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Does Official Development Assistance Affect Donor's Export? Case of Korea*

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Abstract

This paper aims to estimate the impact of bilateral Official Development Assistance (ODA) provided by Korea on its bilateral export to recipient countries. The empirical analysis is based on data from 1996 to 2014 with 121 recipient countries. Although the two models of determinants of ODA and its export effectiveness are highly interrelated, this kind of simultaneous model specification with two-ways causal relationship has not been conducted in the past. Employing a three-stage least squares estimation method leads to accounting for two-ways causal relationships between ODA and export while the endogeneity and sample selection bias are accounted for. Through using the gravity model in analysis of Korea's aggregated export data, the positive effect of bilateral ODA is confirmed when fixed unobserved effects are controlled. The model is further generalized by disaggregation of ODA into its underlying types. The results show that, humanitarian aid and loan-type aid turn out to be effective types of ODA to influence export positively. In terms of Korea's ODA allocation, the finding suggests that there is a two-stage decision making process in aid provision. In the first stage, a humanitarian purpose of aid dominates responding to lower income and disaster experienced countries' needs, even when lower bilateral trade prevails. The second stage is to make a decision regarding the size of ODA to selected recipient countries, and this presents a mixed purposes of giving ODA aiming at higher importer countries.

Key words: Gravity model; bilateral Official Development Assistance; bilateral export; Three-stage least squares; Korea;

JEL Classification Codes: F14; F21; F35;

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1. Introduction

Official Development Assistance¹ (hereafter ODA) are economic resources provided by official sectors that are transferred from donors to developing countries for social and economic development and poverty reduction. Korea was a recipient country which had hugely benefited from ODA after the Korean War (1950~1953). With the aid given, Korea was dramatically transformed from the one of the poorest countries to, depending on the exchange rate, the 10th or 12th largest economy in the world. Korea declared its global role as a donor of ODA in 2010 joining the Development Assistance Committee (DAC) of the Organization for Economic Cooperation and Development (OECD). As member of DAC, Korea has to make contributions in ODA in terms of scale and effectiveness. Thus, the amount of ODA provided by the Korean government increased to more than 2.2 trillion won² based on budgetary in 2014. For aid effectiveness, the international community has recommended donors to expand untying aids, in order to enhance the recipients' independence and reduce their implementation costs. Therefore, the ODA expansion in volume and terms is a heavy burden to Korea, facing growing domestic demands. At this point, the study of the economic impacts of ODA on a donor is important to ensure that ODA policy is sustainable. To examine whether there are economic gains for a donor, like Korea, this paper aims to answer the following question: "Does Korea's ODA affect its export as a donor?"

The reasons why export matters to Korea are explained as follows. A successful economic development, namely Korean miracle, is a result of an exported-oriented industry structure and policy. The transition from the recipient country into the donor set is no precedent for the emerging world. Korea's trade dependence has comprised over 70% of its GDP since 2004. In addition, the number of exporter enterprises in domestic market is 94,825 in 2014. This implies Korea's exports are important as a driving force of its continuous economic growth and development.

There are several studies related to ODA and export. However, this study aims to narrow down the knowledge gap of aid effects on Korea's exports through empirical analysis. Much of the existing literature shows that there are positive relationships between ODA and export and tried to identify causality in both directions. This study takes into account the possibility of existence of simultaneous equations of ODA and export as the literatures imply. By employing three-stage least squares (3SLS) estimation method, two ways causalities between ODA and export are estimated. Moreover, this paper addresses a sample selection bias problem which may occur due to difference of probability of being a receiver of Korean ODA. By using Heckman two-stage estimation method, this problem is minimized. This approach to model specification makes it possible to estimate accurately the impact of Korea's ODA on its export.

This study also makes empirical contributions to the existing literature. The results show that there is positive effect of Korea's ODA on exports to recipient countries, and this is consistent with previous studies findings. However, the estimated coefficient is smaller than the previous ones, implying that the impact has been overestimated due to ignoring a system relationship

¹ Definition of Official Development Assistance (ODA): The DAC defines ODA as "those flows to countries and territories on the DAC List of ODA recipients and to multilateral institutions which are: (1) provided by official agencies (2) each transaction is administered with the promotion of the economic development and welfare of developing countries as its main objective and is concessional in character and conveys a grant element of at least 25% percent." (source: OECD website)

² US\$1=159 Won, December 9, 2016.

and selection bias. For a deeper understanding, the effects of ODA are estimated disaggregated by aid types such as grant, loan, technical cooperation, and humanitarian aid showing humanitarian and loan type aids are more effective than other types. In addition, the finding suggests that Korea's ODA allocation proceed in a two-stage decision making process. In the first stage, humanitarian purpose of aid is revealed leading to responding to lower income, and disaster experienced countries' needs even when lower bilateral trade is observed. The second stage which is to make a decision by considering the size of ODA to selected recipient countries, it presents a mixed purposes of giving ODA which is aiming at higher importer countries.

The remainder of this study is organized as follows. Section 2 introduces relevant literatures and its findings. Section 3 briefly summarizes the history of Korea's ODA. Section 4 introduces models and estimation procedures. Section 5 provides data and its sources. Section 6 presents the result of analysis and interpretations. Section 7 checks robustness of the results. The last section concludes and provides policy implications.

2. Literature Review

Previous studies on foreign aid have in general been conducted in two parts: studies of aid allocation and aid effectiveness. The former focuses on the motivation and determinants of foreign aid by analyzing the donor's aid allocation. The later addresses the issue of how to improve usefulness of aid to reach its goal, e.g. the Millennium Development Goals (MDGs). Since different aid allocations derive different results of aid effectiveness, it is reasonable to conclude that the two subjects are tightly related to each other. In this view, the two subjects should be considered together and simultaneously by taking into account their equal and complementary importance. Hence, this study examines the effect of aid from a donor's perspective, namely its positive trade effects, with considering an application to South Korea's aid allocation.

There are literatures on aid allocation focusing on the above mentioned two parts: the donor's sustained development and fulfillment of the recipient countries' needs. Recent studies on ODA tend to combine these two perspectives and identify various determinants of foreign aid including those associated with economic interests, diplomatic relations, and humanitarian concerns. The analysis of this combined approach was first initiated by McKinley and Little (1997, 1978a, 1978b, 1979) with a series of empirical studies of major development aid donors (USA, UK, and France). The results of their studies imply that donors provide aid not only to meet the recipients' needs, but also for donors' diverse interests. Alesina and Dollar (2000) estimated a full model of aid allocation with 21 major donors and 180 recipient countries. They showed that donors' aid allocation mirrors their political interest and recipients' needs at the same time. According to Alesina and Dollar (2000), Israel and Egypt have received additional aid especially from the USA. In the French case, their aid allocation is adapted such to compensate their former colonies with extra aid. Japan seems to respond to countries whose voting pattern in the UN is in accordance with Japan's international policy. It was seen that the negative coefficients of recipient income were statistically significant during the whole period, which means the poorer obtain more aid than their richer counterparts.

Berthélemy and Tichit (2004) also support this view by analyzing three-dimensional panel data and considering the self-interest of donors and recipient needs. The research revealed that donors pay attention to good political governance of recipient countries by rewarding aid. You (2009), Koo and Kim (2011), and Kim and Oh (2012) empirically examined South Korea's ODA allocation pattern. You (2009) studied the distributions of Korean ODA from 1992 to

2008. This study employs a Heckman two-stage estimation method due to the fact that the decision making process for Korean ODA takes two stages: to choose ODA recipients, and to decide the amount of the ODA for the chosen ODA recipient countries. By doing so, You (2009) found that distribution of Korean ODA relies on USA alliances, the size of trade with Korea, the size of FDI of Korea toward the ODA recipient countries, and the economic level of ODA recipients. Also, the results indicated that the occurrence of civil wars and international wars are considered in the decision making of Korean ODA.

In another related study, Koo and Kim (2011) analyze Korea's ODA allocation with the data from 1989 to 2007. This study finds out that South Korea's economic interests are much more influential than recipients' needs when deciding its ODA allocation. The interesting aspect in this study is the view of global influence with the volume of world total aid, conference related to aid, and the result implies that the Korean ODA has been affected by international expectations. In the case of Kim and Oh (2012), they analyzed the major determinants of South Korea's ODA allocation with the data from 1987 to 2009 and identified that the ODA policies changes over political regimes. Their findings suggest that South Korea provides more aid to candidates with relatively higher levels of income, showing compliance with the donor's economic interests. However, there are no significant differences over political regimes.

Existing studies on aid effectiveness also have two perspectives: recipients' development and donor's gain. There are a large number of studies investigating effects of aid on recipient countries, but agreement does not exist. In this relation three results are mainly debatable. The first one can be found in study of Dalgaard et al. (2004). They reported that no matter the recipients' governance form, aid in the 90s has a positive effect on economic growth of recipient countries, and aid effectiveness follows the law of diminishing returns. A very recent study by Galiani et al. (2015) reached the conclusion that an increase in aid/GNI ratio by 1% leads to a rise in growth rate of per capita GDP by 0.35% in recipient countries. They used an income threshold designated by the International Development Association in 1987 as an instrumental variable of aid. The second view is that the recipients who are under certain conditions are affected positively from development aid. It is evidenced that a certain condition required is high civil liberties according to Isham et al. (1995). Burnside and Dollar (2000) also suggest that foreign aid's effects on recipients grow only if the recipient government design and implement suitable financial and trade policies. However, Easterly (2003, 2004) showed that aid adversely affects recipients' society, pointing out corruption of politicians and the elite. Nathan and Nancy (2014) examined the impact of food aid. Based on their study, since food aid from USA cause civil conflicts in both interstate and intrastate levels, there is negative effect of aid on recipients' growth.

For emerging donor countries like South Korea, the history of foreign aid is short and the volume of aid small in comparison to major donors like USA, Japan, Germany, and France. For this reason, it is hard to distinguish South Korea's aid effectiveness from the recipients' perspective. Lee and Park (2007) examined Korea's ODA effectiveness with the view of its twenty year history, focusing on the effects of aid in recipient countries. Due to the small size of aid to each of the recipient countries, the study came to the conclusion that there is no significant impact of Korea's ODA on recipient countries' economic growth. Lee and Lee (2012), and Kang (2014) tested ODAs effectiveness from the donor's perspective with a gravity model. By using the visit to recipient countries by the President of Korea as an instrumental variable, Lee and Lee (2012) analyzed the effect of bilateral ODA on the exports of the Korea, estimated the elasticity of 0.143 in the period from 1991 to 2008. The remarkable finding of this research is that the impacts of ODA on its export vary over the industrial sector. The labor-intensive sector (textile) had been affected more than capital-intensive sector (machinery). In

addition, Kang (2014) studied theoretical and empirical analyses of multiple ODA types. In this study, Hausman-Taylor method and system-GMM are employed to address the endogeneity problem. The findings confirmed that there is positive effect of total ODA, loans, grants and technical cooperation on South Korea's export but no such effect in the provision of humanitarian aid was found.

Although these studies span a lot of information about the relationship between ODA and donor's export, there are some limitations in each approach. These studies took an approach to study only a single side of the issue; namely aid allocation or aid effectiveness. Given that the two topics are in a close relationship with each other, there hardly exist studies on estimation of the effects with the use of a systematic method. To handle simultaneous equation bias between ODA and export, systems of ODA and export are estimated by a 3SLS estimation method. This study is also taking into account differences in probability of receiving aid in the first stage with a probit model of ODA. The Inverse Mills ratio is computed and plugged into the ODA provision as part of the simultaneous equation to account for the sample selection bias as well.

3. Korea's ODA

Korea is a unique country in the economic development field since it is the first in which a country successfully graduated from being a major recipient of ODA to becoming an emerging and growing into a future major donor. Korea ended its financial dependence on the World Bank's assistance in 1995 and was excluded from the Development Assistance Committee (DAC) list of ODA recipient in 2000. The last year Korea received positive amount of net ODA was 1996. Korea even became the 24th member of the DAC in 2010. What makes it possible to achieve this changed status are the export-oriented development strategies and a huge amount of ODA received from donors (USA, Japan, Germany, etc.) in the past. The estimated total aid size that Korea had been benefitted is about 12 billion USD.

Korea hosted a training program for public officers of developing countries in 1963 for the first time, which was funded by the USA. In the late 1970s the Ministry of Foreign Affairs conducted the first assistance with an official budget of 2 million USD. ODA began in Korea by launching the Economic Development Cooperation Fund (EDFC) in 1987 and establishing the Korea International Cooperation Agency (KOICA) in 1991. Upon joining the OECD DAC in 2010, the position among the OECD countries in terms of the size of ODA was boosted when Korea increased its ODA level from 0.13% of GDP in 2014 to 0.20%. Figure 1 represents development of Korea's total bilateral net commitments and ODA/GNI ratio over time.

[Insert Figure 1 about here]

As Korea has survived and thrived on the aid, there is a high expectation of Korea in the world by pointing out no such precedent record. Because of that, Korea has become a model of development. Now, as an emerging donor, the international community expects Korea to share its know-how and policies which it learned from its experiences in the past. The Knowledge Sharing Program (KSP) launched by the Ministry of Strategy and Finance (MOSF) of the Korea is a part of its attention. Also, export-oriented development strategies of Korea have taken a center stage. Moreover, there is a campaign, namely *Aid for Trade*, promoted by the World Trade Organization (WTO) to help developing countries particularly the least developed ones, related to trade. *Aid for Trade* includes all kinds of programs which can help to build the trade capacity and development infrastructures in recipient countries. Korea as a donor has comparative advantages in the *Aid for Trade* by having gained knowledge from its own

experiences unlike other developed countries passing through different stages of development without receiving ODA. Though Korea's ODA is scant in terms of a short history and a small volume, the policy and strategy of Korea's ODA based on its rich experiences is more importantly considered, nowadays.

4. Models and Estimation

4.1 The Basic Model

According to the existing literatures, there are two-ways causality between ODA and export. Lee (2007), Roh (2008), Kim (2009), You (2009), Koo and Kim (2011), and Kim and Oh (2012) show that bilateral trade with recipient countries is one of key determinant of Korea's ODA. On the other hand, Lee and Park (2007), Lee and Lee (2012), Kang (2014), and Kang (2015) provide evidence from gravity model estimation, that there is a positive impact of Korea's bilateral ODA on Korea's export to recipient countries. Since the two variables are interdependent of each other as previous studies indicated, the relationship should be modelled as a simultaneous equations system of ODA and export. To identify two-ways causal relationships between ODA and export, 3SLS estimation is employed. The main advantages of 3SLS is that a consistent and efficient estimator is obtained. A 2SLS estimation of each equation separately is possible but it ignores the simultaneous correlation between the various equations' error terms. On the other hand, 3SLS is a system of equations estimation method which estimates all coefficients in each equation simultaneously by generalized least squares (GLS) (Zellner and Theil, 1962). The system of ODA and export equations for 3SLS estimation is as follows:

$$\ln(\text{Export}_{it}) = \beta_0 + \beta_1 \ln(\text{ODA}_{it}) + \beta_2 X_{it} + \beta_3 Z_{1it} + \beta_4 W_{1i} + \beta_5 V_{1t} + \varepsilon_{1it} \quad (1)$$

$$\ln(\text{ODA}_{it}) = \alpha_0 + \alpha_1 \ln(\text{Export}_{it}) + \alpha_2 X_{it} + \alpha_3 Z_{2it} + \alpha_4 W_{2i} + \alpha_5 V_{2t} + \sigma \hat{\lambda}_{it} + \varepsilon_{2it} \quad (2)$$

$$\text{where } \hat{\lambda}_{it} = \frac{\phi(Z_{it}\hat{\delta})}{\Phi(Z_{it}\hat{\delta})}$$

To make the estimation approach described above possible, each of export and ODA equations as a system of interdependent relations is necessary and this model requires over-identification condition. To identify Equation (1), the exogenous variables Z_{1it} which affects export but less likely Korea's ODA are used. For a model of provision of Korea's ODA, Equation (2), the exogenous variables are in Z_{2it} given these variables affect ODA but less likely export.

Equation (1) is a modified version of the gravity model employed by Kang (2014) to estimate Korea's ODA effect on bilateral export to recipient countries and Equation (2) is a model of provision of Korea's ODA referred to Kim and Oh (2012) and Kim (2014). In the equations, i and t represent a recipient country ($i=1, 2, \dots, 121$) and year ($t=1996, 1997, \dots, 2014$), respectively. These two equations are estimated jointly. In Equation (1), the key variable of interest is $\ln(\text{ODA}_{it})$ where its coefficient β_1 captures the Korea's export responsiveness to changes in ODA to recipient countries. Both equations contain X_{it} as explanatory variables which includes country i 's economic status at time t . X_{it} is a vector form composed of log of per capita GDP, log of FDI from Korea, log of population, political stability index, and one year lagged growth rate. The vector Z_{1it} contains a country i 's tariff rate, gap in log of per capita GDP with Korea, and economic freedom at time t . The vector W_{1i} has a country i 's time-invariant variables such as log of distance from Korea. The vector V_{1t} has Korea

Producer Price index (PPI) and period dummy variables to control for individual country-invariant effects. In terms of Equation (2), Z_{2it} contains a country i 's characteristics related to receiving ODA at time t with variables: oil revenue, death rate, government efficiency, civil liberties, corruption, one year lagged log of ODA, disaster degree, and DAC list. W_{2i} is included to capture the continent effect of ODA allocation. V_{2t} has period dummy variables representing different administrations³. Finally, ε_{1it} and ε_{2it} are random error terms from each model. In Equation (2), the key interest variables are $\ln(\text{Export}_{it})$ and inverted Mills ratio $\hat{\lambda}_{it}$ and the coefficients of each variable are α_1 and σ , respectively. α_1 captures the Korea's bilateral export elasticity of ODA provided to recipient countries. σ represents the coefficient of inverse Mills ratio.

The reason for inclusion of Mills ratio, $\hat{\lambda}_{it}$, in Equation (2) is as follows. There are several studies which discuss sample selection problem related to ODA recipient countries. Cingraneli and Pasquarello (1985), Neumayer (2003), and Furuoka (2005) conducted research the two-stage decision making process of aid allocations with U.S., Japan, and European countries, respectively. A list of ODA recipient countries is made at first stage based on the donor's policy and then the amount of aid allocated to these selected recipient countries is settled. This kind of concern did not cause much attention to Korea case in the past. This was because Korea did not have a standard rule or policy for selecting ODA recipient countries. However, You (2009) discussed this issue for Korea's case. Based on the interview with a government employee who works in ODA policy field, he evaluated Korea's ODA policy with the Heckman two-stage estimation method. In addition, Korea enacted the *Framework Act on International Development Cooperation (Framework Act)* and came into force in July 2010. This Act laid the legal basis for a more effective ODA system. The Korean government formulated integrative Country Partnership Strategies (CPS) for each priority partner country to improve ODA effectiveness through strategic concentration. In practice, the Korean government selected 26 priority partner countries out of 130 potential partner countries based on their income, political situation, diplomatic relationship with Korea, and economic potential. From this empirical and policy background, sample selection bias may occur without taking into account this issue. This problem will affect the model of decision for Korea's ODA volume since selected recipients are in the sample. Thus, sample selection bias problem should be minimized at the first stage of provision of Korea's ODA. To handle this issue inverse Mills ratio from Heckman two-stage estimation method is used. The model of decision for Korea's ODA recipient countries is as follows:

$$ODA_dummy_{it} = \alpha_0 + \alpha_1 \ln(ex + import_{it}) + \alpha_2 X_{it} + \alpha_3 Z_{3it} + \alpha_4 W_{2i} + \alpha_5 V_{2t} + \varepsilon_{3it} \quad (3)$$

where X_{it} is a vector composed of log of per capita GDP, log of FDI from Korea, log of population, political stability index, and one year lagged growth rate. Z_{3it} contains a country i 's characteristics related to receiving ODA at time t with a number of variables including: dummy of oil revenue, death rate, government efficiency, civil liberties, corruption, dummy of one year lagged ODA, dummy of disaster, and DAC list membership. W_{2i} and V_{2t} are defined in same way as in Equation (2).

³ Because each administration conducts different policies, the administration years is divided into periods as follows: Young-Sam Kim (1996-1997), Dae-Jung Kim (1998-2002), Moo-Hyun Roh (2003-2007), Myung-bak Lee (2008-2012), and Geunhye Park (2013-2014). This part is referred to Kim and Oh (2012) and Cho and Chung (2015).

If the latent amount of Korea's ODA to recipient countries i at time t , i.e. ODA^*_{it} exceeds zero, $\ln(ODA_{it}) = \ln(ODA^*_{it})$. Otherwise, $\ln(ODA_{it}) = 0$. Equation (4) represents this relationship:

$$\begin{aligned} \ln(ODA_{it}) &= \ln(ODA^*_{it}) \text{ if } ODA^*_{it} > 0 \\ \ln(ODA_{it}) &= 0 \text{ if } ODA^*_{it} \leq 0 \end{aligned} \quad (4)$$

In short, a logit model is estimated to account for differences in probability of Korea's ODA receivers in the first step. Using the parameter estimates inverse Mills ratio is obtained from the first step and plugged into the least square model of ODA provision accounting for possible sample selection bias. In this case both ODA and unilateral Export are estimated jointly as a system of interdependent equations. In the following section account is made for heterogeneity in ODA types' effects on unilateral export.

4.2 ODA Type-specific Analysis Model

The models presented in this section are used to investigate aid effects over various types of ODA provided by Korea. The types include grant, loan, technical cooperation, and humanitarian assistance. As Kang (2015) pointed out, ODA types may have heterogeneous effects export. For this analysis the system of equations model in Section 4.1 needs modification. Two equations in one system are estimated and the model is as follows:

$$\ln(Export_{it}) = \beta_0 + \beta_1 \ln(tpODA_{it}) + \beta_2 X_{it} + \beta_3 Z_{1it} + \beta_4 W_{1i} + \beta_5 V_{1t} + \varepsilon_{1it} \quad (5)$$

$$\begin{aligned} \ln(tpODA_{it}) &= \alpha_0 + \alpha_1 \ln(Export_{it}) + \alpha_2 X_{it} + \alpha_3 Z_{2it} + \alpha_4 W_{2i} + \alpha_5 V_{2t} \\ &+ \sigma \hat{\lambda}_{it} + \varepsilon_{2it} \end{aligned} \quad (6)$$

where $tpODA_{it} \in \{grant_{it}, loan_{it}, tech_{it}, human_{it}\}$,

$$\hat{\lambda}_{it} = \frac{\phi(Z_{it}\hat{\delta})}{\Phi(Z_{it}\hat{\delta})}$$

It should be noted that the models for ODA type still account for sample selection bias. Since selecting Korea's ODA recipient countries happens in aggregated level, calculated inverse Mills ratio is the same for all models of decision for Korea's ODA volume. By analyzing this model, the heterogeneous effects of each type of aid are estimated consistently and efficiently

5. The Data

This study is based on a comprehensive dataset covering South Korea's 121 ODA recipient countries between 1996 and 2014. 1996 is the last year that South Korea received positive amount of net ODA from other developed countries, and 2014 is the most recent available year of data. Since in this study we assume a two-ways causal relationship between ODA and export evidence found from many literatures⁴, ODA and export are investigated simultaneously.

The unit of observation in the dataset used is country, i.e. recipient by year. A country that received ODA from Korea at least once between 1996 and 2014 belong to the sample. These

⁴ Lee (2007), Roh (2008), Kim (2009), You (2009), Koo and Kim (2011), Kim and Oh (2012) shows that there is positive relationship between Korea's ODA and export estimating ODA as a dependent variable. Lee and Park (2007), Lee and Lee (2012), Kang (2014), and Kang (2015) provide evidence from gravity model estimation that Korea's export and bilateral ODA are in positive relationship.

countries in the sample are in the OECD DAC list of ODA recipients. This list is announced every three years. There are 5 categories based on per capita GNP: LDC (Least Developed Countries), OLIC (Other Low-Income Countries), LMIC (Lower Middle-Income Countries), UMIC (Upper Middle-Income Countries), and HIC (High-Income Countries). There are 14 countries⁵ which exit the list during 1996 to 2014.

For key variables, unilateral export flows from South Korea to the recipient countries are obtained from Korea Customs Services website (<http://www.customs.go.kr>) and Korea's ODA commitments are downloaded from the OECD database by year and recipient country. Since the commitments reflect donor's intentions and specific purposes well, thus in comparing disbursements, it would be better to use commitments as a main interest variable for this analysis.⁶ For ODA type-specific effects analysis, ODA disbursements allow to estimate categorized aid into grant, loan, technical cooperation, and humanitarian assistance. For estimation these type variables are transformed to natural logarithm for easy interpretation and for handling right-skewedness due to zero values⁷. To take into account differences in probability of receiving aid at first stage, an ODA dummy variable is generated and this variable has value 1 if a country receives ODA from Korea and 0 otherwise.

For explanatory variables of the gravity model of export, per capita GDP, population size, distance, tariff, and gap in per capita GDP between Korea and a recipient are mainly concerned. For per capita GDP and population size, World Bank's World Development Indicators are given by year and recipient country. CEPII serves the most populated cities simple distance between two countries and it is used for measuring distance variable. Distance is expected to be negatively related to trade. Bilateral Foreign Direct Investment data is extracted from the Export-Import Bank of Korea. FDI in- and outflows are expected to positively influence both export and ODA. Tariffs are the weighted mean applied tariff by the product import shares corresponding to each recipient country. The data is downloaded from World Bank database. It should be noted that tariffs are considered as trade barriers.

To explain determinant of Korea's ODA, there are several variables downloaded from World Bank World Development Indicators (WDI) database such as oil revenue, death rate, and growth rate. Most of the index variables regarding recipient's characteristics are downloaded from the Global Economy website such as political stability, government efficiency, civil liberties, and corruption. For disaster variable, natural disasters data provided by Centre for Research on the Epidemiology of Disasters (CRED) are used.⁸ The data is restricted to natural disasters to consider this as an exogenous result. Taking these into account, a dummy variable is generated whether the recipient country had experienced natural disasters during the specific year. Also, a disaster degree variable is produced quantifying the death toll.

A Producer Price Index extracted from Federal Reserve Economic Data in Korea is used. The price index reflects the business environment and competitiveness of the Korean industry at the international market. For a more detailed description and sources of data used, refer to Appendix Table A1. The summary statistics of the variables used in this analysis is shown in Table 1.

⁵ "Exit" countries are: Bahrain, Barbados, Brunei, Cyprus, Hong Kong, Israel, Kuwait, Malta, Oman, Qatar, Saudi Arabia, Singapore, Trinidad and Tobago, and United Arab Emirates.

⁶ Source: OECD website (<http://www.oecd.org/dac/stats/faq>)

⁷ Among 2,299 observations, export and ODA have 44 (1.9%) and 513 (22.3%) zero values, respectively.

⁸ Source: CRED website (<http://www.emdat.be/explanatory-notes>).

[Insert Table 1 about here]

Table 2 shows the correlation matrix of the variables used in the gravity model specification. There is a slight positive relationship between export and ODA being consistent from theoretical and empirical studies. There is scant positive association of export with distance variable. This is because the absolute distance between two countries has become meaningless as time goes by. As an alternative variable, cost of transportation or shipping time could be suggestive in a globalization context. It is shown that ODA and per capita GDP have a negative relationship reflecting humanitarian purpose of aid. As expected, there is significant positive association of ODA with the disaster variable. Many of the variables which are repressor of export also have a significant relationship with ODA. This implies that the estimation should be considered as a system accounting for two-ways causal relationship between ODA and Export.

[Insert Table 2 about here]

Table 3 represents mean of the key variables by the recipients' common characteristics. Column (1) in the second panel shows that the size of bilateral export from South Korea to recipients are increasing as time elapses. This implies that it is important to use a time trend in the model specification. The relation between export and distance is incoherent according to the fourth panel in Column (1). Based on the gravity model, as the distance increases the volume of export should decrease. Column (2) expresses the average ODA of each group. The purpose of Korea's ODA is not absolutely humanitarian, as it is indicated by the first panel. Interestingly, as Alesina and Dolloar (2000) revealed, populous countries could get more aid. Regarding Column (5), low income level countries have experienced higher growth rate relative to countries in high income level. This is obvious since less developed countries have more chances to improve, but once a country reaches a certain level of development its potential growth diminishes.

[Insert Table 3 about here]

6. Analysis of the Results

Table 4 presents the binary estimation results of the decision model for South Korea's ODA provision. Column (1) and (2) show the estimation results through ordinary least squares (OLS) of linear probability model (LPM) and maximum likelihood of logit model, respectively. Because the actual magnitude of the marginal effects varies with the point of evaluation in cases of logit, the coefficients in Column (2) are reported marginal effects evaluated at average (or marginal effect of at the mean) in each group. The coefficients across the two models suggest a qualitatively similar story about the impact of regressors on the probability of receiving aid ($\Pr(ODA=1)$). Also, the magnitude of estimation from logit model and linear probability model are slightly different. Since drawbacks of LPM such as biased estimation and probabilities outside the unit interval $[0, 1]$, the proxy, namely inverse Mills ratio is calculated under logit model and used in the explanation of the amount of ODA.

[Insert Table 4 about here]

The variables in this analysis are among those considered as determinants of Korea's ODA. Although the interpretations of coefficients in logit regression are not as straightforward as the linear regression, interpretation is possible under some assumptions. Estimated coefficients of per capita GDP and population demonstrate that the Korean government responds to lower income level and bigger size countries like the major donors do (Alesina and Dollar, 2000). If the disaster variable changes from zero to one, the probability for the variable ODA taking the

value one rises by 4.2 percentage points. Holding other variables constant at their respective means, a one-unit increase in political stability leads to an increase in predicted probability that the recipient receives bilateral ODA from Korea by an additional 5 percent. If a country has a lower trade volume with Korea, there is higher probability to get ODA from Korea as the coefficient of $\ln(\text{export}+\text{import})$ indicates. This result is contrary to findings from many previous studies and this implies there is two-stage decision making process of Korea's ODA as You (2009) demonstrates. To check this, Heckman two-stage estimation is conducted and Appendix Table A2 presents the results. All coefficients are qualitatively the same except the coefficients of $\ln(\text{export}+\text{import})$ and $\ln(\text{FDI})$. This finding suggests that there is a gatekeeping stage in decision of Korea's ODA like major donors.

6.1 Aggregate Level Results

Estimates of the system of equations models explained in Section 4.1 are reported in Columns from (1) to (8) of Table 5. Column (1), (3), (5), and (7) report the estimated coefficients when the dependent variable is log of Korea's bilateral export to a recipient country, Column (2), (4), (6), and (8) for log of Korea's bilateral ODA commitments to a recipient country.

[Insert Table 5 about here]

Table 5 demonstrates that the Korea's bilateral ODA attracts more Korean bilateral export to the recipient countries. The log of ODA (β_1 in Equation (1)) showed the coefficients of 0.034, 0.040, 0.042, and 0.038 from each mode, respectively with statistical significance at conventional level. Each mode differs in terms of controlled fixed effects (see the bottom of Table 5). This result can be interpreted as the 10 percent increase in amount of Korea's bilateral ODA leads to around a 0.4 percentage increase in bilateral export to recipients. This estimated impact of ODA on export is small implying previous studies overestimated its effect on export. This finding supports that the two equations should be estimated jointly.

There are several things to be noticed in relation to the odd number Columns. The results support the gravity model intend in most parts. The coefficient of tariff is negative and statistically significant at 1% level in all modes, implying that tariff is a trade barrier. The coefficient of population is positive and statistically significant at the 1% level. However, estimated distance effect is reported as negative but insignificant. Due to the evolution of transportation systems, distance in international trades may not be meaningful any more. Estimated per capita GDP effect is positive but only statistically significant in mode 1, implying that there is weak evidence to support income effect on Korea's bilateral export to a recipient country. The result of FDI is consistent with previous studies, showing that FDI is in a complementary relationship with Korea's export. (Lee and Lee, 2012) From the growth rate variables, a higher growth rate brings more imports from Korea. One more interesting thing is about political stability of recipient countries. The negative sign indicates, the weaker political stability a recipient country is in, the greater dependence on Korean export the recipient has. Given the measure of the political stability index, the lower number reflects a high likelihood of a disorderly transfer of government power, armed conflict, violent demonstrations, social unrest, international tensions, terrorism, as well as ethnic, religious or regional conflicts.⁹

⁹ The index is a composite measure as it is based on several other indexes from multiple sources including the Economist Intelligence Unit, the World Economic Forum, and the Political Risk Services, among others. (Source: TheGlobalEconomy.com).

Even number columns report the estimated coefficients when the dependent variable is log of Korea's bilateral ODA commitments to a recipient country. Thus, the coefficients indicate the detriments and purpose of Korea's ODA. The estimated positive coefficients of export are in mode 1 and 4 with statistically significant at a conventional level. The coefficients of per capita GDP are negative and statistically significant at 1% level in all modes. However, examination of DAC list based indicates LMIC gets more ODA than LDC. The coefficient of political stability here can be interpreted as the one-point increases in political stability of recipient countries leads to 22.9 percentage increase in Korea's bilateral ODA, as reported in Column (8). Because aid effectiveness in both (a donor and a recipient) perspectives is highly correlated with the country's circumstance, Korea as a donor cares about recipients' political stability. There is positive and statistically significant coefficient for $\ln(ODA_{t-1})$ variable. This implies Korea's ODA at least keeps the ODA volume up to recipient countries. The coefficients of disaster degree amount to around 0.12 in average of mode meaning that more of Korea's ODA goes to relieve if the recipient experiences a natural disaster. By estimating continent dummy variables, it reveals that Korea's ODA frequently target Asian countries.

6.2 Results of Type-specific Aid Effects

Table 6 reports the coefficients estimated with Korea's bilateral ODA disbursement to a recipient country as a dependent variable. Column (2), (4), (6), and (8) are the results from each system of equations model which consists of grant, loan, technical cooperation, and humanitarian aid, respectively. This model is designed to estimate the effects of Korea's bilateral ODA on Korean bilateral export to the recipient countries distinguished by ODA types.

Table 6 demonstrates that the humanitarian type ODA is the most effective aid type in terms of increasing Korea's bilateral export. Estimated positive coefficient of humanitarian aid is shown 0.249 with statistical significant at 1% level, and the coefficient of loan turns out to be 0.185 and statistical significant at 1% level. Since the independent variable is log of Korea's bilateral ODA commitments and the dependent variable is log of bilateral export to a recipient country, the coefficient of loan can be interpreted as the 10% increase in amount of Korea's bilateral humanitarian ODA leads to a 2.49 percentage increase in Korea's bilateral export to recipients. The magnitude and sign is apprehensible taking into account that loan type of ODA usually accompanies tied aid. Tied aid is conditional aid that the recipient country must spend the amount usually in the donor country.

[Insert Table 6 about here]

The estimated coefficients suggest a qualitatively similar effect shown in Table 5 in terms of the effect of regressors such as tariff, distance, population, and political stability on Korea's bilateral export to recipient countries. Even number columns are reporting the estimation of model for Korea's ODA by ODA types. As for various types of grant, loan, technical cooperation and humanitarian assistance showed the coefficient 0.344, 0.069, 0.629, and -0.053, respectively. Only the coefficient of technical cooperation variable is positive and statistically significant at 1% level. The control variables generally showed similar patterns like those of aggregate level analysis in terms of direction. The coefficients of inverse Mills ratio are statistically significant at conventional level in every ODA type case.

Overall, analogous with the previous literature, the results demonstrate that there is a statistically significant effect of Korea's bilateral ODA on its bilateral export to recipient countries. As Kim and Oh (2012) suggests the results support the idea that Korea's ODA policy may have a dual-track structure. An interesting result is that there are heterogeneous effects by

ODA types, conducted as a humanitarian type is the most effective in terms of increasing bilateral export to recipient countries.

7. Robustness Check

In this section, robustness checks are presented to assess the relevancy of the main estimation. Mainly two issues are handled, in context of practiced free trade agreement (FTA) and subsample regression. First, in order to deal with impact of FTA on export volume since 2004, FTA variable is added in the baseline model and its effect is estimated. Secondly, a subsample is made to identify pure impacts of Korea's ODA on export to recipient countries which are in DAC list during whole analysis period. This robustness checks produced consistent results.

7.1 Practiced FTA

FTA has been in effect since April 1, 2004 with Chile. Ever since that started, Korea approved the FTA with Singapore, EFTA (4 countries), ASEAN (10 countries), India, EU (27 countries), Peru, US, Turkey, and Colombia. These FTA lead to an increase in trade volume between Korea and partner countries. The Figure 2 also shows this tendency. Because of this reason, FTA needs to be controlled in order to estimate the exact impact of ODA to Korea's export.

[Insert Figure 2 about here]

Table 7 shows the result of estimation with FTA variables inclusion in the model specification. The coefficients of FTA are positive and statistically significant at 1% level. This gives empirical evidence of promotion of FTA in Korea's export. However, the coefficients of $\ln(\text{ODA})$ in Column (1) and (3) do not change compared to Column (5) and (7) in Table 5.

[Insert Table 7 about here]

7.2 Subsample Case

There are fourteen countries who graduated DAC list of ODA recipient during the period of study. With the subsample in which these countries are excluded, the model is estimated.¹⁰ The results are reported in Column (3) and (4) of Table 8. Comparing Column (1) with (3), the coefficients suggest a qualitatively similar story about the impact of regressors on Korea's bilateral export to recipient countries, whereas estimated positive coefficient of $\ln(\text{ODA})$ in latter case is slightly larger, showing 0.094 with statistical significance at 1% level. Making a comparison between Columns (2) and (4), the directions of all coefficient are the same and the absolute magnitudes of Column (4) are bigger than Column (2) in terms of coefficients of export, per capita GDP, and population.

[Insert Table 8 about here]

8. Conclusion and Policy Implications

This study focused on the impact of bilateral ODA conducted by Korea on its bilateral export to 121 recipient countries using panel data from 1996 to 2014. Most of the data used for this

¹⁰ By definition, these countries cannot obtain ODA from any donors. Received aid cannot be counted as ODA.

study are secondary data downloaded from websites of World Bank, OECD, and Korean national statistical office. In addition, Korea's ODA allocation is estimated by considering a two-stage decision making process.

Using a disaster dummy variable which is a new determinant of Korea's aid allocations and an oil reserve dummy variable as exclusion restrictions, sample selection problem which is brought up in a series of this type of studies is minimized. Estimation of ODAs effects on export by correcting for sample selection bias is a contribution of this study. Another contribution of this study comes from using three stages least squares estimation method for consistent and efficient estimation and analysis of system of interdependent ODA and export equations. From the usefulness of this methodology, this analyses allows for two-ways causal relationships between ODA and export which are the impact of Korea's bilateral ODA on its export and determinant of Korea's ODA.

The main findings from this study are as follows: (i) the Korean bilateral ODA has a positive influence on Korea's bilateral export during the entire period, (ii) in disaggregated form the overall effects of humanitarian-type ODA is found to be the largest effect among the four ODA types, and (iii) Korea's ODA policy may have a dual-track structure showing that relationship between ODA allocation and per capita GDP is negative overall. However, positive signs appear in the form of coefficients for OLIC, LMIC, and UMIC when comparing to LDC in analyzing by DAC list.

This study has two major contributions. Still, it is hard to conclude that there are substantial returns to bilateral aid. Although Korean's ODA increases bilateral export to ODA recipients, there might be massive trades for intermediary products which will be imported back to Korea again. This means the amount of export is not all recipient consumption unlike in the past. Therefore, in order to capture the pure effect of ODA on bilateral export precisely, further detailed studies into how much of exported good are consumed in the recipient countries is needed. There are little explanations for ODA type effects. To check whether the effect of ODA type on export comes from tied-aid, ODA sector analysis is needed. Because as time elapses, the recipients prefer trade relations independent from ODA and its use determined without donor's intervention. Also, OECD DAC recommend their members for reducing tide-aid.

Possible policy implication from this exercise is suggested as follows. First, the result of this study suggests that there is a 'gatekeeping' stage before the volume of Korea's ODA is allocated to individual recipient countries. In the first stage which makes a decision of Korea's ODA receivers, bilateral trade is considered negatively. In the second decision stage regarding the volume of ODA to selected recipients, bilateral export has positive impact on Korea's ODA. The two-stage decision making process is not a problem in itself but it can reduce the impact of Korea's ODA on bilateral export to recipient countries if the selected countries are less likely to import Korean goods. This process should be considered if ODA policy has a specific goal to increase export to recipients.

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Table 1. Summary Statistics of the data

	Mean	Std. Dev.	Minimum	Maximum
A. Dependent variables:				
Bilateral export flows to recipient (USD thousand)	912.16	2711.23	0	32606.20
1 if a country receives ODA from Korea	0.78	0.42	0	1.00
Bilateral ODA commitments to recipient (USD thousand)	3312.09	12412	0	234560.00
Bilateral technical cooperation disbursements to recipient (USD thousand)	713.91	1906.64	0	21440.00
Bilateral humanitarian disbursements to recipient (USD thousand)	95.45	726.55	0	14000.00
Bilateral grant disbursements to recipient (USD thousand)	1782.52	6815.42	0	149540.00
Bilateral loan disbursements to recipient (USD thousand)	1558.93	8409.95	0	198610.00
B. Independent variables:				
GDP per capita of recipient (constant 2005 dollars)	4972.06	8323.10	72.75	63479.40
Population of recipient (millions)	30.82	108.65	0.07	1295.29
Bilateral FDI flows South Korea to recipient (USD thousand)	51053.13	229029.76	0	3715000.00
Tariff rates in recipient	221.98	275.28	1.00	829.00
Bilateral export and import flows between Korea and a recipient (USD thousand)	1804.33	4894.18	0	48819.14
Lagged growth rate of a recipient country	4.61	6.85	-62.08	149.97
1 if a country has oil rents	0.45	0.50	0	1.00
Oil rents (percent)	6.27	13.23	0	77.19
Disaster degree (0=not affected; 1=the death toll under 25, 2=the death toll between 26~1000, 3=the death toll over 1000)	0.97	0.87	0	3.00
1 if a country experiences a natural disaster	0.63	0.48	0	1.00
Control for corruption (-2.5 weak; 2.5 strong)	-0.34	0.76	-1.91	2.42
Political stability index (-2.5 weak; 2.5 strong)	-0.33	0.92	-3.18	1.54
Government effectiveness index (-2.5 weak; 2.5 strong)	-0.32	0.76	-2.32	2.43
Death rate (per 1000 people)	8.52	4.02	1.48	27.62
Civil Liberties (1=best; 7=worst)	3.84	1.57	1.00	7.00
Economic freedom overall index (0-100)	57.16	10.35	16.00	91.00
C. Control variables:				
Korea Producer Price Index	88.32	12.25	68.00	107.00
Gap in log of GDPpc between South Korea and recipient	2.22	1.36	-1.39	5.19
Distance b/w the most populated cities (km)	9830.8	3927.31	118.63	19447.35
Period (0=1996~1999; 1=2000~2004; 2=2005~2009; 3=2010~2014)	1.58	1.09	0	3.00
Continent (0=Asia, 1=America, 2=Africa, 3=Europe, 4=Oceania)	1.33	1.06	0	4.00
DAC list (0=LDC, 1=OLIC, 2=LMIC, 3=UMIC, 4=HIC, 5=Exit)	1.70	1.46	0	5.00
Observations	2,299			

Table 2. Correlation matrix, N=2299 observations.

	Export	ODA	GDPpc	Population	GDP gap	FDI	tariff	Economic Freedom	Distance	Korea PPI	Disaster	Oil Revenues	Natural Resource	Death rate	Political stability	Civil Liberties	School	Control Corrupt
Export	1																	
ODA	0.2223 ^a	1																
GDPpc	0.3088 ^a	-0.1164 ^a	1															
Population	0.2645 ^a	0.0705 ^a	-0.0968 ^a	1														
GDP gap	-0.2336 ^a	0.1627 ^a	-0.7658 ^a	0.1076 ^a	1													
FDI	0.6720 ^a	0.2961 ^a	0.1354 ^a	0.1602 ^a	-0.0914 ^a	1												
Tariff	-0.0304	0.0497 ^b	-0.0336	0.0234	0.0276	-0.0011	1											
Economic Freedom	0.3043 ^a	-0.0972 ^a	0.4716 ^a	-0.0715 ^a	-0.5111 ^a	0.1381 ^a	0.1195 ^a	1										
Distance	0.0188	0.0682 ^a	0.0711 ^a	-0.0184	0.0069	0.0333	0.0130	0.0354 ^c	1									
Korea PPI	0.1859 ^a	0.2135 ^a	0.0473 ^b	0.0259	0.0535 ^b	0.1478 ^a	0.1598 ^a	0.0484 ^b	0.0000	1								
Disaster	0.0199	0.1222 ^a	-0.3626 ^a	0.1713 ^a	0.3870 ^a	0.0581 ^a	0.1209 ^a	-0.1087 ^a	0.0526 ^b	-0.0125	1							
Oil Revenues	0.0010	0.0078	0.2915 ^a	-0.0326	-0.2794 ^a	0.0006	-0.0419 ^b	-0.2170 ^a	-0.0197	0.0402 ^c	-0.0973 ^a	1						
Natural Resource	-0.0559 ^a	-0.0010	0.2120 ^a	-0.0535 ^b	-0.0762 ^a	-0.0379 ^c	-0.0388 ^c	-0.2847 ^a	-0.0313	0.0671 ^a	-0.0795 ^a	0.8512 ^a	1					
Death rate	-0.2150 ^a	-0.0963 ^a	-0.4300 ^a	-0.0232	0.5693 ^a	-0.1413 ^a	-0.0929 ^a	-0.3345 ^a	-0.0437 ^b	-0.1674 ^a	0.1970 ^a	-0.1211 ^a	0.0037	1				
Political stability	0.0812 ^a	-0.1363 ^a	0.4106 ^a	-0.1978 ^a	-0.5087 ^a	0.0510 ^b	-0.0290	0.4325 ^a	-0.0370 ^c	-0.0095	-0.3435 ^a	-0.0752 ^a	-0.1279 ^a	-0.2849 ^a	1			
Civil Liberties	-0.0400 ^c	0.0816 ^a	-0.0440 ^b	-0.0104	0.2431 ^a	-0.0227	-0.1292 ^a	-0.4463 ^a	-0.0614 ^a	-0.0772 ^a	0.0219	0.3898 ^a	0.4156 ^a	0.0749 ^a	-0.4457 ^a	1		
School	0.0345 ^c	0.0735 ^a	0.0546 ^a	0.0117	-0.1706 ^a	0.0496 ^b	0.1532 ^a	0.1269 ^a	-0.0681 ^a	0.1635 ^a	-0.0512 ^b	-0.0044	-0.0739 ^a	-0.3108 ^a	0.1693 ^a	-0.1972 ^a	1	
Control for Corruption	0.2865 ^a	-0.1473 ^a	0.6006 ^a	-0.0771 ^a	-0.6510 ^a	0.1241 ^a	0.0059	0.6785 ^a	-0.0140	-0.0065	-0.2911 ^a	-0.1281 ^a	-0.2151 ^a	-0.3765 ^a	0.6568 ^a	-0.4733 ^a	0.1292 ^a	1

Note: See Table 1. a, b, and c indicate significance at 1, 5 and 10 percent, respectively.

Table 3. Mean of variables by Recipients' Characteristics, N=2299 observations.

	Export (USD 1,000)	ODA (USD 1,000)	GDPpc (USD 1,000)	FDI (USD 1,000)	Growth rate
Income level (constant 2005) of Recipient:					
1. below 72.75	198.08	4,119.29	394.22	18,775.57	5.14
2. 72.75-658.04	883.68	6,742.60	1,132.32	66,322.94	4.69
3. 658.04-1931.34	555.47	2,138.52	3,335.98	25,241.67	4.25
4. 1931.34-5239.82	2,013.30	242.63	15,043.21	93,946.94	4.38
Period:					
1. Year 1996-1999	408.23	565.59	4,429.73	17,331.33	4.64
2. Year 2000-2004	482.93	1,332.10	4,677.27	12,038.39	3.53
3. Year 2005-2009	989.56	3,210.85	5,224.81	75,650.21	5.93
4. Year 2010-2014	1,667.12	7,600.63	5,447.95	92,448.23	3.88
Continent, Recipient:					
1. Asia	2,310.56	8,102.37	9,203.41	137,685.10	5.44
2. America	620.75	1,310.95	4,762.85	37,681.12	3.34
3. Africa	190.65	1,694.63	1,851.96	5,089.82	5.20
4. Europe	793.34	946.65	8,873.39	25,036.01	3.28
5. Oceania	17.91	387.54	2,059.51	2,789.02	2.39
Distance to Recipient:					
1. below 118.00 km	960.19	2,310.46	4,184.09	35,204.91	4.40
2. 118.00-7292.73	536.26	2,511.90	4,003.78	37,658.63	4.98
3. 7292.73- 8981.47	1,417.01	5,221.75	5,104.73	107,312.70	4.84
4. 8981.47-13047.52	747.69	3,230.93	6,627.90	24,482.78	4.23
Population of Recipient:					
1. below 0.01 millions	79.99	109.25	8,164.99	3,594.47	4.21
2. 0.01-1.79	958.50	1,728.96	6,395.40	32,427.49	4.67
3. 1.79-6.90	643.45	3,218.84	2,657.90	43,495.39	4.88
4. 6.90-23.42	1,966.76	8,188.57	2,672.42	124,662.80	4.69

Table 4. Binary estimation results of the decision model for South Korea's ODA provision.

Column	(1)	(2)
Model	OLS of linear probability model	Maximum Likelihood of Logit model
Dependent variables	ODA_dummy	ODA_dummy
ln(ex+import)	-0.010**	-0.008**
ln(FDI)	-0.002	-0.001
oil rev_dum	0.002	0.004
political stab	0.054***	0.050***
gov't efficiency	0.023	0.021
corruption	-0.061***	-0.051**
civil liberties	-0.001	0.002
death rate	-0.009***	-0.007***
ln(GDPpc)	-0.146***	-0.110***
ln(population)	0.042***	0.041***
growth rate	-0.001	-0.001
disaster_dum	0.045***	0.042***
ODAlag_dum	0.432***	0.204***
Constant	1.404***	.
Observations	2,299	2,299
R-squared	0.473	.
Period	Yes	Yes
Continent	Yes	Yes
Income level	Yes	Yes

Notes: See Table 1. *, **, and *** indicate significance at 10, 5 and 1 percent, respectively.

Table 5. Three-stage Least Squares Estimation – Aggregate level bilateral export and ODA commitment models

Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Model	Mode 1		Mode 2		Mode 3		Mode 4	
Dependent variables	log(export)	log(ODA)	log(export)	log(ODA)	log(export)	log(ODA)	log(export)	log(ODA)
ln(ODA)	0.034**	.	0.040***	.	0.042***	.	0.038***	.
ln(distance)	-0.039	.	-0.035	.	-0.035	.	-0.032	.
tariff	-0.018***	.	-0.022***	.	-0.023***	.	-0.021***	.
diff ln(GDPpc)	0.570	.	-0.318	.	-0.340	.	-0.234	.
KOR ppi	0.008	.	0.010	.	0.012	.	-0.002	.
EconFree	0.021***	.	0.022***	.	0.021***	.	0.021***	.
ln(export)	.	0.449***	.	0.156	.	0.074	.	0.401*
ln(GDPpc)	1.422***	-0.711***	0.536	-0.469***	0.515	-0.413***	0.619	-0.774***
ln(FDI)	0.149***	-0.059***	0.148***	-0.016	0.147***	-0.006	0.148***	-0.057*
oil revenue	.	0.003	.	0.000	.	0.000	.	0.007*
ln(population)	0.885***	-0.234*	0.882***	0.027	0.881***	0.107	0.882***	-0.188
death rate	.	-0.094***	.	-0.095***	.	-0.084***	.	-0.094***
political stab	-0.224***	0.152**	-0.228***	0.095	-0.228***	0.106	-0.228***	0.229***
gov't efficiency	.	-0.003	.	0.070	.	0.073	.	0.225
civil liberties	.	-0.065**	.	-0.052*	.	-0.062*	.	0.000
corruption	.	-0.288**	.	-0.306***	.	-0.337***	.	-0.299**
growth rate	0.008**	-0.003	0.009**	-0.002	0.009**	-0.002	0.010**	-0.008
ln(ODAlag)	.	0.710***	.	0.705***	.	0.709***	.	0.700***
disaster degree.	.	0.100*	.	0.129**	.	0.121**	.	0.141***
invMR	.	-0.029	.	-0.010	.	0.044	.	0.624***
America	.	.	.	.	.	-0.019	.	-0.170
Africa	.	.	.	.	.	-0.205*	.	-0.334***
Europe	.	.	.	.	.	-0.422*	.	-0.929***
Oceania	.	.	.	.	.	-0.251	.	-0.426
OLIC	.	.	.	.	.	.	.	0.095
LMIC	.	.	.	.	.	.	.	0.365*
UMIC	.	.	.	.	.	.	.	0.052
HIC	.	.	.	.	.	.	.	-1.970***
Exit	.	.	.	.	.	.	.	-2.543***
Constant	-11.963***	6.571***	-3.629	5.122***	-3.617	4.828***	-3.611	6.971***
Observations	2,299	2,299	2,299	2,299	2,299	2,299	2,299	2,299
R-squared	0.715	0.688	0.716	0.723	0.716	0.727	0.715	0.711
Period	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Continent	.	No	.	No	.	Yes	.	Yes
DAC list	.	No.	.	No	.	No	.	Yes

Notes: See Table 1. *, **, and *** indicate significance at 10, 5 and 1 percent, respectively.

Table 6. Three-stage Least Squares Estimation - Aggregate level bilateral export and disaggregate ODA type commitment models

Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variables	log(export)	log(grant)	log(export)	log(loan)	log(export)	log(tech)	log(export)	log(human)
ln(grant)	0.026	.	.	.	.	.	.	.
ln(loan)	.	.	0.185***	.	.	.	.	.
ln(tech)	.	.	.	.	0.053***	.	.	.
ln(human)	.	.	.	.	.	.	0.249***	.
ln(distance)	-0.051	.	-0.038	.	-0.102***	.	-0.046	.
tariff	-0.021***	.	-0.019***	.	-0.021***	.	-0.022***	.
diff ln(GDPpc)	-0.193	.	-0.105	.	-0.444	.	-0.542	.
KOR ppi	0.000	.	0.009	.	-0.004	.	0.011	.
EconFree	0.021***	.	0.022***	.	0.019***	.	0.021***	.
lonexport)	.	0.344	.	0.069	.	0.629***	.	-0.053
ln(GDPpc)	0.650	-0.704***	0.807	-0.893***	0.411	-1.056***	0.300	-0.164*
ln(FDI)	0.150***	-0.039	0.124***	0.043	0.149***	-0.072**	0.142***	-0.007
oil revenue	.	0.004	.	0.013**	.	0.009**	.	-0.006*
ln(population)	0.889***	-0.078	0.866***	-0.120	0.858***	-0.142	0.881***	-0.044
death rate	.	-0.095***	.	-0.107***	.	-0.135***	.	-0.065***
political stab	-0.226***	0.111*	-0.257***	0.521***	-0.232***	0.320***	-0.109**	-0.307***
gov't efficiency	.	0.530***	.	0.112	.	0.779***	.	0.014
civil liberties	.	0.049	.	-0.196***	.	0.063*	.	-0.004
corruption	.	-0.436***	.	-0.696***	.	-0.607***	.	-0.234**
growth rate	0.010**	-0.002	0.007	-0.001	0.010**	-0.002	0.009**	-0.004
ln(ODAlag)	.	0.514***	.	0.517***	.	0.467***	.	0.198***
disaster degree	.	0.138***	.	0.224***	.	0.112**	.	0.432***
invMR	.	0.458***	.	1.440***	.	0.649***	.	0.578***
America	.	0.034	.	-1.069***	.	-0.326***	.	-0.650***
Africa	.	-0.117	.	-0.912***	.	-0.139	.	-0.689***
Europe	.	-0.862***	.	-1.479***	.	-0.881***	.	-1.077***
Oceania	.	0.309	.	-2.131***	.	0.426	.	-0.814***
OLIC	.	0.562***	.	0.425**	.	0.810***	.	0.053
LMIC	.	0.454**	.	0.484*	.	0.610***	.	0.358**
UMIC	.	0.183	.	0.599*	.	0.526*	.	0.552**
HIC	.	-2.134***	.	-0.101	.	-1.664***	.	0.129
Exit	.	-3.033***	.	-0.134	.	-2.673***	.	-0.142
Constant	-3.894	6.574***	-5.952	6.520***	-0.684	7.499***	-1.236	1.280**
Observations	2,299	2,299	2,299	2,299	2,299	2,299	2,299	2,299
R-squared	0.715	0.704	0.696	0.363	0.716	0.734	0.695	0.267
Period	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Continent	.	Yes	.	Yes	.	Yes	.	Yes
DAC list	.	Yes	.	Yes	.	Yes	.	Yes

Notes: See Table 1. *, **, and *** indicate significance at 10, 5 and 1 percent, respectively.

Table 7. Three-stage Least Squares Estimation – Aggregate bilateral export and ODA commitment models controlling for FTA

Column	(1)	(2)	(3)	(4)
Dependent variables	log(export)	log(ODA)	log(export)	log(ODA)
ln(ODA)	0.042***	.	0.038***	.
ln(distance)	-0.027	.	-0.026	.
tariff	-0.022***	.	-0.021***	.
diff ln(GDPpc)	-0.366	.	-0.320	.
KOR ppi	0.013	.	0.002	.
EconFree	0.021***	.	0.021***	.
FTA	0.552***	.	0.470***	.
ln(export)	.	0.037	.	0.276
ln(GDPpc)	0.490	-0.380***	0.532	-0.644***
ln(FDI)	0.142***	-0.000	0.143***	-0.035
oil revenue	.	0.000	.	0.007*
ln(population)	0.876***	0.140	0.878***	-0.078
death rate	.	-0.084***	.	-0.091***
political stab	-0.237***	0.097	-0.237***	0.194***
gov't efficiency	.	0.076	.	0.228*
civil liberties	.	-0.063*	.	-0.005
corruption	.	-0.336***	.	-0.294**
growth rate	0.009**	-0.002	0.009**	-0.007
ln(ODAlag)	.	0.710***	.	0.700***
disaster degree	.	0.121**	.	0.141***
invMR	.	0.044	.	0.598***
America	.	-0.016	.	-0.156
Africa	.	-0.202*	.	-0.322***
Europe	.	-0.420*	.	-0.897***
Oceania	.	-0.249	.	-0.394
OLIC	.	.	.	0.087
LMIC	.	.	.	0.357*
UMIC	.	.	.	0.033
HIC	.	.	.	-1.954***
Exit	.	.	.	-2.547***
				(0.447)
Constant	-3.450	4.627***	-3.116	6.147***
Observations	2,299	2,299	2,299	2,299
R-squared	0.717	0.728	0.717	0.728
Period	Yes	Yes	Yes	Yes
Continent	.	Yes	.	Yes
DAC list	.	No	.	Yes

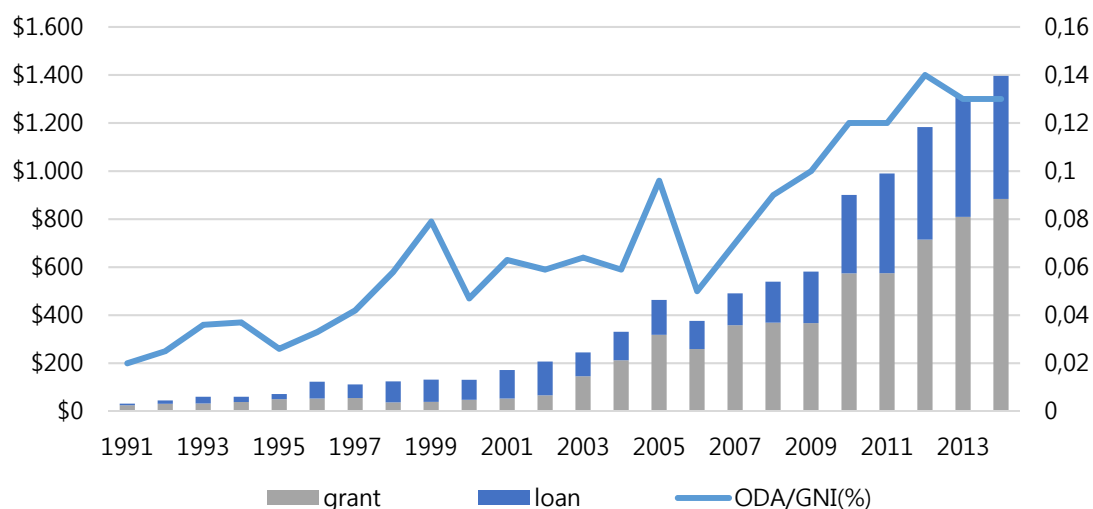
Notes: See Table 1. *, **, and *** indicate significance at 10, 5 and 1 percent, respectively.

Table 8. Three-stage Least Squares Estimation – Aggregate bilateral export and ODA commitment with full and subsample of data (DAC graduated countries excluded).

Column	(1)	(2)	(3)	(4)
Sample	Full Sample		Subsample	
Dependent variables	log(export)	log(ODA)	log(export)	log(ODA)
ln(ODA)	0.038***	.	0.094***	.
ln(distance)	-0.032	.	-0.023	.
tariff	-0.021***	.	-0.012**	.
diff ln(GDPpc)	-0.234	.	-0.379	.
KOR ppi	-0.002	.	-0.008	.
EconFree	0.021***	.	0.017***	.
ln(export)	.	0.401*	.	0.693**
ln(GDPpc)	0.619	-0.774***	0.459	-0.972***
ln(FDI)	0.148***	-0.057*	0.137***	-0.090**
oil revenue	.	0.007*	.	0.008*
ln(population)	0.882***	-0.188	0.861***	-0.436*
death rate	.	-0.094***	.	-0.090***
political stab	-0.228***	0.229***	-0.234***	0.285***
gov't efficiency	.	0.225	.	0.156
civil liberties	.	0.000	.	0.005
corruption	.	-0.299**	.	-0.244**
growth rate	0.010**	-0.008	0.008*	-0.008
ln(ODAlag)	.	0.700***	.	0.656***
disaster degree	.	0.141***	.	0.130**
invMR	.	0.624***	.	0.564***
America	.	-0.170	.	-0.201
Africa	.	-0.334***	.	-0.332***
Europe	.	-0.929***	.	-0.930***
Oceania	.	-0.426	.	-0.412
OLIC	.	0.095	.	0.083
LMIC	.	0.365*	.	0.328
UMIC	.	0.052	.	0.024
HIC	.	-1.970***	.	-1.914***
Exit	.	-2.543***	.	.
Constant	-3.611	6.971***	-1.753	8.170***
Observations	2,299	2,299	2,180	2,180
R-squared	0.715	0.711	0.700	0.614
Period	Yes	Yes	Yes	Yes
Continent	.	Yes	.	Yes
DAC list	.	Yes	.	Yes

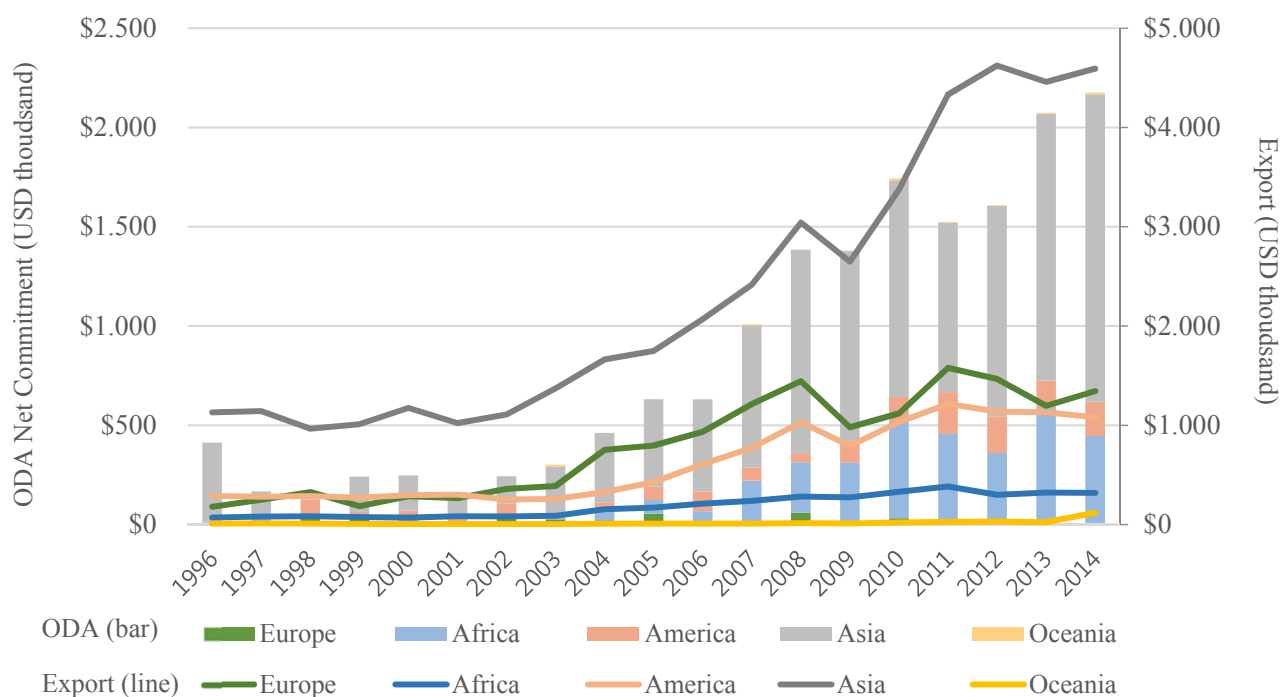
Notes: See Table 1. *, **, and *** indicate significance at 10, 5 and 1 percent, respectively.

Figure 1. Korea's total bilateral net commitments in form of grant and loans and ODA share of GNI 1991-2014



Source: OECD, International Development Statistics Online DB

Figure 2. Korea's total bilateral net ODA commitments and Export by Region (unit USD Thousand)



Source: OECD, International Development Statistics Online DB, The Export-Import Bank of Korea Online DB

Appendix Table A1. Variable Notation, Definition, and Sources

Variable	Definition	Data sources
civil liberties	Civil Liberties (1=BEST, 7=WORST)	Global Economy
Continent	0=Asia, 1=America, 2=Africa, 3=Europe, 4=Oceania	
corruption	control for corruption (-2.5 weak; 2.5 strong)	Global Economy
DAC list	0=LDC, 1=OLIC, 2=LMIC, 3=UMIC, 4=HIC, 5=Exit	OECD DAC
death rate	Death rate (per 1000 people)	World Bank WDI
diff ln(GDPpc)	Gap in log of GDPpc between South Korea and recipient	WDI
disaster degree	0=not affected; 1=the death toll under 25, 2=the death toll between 26~1000, 3=the death toll over 1000	CRED
disaster_dum	1 if a country experienced a natural disaster	CRED
EconFree	Economic freedom overall index (0-100)	Global Economy
FTA	1 if a country has in effect FTA with Korea	Korea Customs Service
gov't efficiency	Government effectiveness index (-2.5 weak; 2.5 strong)	Global Economy
growth rate	One year lagged growth rate of a recipient country	WDI
Income level	Categorical variable of per capita GDP	WDI
KOR ppi	Korea Producer Price Index	Bank of Korea
ln(distance)	Log of distance between the most populated cities (km)	CEPII
ln(ex+import)	Log of total bilateral export and import flows with recipient	Korea EXIM
ln(export)	Log of bilateral export flows to recipient	Korea EXIM
ln(FDI)	Log of FDI outflows Korea to recipient	Korea EXIM
ln(GDPpc)	Log of per capita GDP of recipient	WDI
ln(grant)	Bilateral grant type disbursements to recipient (USD thousand)	WDI
ln(human)	Bilateral humanitarian aid of disbursements to recipient (USD thousand)	WDI
ln(loan)	Bilateral loan type disbursements to recipient (USD thousand)	WDI
ln(ODA)	Log of bilateral ODA commitment to recipient	WDI
ln(ODAlag)	One year lagged log of bilateral ODA commitment to recipient	WDI
ln(population)	Log of population of recipient	WDI
ln(tech)	Bilateral technical cooperation disbursements to recipient (USD thousand)	WDI
ODA_dummy	1 if a recipient has bilateral ODA from South Korea	WDI
ODAlag_dum	One year lagged ODA dummy variable	WDI
oil rev_dum	1 if a recipient has oil rents	WDI
oil revenue	Oil rents (percent)	WDI
period	Categorical variable of year (96-99; 00-04; 05-09; and 10-14)	..
political stab	Political stability index (-2.5 weak; 2.5 strong)	Global Economy
tariff	Weighted mean applied tariff rates in recipient	WDI

Appendix Table A2. Heckman Two-stage estimation of bilateral export and ODA commitment models.

Column	(1)	(2)
Model	Probit	OLS
Dependent variables	ODA_dummy	log(ODA)
ln(export+import)	-0.037*	0.022
ln(FDI)	-0.009	0.022
oil revenue	.	0.002
political stab	0.297***	0.046
gov't efficiency	0.167	0.277
corruption	-0.327**	-0.355*
civil liberties	0.012	-0.034
death rate	-0.042***	-0.079***
ln(GDPpc)	-0.707***	-0.652***
ln(population)	0.243***	0.152*
growth rate	-0.004	-0.000
disaster degree	.	0.115
2nd quantile	0.795***	0.549**
3rd quantile	1.714***	0.984**
4th quantile	1.610***	0.534
ln(ODAlag)	.	0.642***
oil rev_dum	0.019	.
disaster_dum	0.261***	.
ODAlag_dum	1.343***	.
lambda	.	2.519***
Constant	4.522***	6.144***
Observations	2,299	2,299
Period	Yes	Yes
Continent	Yes	Yes
Income level	Yes	Yes

Notes: See Table 1. *, **, and *** indicate significance at 10, 5 and 1 percent, respectively.

Appendix Table A3. 2SLS Estimation of bilateral export and ODA commitment models.

Column	(1)	(2)	(3)	(4)
Model	Model 1		Model 4	
Dependent variables	log(export)	log(ODA)	log(export)	log(ODA)
ln(ODA)	0.038***	.	0.035***	.
ln(distance)	-0.031	.	-0.030	.
tariff	-0.023***	.	-0.023***	.
diff ln(GDPpc)	-0.360	.	-0.315	.
KOR ppi	0.021***	.	0.017*	.
EconFree	0.021***	.	0.022***	.
ln(export)	.	0.074***	.	0.051*
ln(GDPpc)	0.493	-0.345***	0.535	-0.389***
ln(FDI)	0.147***	0.004	0.147***	0.003
oil revenue	.	0.001	.	0.005
ln(population)	0.884***	0.093**	0.886***	0.118***
death rate	.	-0.090***	.	-0.079***
political stab	-0.227***	0.053	-0.227***	0.126**
gov't efficiency	.	0.007	.	0.261**
civil liberties	.	-0.087***	.	-0.010
corruption	.	-0.282**	.	-0.293**
growth rate	0.008**	-0.000	0.009**	-0.005
ln(ODAlag)	.	0.727***	.	0.701***
disaster degree	.	0.096*	.	0.144***
invMR	.	-0.041	.	0.542***
Constant	-4.039	4.368***	-4.140	4.468***
Observations	2,299	2,299	2,299	2,299
R-squared	0.716	0.722	0.716	0.742
Period	No	No	Yes	Yes
Continent	.	No	.	Yes
Income level	.	No	.	Yes

Notes: See Table 1. *, **, and *** indicate significance at 10, 5 and 1 percent, respectively.