of welfare of developing countries. This study is based on the assumption that investment on economic infrastructure & services such as transport, communication, energy and banking can promote economic growth more in developing countries, which indicates

that developing countries should allocate more aid on infrastructure. Also, this study comes with the prediction that aid allocation to social sectors will contribute to the improvement of human development of developing countries, rather than economic growth.

Based on the three types of analysis, no time lagged effect (short-term), 3-year time lagged effect (medium-term), and 6-year time lagged effect (long-term) of aid allocation, this thesis will present the evidence that aid allocation to economic infrastructure & services will bring the higher economic growth in short-term and long-term period. Also, this study will show that aid allocation to economic infrastructure & services will improve the welfare of developing countries as well, which is quite different result from the previous literatures. Economic growth and welfare improvement promoted by aid allocation to economic infrastructure & services will provide the basement for solution to the further and potential problems developing countries have been facing such as economic stagnation, health problems, education issues, etc.

4. Structure of Paper

This paper is organized as below. Section II will deal with a previous literature review regarding different streams of aid effectiveness according to different positions and diverse definitions of development. Section III will provide model specification and data of this study with the data characteristics. Section IV will offer empirical results of the study based on the two types of dependent variable, GDP per capita growth rate and HDI. Section V will provide summary and conclusion of this study with the policy implications.

II. Literature Review

There are plenty of literatures regarding aid effectiveness on economic development and welfare of developing countries. There have been two major streams of arguments regarding aid effectiveness: (i) Unconditional Positive Effect of Aid and (ii) Positive Effect under the Certain Conditions. (i) Unconditional positive effect of aid means that aid usually has the positive effect on average regardless of the specific traits of each developing county. On the other hand, some scholars argue that aid usually shows the negative or zero effect on economic growth of developing countries but there could be the positive effect under the certain conditions.

Through severe arguments between two streams, the recent papers focus on the aid effectiveness based on the type of aid. Based on the assumption that the different sectors of aid bring the different impact on economic growth, impact of disaggregated aid has received many scholars' interest. Regarding this paper, the most important thing is to compare the aid effectiveness of economic infrastructure aid to the one of social infrastructure aid. In this regard, previous literature review shall be made based on the different sectors of aid allocation: (i) Ineffectiveness of Aid in General (ii) Effectiveness of Aid Allocation to Economic Infrastructure and (iii) Effectiveness of Aid Allocation to Social Infrastructure. Also, additionally, this chapter will provide the literature review regarding another definition and objective of development, which is HDI covering life expectancy and education together with income level.

1. Literature Supporting Unconditional Effectiveness of Aid

The literature supporting unconditional effectiveness of aid argues that aid has the positive effect on economic growth of recipient countries regardless of countries' specific characteristics. Durbarry et al. (1998) found that there is strongly positive impact of aid with a sample from 68 countries during 1970-1993. With the panel data, this study showed that averaged aid inflow for four (4) years stimulated the fast economic growth of developing countries. Durbarry et al. (1998) also exhibited that there is an optimal level of aid for economic growth since the low level of aid or too high ratio of aid/GDP is associated with the slow economic growth. Hadjimichael et al (1995) also emphasized the positive effect of aid on economic growth with 31 sub-saharan African countries from 1986-1993 with diminishing return of aid on growth. Dalgarrd et al. (2004) analyzed the cross-country data of 54 countries and found out that aid is generally effective which is applied even to bad circumstances. Also, this paper suggested that there is a certain relationship between climate and aid effectiveness considering that the impact of aid exhibited the different pattern according to the differences in geography.

2. Literature Against Effectiveness of Aid

Regarding the effectiveness of aid on economic growth of developing countries, Boone (1996) insisted that aid does not promote any economic growth in poor countries. According to the author, aid only promotes the consumption of developing countries, which does not help economic growth. The author also argued that aid allocation to social sectors such as health and education does not show the significant impact on human development of developing countries between 1971 and 1990 as well. Ovaska(2003) used the data of 86 countries to analyze the relationship of aid and

economic growth. In this study, the author emphasized the declining real per capita incomes of developing countries since 1970s, which shows the negative relationship between aid and economic growth.

Also, Mamoun Benmamoun and Kevin Lehnert (2013) compared the significance of FDI, ODA, and international remittance together for economic growth in developing countries. Based on the panel data including 180 countries, the author concluded that international remittances have the most significant contribution to the economic growth rate of low income countries compared to FDI and ODA. According to the result, only highly indebted low income countries can be benefited by ODA, which means that there should be the certain condition where ODA can be effective to the development of developing countries.

However, this simple comparison is only using ODA/GDP (net disbursements as a percentage of GDP) rather than utilizing any disaggregated ODA information. Therefore, it is not reasonable to say that international remittance is superior to ODA and ODA cannot make a significant impact to economic growth of developing countries only based on the gross amount of ODA. If different sectors ODA can be analyzed based on disaggregated data, the contribution of ODA to economic growth of developing countries can exhibit a different story. This is why the sectoral aid effectiveness should be studied in detail.

3. Literature Supporting Effectiveness of Sectoral Aid Allocation

3.1 Literature Supporting Effectiveness of Aid in Economic Infrastructure

To overcome the problem of analysis on aggregated aid, Clemens and Radelet (2004) disaggregated aid into 'short-impact' aid which can affect economic growth within four (4) years, which includes transportation, roads, communications, energy and agriculture. On the other hand, 'long-impact' aid includes the aid which might raise permanently GDP per capita but not within four years of disbursement, which technical cooperation and social sector investments such as education, health and water belong to. In this paper, the authors analyzed the entire 1973-2001 period data of 67 countries in total. The main conclusion of this article is that "short-impact" aid shows the strong and statistically significant impact on economic growth even though it does not mean that it works for every country.

3.2 Literature Supporting Effectiveness of Aid in Social Sector

Aid allocation to social sector also brings a number of supporting arguments that aid allocation to education, technology, and health brings the significant impact in developing countries. For example, aid effectiveness in education field has been widely studied. Birchler and Michaelowa (2016) showed in their paper that an increase of education aid by 1% promotes the growth rate of primary enrolment by about 0.06 percentage points.

Also, Asiedu (2014) analyzed whether foreign aid in education promotes economic growth or not with 38 countries data over the period 1990-2004. Regarding the effect of aid in education on economic growth in Sub-Saharan Africa, the author argued that aid in primary education has a positive and significant effect on growth while aid in post-primary education has an adverse or at best no significant impact on growth. It is significant in that it disaggregated aid allocation into primary and post-primary education

to capture more precise impact of aid allocation to education on economic growth. This result is consistent with the recent papers which argue that higher education does not have a significant effect on growth for East Asia or have an adverse effect on growth for South Asia (Bairam and Kulkolkarn (2001), Lau et al. (2005)). In the similar context, another paper by Asiedu (2007) showed that the effectiveness of aid depends on the level of development of the recipient country (low and middle income) as well as the level of education at which aid is being targeted (primary, secondary or higher).

4. Literature regarding Different Definition of Development

All of the literature above are based on the similar definition of development, which is 'economic growth' of recipient countries. However, some scholars have raised the different concept and definition of development arguing that defining development as economic growth only is too narrow definition. First, there is literature focusing on the relationship between poverty and aid questioning whether aid allocation contributes to poverty reduction or not. Collier and Dollar (2001, 2002) suggested the new methodology, 'poverty-efficient' aid allocation. According to Collier and Dollar (2001, 2002), whether aid allocation contributes to GDP per capita growth affecting 'poverty reduction' is very important issue rather than focusing only on GDP per capita growth. However, Quibria(2004) criticized that this argument of two authors does not show the direct impact of aid on poverty reduction since this analysis covered the intermediate impact of GDP per capita growth to reach the poverty reduction effect. In this regard, Mosley and Verschool(2004) more directly focused on 'aid's ability to reduce poverty'. The authors proved that aid allocation in consideration of micro and macro policies of recipient countries can increase the effect of aid on poverty reduction. For example,

composition of expenditure of LDCs such as pro-poor expenditures can improve the ability of aid to reduce the poverty of developing countries.

In this regard, Sen(1999) steped forward to broaden the concept of development as 'freedom'. This new concept of development focused on more diverse aspects of development such as political freedoms, freedom of opportunities, and economic protection. This idea of development as 'freedom' and 'achievement' are well reflected into Human Development Index (HDI) invented by Mahbub ul Haq in 1990. To change the existing perspective from the economic growth to human well-being, life expectancy, knowledge and education, and standard living are equally represented in HDI as below.

- Life Expectancy Index = $\frac{Life\ Expectancy - \min(x)}{\max(x) - \min(x)}$
- Education Index = $\frac{2}{3} \times ALI + \frac{1}{3} \times GEI$
  - Adult Literacy Index (ALI) = $\frac{Adult\ Literacy\ Ratio - 0}{100 - 0}$
  - Gross Enrollment Index (GEI) = $\frac{Combined\ Gross\ Enrollment\ Ratio - 0}{100 - 0}$
- GDP = $\frac{\log(GDP_{pc}) - \log(100)}{\log(40000) - \log(100)}$ [1]

5. Discussion of the Literature Review

[Table 1: Summary of Literature Review]

Author (year)	Topic	Data	Results
Durbarry et al. (1998)	Impact of foreign aid on growth for developing	Averaged data from 1970-1993 from IMF regarding 68 developing countries	Aid inflow is very effective in stimulating the fast growth of developing economy.

[1] New HDI is adjusted by inequality for more precise analysis.

	countries		There is an optimal level of aid/GDP for each economy.
Hadjimichael et al (1995)	Impact of aid on economic growth of Sub-Saharan African countries	Sub-Saharan Africa data of 1986 to 1993 regarding 31 countries	Aid exhibits positive impact on economic growth with diminishing return.
Dalgarrd et al. (2004)	Aid effectiveness on economic growth	Panel data of54 countries over five 4 year averaged data	Aid shows unconditional positive effect on the growth even in bad condition.
Boone (1995)	Aid effectiveness and political regime of recipient countries	OECD ODA data and World Bank data for 5-year averaged data of 97 countries	Aid is not effective in economic growth only causing fungibility and high consumption.
Ovaska(2003)	Effect of aid on economic growth	86 developing countries between 1975 and 1998	There is a negative relationship between aid and economic growth.
Mamoun Benmamoun and Kevin Lehnert (2013)	Financing Growth: Comparing the effects of FDI, ODA, and International Remittances	16 year panel (1990-2006) covering 182 countries Dependent: Growth rate of real GDP, Independent: FDI/GDP, ODA/GDP, Remittance/GDP	The contribution of international remittances on the economic growth rate of low income countries is greater than that of FDI and ODA. Only for highly indebted low income countries, ODA positively and significantly contribute to the economic growth rate.
Clemens and Radelet (2004)	Timing and the effects of aid on growth	1973-2001 period CRS data of 67 countries (net ODA/GNI)	Aid inflows are systematically associated with modest, positive subsequent growth in cross-country panel data.
Owens and Hoddinott (1999)	Investing in development or investing in relief: Quantifying the poverty tradeoffs using Zimbabwe household panel data	Households data of the rural area in Zimbabwe	When the aid allocation was moved from relief aid to development aid to increase access to capital stocks, poverty was reduced significantly and the increased income contributed to adequate diet.
Mavrotas (2002)	Aid and Growth in India: Some	India time-series data of the period 1970-	Composition of aid is important in aid

	Evidence from Disaggregated Aid Data	1992 (disaggregated aid data)	effectiveness.
Birchler and Michaelowa (2016)	Making aid work for education in developing countries: An analysis of aid effectiveness for primary education coverage and quality	Education disbursement and primary enrollment rates (OECD CRS data) of countries whose initial NER was below 80%.	An increase of education aid by 1% promotes the growth rate of primary enrolment by about 0.06 percentage points
Asiedu (2014)	Does foreign aid in education promote economic growth? Evidence from Sub-Saharan Africa	38 countries data over the period 1990-2004	Stock of human capital and investment in education, especially, aid in primary education, are positively correlated with the economic growth.
Bairam and Kulkolkarn (2001)	Human capital, production and growth in East Asia	6 countries data over the period of 1965-1990 (Hong Kong, Japan, Korea, the Philippines, Taiwan and Thailand)	Education contributes to economic growth in East Asian countries. Educational attainment and the level play the important role in development.
Lau et al. (1993)	Education and economic growth Some cross-sectional evidence from Brazil	Data of Brazilian states from 1970's to 1980's	Education per person made a great contribution to the economic growth in Brazil in 1970's and 1980's.
Asiedu (2007)	On the Impact of Foreign Aid in Education on Growth: How Relevant Is the Heterogeneity of Aid Flows and the Heterogeneity of Aid Recipients?	Disaggregated aid data and countries of different income level (education projects funded by DAC member countries)	Aid in education has the important role in economic growth
Collier and Dollar (2001)	Can the World Cut Poverty in Half? How	OECD data covering 62 countries from 1974 to 1997 (four-	Quality of economic policy is crucial in achieving the poverty

	Policy Reform and Effective Aid Can Meet International Development Goals	year period)	reduction by 2015.
Collier and Dollar (2002)	Aid Allocation and Poverty Reduction	Burnside and Dollar(1997) data and results	The current aid allocation is not the most efficient way of reducing the poverty. Aid could be effective in reducing poverty if the policy and institutions are desirable.
Quibria(2004)	Development effectiveness: What does recent research tell us?	Review of empirical results of previous literatures	Aid is generally effective under the wide range of policy quality but with the diminishing return.
Mosley and Verschool(2004)	Aid, Poverty Reduction and the 'New Conditionality'	Country-level data for aid-allocation simulations	Corruption and inequality in recipient countries have the certain relationship with aid effectiveness, poverty reduction.

Based on the previous literature review, this paper shall go further with these four (4) points. First, this paper will deal with the detailed and direct comparison between the impact of aid allocation for economic infrastructures and the impact of aid for social sectors such as education and health. This comparison will clearly show how aid allocation to economic infrastructures brings the larger contribution to economic growth of developing countries compared to aid allocation to social sectors. This kind of 'disaggregated sectoral analyses' will bring the significant lesson regarding aid allocation based on the effectiveness of aid, which is 'evidence-based policy'.

Secondly, this study will go forward with exploring the aid allocation from the perspective of the impact on human development and welfare. Even though there have been several decades since HDI was invented, there was no direct comparison between

the result of economic growth and HDI together in analyzing aid effectiveness. Therefore, this study will compare the two dependent variables simultaneously so that the result of both aspects can be clearly reviewed.

Third, this paper will explore three types of impact on economic growth based on specified time lag: short-run impact (no time lag), medium-run impact of 1 time period lag and long-run impact of 2 time periods lag. Even though Clemens and Radelet (2004) assigned each kind of aid to 'short-impact' aid, 'long-impact' aid and 'humanitarian aid', there should be more specific proof regarding the impact of each kind of aid. This paper will be exploring the evidence to prove whether aid allocation to economic infrastructures shows the significant impact on economic growth and HDI in the different types of period.

Lastly, considering that many previous literatures are based on the data by 2000, this paper will go forward with more recent data by 2013. From 2000 to 2015, there was a big worldwide project of development, Millennium Development Goals (MDGs). Therefore, this paper will check if the importance of aid for infrastructure investment asserted by other authors is still effective after 2000 or there is any difference or change in the contribution of infrastructure investment compared to other types of aid.

III. Model and Data Specifications

1. Hypothesis

Considering that financial inflow in developing countries will promote the economic growth through investment in different sectors, it is hard to deny that foreign aid in recipient countries can influence the recipient countries' economic growth. In this regard, the question that which sector will bring the higher economic growth is the most significant question. More specifically, we can simply assume that aid allocation to economic infrastructures will bring the higher economic growth in that aid allocation to economic infrastructure will construct better networks for communication, transportation, and energy transfer within a recipient country which will benefit commerce generally. Also, aid in economic infrastructures is highly observable; a donor country that provides aid to build a bridge can easily observe whether or not a bridge is built. Therefore, there is not much room for a recipient country to use provided aid for the other purpose, which is a main reason for ineffectiveness of aid. In addition, foreign aid inflow in economic infrastructures may bring another spill-over effect on human welfare with the better network and communication infrastructure.

On the other hand, compared to aid allocation to economic infrastructures, aid allocation to social sectors may take several years to make a significant impact on economic growth and human welfare of developing countries. For example, when there is an investment in a primary education with foreign aid, it will take at least more than 10 years for students to contribute to the economic growth of a developing country. In the same context, aid allocation to nutrition projects for children will create the visible impact after those children get a job after graduation of basic education course. Therefore, aid allocation to

social infrastructure & services could have negative impact or at best insignificant impact on economic growth and human welfare within several years.

Based on the above assumptions regarding aid allocation to economic infrastructure & services, the main purpose of this study is to prove the effectiveness of aid allocation to economic infrastructure & services compared to aid allocation to social infrastructure & services according to the different aspects of development. Therefore, this thesis will test the following two hypotheses: 1) Aid allocation to economic infrastructure & services shows the significant impact on economic growth and human development of developing countries in the short run and 2) Aid allocation to social infrastructure & services brings the negative or insignificant impact on economic growth and human welfare of developing countries in the short run. In this thesis, the three types of different timing methodologies will be used such as 'short-run impact', which will be tested through no time-lag regression between aid allocation and dependent variables, 'medium-run impact' of 3 to 5 years time-lag, and 'long-run impact' of 6 to 8 years time-lag. With testing those two hypotheses, it will be proved that aid allocation to economic infrastructure & services is much more important in economic growth and even human welfare improvement of developing countries compared to aid allocation to social infrastructure & services.

2. Econometric Specifications

2.1 No Time-lag Effect of Aid Allocation on Economic Growth: Short-run Impact

To test a short-run impact of aid allocation on economic growth, the following model will be used.

$$\mathbf{GDPPC_{it} = B_0 + B_1 AidS_{it} + B_2 AidE_{it} + B_3 (AidS_{it})^2 + B_4 (AidE_{it})^2 + B_5 Policy_{it} + B_6 (AidS_{it}) * (Policy_{it}) + B_7 (AidE_{it}) * (Policy_{it}) + B_8 HumanCapital_{it} + B_9 Trade_{it} + B_{10} Inv_{it} + B_{11} IniGDPPC_{it} + e_{it}} \quad \text{--- (1)}$$

Where: $GDPPC_{it}$ is GDP per capita annual growth rate (%) of *i* country in *t* period

$AidS_{it}$ is the averaged ratio of official development assistance in social infrastructure & services to GDP in constant 2005 U.S. dollar price,

$AidE_{it}$ is the averaged ratio of official development assistance in economic infrastructure & services to GDP in constant 2005 U.S. dollar price,

$Policy_{it}$ is the averaged policy and institution index proxied by index of economic freedom of Heritage Foundations,

$HumanCapital_{it}$ is the averaged Human Capita proxied by World Development Index gross enrollment ratio of secondary education,

$Trade_{it}$ is the trade openness proxied by World Development Index trade percentage of GDP,

Inv_{it} is the averaged ratio of fixed capital formation to GDP,

$IniGDPPC_{it}$ is the averaged initial GDP per capita in constant 2011 international U.S. dollar prices,

All aid data come from the OECD statistics.

According to the OECD's categorization, social infrastructure & services means education, health, population policies, water supply and sanitation while economic

infrastructure & services includes transport & storage, communications, energy, banking & financial services. Including the determinants of GDP per capita annual growth rate (%) will prevent any overestimation of impact of foreign aid allocation in this study: 1) level of policy and institution 2) level of human capital accumulation, 3) level of fixed capital formation, 4) level of trade openness and 5) level of initial GDP per capita. As Burnside and Dollar (2000, 2004) and Collier and Dollar (2000) argued that aid is effective only under the good quality of institution and policy, level of policy and institution has been expected to affect the effectiveness of aid. Therefore, the index of economic freedom such as property rights, government spending, and investment freedom is also included in this model as policy and institution variable.

In the similar context, interaction term between policy and sectoral aid is used to test the conditional aid effectiveness under the better condition of policy. Also, the level of human capital accumulation has been discussed as the important determinant for economic growth as Hanushek(2013) and Barro(1992) discussed. Thus, this model includes the level of human capital accumulation which is well explained by the gross enrollment ratio of secondary education of World Bank Index. To filter the specific impact of aid allocation, the fixed capital formation, trade openness and initial GDP per capita of each country are also controlled as other variables in the consideration of Harrod-Domar theory.

2.2 Time-lagged Impact of Aid Allocation on Economic Growth: Medium-run and Long-run Impact

In this study, the impact of aid allocation on economic growth will be explored with the time-lagged data. Since aid allocation may have more significant impact on economic growth after several years, it is very important to check the time-lagged impact of aid allocation on economic growth. Considering that construction of road takes at least two to three years, the effectiveness of aid allocation to economic infrastructure should be tested with time-lagged data. Thus, this study aims to test two types of time-lagged impact of aid allocation on economic growth.

$$GDPPC_{it} = B_0 + B_1 AidS_{it-1} + B_2 AidE_{it-1} + B_3 (AidS_{it-1})^2 + B_4 (AidE_{it-1})^2 + B_5 Policy_{it-1} + B_6 (AidS_{it-1}) * (Policy_{it-1}) + B_7 (AidE_{it-1}) * (Policy_{it-1}) + B_8 HumanCapital_{it-1} + B_9 Trade_{it-1} + B_{10} Inv_{it-1} + B_{11} IniGDPPC_{it-1} + e_{it-1} \quad \text{--- (2)}$$

$$GDPPC_{it} = B_0 + B_1 AidS_{it-2} + B_2 AidE_{it-2} + B_3 (AidS_{it-2})^2 + B_4 (AidE_{it-2})^2 + B_5 Policy_{it-2} + B_6 (AidS_{it-2}) * (Policy_{it-2}) + B_7 (AidE_{it-2}) * (Policy_{it-2}) + B_8 HumanCapital_{it-2} + B_9 Trade_{it-2} + B_{10} Inv_{it-2} + B_{11} IniGDPPC_{it-2} + e_{it-2} \quad \text{--- (3)}$$

The equation (2) will check the impact of aid allocation to the economic growth of later period, which is 1 time period after. To check longer time-lagged impact, the equation (3) will evaluate the impact of aid allocation to economic growth of 2 time periods later. All independent variables are the average of three years data.

2.3 No Time-lag Effect of Aid Allocation on Human Welfare: Short-run Impact

To test a short-run impact of aid allocation on human welfare, the following model will be used.

$$HDI_{it} = B_0 + B_1 AidS_{it} + B_2 AidE_{it} + B_3 (AidS_{it})^2 + B_4 (AidE_{it})^2 + B_5 Policy_{it} + B_6 (AidS_{it}) * (Policy_{it}) + B_7 (AidE_{it}) * (Policy_{it}) + B_8 HumanCapital_{it} + B_9 Trade_{it} + B_{10} Inv_{it} + B_{11} IniGDPPC_{it} + e_{it} \quad \text{--- (4)}$$

Where: HDI_{it} is HDI of *i* country at the last year of *t* period

2.4 Time-lagged Impact of Aid Allocation on Human Welfare: Medium-run and Long-run Impact

Additionally, the impact of aid allocation on human welfare will be explored with the time-lagged data. Since aid allocation may show different impact on human welfare after certain period, it is very important to check the time-lagged impact of aid allocation on HDI, similarly with the analysis on economic growth. Thus, this study aims to test two types of time-lagged impact of aid allocation on HDI.

$$HDI_{it} = B_0 + B_1 AidS_{it-1} + B_2 AidE_{it-1} + B_3 (AidS_{it-1})^2 + B_4 (AidE_{it-1})^2 + B_5 Policy_{it-1} + B_6 (AidS_{it-1}) * (Policy_{it-1}) + B_7 (AidE_{it-1}) * (Policy_{it-1}) + B_8 HumanCapital_{it-1} + B_9 Trade_{it-1} + B_{10} Inv_{it-1} + B_{11} IniGDPPC_{it-1} + e_{it-1} \quad \text{--- (5)}$$

$$HDI_{it} = B_0 + B_1 AidS_{it-2} + B_2 AidE_{it-2} + B_3 (AidS_{it-2})^2 + B_4 (AidE_{it-2})^2 + B_5 Policy_{it-2} + B_6 (AidS_{it-2}) * (Policy_{it-2}) + B_7 (AidE_{it-2}) * (Policy_{it-2}) + B_8 HumanCapital_{it-2} + B_9 Trade_{it-2} + B_{10} Inv_{it-2} + B_{11} IniGDPPC_{it-2} + e_{it-2} \quad \text{--- (6)}$$

3. Data and Data Characteristics

This study focuses on the recent trend of sectoral aid allocation and its impact on economic growth. Thus, the main data of each variable is based on the data from 2002 to 2013, 12 years. All data regarding independent variables and dependent variable as economic growth were averaged with every three (3) years data in consideration of yearly fluctuations and to remove the possible reverse effects between dependent and independent variables. Therefore, time period consists of every three years: Period 1 is from 2002 to 2004, Period 2 is from 2005 to 2007, Period 3 is from 2008 to 2010, and Period 4 is from 2011 to 2013. Also, HDI data for dependent variable was measured with the data of last year of each period, 2004, 2007, 2010, and 2013.

Regarding the data set, the data of sectoral aid allocation is from OECD Creditor Reporting System (CRS) data: code 100 for aid in social infrastructure and services and code 200 for aid in economic infrastructure and services. All of the data is based on 'actual disbursement' rather than 'commitment' to look for the precise impact on economic growth. A total of 78 developing countries are selected based on the category of countries: low income countries (LICs) and lower middle income countries (LMICs). Annual data for GDP per capita annual growth rate, gross enrollment ratio of primary education, fixed capital formation and initial GDP per capita is from World Bank Development Index (WDI). Also, HDI is from UNDP's Human Development Reports of every year.

IV. Empirical Results

1. Descriptive Statistics

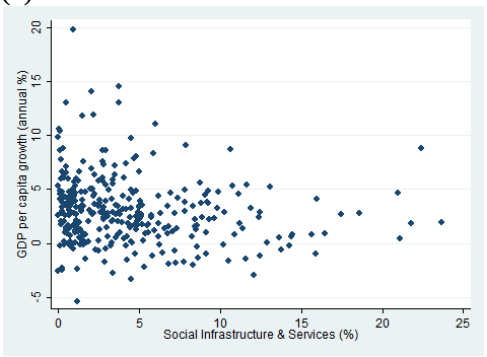
The summary of data set for each equation is as below. Even though there are some fluctuations regarding observation numbers of each variable, most of the variables show the similar level of observations. Also, the mean value of each sectoral aid shows the recent trend of aid allocation, which is that the proportion of aid allocation to social infrastructure & services (4%) is larger than the one in economic infrastructure & services (1%). This trend is also well explained by the maximum value of the ratio of aid allocation to social infrastructure & services (24%) is almost two times bigger than the maximum value of the ratio of economic infrastructure & services (13%).

[Table 2: Descriptive Statistics of the Variables]

Variable	Observation	Mean	Min	Max	Standard Deviation
GDPPC (%)	312	3.02	-5.35	19.79	3.36
HDI	293	0.56	0.31	0.80	0.12
AidS (%)	312	4.41	0	23.68	4.47
AidE (%)	312	1.31	0	12.66	1.54
$(AidS)^2$	312	39.37	0	560.97	78.87
$(AidE)^2$	312	4.08	0	160.36	13.31
Policy	259	54.77	15.6	71.9	6.52
(AidS)*(Policy)	259	184.54	0	804.25	166.9
(AidE)*(Policy)	259	61.25	0	580.83	68.72
TradeOpen	289	79.14	0	268.05	38.96
HumanCapital	312	55.92	0	145.63	25.56
Inv	255	22.41	3.33	82.29	9.85
IniGDPPC	296	3408.09	492.61	21293.38	2955.81

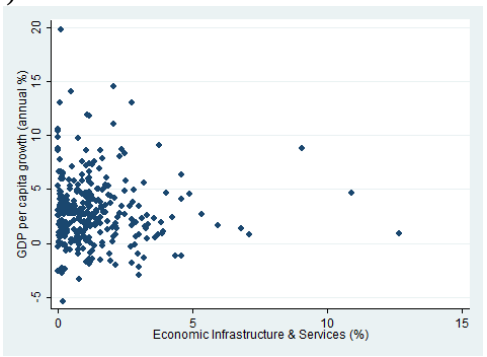
[Figure 2: Correlation between Independent and Dependent Variable]

(a) Aid in Social Infra & Services



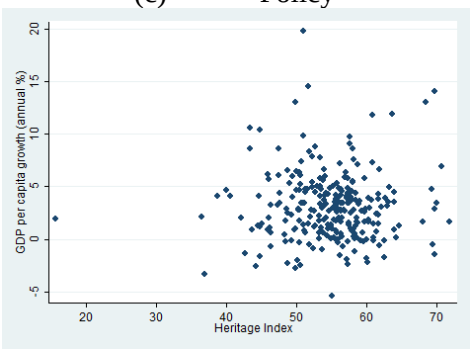
Correlation: -0.0831

(b) Aid in Economic Infra & Services



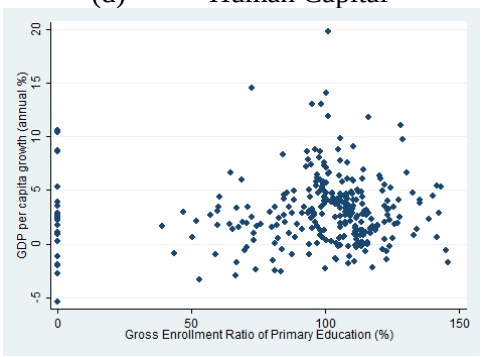
Correlation: 0.0038

(c) Policy



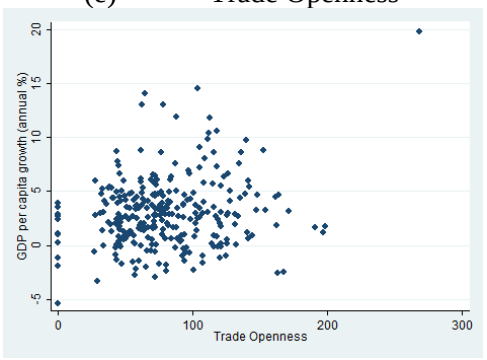
Correlation: 0.004

(d) Human Capital



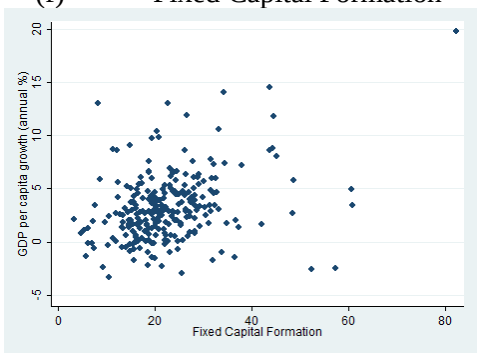
Correlation: 0.21

(e) Trade Openness



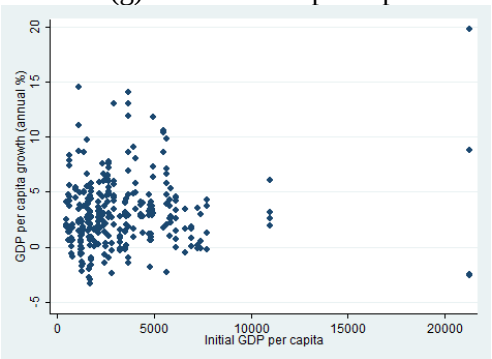
Correlation: 0.19

(f) Fixed Capital Formation



Correlation: 0.36

(g) Initial GDP per capita



Correlation: 0.08

Also, Figure 1 shows the correlation between each independent variable and dependent variable. As shown in the correlation value, aid allocation to social infrastructure & services shows the negative correlation with GDP per capita growth rate. Even though we cannot simply conclude that aid allocation to social infrastructure & services brings the negative impact on economic growth, the negative signal of correlation value suggests that aid in social sectors could affect the economic growth in the negative direction. In this regard, the relationship between the sectoral aid allocation and economic growth will be analyzed further in the next session. Also, the additional analysis on the relationship between aid allocation and HDI will be analyzed together.

2. Empirical Results on Economic Growth

2.1 No Time-lag Effect of Aid Allocation on Economic Growth : Short-run Impact

The result of analysis of equation (1) is represented in the below Table 3. The time-series and cross-country analysis showed the significant figures for the study. As shown in the table, the negative coefficient of ‘Aid in Social Infra and Services’ and the positive coefficient of ‘Aid in Economic Infra and Services’ are substantially and statistically significant. When the calculation method is taken from Lee (2013), net marginal effect of aid allocation to each sector on economic growth can be calculated as below. First, the aid allocation to social sectors showed the negative net marginal effect on economic growth by utilizing the significant coefficient and mean value of each independent variable.

Net Marginal Effect of Aid Allocation to Social Sectors = -1.74 + (0.03)(54.77) = -0.096

This figure '-0.096' shows that an increase of aid allocation to social infrastructure & services makes GDP per capita growth rate decrease.

[Table 3: Result of Short-run Impact on Economic Growth]

Dependent Variable: GDP per capita growth rate (annual %)	
Aid in Social Infra and Services	-1.74 (0.97)*
Aid in Economic Infra and Services	2.31 (1.28)*
(Aid in Social Infra and Services)^2	0.03 (0.03)
(Aid in Economic Infra and Services)^2	-0.09 (0.09)
Policy	-0.05 (0.05)
(Aid in Social Infra and Services)*(Policy)	0.03 (0.02)*
(Aid in Economic Infra and Services)*(Policy)	-0.04 (0.02)*
Human Capital	0.03 (0.01)**
Trade Openness	0.01 (0.01)
Fixed Capital Formation	0.12 (0.04)***
Initial GDP per capita	-0.00 (0.00)**
Constant	1.38 (4.71)
No. of Observations	221
R^2	0.23
Overall Specification Test	Wald chi2(11)= 53.85 Prob>chi2=0.0000

1) * p<0.1; ** p<0.05; *** p<0.01, 2) Numbers in parentheses are standard errors.

On the contrary to this result, aid allocation to economic infra and services showed the significant positive impact on economic growth.

Net Marginal Effect of Aid Allocation to Economic Sectors = 2.31 + (-0.04)(54.77) = 0.12

This figure suggests that when there is an increase in the ratio of aid in economic sectors, GDP per capita growth rate also escalates together.

Considering that this result is regarding the short-term impact of aid allocation on economic growth with 3-year averaged data, this analysis of equation (1) shows that there is a significant 'immediate' positive impact of aid allocation to economic infrastructure & services while aid allocation to social infrastructure & services shows a negative 'immediate' negative impact on economic growth.

2.2 Time-lagged Impact of Aid Allocation on Economic Growth

2.2.1 3-year Time-lagged Impact: Medium-run Impact on Growth

Since this study aims to capture more precise impact of sectoral aid allocation, the equation (2) was also analyzed for time-lagged impact as below Table 4. In this 3-year time-lagged impact, we can closely observe the impact of aid allocation on the economic growth after three years. The net marginal effect of each sectoral aid allocation was calculated in the same way of short-run impact.

Net Marginal Effect of Aid Allocation to Social Sectors = -2.96 + 2(0.08)(4.41) + (0.04)(54.77) = -0.06

This result shows that aid allocation to social sectors has the negative impact on economic growth in medium term as well. This means that it is very hard for aid in social sectors to bring the economic growth in developing countries even one time period later.

[Table 4: Result of Medium-run Impact on Economic Grwoth]

Dependent Variable: GDP per capita growth rate$_t$ (annual %)	
Aid in Social Infra and Services$_{t-1}$	-2.96 (0.81)***
Aid in Economic Infra and Services$_{t-1}$	1.13 (2.22)
(Aid in Social Infra and Services$_{t-1}$)^2	0.08 (0.02)***
(Aid in Economic Infra and Services$_{t-1}$)^2	-0.46 (0.13)***
Policy$_{t-1}$	-0.21 (0.07)***
(Aid in Social Infra and Services$_{t-1}$)*(Policy$_{t-1}$)	0.04 (0.01)**
(Aid in Economic Infra and Services$_{t-1}$)*(Policy$_{t-1}$)	0.03 (0.05)
Human Capital$_{t-1}$	0.04 (0.01)***
Trade Openness$_{t-1}$	0.01 (0.01)
Fixed Capital Formation$_{t-1}$	0.04 (0.04)
Initial GDP per capita$_{t-1}$	-0.00 (0.00)
Constant	11.67 (4.03)
No. of Observations	165
R^2	0.33
Overall Specification Test	Wald chi2(11)= 100.12 Prob>chi2=0.0000

1) * p<0.1; ** p<0.05; *** p<0.01, 2) Numbers in parentheses are standard errors.

Net Marginal Effect of Aid Allocation to Economic Sectors = 2(-0.46)(1.31) = -1.21

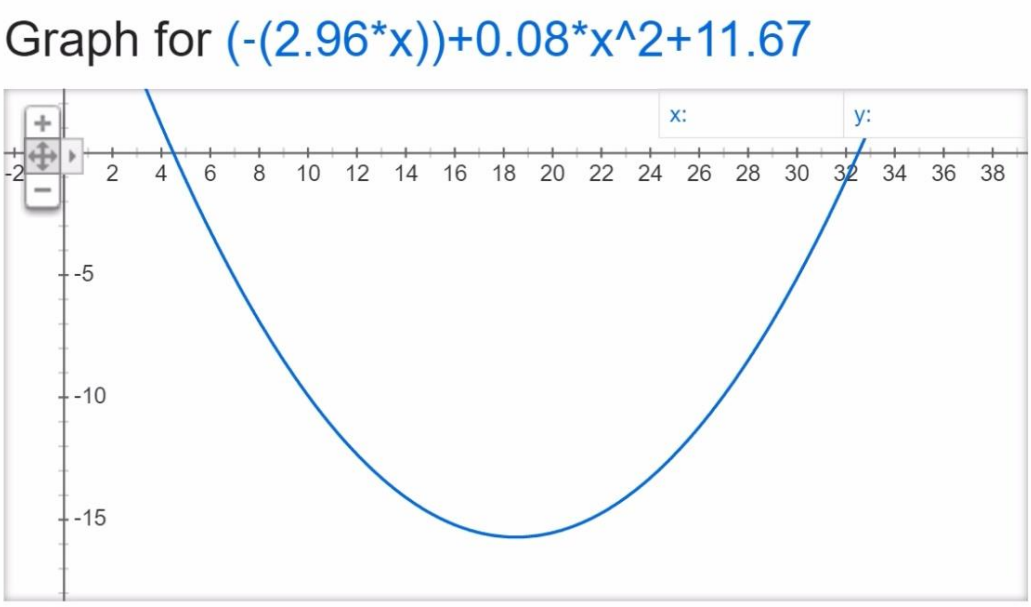
This negative figure of economic sectors shows that aid in economic sectors also brings negative impact on economic growth in the medium term, which is similar to the aid allocation to social sectors. Even though the aid allocation to economic sectors showed

the short-term positive impact on economic growth, it worsened the economic growth of developing countries in the medium term.

Also, the interaction terms between the sectoral aid and policy showed the significant figures again here in the time-lagged data set. This positive figure means that the better quality of policy and institution compensates the negative impact on economic growth caused by aid allocation to social sectors.

One of the most interesting figures in this analysis is the squared term of both social aid and economic aid. The squared aid allocation to social sector showed the positive figure, which indicates the increasing return of aid allocation to social sector. Since the aid allocation to social sectors showed the negative impact on economic growth, it denotes that the negative impact of aid allocation to social sector may become the positive impact when there is large amount aid allocation to social sector enough to change the impact of social aid as shown in the below graph.

[Figure 3: Graph of Aid Allocation to Social Sectors]



On the opposition to this result, the squared aid allocation to economic infrastructure and services has the negative figure, which is a similar result of Hansen et al (2000). Hansen et al (2000) found that there is a diminishing return of foreign aid on economic growth as shown in this analysis. However, in this analysis, the impact of aid allocation to economic sector on economic growth itself did not show any significant figure. Therefore, the diminishing return of foreign aid allocation to economic sector cannot be interpreted as the significant one.

2.2.2 6-year Time-lagged Impact: Long-run Impact on Growth

Table 5 is the result of 6-year time-lagged impact of sectoral aid allocation, which shows the relatively long-term effect of aid allocation on economic growth. The result of long-term impact analysis showed the different impact of social aid and economic aid compared to the immediate and 3-year time-lagged impact.

First, aid in social infra and services shows the significant negative impact and when it comes to the net marginal effect on economic growth, the result is as below.

Net Marginal Effect of Aid Allocation to Social Sectors = -3.18 + 2(0.08)(4.41) + (0.05)(54.77) = 0.22

This net marginal effect of social aid shows the positive figure, 0.22, which means that when there is an increase in aid allocation to social infra and services, GDP per capita growth rate of 6 years later also increases. This result shows that aid allocation to social sectors brings the positive impact on economic growth of developing countries in the long run.

Net Marginal Effect of Aid Allocation to Economic Sectors = 5.95 - (0.10)(54.77) = 0.22 = 0.47

Also, net marginal effect of aid in economic infra and services indicates the significant positive impact (0.47), which is the similar but larger impact compared to the one of aid in social sectors. This shows that the impact of aid allocation to economic sector is also positive and the impact is two times larger than the impact of social aid in the long run such as six (6) years later.

[Table 5: Result of Long-run Impact on Economic Growth]

Dependent Variable: GDP per capita growth rate$_t$ (annual %)	
Aid in Social Infra and Services$_{t-2}$	-3.18 (0.95)***
Aid in Economic Infra and Services$_{t-2}$	5.95 (1.30)***
$(\text{Aid in Social Infra and Services}_{t-2})^2$	0.08 (0.02)***
$(\text{Aid in Economic Infra and Services}_{t-2})^2$	-0.19 (0.15)
Policy$_{t-2}$	-0.09 (0.06)
(Aid in Social Infra and Services$_{t-2}$)*(Policy$_{t-2}$)	0.05 (0.01)***
(Aid in Economic Infra and Services$_{t-2}$)*(Policy$_{t-2}$)	-0.10 (0.02)***
Human Capital$_{t-2}$	0.05 (0.01)***
Trade Openness$_{t-2}$	-0.00 (0.01)
Fixed Capital Formation$_{t-2}$	0.10 (0.03)***
IniGDPPC$_{t-2}$	-0.00 (0.00)***
Constant	5.36 (3.75)
No. of Observations	107
R^2	0.41
Overall Specification Test	Wald chi2(11)= 240.78 Prob>chi2=0.0000

1) * p<0.1; ** p<0.05; *** p<0.01, 2) Numbers in parentheses are standard errors.

Additionally, this analysis also shows the increasing return of aid allocation to social infrastructure & services, which denotes the bigger marginal impact of social aid on economic growth. Also, it indicates similar coefficient of interaction term between aid allocation to social sector and policy and institution, which functions as the compensating factor for the negative impact of social aid on economic growth.

In sum, social sector aid showed the negative impact on economic growth in the short run and the medium run but it brought the positive impact in the long run. Aid in economic sectors brought the positive impact on economic growth in the short run and the long run but negative impact in the medium run. Social sector aid and economic sector aid showed the opposite result in short run and medium run but in the long run, both aid sectors brought the positive impact on economic growth of developing countries.

3. Empirical Results on HDI

Regarding the above empirical results of economic growth, there could be criticism that economic growth is too narrow definition of development. Therefore, this chapter will show the result of impact of aid allocation on the broader concept of development by using HDI.

3.1 No Time-lag Effect of Aid Allocation on HDI : Short-run Impact on HDI

The analysis result of short-run impact of aid allocation on HDI is as below Table 6. As shown in the table, social aid did not show any significant impact on HDI. This indicates that aid in social infrastructure and services did not affect human welfare and development for the short-run.

[Table 6: Result of Short-run Impact on HDI]

Dependent Variable: HDI	
Aid in Social Infra and Services	-0.03 (0.02)
Aid in Economic Infra and Services	0.04 (0.04)
(Aid in Social Infra and Services)^2	0.00 (0.00)
(Aid in Economic Infra and Services)^2	0.01 (0.00)***
Policy	0.00 (0.00)*
(Aid in Social Infra and Services)*(Policy)	0.00 (0.00)
(Aid in Economic Infra and Services)*(Policy)	-0.00 (0.00)*
Human Capital	0.00 (0.00)***
Trade Openness	0.00 (0.00)**
Fixed Capital Formation	-0.00 (0.00)
Initial GDP per capita	0.00 (0.00)***
Constant	0.27 (0.07)***
No. of Observations	220
R^2	0.78
Overall Specification Test	Wald chi2(11)= 345.64 Prob>chi2=0.0000

1) * p<0.1; ** p<0.05; *** p<0.01, 2) Numbers in parentheses are standard errors.

On the contrary, aid allocation to economic sectors showed the positive impact on HDI of developing countries.

Net Marginal Effect of Aid Allocation to Economic Sectors = 2(0.01)(1.31) + (0.00)(54.77) = 0.03

Considering this positive figure, more aid allocation in social sectors can be interpreted as the factor to promote improvement of HDI of developing countries in short run.

Also, the interaction term between aid in economic infrastructure and services and policy showed the negative significant figure, which is very similar with the analysis of economic growth in the short run and long run. Even though the further analysis is necessary, the similar trend of those two figures shows that there is a consistency of both analyses regarding the policy impact on economic growth and human welfare.

3.2 Time-lagged Impact of Aid Allocation on HDI

3.2.1 3-year Time-lagged Impact: Medium-run Impact on HDI

The result of medium-rum impact of aid allocation on HDI provided quite interesting result in that the result is very similar with the impact on economic growth.

Net Marginal Effect of Aid Allocation to Social Sectors = -0.07 + 2(0.00)(4.41) + (0.00)(54.77) = -0.07

First, net marginal effect of aid allocation to social infrastructure and services on HDI shows the negative figure, which means that increase in the ratio of social aid to GDP in one country worsened HDI in medium run. This result of social aid on HDI is very similar to the impact of social aid on economic growth in that both figures denote the negative impact of social aid.

[Table 7: Result of Medium-run Impact on HDI]

Dependent Variable: HDI	
Aid in Social Infra and Services$_{t-1}$	-0.07 (0.02)***
Aid in Economic Infra and Services$_{t-1}$	0.10 (0.05)**
(Aid in Social Infra and Services$_{t-1}$)^2	0.00 (0.00)***
(Aid in Economic Infra and Services$_{t-1}$)^2	-0.00 (0.00)**
Policy$_{t-1}$	0.00 (0.00)
(Aid in Social Infra and Services$_{t-1}$)*(Policy$_{t-1}$)	0.00 (0.00)**
(Aid in Economic Infra and Services$_{t-1}$)*(Policy$_{t-1}$)	-0.00 (0.00)
Human Capital$_{t-1}$	0.00 (0.00)***
Trade Openness$_{t-1}$	0.00 (0.00)
Fixed Capital Formation$_{t-1}$	-0.00 (0.00)
Initial GDP per capita$_{t-1}$	0.00 (0.00)**
Constant	0.35 (0.08)***
No. of Observations	164
R^2	0.80
Overall Specification Test	Wald chi2(11)= 622.91 Prob>chi2=0.0000

1) * p<0.1; ** p<0.05; *** p<0.01, 2) Numbers in parentheses are standard errors.

Net Marginal Effect of Aid Allocation to Economic Sectors = 0.10 + 2(0.00)(1.31) = 0.10

On contrary, aid allocation to economic infrastructure and services showed the positive and significant impact on HDI with 3-year time lag. As shown in the table and the calculation, an increase in the ratio of aid in economic infrastructure and services to GDP in one country made HDI increase in the medium run. This is very significant result in

that aid allocation to economic sectors brought the positive impact on HDI as well as economic growth of developing countries.

Also, the squared term of aid in social sectors and aid in economic sectors exhibited the opposite sign. The positive figure of the squared term of aid in social sectors means that there will be the positive impact of social aid if the amount of social aid exceeds the certain point. The negative and significant sign of the squared term of aid in economic sectors shows that the impact of aid in economic sectors exhibits the diminishing returns on HDI, which is the similar result of impact on economic growth.

3.2.2 6-year Time-lagged Impact: Long-run Impact on HDI

When it comes to the 6-year time-lagged impact of aid allocation on HDI, the result is very similar with the short-run impact regression in that there is no significant impact of each sectoral aid allocation. This is very significant result since aid allocation to social infrastructure and services does not show any significant impact on HDI even after 6 to 8 years later. That is, aid allocation to social sectors does not contribute to improving human welfare for the long-run, which is very similar with the result of short-run impact analysis.

[Table 8: Result of Long-run Impact on HDI]

Dependent Variable: HDI	
Aid in Social Infra and Services$_{t-2}$	-0.01 (0.01)
Aid in Economic Infra and Services$_{t-2}$	-0.02 (0.02)
(Aid in Social Infra and Services$_{t-2}$)^2	0.00 (0.00)

(Aid in Economic Infra and Services$_{t-2}$)^2	-0.00 (0.00)
Policy$_{t-2}$	-0.00 (0.00)
(Aid in Social Infra and Services$_{t-2}$)*(Policy$_{t-2}$)	0.00 (0.00)
(Aid in Economic Infra and Services$_{t-2}$)*(Policy$_{t-2}$)	0.00 (0.00)
Human Capital$_{t-2}$	0.00 (0.00)***
Trade Openness$_{t-2}$	-0.00 (0.00)*
Fixed Capital Formation$_{t-2}$	0.07 (0.04)*
Initial GDP per capita$_{t-2}$	0.00 (0.00)**
Constant	0.44 (0.04)***
No. of Observations	107
R^2	0.85
Overall Specification Test	Wald chi2(11)= 607.75 Prob>chi2=0.0000

1) * p<0.1; ** p<0.05; *** p<0.01, 2) Numbers in parentheses are standard errors.

In sum, aid allocation to social sectors on HDI was ineffective in the short run and the long run, and even in the medium term, social sectors brought the negative impact on HDI. On the contrary, the impact of aid allocation to economic sectors on HDI was positive in short run and medium run. However, in the long run, economic sectors' aid also was ineffective on HDI.

4. Major Findings

The above results analysis brings out a few important points. Firstly, the aid allocation to social infrastructure and services brings the negative 'short-term' impact and 'medium-term' impact while it brings the positive 'long-term' impact on economic growth. In

other words, it takes at least more than 5 years for aid allocation to social sectors to bring any significant positive impact on economic growth.

Secondly, another major finding is that aid allocation to economic infrastructure and services brings the positive 'short-term' impact and 'long-term' impact on economic growth. Aid allocation to economic sector also showed the bigger impact in the 6-year time lagged impact analysis compared to the short-term impact, which indicates that aid allocation to economic sectors shows the bigger positive impact on economic growth after at least 6 years. Even though economic sectors showed the negative impact on economic growth in medium term, the impact on economic growth became positive in the long run.

Also, aid allocation to each sector did not show any opposite or significantly different result even when the broader concept of development is adopted by utilizing HDI. Even when development is defined as the human welfare and development, which is much broader definition compared to economic growth, aid allocation to social sectors shows the negative impact on HDI in the medium term. Also, aid in social sectors was ineffective in enhancing HDI in the short run and the long run.

On the other hand, aid allocation to economic sectors showed the positive and significant impact on HDI when it comes to the short-run and the medium-run even though this impact was also ineffective in the long run. It denotes that aid allocation to economic sectors brings more significant improvement of human welfare of developing countries compared to aid to social sectors.

The result also has the additional finding regarding the role of policy and institution in aid effectiveness. When it comes to aid allocation to social sectors, the index of policy

and institution shows the positive interaction term with social aid, which means that the better policy can relieve the negative impact from aid allocation to social infrastructure and services. Even though there is a significant negative impact of social aid, if the policy and institution is good enough, the negative effect can be reduced in the final stage.

Lastly but not least, the interesting finding is that the squared term of aid allocation to social sector shows the positive sign, which is opposite to the existing statement from the scholars. The positive squared term of social aid shows that the negative impact can be turned into the positive impact when the amount of aid allocation to social sector exceeds the certain point.

V. Conclusion and Policy Implications

The paper analyzed the impact of disaggregated aid allocation on economic growth and human welfare: (1) aid allocation to social infrastructure and services and (2) aid allocation to economic infrastructure and services. Furthermore, this paper aimed to capture three different types of impact based on the time difference: (1) short-run impact (2) medium-run impact and (3) long-run impact. In this analysis, the additional effect from the institution quality was also considered to testify the existing argument of 'conditional effectiveness' of aid.

The previous literatures showed the three different streams regarding aid effectiveness such as ineffectiveness, conditional effectiveness, and effectiveness of sectoral aid. Clemens and Radelet (2004) supporting 'Aid is not all alike', especially, disaggregated

the foreign aid into ‘short-impact’ aid, ‘long-impact’ aid and ‘humanitarian’ aid. From this study, the authors found out that the aid they assigned to ‘short-impact’ aid shows the significant positive impact on economic growth. However, in this study, the most differentiated point from Clemens and Radelet (2004) is to show the difference between the impact of aid allocation to social sectors and the one to economic sectors on economic growth. This study analyzed the recent data to capture the positive impact of aid allocation to economic sectors and the negative impact of aid allocation to social sectors with different versions of analysis.

Empirical result of regressions in this study showed the very opposite impact of each sectoral aid allocation. As expected from the correlation between variables, aid allocation to social sectors showed the negative impact in short-term and medium term, which is different from Clemens and Radelet (2004). While Clemens and Radelet (2004) showed that long-impact aid, which is consist of majority of aid in social sectors, does not show any significant figure in the analysis, this study showed that there is a significant short-term and medium-term negative impact of social aid on economic growth.

Also, aid allocation to economic infrastructure and services showed the positive short-term and long-term impact on economic growth, which is another different point from the previous literature. Even though the previous literature denoted that aid allocation to economic sectors brings short-term effect, which is usually within 4 years, this study exhibits that aid in economic infrastructure and services brings out the larger positive impact when it comes to the economic growth in the long run. Considering that investment in infrastructure strengthens the road network, communication network, and other basic social infrastructure, foreign aid allocation to economic sectors such as

transport, communication and energy can establish the strong basis for the future economic growth of a country.

This study also stepped further by analyzing the impact of sectoral aid allocation on human welfare as well by analyzing HDI. Interestingly, the result of analysis on human welfare also exhibits the similar result with the one of economic growth. When it comes to the medium-run impact, the aid allocation to social sectors denoted the negative impact on human welfare while the aid in economic sectors improved the human welfare in developing countries in both short-term and medium-term. In the short-term and long-term, the aid allocation to social sectors was ineffective in promoting the human welfare.

Based on the above points of this study, aid allocation in developing countries should be cautiously made in consideration of its different impact on economic growth and human development. Rather than sticking to the donor countries' interest or elites' interest in recipient country, there should be sufficient analysis to find out the perfect solution to achieve the goal and objective of donor and recipient countries. If the urgent purpose of aid allocation is the immediate economic growth, aid allocation should be made in the direction of economic infrastructure & services. In this regard, the deep understanding toward each sectoral aid is also required for both donor and recipient countries. Also, considering that policy and institution quality can compensate the negative impact coming from the social aid, there should be significant attention and effort to improve the quality of policy and institution in developing countries. As the previous literature indicated and the result of this study clearly showed, the institution quality is closely related with the impact of aid allocation to economic growth, which should not be ignored in discussing aid effectiveness.

Also, even though there has been the scholars' idea that the aid effectiveness will show the different story if the definition of development is broaden, this study showed that aid allocation to economic infrastructure and services showed the better result in human development as well as economic growth. This is very significant result in that aid allocation to economic sectors can contribute more even to the broad concept of development in developing countries. The short-run and medium-run effect, of sectoral aid allocation especially, showed that aid allocation to economic sectors can improve the welfare of recipient countries while aid allocation to social sectors was ineffective in promoting the human welfare. From this analysis, we can conclude that aid allocation to economic sectors can bring the larger effect on both economic growth and human development.

Nevertheless, this study has the a few limitations. First, aid effectiveness has been discussed in much broader scope, which cannot be limited to the economic growth rate and human development index. Even though this study only deals with GDP per capita growth rate and HDI as the index of aid effectiveness, there are a number of different indices to measure the aid effectiveness. The effectiveness of aid allocation to social infrastructure & services shall be analyzed again in the context of educational attainment, effect of education regarding income level and so on. Secondly, the observed data in this study covers only twelve (12) years (4 period of 3 years each), which have more rooms to discuss the more concrete analysis with the longer period. Considering that the aid allocation to social infrastructure takes at least ten (10) years to show the significant impact, if there is more collective data for the longer period, it will be possible to capture the long-term effect of aid allocation to social infrastructure and services.

In conclusion, aid effectiveness shows the different impact according to which sector aid was allocated to. This study found out that aid allocation to economic infrastructure and services shows the positive and significant impact on economic growth and human welfare, which is quite opposite to the aid allocation to social infrastructure and services. For the future study, there should be broader and more diverse approach toward aid effectiveness rather than restricting the aid effectiveness to GDP per capita growth rate and HDI. Also, to explore much longer-term effect of aid allocation, the future studies shall expand the time frame by including years before 2002 or after 2012, which will be dealt with broader panel data than this study. Based on this study, the future study also will be another attempt to find out more effective aid allocation, which fits well to the need of donor and recipient country.

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Appendices

Appendix 1 : Detailed Sectors of Each Variable (OECD CRS Data Set)

100: I. Social Infrastructure & Services, Total	
110: I.1. Education, Total	14020: Water supply & sanit. - large systems
111: I.1.a. Education, Level Unspecified, Total	14021: Water supply - large systems
11110: Education policy & admin. management	14022: Sanitation - large systems
11120: Education facilities and training	14030: Basic drinking water supply and basic sanitation
11130: Teacher training	14031: Basic drinking water supply
11182: Educational research	14032: Basic sanitation
112: I.1.b. Basic Education, Total	14040: River basins' development
11220: Primary education	14050: Waste management/disposal
11230: Basic life skills for youth & adults	14081: Educ./trng:water supply & sanitation
11240: Early childhood education	150: I.5. Government & Civil Society, Total
113: I.1.c. Secondary Education, Total	151: I.5.a. Government & Civil Society-general, Total
11320: Secondary education	15110: Public sector policy and adm. management
11330: Vocational training	15111: Public finance management
114: I.1.d. Post-Secondary Education, Total	15112: Decentralisation and support to subnational govt.
11420: Higher education	15113: Anti-corruption organisations and institutions
11430: Advanced tech. & managerial training	15130: Legal and judicial development
120: I.2. Health, Total	15150: Democratic participation and civil society
121: I.2.a. Health, General, Total	15151: Elections
12110: Health policy & admin. management	15152: Legislatures and political parties
12181: Medical education/training	15153: Media and free flow of information
12182: Medical research	15160: Human rights
12191: Medical services	15170: Women's equality organisations and institutions
122: I.2.b. Basic Health, Total	152: I.5.b. Conflict, Peace & Security, Total
12220: Basic health care	15210: Security system management and reform
12230: Basic health infrastructure	15220: Civilian peace-building, conflict prevention and resolution

12240: Basic nutrition	15230: Participation in international peacekeeping operations
12250: Infectious disease control	15240: Reintegration and SALW control
12261: Health education	15250: Removal of land mines and explosive remnants of war
12262: Malaria control	15261: Child soldiers (prevention and demobilisation)
12263: Tuberculosis control	160: I.6. Other Social Infrastructure & Services, Total
12281: Health personnel development	16010: Social/welfare services
130: I.3. Population Pol./Progr. & Reproductive Health, Total	16020: Employment policy and admin. mgmt.
13010: Population policy and admin. mgmt	16030: Housing policy and admin. management
13020: Reproductive health care	16040: Low-cost housing
13030: Family planning	16050: Multisector aid for basic soc. serv.
13040: Std control including hiv/aids	16061: Culture and recreation
13081: Personnel dvpt: pop. & repro health	16062: Statistical capacity building
140: I.4. Water Supply & Sanitation, Total	16063: Narcotics control
14010: Water resources policy/admin. mgmt	16064: Social mitigation of HIV/AIDS
14015: Water resources protection	

200: II. Economic Infrastructure & Services, Total	
210: II.1. Transport & Storage, Total	23063: Coal-fired power plants
21010: Transport policy & admin. management	23064: Nuclear power plants
21020: Road transport	23065: Hydro-electric power plants
21030: Rail transport	23066: Geothermal energy
21040: Water transport	23067: Solar energy
21050: Air transport	23068: Wind power
21061: Storage	23069: Ocean power
21081: Educ./trng in transport & storage	23070: Biomass
220: II.2. Communications, Total	23081: Energy education/training
22010: Communications policy & admin. mgmt	23082: Energy research
22020: Telecommunications	24020: Monetary institutions
22030: Radio/television/print media	24030: Formal sector financ. intermediaries
22040: Information and communication technology	24040: Informal/semi-formal fin. intermed.

(ICT)	
230: II.3. Energy, Total	24081: Education/trng in banking & fin. services
23010: Energy policy and admin. management	250: II.5. Business & Other Services, Total
23020: Power generat./non-renewable sources	25010: Business support services & institutions
23030: Power generation/renewable sources	25020: Privatisation
23040: Electrical transmission/distribution	200: II. Economic Infrastructure & Services, Total
23050: Gas distribution	210: II.1. Transport & Storage, Total
23061: Oil-fired power plants	21010: Transport policy & admin. management
23062: Gas-fired power plants	

Appendix 2. Country Sample (78 countries in Total)

Benin	Uganda	Swaziland
Burundi	Zambia	Belize
Chad	Haiti	El Salvador
Congo, Dem. Rep.	Cambodia	Guatemala
Djibouti	Lao People's Democratic Republic	Honduras
Equatorial Guinea	Afghanistan	Nicaragua
Eritrea	Bangladesh	Bolivia
Ethiopia	Bhutan	Guyana
Gambia	Nepal	Paraguay
Guinea	Yemen	Indonesia
Guinea-Bissau	Kiribati	Mongolia
Kenya	Samoa	Philippines
Lesotho	Vanuatu	Vietnam
Madagascar	Kyrgyzstan	Armenia
Malawi	Tajikistan	Georgia
Mali	Kosovo	India
Mauritania	Moldova	Pakistan
Mozambique	Ukraine	Sri Lanka
Niger	Egypt, Arab Rep.	Turkmenistan
Rwanda	Morocco	Uzbekistan
Sao Tome and Principe	Cabo Verde	Iraq
Senegal	Cameroon	West Bank and Gaza
Sierra Leone	Congo, Rep.	Fiji
Sudan	Cote d'Ivoire	Marshall Islands
Tanzania	Ghana	Micronesia, Fed. Sts.
Togo	Nigeria	Papua New Guinea