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Analysis of Determinants of Climate-Related Development Finance in Korea

Dong-Hoon Shin

Associate Professor

Dept. of Global Finance and Banking
Inha University, Incheon, South Korea.
Email: dhshin@inha.ac.kr

Dongwook Kim

Assistant Professor

Dept. of Mathematics
Texas A&M University-Kingsville
Kingsville, Texas, US.
Email: Dongwook.Kim@tamuk.edu

Abstract

Global warming and the climate crisis caused by the increase in greenhouse gases are problems that the world must unite and solve. The Organization for Economic Cooperation and Development (OECD) has included climate-related development finance (CRDF) in official development assistance (ODA) since the early 2000s to support developing countries vulnerable to climate change. This study studied which factors Korea, a member of the Development Assistance Committee (DAC), determines the scale of CRDF included in ODA with reference to. From 2012 to 2020, we performed a regression analysis with Korea's bilateral CRDF flow as the dependent variable and factors representing wealth, trade volume, carbon dioxide emissions, population, natural resources, distance, and Korea's wealth in developing countries as explanatory variables. As the result, it was observed that only the trade volume and distance of the partner country were variables with significant explanatory power. This study is the first to statistically show how Korea's CRDF is determined by the partner country's factors.

Key words: climate-related development finance, official development assistance, Factor Analysis, Organization for Economic Cooperation and Development, Development Assistance Committee

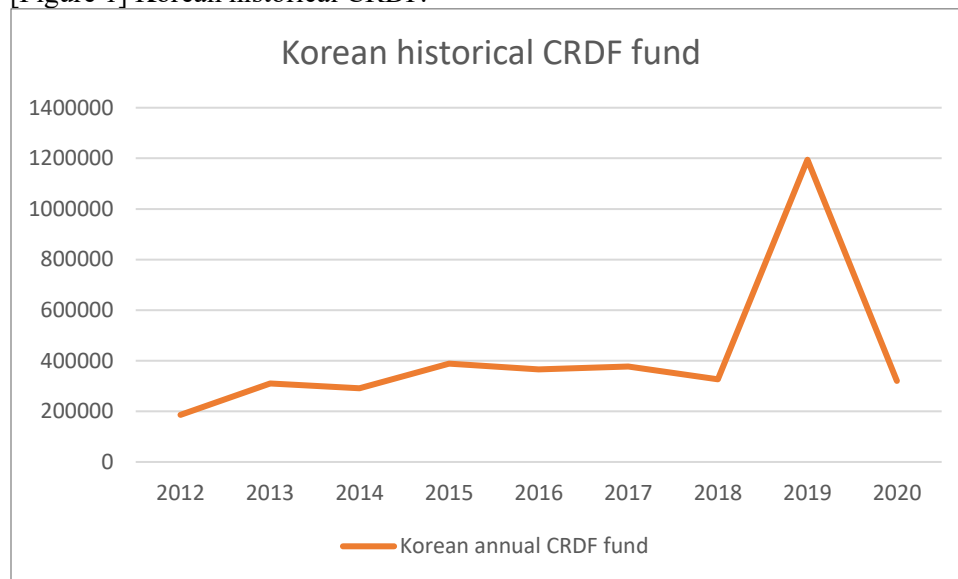
1. Introduction

Climate change is the most important global issue to be addressed at this time. But the worse side of the climate change problem is that it has a bigger negative impact on the poor and vulnerable. Poor people are more vulnerable to climate change risks, "climate shocks result in higher relative losses for poorer populations, who are less equipped to recover from such extreme incidents"(OECD, 2018).

Therefore, the help and efforts of developed countries for developing countries are very important in the issue of climate change. Within the Organization for Economic Cooperation and Development (OECD), a group of developed countries, the Development Assistance Committee (DAC) supports developing countries with official development assistance (ODA), a fund set up to help developing countries, and ODA include the cost(climate-related development finance) to respond to climate change issues. The OECD defines climate-related development finance (CRDF) as: The CRDF consists of official development assistance (ODA), other public flows (OOF), and private investment in developing countries. Among of them, ODA occupies the largest proportion. According to the OECD, as of 2020, 33.4% of ODA is being supported as CRDF, a fund for adaptation and mitigation of the climate crisis in developing countries.

As Korea ranks in the top 10 in the world in terms of CO2 emissions and economic size as of 2020, Korea has a responsibility to support developing countries. Korea went through the war in 1950 and started as a poorest country and experienced the situation of a recipient country until the 1990s, but Korea's international status as a donor country as the first and only one in the world to be classified as an advanced country in 2010 is unique. However, it is questionable whether it provides climate finance suitable for its current status. Kim (2020) said, "Korea, one of the OECD's Development Assistance Committee (DAC) members, has a considerable gap between its contribution and its target. This is due to several reasons such as the lack of official development assistance (ODA) as a primary public resource for developing countries, limitations of other forms of public climate finance, and the low level of public-private partnerships (PPP) related to climate change." He analyzes Korea's CRDF in his research and presented three policy strategies to solve the Korean government's CRDF problems (setting specific goals in the government plan, implementing new financial schemes for private partners, and managing the whole process by regular monitoring and evaluation).

[Figure 1] Korean historical CRDF.



Source: OECD DAC External Development Finance Statistics

This study is significant in that it numerically revealed for the first time what factors affect Korea's CRDF. In general, it is easy to think that the CRDF is used for financial or environmental issues of the recipient country, especially for CO2 reduction, as some of the ODA for developing countries accounts for the largest portion. The contribution of this study is that the Korean CRDF has numerically revealed whether support that reflects such factors is being implemented.

The structure of this thesis is as follows. Section 2 introduces studies related to this study and hypotheses. Section 3 introduces the data collected for the study and explains how to process them to fit the model. Section 4 introduces the key analysis results of this study. Section 5 describes the results and limitations of the study and further studies.

[Table 1] List of bilateral CRDF supported countries in Korea from 2012 to 2020

Year	Recipient countries (59 countries. Descending order of grant amount for the year)
2012	Viet Nam, Azerbaijan, Jordan, Bolivia, Indonesia, Democratic Republic of the Congo, Morocco, Kyrgyzstan, Ghana, Philippines, Cambodia, China (People's Republic of), Guatemala
2013	Philippines, Cambodia, Viet Nam, Indonesia, Rwanda, Paraguay, Ethiopia, Iraq, El Salvador, Bolivia, Sri Lanka, Lao People's Democratic Republic, Uzbekistan, Myanmar, Mongolia, Tunisia, Solomon Islands
2014	Viet Nam, Indonesia, Mongolia, Colombia, Kenya, Solomon Islands, Ethiopia, Philippines, Cameroon, Tunisia, Tanzania, Cambodia, Bangladesh

2015	Viet Nam, Myanmar, Lao People's Democratic Republic, Philippines, Indonesia, Afghanistan, Paraguay, Senegal, Mozambique, Peru, Morocco, Mongolia, Tanzania, Ghana, Rwanda, Bangladesh, Cambodia, Sierra Leone, South Sudan
2016	Cambodia, Lao People's Democratic Republic, Nicaragua, Bangladesh, Peru, Rwanda, Philippines, Nepal, Thailand, Mongolia, Sri Lanka, Cuba, Mali, Indonesia, Kazakhstan, Kyrgyzstan, Ecuador
2017	Indonesia, Solomon Islands, Bolivia, Nicaragua, Morocco, El Salvador, Viet Nam, Rwanda, Mongolia, Nepal, Peru, Myanmar, Sri Lanka, Tunisia, Kyrgyzstan, Ecuador, Philippines, Guatemala, Fiji
2018	Cambodia, Fiji, Uganda, Bolivia, Guatemala, Bangladesh, Mongolia, Kenya, Côte d'Ivoire, Viet Nam, Lao People's Democratic Republic, Paraguay, Afghanistan, Indonesia, Nicaragua, Ethiopia, Niger, Myanmar, Tanzania, Philippines, Malawi, Ecuador
2019	Mongolia, Kenya, El Salvador, Ghana, Rwanda, Ethiopia, Cambodia, Nepal, Honduras, Lao People's Democratic Republic, Pakistan, Sudan, Philippines, Guatemala, Morocco, Uganda, Fiji, Yemen, Indonesia, Iran, Zimbabwe, Timor-Leste, Myanmar, Sierra Leone, Kiribati, Senegal, Solomon Islands, Marshall Islands, Tuvalu, Vanuatu, Mozambique, Viet Nam
2020	Indonesia, Viet Nam, Rwanda, Mongolia, Lao People's Democratic Republic, Myanmar, Paraguay, Jordan, Ghana, Madagascar, Cuba, Cambodia, Tanzania, Timor-Leste, Bangladesh, Ethiopia, Fiji, Uzbekistan

* CRDFs less than 1000 units are omitted.

Source: OECD DAC External Development Finance Statistics

2. Literature review and Hypothesis

As the climate crisis progresses, many developing countries will face greater difficulties than developed countries. The losses from climate-related weather shocks will continue to grow in the future because of the accumulation of people and assets in high-risk areas, shocks that are more frequent and greater in scale, and the lack of proper financial protection tools (Campillo et al., 2017: 7). Unlike developed countries, which have financial leeway to overcome the difficulties caused by climate change, developing countries will need more and more finances for climate change. In the Paris Agreement in 2015, the countries agreed that “developed country parties shall provide financial resources to assist developing country Parties with respect to both mitigation and adaptation in continuation of their existing obligations under the convention” in Article 9 (UNFCCC, 2015: 13). Increasingly, funding for the CRDF will become an essential factor in overcoming the climate crisis.

However, in the case of Korea, financial support for the climate crisis is still stingy compared to its economic size and carbon dioxide emissions. Korea ranks 8th in the world and 4th among OECD DAC countries as of 2018 (Union of Concerned Scientists, 2020). Based on per capita emissions, Korea ranks 6th in the world and 4th among OECD DAC countries (Union of Concerned Scientists, 2020). If it does not contribute to climate finance for developing countries, Korea will fall into a selfish country that emits CO₂ on a large scale but does not help the earth. Nevertheless, Korea's contribution to the GCF is only less than 1% of the total financial resources (Moon, 2016; GCF, 2020).

Korea's policy integration of public climate finance is low in terms of evaluation criteria such as inclusion, consistency, weight, reporting, resources, and deliberation. The governance structure needs to be improved, and making an integrated and reliable channel would help to deal with climate change policy and energy policy comprehensively. (Jin & Kim, 2016)

Maizels and Nissanke (1984), in a comparative analysis of bilateral aid and multilateral aid from the United States, France, and Germany, drew the conclusion that in the case of bilateral aid, the donor country's interests were greatly expressed. Berthelemy and Tichit (2002) comprehensively analyzed DAC member countries' ODA data for 20 years after 1980, and found that the economic interests of donor countries were a decisive factor in the ODA distribution process after 1990. Most of the studies that analyzed Japan's ODA distribution process also empirically demonstrated that Japan pursued ODA in the context of expanding its own economic interests (i.e., trade and investment) (Hook and Zhang, 1998; Tuman and Strand, 2006). Analyzing the official development assistance strategy of each country is the analysis of the determinants of ODA.

In this study, the following hypotheses will be analyzed through regression analysis.

Hypothesis 1: Korea would have provided more CRDF to countries with low GDP per capita.

Hypothesis 2: Korea would have provided more CRDF to countries with high trade volume.

Hypothesis 3: Korea would have provided more CRDF to countries with high CO2 emissions.

Hypothesis 4: Korea would have provided more CRDFs to countries with high populations.

Hypothesis 5: Korea would have provided more CRDF to countries where income from resources has a greater impact on GDP per capita.

Hypothesis 6: Korea would have provided more CRDFs to countries with a shorter distance.

Hypothesis 7: Korea would have provided more CRDF during the period when Korea's GDP per capita was high.

3. Data and Model

The data used in this study referred to Korea's bilateral climate-related external development finance flows from 2012 to 2020 among the OECD DAC External Development Finance Statistics. Since the largest share of CRDF comes from ODA, a public resource, analyzing CRDF data based on regular reports from DAC countries seems to be the most transparent and rational analysis method.

In the analysis model, the dependent variable is Korea's bilateral climate-related external development finance flows for each developing country, and the unit is 1,000 USD as of 2020. Small grants of less than 1,000 units were excluded from the analysis as they were judged not to affect the research. We investigated which factors affect the dependent variable on the total amount of aid to each developing country from 2012 to 2020. These factors are unique to each country that are judged to lead to Korea's investment desire and justification when Korea views developing countries as a kind of investment target.

For example, if Korea provides aid to help the developing country's absolute poverty as an investment target, it will consider per capita gdp (USD), a factor that indicates the country's wealth and poverty. If the developing country is a meaningful trade partner of Korea, the amount of trade with Korea (import + export amount, 1,000 USD) will be referenced. If Korea invests to reduce CO2 emissions in accordance with the original meaning of the CRDF, the amount of investment will be determined according to the CO2 emissions (MtonCO2e) of the developing country. In addition, factors such as the number of population, natural resources, and the distance (Km) between Korea and the target country are factors that can determine the amount of investment. In addition, Korea's gdp (USD) per capita in the previous year is also taken into consideration, as there is no political burden in supporting other countries when Korea is wealthy. Therefore, we would like to consider the following data that can be measured and disclosed as factors. The factors are GDP per capita for each country, trade volume with Korea, CO2 emissions, population, the ratio of natural resource income to GDP per capita (greater than 0, less than 1), and distance from the capital of the developing country to Seoul, Korea's per capita gdp, which are treated as independent variables. When calculating the percentage of income from annual resources to per capita gdp, only revenues from pure natural resources, oil fields, natural gas, coal fields, mineral resources, and forest resources were reflected, and rental rates or revenues for these resources were reflected. Since a lag of one year is required for the dependent variable to be determined, data from one year ago was used as the independent variable for the dependent variable. The gdp per capita and population data of each country were referenced from Data Commons and the World Bank, and the ratio of trade volume to Korea and imports from natural resources to gdp per capita could be found from the Korean Statistical Information Service (KOSIS). Carbon emissions were referenced from the Emissions Database for Global Atmospheric Research (EDGAR).

The data gathered in this way is processed once more to be displayed as data on the total amount of subsidy by developing country from 2012 to 2020. If Korea's aid to a developing country (CRDF_KR) was limited to one of the years in the scope of the study, the data were used as is. However, due to the nature of ODA, it is rare for a country to provide all subsidies of a certain size or more in one year, so in the case of many developing countries, the dependent variable was obtained by summing all subsidies from 2012 to 2020, the study period. In this case, each explanatory variable was treated under the following rules. gdp per capita (gdp), trade volume (trade), carbon emissions (co2_emit), population (population), ratio of income from natural resources to gdp per capita (resource) corresponding to the previous year of the year in which support was provided, Korea Average gdp per capita (gdp_kr) was calculated, and distances from the relative capital were used as constants in time series. Namely,

$$y_i = \sum_{t \in I} y_{i,t},$$

where $I = \{t | t \text{ is the year Korea gave country } i \text{ a CRDF}\}$, $y_{i,t}$ = bilateral CRDF Korea gave country i in year t , and

$$x_{n,i} = \text{Mean of } x_{n,i,t-1} = \overline{x_{n,i,t-1}},$$

where $x_{n,i,t-1}$ is the element of n at time $t-1$ that explains $y_{i,t}$, $n \in \{gdp, trade, co2_emit, population, resource, distances, gdp_kr\}$

The table below shows the dependent variables and the basic statistics of each explanatory variable.

[Table2] Basic statistics

Observations=59 countries					
Variables	mean	standard deviation	max	median	min
CRDF_KR	42691.91	75828.25	424901.2	6893.831	1008.875
gdp	2939.777	2334.842	10510.77	2211.218	376.375
trade	5936171	28943014	2.21E+08	217217	349
co2_emit	227.0814	1309.114	10155.48	12.53144	0
population	59185832	1.84E+08	1.41E+09	18112907	10865
resource	0.081008	0.113925	0.58456	0.04733	0
distances	8892.17	4172.675	18572.53	9242.485	954.1125
gdp_kr	30104.12	2219.673	33436.92	29879.31	25096.26

According to the definition of the variables described above, the model we want to analyze is given as follows.

$$y_i = \beta_0 + \beta_1 x_{gdp,i} + \beta_2 x_{trade,i} + \beta_3 x_{co2_emit,i} + \beta_4 x_{population,i} + \beta_5 x_{resource,i} + \beta_6 x_{distances,i} + \beta_7 x_{gdp_kr,i} + \varepsilon \quad (1)$$

4. Analysis

The table below shows the regression analysis results of model (1).

[Table3] The results of the regression analysis

Variables	Estimate	Std. Error	t value	Pr(> t)
intercept	2.698e+05	1.487e+05	1.814	0.0755
gdp	-9.109e-01	4.420e+00	-0.206	0.8376
trade	3.583e-03	1.762e-03	2.034	0.0472 *
co2_emit	-5.163e+01	5.800e+01	-0.890	0.3776
population	-3.591e-05	2.424e-04	-0.148	0.8828
resource	-5.457e-07	5.737e-07	-0.951	0.3460
distances	-6.283e+00	2.412e+00	-2.605	0.0120 *
gdp_kr	-5.520e+00	4.652e+00	-1.187	0.2409

R-squared: 0.2697, F-statistic: 2.69 on 7 and 51 DF, p-value: 0.01885

Signif. codes: ‘*’ 0.05

First, the R-squared, which is the criterion for the adequacy of the model, came out with a low value of about 0.27. However, since the sample of this model is small at 59, and it is inappropriate to focus support on a specific country due to the nature of the CRDF project, 0.27 is considered a sufficiently meaningful value considering the number of samples and project characteristics.

Among the seven parameters that we hypothesized would affect Korea's CRDF investment, the factors that rejected the null hypothesis at the 5% confidence level were analyzed as trade volume and distances with the developing countries. In other words, the results of the study appeared to support Hypotheses 2 and 6. As the trade volume increases by 0.00358 units, the CRDF increases by 1 unit. In addition, it was analyzed that the negative effect of increasing the CRDF by 1 unit can be expected as the distance from the counterpart station increases by 5.52 units.

5. Conclusion

The whole world is making great efforts to reduce greenhouse gases, which are the cause of the climate crisis. Korea has expanded its ODA amount since joining the OECD DAC in 2009, and ODA includes a significant amount of CRDF costs. In this study, Korea's bilateral CRDF data from 2012 to 2020 was used as a dependent variable to examine what factors in the partner country affected this subsidy. As explanatory variables, the cost of determining Korea's CRDF used figures representing the wealth of developing countries, trade volume, CO2 emissions, population, natural resources, distance, and Korea's own wealth.

As a result of the analysis, among the seven explanatory variables that were assumed to affect Korea's CRDF investment, only two variables, trade volume and distance, had a statistically significant effect on CRDF investment. The counterpart country's trade volume with Korea showed a positive effect with CRDF, and the distance between the counterpart country and Korea showed a negative effect with CRDF.

The results of this study do not seem to have a significant impact on poverty and greenhouse effect reduction in the developing country by Korea's CRDF. Rather, it raises doubts about whether it prefers nearby countries and countries with large trade volumes. However, while the greenhouse effect reduction expected in this study and the increase in the wealth of the other country are problems that can only be improved by observing and striving for a very long period of time, there is a limitation in the research because the period used for the research analysis is only 9 years. In addition, Korea's accession to the DAC was not made until the end of 2009, so more time is needed for Korea's ODA to show tangible results.

Korea was an ODA recipient until 1999, and is the first and only country in the world to become an aid donor in 2010. As such, interest in Korea's ODA support is great. In the era of climate crisis, the use of CRDF, which relies on ODA for a significant amount, is also a very important issue. This study is the first to study how Korea's CRDF is affected by the factors of the other country using a statistical methodology, and its contribution is made. As a donor country, Korea's support for developing countries is currently in progress, and Korea's CRDF is expected to show clear results in terms of greenhouse gas reduction and adaptation in the future.

References

- [1] Berthelemy, J. & Tichit, A. (2002). Bilateral Donors' Aid Allocation Decisions: a Three-dimensional Panel Analysis. WIDER Discussion Paper 2002/123.
- [2] Campillo, G., Mullan, M., & Vallejo, L. (2017). Climate change adaptation and financial protection: Synthesis of key findings from Colombia and Senegal. OECD Environment, Working Papers.
- [3] Moon, J. (2016). Burden-sharing analysis for GHG reduction and climate finance mobilization. *Journal of Environmental Policy and Administration*, 24(2), 211– 232.
- [4] GCF, Resource mobilisation(2020). [Online] Available: <https://www.greenclimate.fund/about/resource-mobilisation/irm>
- [5] Jin, I. & Kim, Y. (2016). Policy evaluation on public climate finance of Korea. [Online] Available: https://www.nabo.go.kr/Sub/01Report/01_01_Board.jsp?bid=19&arg_id=6078&funcSUB=view
- [6] Hook, S. W. & Zhang, G. (1998). Japan's aid policy since the Cold War: Rhetoric and Reality. *Asian Survey* 38(11): 1051~1066.
- [7] Kim, Y. (2020). Improving Korea's Climate Finance for Developing Countries: Policy Analysis of the Management of Climate-Related Development Finance (CRDF). *Journal of International Development Cooperation*, 15 (2), 141-185, [Online] Available: <https://doi.org/10.34225/jidc.2020.15.2.141>
- [8] Maizels, A. & Nissanke, M. K. (1984). Motivations for Aid to Developing Countries. *World Development* 12(9): 879~900
- [9] OECD. (2018a). Climate-related development finance data. [Online] Available: <http://www.oecd.org/dac/financing-sustainable-development/development-finance-topics/Climate-related-development-finance-in-2018.pdf>

- [10] OECD. (2018b). Development co-operation report 2018. [Online] Available: <https://www.oecd-ilibrary.org/docserver/dcr-2018-en.pdf?expires=1571153694&id=id&acname=guest&checksum=7987028A73E637DE3BA0CAB8F22D30C3>
- [11] OECD. (2023) Climate Change: OECD DAC External Development Finance Statistics. [Online] Available: <https://www.oecd.org/dac/financing-sustainable-development/development-finance-topics/climate-change.htm>
- [12] Tuman, J. P. & Strand, J. R. (2006). The role of mercantilism, humanitarianism, and gaiatsu in Japan's ODA programme in Asia. *International Relations of the Asia-Pacific* 6(1): 61~80.
- [13] United Nations Framework Convention on Climate Change [UNFCCC]. (2015). The Paris agreement. [Online] Available: <https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement>