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Searching for the Various Effects of Subprograms in Official Development Assistance on Human Development across 15 Asian Countries: Panel Regression and Fuzzy Set Approaches

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Received: 5 December 2018; Accepted: 4 February 2019; Published: 21 February 2019

Abstract: Previous studies are limited in identifying the effectiveness of each country to seek sectoral support rather than integrated aid. However, it is hypothesized that sector-specific aid by Official Development Assistance (ODA) may be more effective than total aid. This study aims to identify the determinants of economic growth and the living standard levels in 15 Asian countries, focusing particularly on the effects of Official Development Assistance (ODA). In order to explore this research question, we have used two indexes: (1) the annual ODA grants to Korea, with aid type as the key independent variable; and (2) the human development index (HDI), to measure dependent variables from 2006 to 2016, across the 15 Asian countries. Special attention has been paid to understand which is more significant on human development, the effects of each type of aid program individually, and the whole amount of ODA assistance. We have constructed a panel model and a fuzzy set ideal type model to account in the data for qualitative attributes by recipient countries. We have found that the economic and social impacts of ODA on the basis of panel data are significant and that our instrumental variable (IV) method illustrates a statistically significant impact of the total ODA on the HDI of the recipient countries. By separating the total amount of ODA into economic and social sectors, we have found that specific programs of public service, medical care, and welfare are more likely to directly affect HDI. While the total amount of ODA still has a positive impact on HDI, education, health, and the public service field, aids also have significant effects on HDI. Although the effect of sector-specific aid in the water and sanitation field grant-aid is not significant in panel regression results, our fuzzy set method shows that, even if education aid is low, HDI is estimated to increase if the level of health and public service aid is high. Our empirical findings suggest that (1) sector-specific aid may be more effective than total aid with ineffective sub-aid programs and that (2) an optimally specific combination of various sub-programs in ODA may exist for each developing country.

Keywords: Official Development Assistance (ODA); human development index (HDI); aid effectiveness; instrumental variable

1. Introduction

Official Development Assistance (ODA) dates back to the post-World War II era. The beginning of ODA is considered humanitarian aid from the United States in 1948 to contribute to post-war restoration efforts in Europe. Since that time, many organizations have been established on the

international level to contribute to aid activities, and various efforts have been ongoing, including many kinds of meetings and declarations between countries [1].

In the past, the poverty level of the recipient country and the economic interests of the donors have been the main reasons for the ODA. In the 1990s, however, democratization movements began to spread internationally around the world, and these changes gave legitimacy to the pro-democratic aid policy of the West. In other words, it could provide the reason that the recipient country needs the donor's assistance type in accordance with the political conditions such as the degree of democratization of the recipient country [1]. In recent years, a consensus has emerged that, no matter how many aid benefits or resources are provided, such aid cannot bring the intended good results given poor conditions, such as poor governance. According to the 2005 Human Development Report [2], there is a general consensus that foreign aid's first objective should be human development. In 2000, governments from various countries signed the Millennium Declaration with a pledge to work toward the freedom for peoples under dehumanizing conditions. The various movement to differentiate aid according to the governance conditions of the recipient country has begun to emerge. This led to diversity of aid, for example, as an opportunity to shift to sector-specific aid and bilateral assistance rather than total amount of ODA or multilateral assistance. Since the 1990s, Korea has been donating to various sub-programs of ODA in line with this international trend [1].

The size of aid from the international community has increased steadily, and the total amount of ODA in 2013 has been renewed since the beginning of support in 1984. While the initial international cooperation focused more on the economic growth of recipient countries, recent trends are focusing on welfare areas such as health and education that can enhance the quality of life of individuals. In the history of short-term aid, aid effectiveness has also been discussed. A main topic of discourse was the effectiveness of aid through wrong management and input/output analysis. In recent years, discussion has focused on macroeconomic development effects and studying the causes of economic growth, as well as an estimation of contribution to the slowdown of growth. However, there is no consensus among donors and aid agencies as to what factors determine the effectiveness of aid. The ripple effect of aid might be derived from various internal and external environmental factors embedded in recipient countries. In addition, it is difficult to confirm whether or not the improvement in the vulnerability of some determinants is the causal effect directly linked to the enhancement of aid effectiveness.

Korea has followed the recommendations of the 2013 DAC Peer Review and integrated the list of 24 priority partner countries common to both grants and loans [3]. It is now concentrating over 70% of bilateral ODA to these countries for greater impact and effectiveness. More than half of the recipient countries are in Asia. Asia is the world's most populous region where two-thirds of the world's poorest people live. The priorities of development vary greatly from country to country or from area to area since Asia is an ethnically, historically, and culturally diverse region. With a rapid economic growth rate—with China, India, and other Asian countries growing at the rates of 13%, 9%, and 6% respectively, on average per year—the Millennium Development Goals (MDGs) are likely to be achieved in many Asian countries; however, the development gaps between the rich and poor and between rural areas and urban areas need to be resolved for balanced and sustainable development [1].

In addition, Korea is well aware that achieving the Sustainable Development Goals (SDGs) Agenda requires a concrete implementation mechanism and well-designed plans. Legislation that directly addresses the issue in the domestic context includes the Sustainable Development Act, and Korea uses the mechanism underpinned by such legislation to internalize and implement the 2030 Agenda through whole-of-government commitment.

The Third Basic Plan for Sustainable Development, adopted in January 2016, presents a vision of the harmonious development of the environment, society, and economy, and sets outs the four goals of a healthy environment, a safe and integrated society, an inclusive and innovative economy, and a globally responsible country, as well as 50 implementation tasks. Each government agency carries out tasks, and the Commission on Sustainable Development will review their implementation and

issue a sustainable development report every two years. The Korean government also has a plan to develop indicators in order to evaluate progress in implementing SDGs in the country and ensure policy coherence [1].

While the implementation of SDGs in Korea is carried out by all relevant ministries, under the Sustainable Development Act and its mechanism, the country's support for the international community's sustainable development efforts is based on the Framework Act. Enacted in 2010, the Framework Act includes the "pursuit of sustainable development" as one of its principles. The Korean government set a basic policy goal of contributing to the 2030 Agenda for Sustainable Development by adopting the Mid-Term Strategy for Development Cooperation (2016–2020) in November 2015, the highest-level policy document endorsed by the Prime Minister. Based on annual implementation plans, the total amount of budget set aside for ODA in 2015 reaches 0.14% of Korea's Gross National Income (GNI), which is equivalent to 2.3 trillion KRW (about 1915 billion USD) among which 77% is bilateral ODA and 23% is multilateral ODA. Within bilateral ODA, grant aid occupies 62% and concessional loan accounts for 38%. In terms of geographic distribution, 46% of the total bilateral ODA will go for Asian countries and 24% will be allocated in African countries. By sector, 27% of the budget will go toward developing the economic infrastructure, while 42% will be allocated to support social infrastructure in the total amount of bilateral ODA. In the meantime, support for NGOs, emergency relief aid, and public–private partnerships doubled compared to the previous year [1]. As such, the increase in budgeting for aid and the assessment of effectiveness remains a constant challenge. In particular, how resources can be allocated by subdividing the aid by sector, considering the characteristics of each country, could be an important issue because it is linked to the effectiveness of the aid. Therefore, this study examines whether aids by sector are effective for countries in Asia where Korea continues to increase support.

This study aims to analyze the extent to which each type of aid for Asia contributes to the improvement of personal welfare. The human development index (HDI) has been selected as a personal welfare development index and used as a subordinate variable of the panel [4,5]. This is a result of assuming that HDI represents the living conditions of residents. Panel models and fuzzy set ideal type analyses are used to explain the various determinants of ODA effectiveness. The fuzzy set ideal type model compensates for the general panel model, which has shortcomings in explaining the qualitative attributes of an each country case. The fuzzy set ideal type model can correct statistical problems that overlook the nonlinear characteristics of the variables and show that configurational determinants of the aid effectiveness are different by nation.

2. Relevant Literature Review

2.1. ODA Determinants

Since the late 1970s, an increasing number of studies have been actively conducted on aid determinants and the motivations for ODA programs. Previous studies have built a framework in terms of "donor's interest" (DI) and "recipient's needs" (RN) based on international political theories [6–8]. Through these models, many elements and drives for determining a donor's ODA have been identified. Since the Cold War ended in the 1990s, there are no longer dominant factors in ideological characteristics, and more studies have been conducted on the determinants of ODA in terms of a realistic perspective [9]. The DI model is based on the fact that the international community recognizes the state as a rational actor of international politics and relations. Thus, according to the theory of realism, the state decides the policies to maximize its economic and military interests. The DI model explains that the allocation of the ODA budget is pursued in the direction of expanding the economic, military, and diplomatic interests of donors [9–12]. The United States and Japan are representative countries whose aid can be explained by these models. Katada (1997) demonstrates empirically that these countries allocate their ODA budget considering factors based on realism, especially national and political interests [12,13].

On the other hand, the RN model reflects the liberalism of international politics. According to liberalism, countries try to maintain international peace by creating international institutions and cooperating through the international institutions [14]. What is important in this cooperation is to reduce the economic gaps between countries so that free trade and exchanges are possible. Liberals also argue that the international community seeks peace based on cooperation and coexistence rather than war and forced competition. Donors distribute aid for more humanitarian purposes and provide more aid to the least developed and the developing countries that need more help regardless of the donor's political, economic, and diplomatic interests. Liberalism also regards the value of democracy as a key measure of peace and prosperity, as well as of its own importance. Therefore, according to the RN model, the donor countries, realizing these values, can allocate more aid programs to recipient countries for democratic reforms and human rights advancements. In short, the donor allocates aid to spread the universal values of the international community. Donors are expected to spread the universal values of the international community, such as democracy and human rights, through such cooperation.

Several studies have empirically explained the ODA allocation of donors by applying this model [15–20]. They focus on aid to Nordic countries that have been traditionally supported by humanitarian motives, such as Sweden, Norway, and Finland [21,22]. These studies also explain that the U.S. in the 1970s and Japan since the 1990s helped sub-Saharan African countries and other developing countries and that both consider the level of democracy and the extent of human rights development in recipient nations as important factors in determining the amount of aid [11,12]. The limitation of this argument is that the state is assumed to be a single actor. Savun and Tirone (2011) argued that aid programs are designed to assist democratizing states adopt key principles such as the decentralization of political power and increased transparency and accountability as they develop democratic institutions [23]. By training state officials and providing necessary financial resources, democracy assistance programs can increase the legislature's capacity to shape and monitor policy and strengthen its oversight capacity in recipient countries.

Since the 2000s, studies have focused on the concentration of aid, and scholars have mainly explored the determinants of this allocation in terms of two models: the DI model and the RN model. First, Gibb (2000) explained the concentration of aid in terms of the donor's interest. He analyzed the Cotonou Agreement as a legal basis for the EU to strengthen its trade and development cooperation with African, Caribbean, and Pacific countries. He highlighted that this agreement guaranteed tariff-free imports of agricultural products from developing countries instead of encouraging the convergence of aid to these countries [24]. Lebovic (1998) and Poe (1992), using US foreign aid data, also demonstrated that political and military interests played a key role in promoting public development aid policies [25,26].

On the other hand, studies have found that more aid has been provided to developing countries with low levels of income and high rates of infant mortality [16,18,20]. Researchers have argued that these results are evidence that the humanitarian motivation is an important incentive to provide aid. Brown & Swiss (2013) have explained the degree of recipient concentration of aid based on the RN model. They also examined 23 donors' actual records of country concentration and found that aid was distributed in so many different areas that it was difficult to apply the "selection and concentration" principle [27]. Furthermore, they argued that aid assets were not being allocated to countries in need. In short, they diagnosed this problem as decoupling and explained that the budget was not allocated to countries with needs for assistance.

2.2. ODA Effectiveness

Although developed countries have continued to provide aid to developing countries in spite of their financial burdens, no clear result has been drawn as an answer to whether ODA has contributed to the economic growth of recipient countries. In developed countries, public opinion has been formed, such as "aid fatigue," [28] which means that tax revenues are wasted on continued aid.

Moreover, criticism has been raised that a donor's aid is being used to pursue a donor's strategic and commercial interests rather than to support domestic development in developing countries [20,29,30]. In this context, discussions about effectiveness have been raised to improve aid policies that are not satisfactory for both the donor and recipient countries, and to enhance policy performance. In order to improve the effectiveness of aid, it is becoming more important to consider the conditions of the recipient's administrative system rather than the relationship between the aid and economic growth. The main conclusions of these discussions are that aid should be provided to countries that have a sound policy environment because this can guarantee the effectiveness of aid in these countries. The Assessing Aid report, published by the World Bank in 1998, became the starting point of a new discussion on the effectiveness of development aid, and the linkage between democracy and administrative systems began to attract attention [31,32]. The report pointed out that, while some countries, such as Korea, Indonesia, and Vietnam, have succeeded through aid, many countries still do not show the effects of aid. The report suggested ways in which aid could be most effective. With the publication of the Assessing Aid report, the international community has begun to highlight "good governance" as a key development agenda [32,33].

However, there are studies showing that the effectiveness of aid depends on the recipients' political circumstance. Evans and Rauch (1999) argued that these bureaucratic characteristics significantly enhance prospects for economic growth, even when they control for initial levels of GDP per capita and human capital [28]. The results imply that political condition is a crucial factor in general models of economic growth in developing countries. Alesina and Weder (2002) showed that there is no evidence that bilateral or multilateral aid goes disproportionally to less corrupt governments [29]. Knack (2004) showed that either the favorable impacts of aid on democratization are minor or they are roughly balanced by other democracy-undermining effects of aid dependence. Cross-country, highly aggregated studies such as this one must be complemented by case study evidence that more closely examines the effectiveness of particular democracy-promoting programs [30]. Rajkumar and Swaroop (2007) examined the role of governance—measured by the level of corruption and the quality of bureaucracy—in determining the efficacy of public spending in improving human development outcomes [31]. This contributes to an increased understanding of the relationship between public spending, governance, and outcomes, and helps explain the surprising result that public spending often does not yield the expected improvement in outcomes. Dreher et al. (2018) investigated the effects of short-term political motivations on the effectiveness of foreign aid with an African sample [32]. The analytical results showed that the effect of aid on growth is significantly lower in the African case, where short-term political preferences reduce the effectiveness of aid. Yanguas (2018) argued that the transfers generated political incentives for local authorities to pursue short-term, clientelistic spending that has reduced their potential benefits [33]. Even after controlling for the political factors, the ODA program impacts, particularly education and healthcare, may show program effects. For example, there are studies that discuss the effectiveness of aid by applying both the national level economic development and the personal level of human development [32–34]. Dreher et al. (2008) examined the impact of aid on education across various low- and middle- income countries.

The effectiveness of sector-specific aid was mainly assessed within the framework of social production functions [18]. The analysis suggested that higher per capita aid for education significantly increases primary school enrollment, while increased domestic government spending on education does not. Shirazi et al. (2010) suggested that the causal effects of aid and economic growth are positive impacts on education, life expectancy, and human development [35–37]. The results of Ranis et al. (2000) were also similar. Aid for health and education contributes to the development of human capital. Akinkugbe & Yinusa (2009) also confirmed the relationship between technological cooperation and policy support and the level of the human development index (HDI) in sub-Saharan African countries [38].

Most research has been largely based on case studies [37] of specific donor countries, but such studies have not conducted much specific statistical analysis, such as the types of aid program

individually, to verify the determinants of aid concentration. Previous research has neglected the fact that sector-specific aid can be more effective than total aid with ineffective sub-aid programs and, furthermore, that each developing country has a unique combination of various sub-programs in ODA. It should be also noted that a smart combination among the various health, housing, and education sectoral programs could generate positive dynamics of open community innovation and build up a effervescent foundation for social infrastructure to induce sustainable economic development [39–43]. Further study is necessary to identify how the effects of various sub-programs of ODA on human development vary across recipient countries and what type of arrangements among various sub-programs is effective for each country.

3. Methodology and Data

3.1. Empirical Model: Panel Analysis and Fuzzy Set Ideal Type Analysis

This study relies on two research methods: the panel data method and the fuzzy set approach. Our research seeks diversification of interpretation by applying fuzzy ideal type analysis in addition to the existing regression analysis method. By explaining the effects of ODA on HDI in various combinations of conditions, it is possible to offer various analyses that show the impact of the average oriented single variable. In addition, it is easy to compare cases by classifying and considering the qualitative characteristics of the cases. We will attempt to find various significant relationships between ODA and HDI by combining panel analysis and fuzzy ideal type analysis.

First, we introduce the panel model, which has the advantage of controlling unobserved heterogeneity across various countries. This means that we can overcome the limitations of missing variables by controlling the estimation errors that occur in the time series process and those that occur in the individual unit. Panel models are divided into a fixed effects (FE) model and a random effects (RE) model, depending on the assumptions of the error term that controls the missing variable. The FE model takes into account the inherent heterogeneity of the panel entity that does not change with time, that is, the effect of individual characteristics, and assumes that its inherent characteristics are latent. On the other hand, the stochastic effect model assumes that the inherent characteristics of an individual are not fixed but change stochastically. The choice of which of the two models is related to the research. However, in general, the Hausman test can be used to determine which model is more suitable. In this study, the pooled OLS model, the FE model, and the RE model were analyzed. We compared the pooled OLS with the FE model through the F test, and the significance of the time probability effect was tested through the Breusch-Pagan LM test. Finally, the Hausman test was used to compare the stationary effect and the random effect. As a result, the pooled OLS model was not suitable because of autocorrelation and heterogeneity.

Second, we use fuzzy set ideal type analysis. This approach has the advantage of being able to analyze the closeness of each type and the changes in the time series by converting the raw data into a fuzzy-set membership score [44]. The fuzzy set theory was first proposed by Lofti Zadeh in 1965 and has been used in mathematics and psychology as an extension of classical set theory (crisp-set theory), and its application in social sciences is gradually expanding widely. The traditional set (crisp-set) allows only two membership scores: 1 (present) and 0 (absent). X is a sufficient cause of Y if X is a subset of Y [45–47]. Set relations are linked to the idea of sufficiency and necessity. The notion triggers several analytic consequences. A sufficient (but not necessary) condition generally requires the existence of other sufficient conditions for the same outcome. This means that, by embracing a set-theoretic perspective on social science phenomena, one unavoidably recognizes the existence of equifinality. This shows that alternative factors can produce the same outcome [45]. This study sets out to determine factors by sufficient condition. On the other hand, in the fuzzy set, it is possible to measure various affiliation scores between 0.3 and 0.75 instead of 0 (membership) and 1 (non-membership) dichotomies [46]. In this study, we used fuzzy set ideal type analysis to determine which factors lead to aid in Korea, and we analyzed the differences among the countries in the time series dimension

focusing on the period from 2006 to 2016. In the analysis, a calibration process is performed to convert the fuzzy set score. However, if the variables are not standardized in advance, there may be a problem in that the reference point for each variable is randomly set in the conversion process. In this study, we standardized the values between 0 and 1, considering the maximum and minimum values of the variables in each category. The value of each variable was converted to the fuzzy set membership score by standardizing through the calibration function of the fuzzy set analysis. The comparison of the standardized values before the conversion into the fuzzy set membership score can be interpreted as relative to the position between the countries or between the variables. Calibration is basically set to three boundaries. According to the conventional set theory mentioned above, there are 1 and 0, which means FI (fully in or full membership) and FO (fully out or full non-membership), and 0.5, which is a crossover point, a branch point of 1 and 0. In this study, as suggested by Ragin (2008), we set the value representing 95% within each category to FI, and the FO was set to a value representing 5% within each category. The branch point was based on the average value. The formula for calculating the fuzzy membership score is as follows. Ragin (2008) suggested the function to calibrate the degree of membership [46].

$$\text{Degree of Membership} = \exp(\log \text{odds})/1 + \exp(\log \text{odds})$$

In this study, the degree of membership is analyzed on the fuzzy set score derived from this formula with 0.5 as a reference point. The http://www.compasss.org site, which provides comprehensive information on QCA, provided 18 statistical software contents by the end of May 2017. Among the statistical software, the fs/QCA2.5 program developed by Ragin & Davey (2014) is commonly used [47]. We applied the program to calibrate and analyze the variables.

3.2. Data and Variables

In general, the contents specified in the Development Assistance Committee (DAC) are used as the definition of ODA. In other words, the ODA can be conceptualized as flows of funds provided to countries and regions, or multilateral development institutions, which are included in the list of recipients established by the DAC (OECD 2010). The DAC is an organization under the Organization for Economic Cooperation and Development (OECD), which was established to assist developing countries. Among the OECD countries, the countries providing loans are divided into the so-called "donors club" or the "advanced group for aid." The predecessor of the DAC is the Development Assistance Group (DAG), which was launched in 1960. The purpose of the establishment is to exchange information and opinions required to effectively assist developing countries and to coordinate the development process. Korea also joined the DAC as the 24th member country on 25 November 2009 [48]. However, analyzing all of these flows of funds can widen the scope of the study too much, and may lead to a blurring of the focus of analysis. Therefore, this study focused on the grant aid of bilateral aid among various types of ODA. Because the purpose of this study is to determine under what conditions recipients receive aid from donors, bilateral aid (which is the direct aid between the recipient and donor) is more appropriate in contrast to multilateral aid (which means indirect aid, such as investments through international organizations). Since credit assistance also has a repayment obligation for aid, repayment capabilities can be the most important reason for aid. Therefore, grant-aid, which has no burden of repayment, is more appropriate for examining the reasons and conditions of aid, so the range of ODA in this study means that the flow of funds into the recipient countries in the form of bilateral direct grants among ODA types, such as education, health, water and sanitation, and public services [49,50].

This study focuses on South Korea as a donor. It analyzes 15 Asian countries in which they have received the largest amount of aid from South Korea from 2006 to 2016. The recipient countries include Vietnam, Myanmar, Cambodia, Philippines, Lao PDR, Indonesia, Mongolia, Sri Lanka, Timor-Leste, Nepal, Bangladesh, Thailand, Pakistan, Afghanistan, and China. According to the Korea International

Cooperation Agency (KOICA), which is the implementing agency for grant-aids, an average of 53.8% of Korea's ODA had been donated to Asian countries by 2016 [1]. South Korea has had close ties with Asian countries given its geographic proximity and cultural familiarity. This has been reflected in its concentration of aid allocation to Asia.

Given geographical proximity and cultural similarities with Asian partner countries, the Korean government has allocated the greatest amount of its ODA to Asian partner countries. There are 11 countries out of the 24 priority partner countries located in Asia, and more than half of Korea's bilateral aid is distributed to the Asian region. Since Korea kept the recommendations of the 2013 DAC Peer Review, Korea integrated the list of 24 priority partner countries common to both grants and loans. It is now concentrating over 70% of bilateral ODA to these countries for greater impact and effectiveness [3,50].

We selected 15 Asian regions as research subjects to investigate the ODA effectiveness. In this study, we also used the human development index (HDI) that was created to emphasize that people and their capabilities should be the ultimate criteria for assessing the development of a country, not economic growth alone. The HDI can also be used to question national policy choices, asking how two countries with the same level of GNI per capita can end up with different human development outcomes [2,3].

Table 1 shows that the dependent variable is the time t (2007–2016) and the independent variable and the control variable are the time t − 1 (2006–2015). This reflects the time lag between the aid and the effects.

Table 1. Measurement of variables.

Variables		Symbol	Description of Variables
Dependen Variables	HDI	*H*	Human development index: average achievement in a long and healthy life, knowledge and decent standard of living (HDI of t_time)
	HDI_life_expectancy	*HL*	Life expectancy at birth (HDI of t_time)
	HDI_education	*HE*	Years of schooling for adults aged 25 years and more and expected years of schooling for children of school entering age (HDI of t_time).
	HDI_GNI per capita	*HG*	Gross national income per capita (HDI of t_time)
Independent Variables	Total ODA	*TO*	Total grant-aid of bilateral aid to recipient countries: t − 1 (USD, in millions)
	ODA_education	*OE*	Education field grant-aid of bilateral aid to recipient countries: t − 1 (USD, in millions)
	ODA_health	*OH*	Health field grant-aid of bilateral aid to recipient countries: t − 1 (USD, in millions)
	ODA_water and sanitation	*OW*	Water and sanitation field grant-aid of bilateral aid to recipient countries: t − 1 (USD, in millions)
	ODA_public service	*OP*	Public service field grant-aid of bilateral aid to recipient countries: t − 1 (USD, in millions)

Table 1. *Cont.*

Variables		Symbol	Description of Variables
Control Variables	Inflation	*I*	Annual consumer price index (CPI): t − 1
	Population (log)	*POP*	The number of people that live in the country: t − 1
	FDI (log)	*F*	FDI (Foreign Direct Investment) financial flows: t − 1 (USD, in millions)
	Political stability and Absence of violence	*PS*	Perceptions of the likelihood of political instability and/or politically motivated violence, including terrorism: t − 1 (Worldwide Governance Indicators: WGI)
	Government Effectiveness	*G*	Perceptions of the quality of public services and the degree of its independence from political pressures: t − 1 (WGI)
	Control of Corruption	*C*	Perceptions of the extent to which public power is exercised for private gain as well as "capture" of the state by elites and private interests: t − 1 (WGI)

Sources: Official Development Assistance (ODA) (http://www.odakorea.go.kr/ez.main.ODAEngMain.do), UNDP (hdr.undp.org/en/statistics/hdi), WGI(www.govindicators.org).

4. Empirical Results

We performed panel analysis involving both FE (fixed effects) and RE (random effects). The total amount of ODA was applied as an independent variable. Model 1 is a regression model including demographic factors (population and economic factors) and governance factors (political stability, absence of violence, government effectiveness, and control of corruption) [51–53]. In the model, the FE model is more suitable by rejecting Ho as the Hausman test result.

4.1. Descriptive Statistics

This study observes Korea as a donor and analyzes 15 countries in the Asia region that Korea supported from 2006 to 2016. The observations are 150 and the values of mean, standard deviation, maximum, and minimum are standardized from 0 to 1 (see Table 2). This method enables us to compare the results between regression analysis and fuzzy set ideal type analysis [54].

Table 2. Descriptive statistics.

Variables	N	Mean	Standard Deviation	Minimum	Maximum
H	150	0.508534	0.3505276	0.010590	0.969988
HL	150	0.512992	0.3157069	0.008578	0.962822
HE	150	0.505424	0.3349232	0.024349	0.963258
HG	150	0.481802	0.3238082	0.029539	0.976328
TO	150	0.517705	0.3219417	0.010941	0.998624
OE	150	0.450524	0.3005218	0.028130	0.998793
OH	150	0.403426	0.3090197	0.046957	0.998573
OW	150	0.389493	0.333559	0.047426	0.998280
POP	150	0.483216	0.2669492	0.042851	0.954080
F	150	0.473743	0.2848984	1.55e-09	0.969215
I	150	0.447262	0.2738403	0.000493	0.998052
PS	150	0.225314	0.204469	0.048727	0.802184
G	150	0.214451	0.1295361	0.048727	0.557990
C	150	0.315111	0.2199036	0.054348	0.755253

4.2. Panel Regression Analysis

In this research, we tested the FE and RE models and reported the appropriateness of the Hausman test and the Breusch and Pagan Lagrangian multiplier test, respectively. More specifically, we conducted panel analysis of the HDI (H, HL, HE, HL) of total ODA (TO). We then examined a causal relationship between the size of aid from the Korean government and the HDI of recipient countries from 2006 to 2016. We investigated endogeneity in the panel regressions and introduced instrumental variables. The differences in the amount of ODA across Korean presidential administrations, irrespective of the HDI-related indicators of the beneficiary country, were used as instrumental variables generating an exogenous variation of the overall size of ODA. As for the instrumental variables, the Roh Moo-hyun government was used as the reference group, and Lee Myung-bak and Park Geun-hye were used as two government dummy variables. The statistical significance of these instrument variables was all within 1% (refer to Tables A1 and A2 for details). While the exogenous variations come from three different administrations, there may be additional sources of exogenous variations from country-specific time-varying trends from the 15 recipient countries from 2006 to 2015 (see Table A3). However, this study did not use various interaction variables between the 15 Asian countries and the three different presidential administrations of South Korea as instrumental variables. The reason is that the adoption of such instrumental variables involves a substantial loss of degree of freedom for estimation and that our FE approach may also simultaneously absorb a substantial part of the country-specific variation. Future research is required to explore this issue in terms of internal validity as well as external validity.

The effectiveness of ODA on specific program details was further analyzed through panel data analysis and fuzzy analysis. The specific explanatory variables (OE, OP, etc.) of ODA also have endogeneity, but here we focused on checking whether there is a difference according to program type using the program rather than the causality effect of these programs. Therefore, panel analysis by each type of program focused on identifying differences among these programs.

Tables 3–6 shows the effects of TO on H, H, HL, HE, and HG using the FE model, the RE model, and the IV (instrumental variable) model.

In Table 3 (HDI-dependent variables), the FE model explains 5.8% of the variation in HDI (H) overall, but 71.2% of the variation within countries over time and 5.6% of the variation across countries. The RE model explains 61.9% of the variation in HDI overall, but 61.4% of the variation within countries over time and 62.9% of the variation across countries. In both FE and RE models, TO has a positively significant effect on HDI at a significance level of 1%. As a result of the instrumental analysis, the estimates of TO are relatively larger than those of the FE model (0.082) and the RE model (0.101) (0.300 when we put the IV into the fixed model and 0.409 when we apply the IV into the random model).

As shown in Tables 4–6, TO also had a significantly positive effect on the sub-factors of HDI (HL, HE, HG). Moreover, the estimates of TO were larger than those of the FE and RE models.

We can confirm that TO also affects the HDI, HL, HE, and HG of the recipient countries. However, the estimates of the instrumental variables used in this study (TO, which is much more influenced by the Lee Myung-bak and Park Geun-hye governments than by Roh Moo-hyun) are larger than those of the FE and RE models (the size of TO was increased by several times). In the future, further analysis will be necessary to expand sample size and appropriate instrument variables should be explored.

Table 3. The effects of ODA on the human development index (HDI) (H: HDI).

N = 150	Fixed Effects Model		Fixed Effects Model (IV)		Random Effects Model		Random Effects Model (IV)	
Variables	**b**	**SE**	**B**	**SE**	**B**	**SE**	**b**	**SE**
TO	0.082 ***	0.017	0.300 ***	0.077	0.101 ***	0.021	0.409 ***	0.095
I	−0.004	0.016	0.017	0.025	−0.025	0.019	0.024	0.033
POP	3.659 ***	0.558	2.289 **	0.952	0.190	0.167	−0.275	0.209
F	0.227 ***	0.038	0.202 ***	0.057	0.240 ***	0.046	0.219 ***	0.077
PS	0.187 ***	0.060	0.072	0.098	0.269 ***	0.068	0.024	0.127
G	0.028	0.098	0.146	0.152	0.122	0.109	0.582 ***	0.182
C	0.243 ***	0.074	0.175	0.114	0.442 ***	0.085	0.273 *	0.154
Intercept	−1.511 ***	0.266	−0.956 **	0.440	0.068	0.091	0.068	0.105
	Within R^2 = 0.712 Between R^2 = 0.056 Overall R^2 = 0.058		Within R^2 = 0.352 Between R^2 = 0.074 Overall R^2 = 0.079		Within R^2 = 0.614 Between R^2 = 0.629 Overall R^2 = 0.619		Within R^2 = 0.418 Between R^2 = 0.734 Overall R^2 = 0.657	
	Hausman test $\chi^2(7)$ = 10.72, Prob. >χ^2 = 0.1514				POLS relevance test: $\chi^2(1)$ = 278.66, Prob. >χ^2 = 0.0001			

Notes: (1) IV = Instrumental variable estimation to control for the endogenous problem of the TO variable. Two instrumental variables such as two administrations (Lee Myung-bak and Park Geun-hye administrations) of South Korea as dummy variables compared with the reference group (i.e., Rho Moo-hyun administration); (2) b = regression coefficient; SE = standard error; (3) Hausman test for the null hypothesis that difference in coefficients is not systematic (i.e., the coefficients are equal); (4) POLS test indicates Breusch and Pagan Lagrangian multiplier test for random effects, judging whether or not to reject the null hypothesis that there is a common intercept (i.e., pooled OLS is appropriate); (5) *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table 4. The effects of ODA on the HDI (HL: Life Expectancy).

N = 150	Fixed Effects Model		Fixed Effects Model (IV)		Random Effects Model		Random Effects Model (IV)	
Variables	**B**	**SE**	**b**	**SE**	**B**	**SE**	**b**	**SE**
TO	0.046 *	0.025	0.320 ***	0.102	0.071 **	0.028	0.460 ***	0.118
I	0.014	0.023	0.040	0.033	−0.016	0.025	0.040	0.042
POP	4.945 ***	0.797	3.220 **	1.274	0.663 ***	0.211	0.250	0.315
F	0.233 ***	0.054	0.202 ***	0.076	0.235 ***	0.061	0.193 **	0.096
PS	0.412 ***	0.086	0.267 **	0.130	0.494 ***	0.091	0.202	0.161
G	−0.267	0.140	−0.118	0.203	−0.225	0.144	0.122	0.236
C	0.168	0.106	0.082	0.152	0.425 ***	0.113	0.187	0.190
Intercept	−2.062 ***	0.380	−1.363 **	0.588	−0.080	0.114	−0.079	0.161
	Within R^2 = 0.593 Between R^2 = 0.159 Overall R^2 = 0.156		Within R^2 = 0.197 Between R^2 = 0.171 Overall R^2 = 0.171		Within R^2 = 0.494 Between R^2 = 0.334 Overall R^2 = 0.344		Within R^2 = 0.249 Between R^2 = 0.365 Overall R^2 = 0.335	
	Failure to meet the asymptotic assumptions of the Hausman test				POLS relevance test: $\chi^2(1)$ = 324.40, Prob. >χ^2 = 0.0001			

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table 5. The effects of ODA on the HDI (HE: Years of Schooling).

N = 150	Fixed Effects Model		Fixed Effects Model (IV)		Random Effects Model		Random Effects Model (IV)	
Variables	**B**	**SE**	**b**	**SE**	**B**	**SE**	**b**	**SE**
TO	0.079 ***	0.024	0.309 ***	0.093	0.104 ***	0.028	0.469 ***	0.117
I	0.026	0.022	0.048	0.030	0.001	0.025	0.056	0.041
POP	4.590 ***	0.768	3.141 ***	1.153	0.069	0.181	−0.382	0.235
F	0.237 ***	0.052	0.212 ***	0.069	0.250 ***	0.061	0.223 **	0.093
PS	0.268 ***	0.082	0.146	0.118	0.358 ***	0.090	0.069	0.154
G	−0.060	0.134	0.065	0.184	0.132	0.140	0.616 ***	0.216
C	0.115	0.102	0.043	0.138	0.380 ***	0.113	0.157	0.188
Intercept	−1.944 ***	0.366	−1.357 **	0.532	0.096	0.098	0.073	0.116
	Within R^2 = 0.580 Between R^2 = 0.018 Overall R^2 = 0.019		Within R^2 = 0.269 Between R^2 = 0.023 Overall R^2 = 0.026		Within R^2 = 0.444 Between R^2 = 0.644 Overall R^2 = 0.621		Within R^2 = 0.280 Between R^2 = 0.693 Overall R^2 = 0.596	
	Failure to meet the asymptotic assumptions of the Hausman test				POLS relevance test: $\chi^2(1)$ = 243.05, Prob. >χ^2 = 0.0001			

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table 6. The effects of ODA on the HDI (HG: GNI per capita).

N = 150	Fixed Effects Model		Fixed Effects Model (IV)		Random Effects Model		Random Effects Model (IV)	
Variables	**B**	**SE**	**b**	**SE**	**B**	**SE**	**b**	**SE**
TO	0.119 ***	0.024	0.344 ***	0.093	0.129 ***	0.024	0.399 ***	0.093
I	−0.055 **	0.022	−0.034	0.030	−0.072 ***	0.022	−0.034	0.033
POP	2.362 ***	0.785	0.946	1.156	0.017	0.222	−0.327	0.260
F	0.184 ***	0.053	0.159 **	0.069	0.196 ****	0.054	0.171 **	0.075
PS	0.057	0.084	−0.062	0.118	0.111	0.081	−0.094	0.127
G	0.290 **	0.137	0.412 **	0.184	0.294 **	0.130	0.554 ***	0.187
C	0.444 ***	0.104	0.373 ***	0.138	0.570 ***	0.100	0.408 ***	0.149
Intercept	−0.983 **	0.374	−0.410	0.534	0.106	0.121	0.127	0.134
	Within R^2 = 0.615 Between R^2 = 0.082 Overall R^2 = 0.086		Within R^2 = 0.356 Between R^2 = 0.154 Overall R^2 = 0.167		Within R^2 = 0.588 Between R^2 = 0.589 Overall R^2 = 0.584		Within R^2 = 0.455 Between R^2 = 0.518 Overall R^2 = 0.487	
	Hausman test $\chi^2(7)$ = 16.02, Prob. >χ^2 = 0.0250				POLS relevance test: $\chi^2(1)$ = 447.22, Prob. >χ^2 = 0.0001			

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

ODA consists of various sub-components of international aid programs. They include education, health, water, and public service. We examined the influence of the subordinate factors (program) of TO, OE, OH, OW, and OP on sub-factors of HDI. We selected the appropriate model between the FE model and RE model after the Hausman test. In Table 7, Model 1 is a regression model including demographic factors (population and economic factors) and governance factors (political stability, absence of violence, government effectiveness, and control of corruption). The FE model is more suitable, rejecting Ho as the Hausman test result. Table 7 shows the effect of the level of HDI of the

recipients on the amount of aid provided by Korea. We examine the impact the amounts of ODA by support types on HDI as follows.

$$HDI_{it} = \beta_0 + \beta_{11}{}^{*}OE_{it-1} + \beta_2{}^{*}OH_{it-1} + \beta_3{}^{*}OW_{it-1} + \beta_4{}^{*}OP_{it-1} + \beta_{4k}{}^{*}X_{kit-1} + \mu_{it} \text{ ———— } (Model\ 1)$$

where (1) HDI includes H, HL, HE, and HG; (2) X_k represents control variables (I, POP, F, PS, G, and C).

Table 7. The results of regression analysis.

	Human Development Index (Dependent Variables)			
	H	***HL***	***HE***	***HG***
Variable	**Model 1**	**Model 1**	**Model 1**	**Model 1**
OE	−0.029 *	0.053 **	0.011	−0.109 ***
OH	0.061 ***	0.032	0.037	0.085 ***
OW	0.007	0.035	0.0004	−0.002
OP	0.079 ***	0.093 ***	0.073 ***	0.108 ***
I	0.004	0.024	0.034	−0.042 *
POP	2.056 **	1.323	2.806 **	1.537
F	0.196 ***	0.134 **	0.198 ***	0.192 ***
PS	0.227 ***	0.416 ***	0.306 ***	0.128
G	−0.016	−0.262 *	−0.107	0.221 *
C	0.271 ***	0.220 **	0.166	0.469 ***
Intercept	−0.7307 *	−0.349	−1.081 **	−0.562

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Model 1 represents which factors are statistically significant, after including the control variables (I, POP, F, PS, G, and OH). In Model 1, the public service aid of ODA (OP) has a significantly positive effect on all HDI (H, HL, HE, and HG) but, the water and sanitation of ODA (OW) has no impact on all the dependent variables. The health aid (OH) has a statistically positive effect on human development index (H) and GNI per capita (HG) of recipient countries but not on human development index (H) and years of schooling (HE) of the recipient countries. On the other hand, the effects of educational aid of ODA (OE) vary from different human development outcomes. It appears that the effects of educational aid of ODA on development outcomes of recipient countries are complicated. OE is positively associated with HL, but negatively with HG and H. OE is not related to HE. Future research is required to explore a relationship between educational aid of ODA and development outcomes. The effect of foreign aid-based education is expected to be positively related to development. But there are potential confounding factors to influence (or distort) the relationship between educational aid and development outcomes. In addition, the impact of educational aid program might be non-linear. For instance, the effect of educational aid in small amounts may be very weak at the early stage of ODA program but increasingly strong as the amount of educational aid increases over time. In other words, the effect of educational aid takes time to emerge. Even if it does not significantly appear at the beginning of an educational support project, it is necessary to invest in education with a long term effect continuously.

4.3. Fuzzy Set Ideal Type Analysis

Fuzzy set ideal type analysis is a framework that allows us to operate a precise configuration of concepts into ideal types and to categorize the cases.

To analyze and categorize the determinants of the differences in the size of aid in Korea, we used three conditions in the HDI index (education, health, and public service aid in ODA), according to the

amount of the aid, using the fuzzy set method. Table 8 shows the ideal types of aid effectiveness. It is further divided into the three dimensions: OE (ODA education aid), OH (ODA health aid), and OP (ODA public service aid). Once the membership scores for each case in each dimension were assessed, aid effectiveness as a combination of these three dimensions was analyzed.

Table 8. Ideal types of aid effectiveness.

ODA_Education	ODA_Health	ODA_public Service	Condition	Ideal Types
OE	*OH*	*OP*	*OE*OH*OP*	education * health * public service aid
OE	*OH*	*~OP*	*OE*OH*~OP*	education * health aid
OE	*~OH*	*OP*	*OE*~OH*OP*	education * public service aid
OE	*~OH*	*~OP*	*OE*~OH*~OP*	education aid
~OE	*OH*	*OP*	*~OE*OH*OP*	health * public service aid
~OE	*OH*	*~OP*	*~OE*OH*~OP*	health aid
~OE	*~OH*	*OP*	*~OE*~OH*OP*	public service aid
~OE	*~OH*	*~OP*	*~OE*~OH*~OP*	no aid

The results of the analysis by a complex solution show three types of causal conditions. As shown in Table 9, Asian countries are categorized into three types of aid effectiveness: (1) education * health aid, (2) education * public service aid, and (3) health * public service aid. The empirical consistency of the complex solution is 0.798, and the coverage is 0.437. Three configurations account for 43.7% of the mechanisms involved in determining the HDI by Korea's aid. Examining three configurations demonstrates three causal conditions: (1) though the level of public service aid is low (*~ODA_publicservice*), the HDI of recipient countries is impacted when educational and health aids are high; (2) when the level of health aid is low (*~ODA_health*), and when the aids of education and public service are high, the HDI is influenced; (3) if the educational aid is low (*~ODA_education*) when health and public service aids are high, the level of HDI could become significant.

Table 9. Configuration of conditions affecting HDI by allocation.

Configuration	Raw Coverage	Unique Coverage	Consistency
ODA_education * ODA_health * ~ODA_publicservice	0.321835	0.058399	0.818084
ODA_education * ~ODA_health * ODA_publicservice	0.334142	0.0781004	0.873652
~ODA_education * ODA_health * ODA_publicservice	0.27054	0.0204439	0.833568
solution coverage: 0.437713 solution consistency: 0.798332			

Based on the results of Table 9, the formula conditions that determine HDI are summarized as follows.

$$\langle (ODA\_education * ODA\_health * \sim ODA\_publicservice) + (ODA\_education * \sim ODA\_health * ODA\_publicservice) + (\sim ODA\_education * ODA\_health * ODA\_publicservice) \rangle \quad (1)$$

These results show that, if a country receives a low level of aid, other types of aid are necessary for the recipient country's quality of life to improve. Figure 1 shows that the analysis of ideal types may be graphically organized as follows.

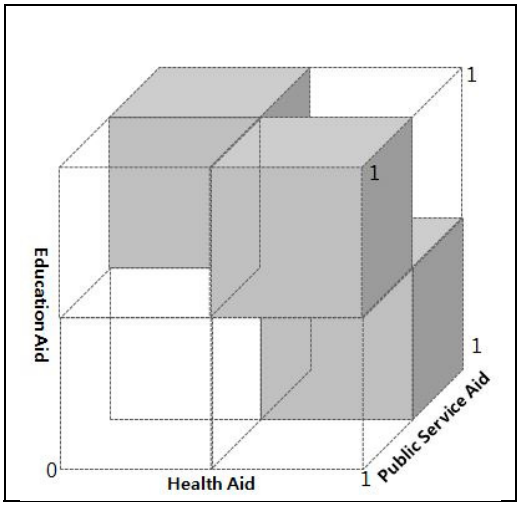

Figure 1. Cubic property of ODA policy in Korea (2006–2016).

Even if educational aid is low, the HDI is estimated to be high if the level of health and public service aid is high. Nations in which this is the case include Sri Lanka, Timor-Leste, Laos, Cambodia, and Nepal. These countries are of the health * public service aid type of effectiveness in Table 4. For these countries, support for health and sanitation, or for public services, is more effective than support for education. Second, even if the health aid is low, the HDI increases when the educational aid and public services aid are high. This is the education * public service aid type of effectiveness. Nations in which this is the case include Mongolia, Bangladesh, and Sri Lanka. Even if it takes time for these countries, long-term support policies for education and public service improvement can be effective. Third, when the public service aid is low, the HDI becomes effective if the educational and health aids are high. This pertains to the education * health aid type of effectiveness. The countries in which this is the case include Myanmar, Indonesia, and Lao PDR. For these countries, health, hygiene, and education-related support should be preceded, which can directly affect their quality of life. Additionally, we examined political determinants of ODA effectiveness: political stability, absence of violence, and control of corruption. As shown in Table A4 in Appendix A, Asian countries showed seven configurations of aid effectiveness. The causal conditions explained the configurations of causal condition. More specifically, OE and OH affect the HDI in Sri Lanka, Timor-Leste, Cambodia, and Nepal, but these countries were less affected by the political condition. In Mongolia and Bangladesh, OE is a key factor to increasing HDI. OH is necessary for the quality of life of Myanmar and Indonesia. A good political status, i.e., political stability, absence of violence, and control of corruption, is not always an essential condition for HDI. This implies that aid effectiveness depends on the country and that sector-specific aid by an ODA item may be more effective than total aid. In sum, some sub-programs of ODA are more effective in some countries but not in others. This finding allows us to design a well targeted aid program relevant to country-specific needs and priorities.

5. Conclusions

5.1. Summary of Key Findings

Recent empirical studies have paid attention to the causal relationship between aid, economic development, and quality of life, but discussions on the effects of aid on economic growth and quality of life are currently ongoing in the light of governance perspective [52,53]. This study applied various models based on panel data to confirm the effect of aid on a country's quality of life. We analyzed the relationship between HDI and aid type in recipient countries. Based on UNDP's HDI, we looked at what types of aid led to meaningful changes in the quality of life (HDI) of recipient countries with

panel regressions from 2006 to 2016, across 15 Asian countries, and then typified them by country with the fuzzy set method.

First, the panel regression analysis shows that the total amount of ODA has a positively significant effect on the HDI, including life expectancy, education, and economic growth in recipient countries. In other words, the higher the aid, the better the quality of life. The effect of sector-specific aid was not significant in the water and sanitation field grant-aid. On the other hand, education, health, and public service field aids have effects on the HDI. In particular, the effect of educational aid on the national income of developing countries is nonlinear with a quadratic form. The effectiveness of educational assistance takes time to materialize. The educational sector of the ODA program requires long-term intensive investment.

Second, the fuzzy set ideal type analysis was conducted to investigate which countries have different effects on aid type. For instance, Sri Lanka, Timor-Leste, Laos, Cambodia, and Nepal have shown that the ODA of public service and health is effective. Mongolia, Bangladesh, and Sri Lanka reveal the most effective support of education and public services. Myanmar, Indonesia, and Lao PDR are countries that require intensive aid in education and health. It is necessary to identify the effectiveness of each country and seek sectoral support rather than integrated aid.

This study addresses the limitations of previous research that analyze the effects of ODA. The analysis of the economic and social impacts of ODA on the basis of the panel data is significant. ODA variables were analyzed according to the purpose of the utilization of the aid amount. By separating the total amount of ODA into economic and social sectors, such as education, health, water and sanitation, and public service, we were able to analyze the effects on each dependent variable. In other words, social support, such as education, medical care, and welfare, is more likely to directly affect HDI. Further, it is necessary to carefully explore whether or not there are potential unrevealed causal relations between ODA and human development outcomes across countries. The IV approach in this study was not sufficient to identify all the possible causal links embedded in various contexts across countries. Since the IV method still contains a significant caveat regarding the causality of our empirical estimations, further research should explore how the existence of country-specific time-varying trends can generate the degree of exogenous variation in the ODA program, not correlated with the degree of human development factors. Beside the internal validity issue, the degree of the causality may also vary across different country groups other than the 15 recipient countries in this study. More expanded multiple sources from other developing countries can improve the external validity of our empirical findings.

5.2. Policy Implications of ODA Programs

The main topic of ODA is related to the effectiveness of the aid project and the development capacity of the recipient countries through aid. The theme has attracted the attention of many researchers due to the appearance of aid fatigue in 1990 and the end of the Cold War, which rationalized ideological aid [29–37,55]. This was a very controversial issue due to the effectiveness of aid and development. However, in spite of the controversy over the direction of aid, understanding the characteristics of the recipient country can lead to sustainable and effective aid.

Further research is required to explore all recipient countries and the whole ODA program to improve the ODA system. Previous research [56–62] has neglected open and social innovation ideas and missed potential effective roles of various stakeholders in communities and markets in developing countries. An open innovation approach can provide smart and sustainable solutions to improving the effectiveness of various ODA programs [39–42]. The outcome function of ODA programs depends not only on their financial resources and managerial factors [58–62] but also on market forces, state bureaucracies, the effective collaborations among nations, and social business innovations [41]. There are state roles, market elements, and social forces that facilitate the emergence of social innovations [43] through formal and informal interactions among various stakeholders involved in the implementation of ODA programs. More specifically, future research should be paid to improving the effectiveness

and quality of ODA programs in terms of three aspects: (1) the significance of informal interactions in the open innovation system of developing countries [20]; (2) the importance of social entrepreneurs and social business models with grassroots ideas in developing countries [41]; and (3) the effective elimination of bureaucratic inertia of ODA programs through the mobilization of the grassroots and community innovators [15]. Our study does not consider these three points, and future research is required in order to explore a more scientific approach for the effective function of ODA programs.

Author Contributions: E.L. and K.J. conceived and designed the research frame and analyzed empirical findings; E.L. conducted fuzzy set analysis; E.L. and K.J. wrote the paper. J.S. coded panel data and analyzed statistics.

Funding: This work was supported by the National Research Foundation of Korea Grant funded by the Korean Government (NRF-2017S1A3A2066084).

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. First stage estimation within regression (fixed effects (FE) model).

Variables	Coefficient	SE	t-Value	p > |t|
I	−0.108	0.077	−1.40	0.163
POP	−2.183	3.580	−0.61	0.543
F	−0.072	0.188	−0.38	0.701
PS	0.319	0.306	1.04	0.298
G	−0.337	0.478	−0.71	0.482
C	0.230	0.396	0.58	0.563
Lee Myung-bak Administration	0.193	0.049	3.91	0.000
Park Geun-Hye Administration	0.265	0.077	3.43	0.001
Intercept	1.464	1.731	0.85	0.399

Notes: (1) N = 150; (2) F(8, 127) = 5.20, Prob. > F = 0.001; (3) within R^2 = 0.247; between R^2 = 0.068; overall R^2 = 0.024 (dependent variable: TO).

Table A2. First stage estimation within regression (random effects (RE) model).

Variables	Coefficient	SE	z-Value	p > |z|
I	−0.088	0.072	−1.22	0.223
POP	0.554	0.444	1.25	0.212
F	−0.097	0.177	−0.55	0.584
PS	0.382	0.269	1.42	0.156
G	−0.346	0.386	−0.90	0.370
C	0.304	0.367	0.83	0.408
Lee Myung-bak Administration	0.175	0.041	4.25	0.000
Park Geun-Hye Administration	0.221	0.055	4.02	0.000
Intercept	0.139	0.245	0.57	0.571

Notes: (1) N = 150; (2) Waldo $\chi^2(7)$ = 106.66, Prob. > χ^2 = 0.001 (dependent variable: TO).

Table A3. Total amount of ODA from South Korea (2006–2015).

Country		Roh Administration	Lee Administration	Park Administration	Total
Afghanistan 1	Mean	0.165	0.951	0.338	0.610
	SD	0.055	0.030	0.348	0.401
Bangladesh 2	Mean	0.411	0.452	0.681	0.513
	SD	0.042	0.231	0.174	0.210
Cambodia 3	Mean	0.257	0.091	0.029	0.105
	SD	0.248	0.057	0.015	0.125
China 4	Mean	0.573	0.808	0.823	0.766
	SD	0.105	0.078	0.069	0.124
Indonesia 5	Mean	0.592	0.776	0.939	0.788
	SD	0.177	0.231	0.012	0.208
Lao PDR 6	Mean	0.424	0.462	0.743	0.539
	SD	0.046	0.074	0.102	0.159
Mongolia 7	Mean	0.624	0.437	0.557	0.511
	SD	0.161	0.160	0.141	0.159
Myanmar 8	Mean	0.204	0.322	0.904	0.473
	SD	0.195	0.174	0.046	0.330
Nepal 9	Mean	0.486	0.863	0.870	0.790
	SD	0.217	0.186	0.106	0.221
Pakistan 10	Mean	0.254	0.517	0.644	0.503
	SD	0.021	0.222	0.062	0.208
Philippines 11	Mean	0.073	0.181	0.221	0.172
	SD	0.031	0.098	0.066	0.092
Sri Lanka 12	Mean	0.400	0.830	0.920	0.771
	SD	0.110	0.173	0.022	0.234
Thailand 13	Mean	0.043	0.082	0.200	0.109
	SD	0.009	0.033	0.068	0.075
Timor-Leste 14	Mean	0.052	0.215	0.406	0.240
	SD	0.032	0.164	0.222	0.201
Vietnam 15	Mean	0.596	0.930	0.975	0.877
	SD	0.087	0.036	0.003	0.154
Total	Mean	0.344	0.528	0.617	0.518
	SD	0.224	0.331	0.321	0.322

Notes: (1) The total amount of the aid (ODA) was converted into the log value and then standardized by the fuzzy score. It was calculated by setting the upper 5% of the data value to 1, the median value to 0.5, and the lower 5% to 0. Statistical software fs/QCA2.5 program developed by Ragin & Davey (2014) was used. (2) SD = standard deviation.

Table A4. Configuration of conditions affecting HDI according to political environment.

Configuration	Raw Coverage	Unique Coverage	Consistency
ODA_education * ODA_health * ~ODA_publicservice * ~politicalstability	0.318565	0.0186003	0.818926
ODA_education * ~ODA_health * ODA_publicservice * ~controlofcorruption	0.333115	0.0217993	0.873311
ODA_education * ODA_health * controlofcorruption * ~politicalstability	0.268618	0.000516593	0.979762
ODA_education * ODA_publicservice * ~controlofcorruption * politicalstability	0.308036	0.0339696	0.923998

Table A4. *Cont.*

Configuration	Raw Coverage	Unique Coverage	Consistency
~ODA_education * ~ODA_health * ~ODA_publicservice * controlofcorruption * ~politicalstability	0.31387	0.0662706	0.965027
~ODA_education * ~ODA_health * ~ODA_publicservice * ~controlofcorruption * politicalstability	0.244026	0.0217538	0.922738
~ODA_education * ODA_health * ODA_publicservice * ~controlofcorruption * ~politicalstability	0.267347	0.00730443	0.837683
solution coverage: 0.596918 solution consistency: 0.821761			

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