2018 미래산업연구소 봄학기 세미나

The RIFI Seminar: Spring Semester 2018

일시: 2018년 6월 21일 16:00-17:30
장소: 단국대학교 죽전캠퍼스 국제관 502호

사회: 문보영 교수

· 발표 1: Jung Wan Lee, Boston University

"Environmental Best Practices, It Begins with Us: Business, Local Governments and International Community Should Work Together"

토론: 정연승 교수 & 김병모 교수

· 발표 2: Sang-Chul Yoon, Dankook University

"The Impact of Grants and Loans on Economic Growth in Sub-Saharan Africa"

토론: 김윤영 교수 & 송재은 교수

· 미래산업연구소 운영회의 및 편집회의 (2018. 6. 21. 17:30)

단국대학교 상경대학 미래산업연구소
The Research Institute of Future Industry
Dankook University

Environmental Best Practices, It Begins with Us: Business, Local Governments and International Community Should Work Together

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Boston University
United States

Objectives of the Paper

The paper provides some explanations and best practices for:

- What factors influence the adoption of environmental policies and regulations as a strategic asset?
- How business and local governments better manage their environmental policies and practices on a global basis?

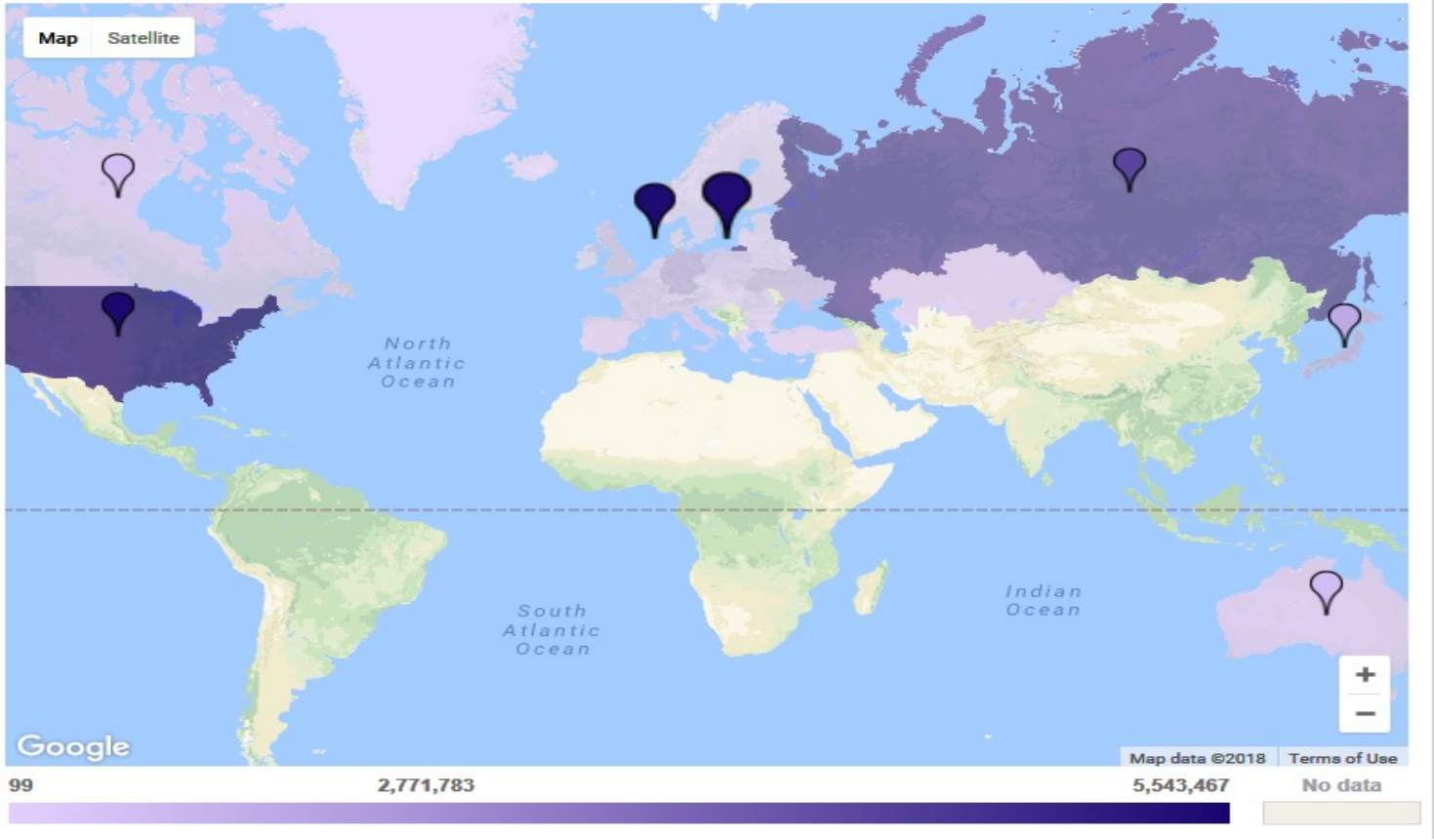
Background

- Who is responsible?
- Just 90 of the world's largest producers of crude oil, natural gas, coal and cement account for almost two thirds of the problem (Greenpeace, 2017).
- They produced 63 percent of global industrial emissions of carbon dioxide (CO2) and methane since the start of the industrial revolution (Greenpeace, 2017).

The Earth Summit 1992

- **The United Nations Conference on Environment and Development (UNCED)**, also known as the "Rio Earth Summit" and the "Earth Summit," was held in Rio de Janeiro, Brazil, June 1992.
- **The Earth Summit** influenced all subsequent UN conferences, which have examined the relationship between human rights, population, social development, women and human settlements - and the need for environmentally sustainable development.

Global map - Annex I Aggregate GHGs 1990 (Base Year)

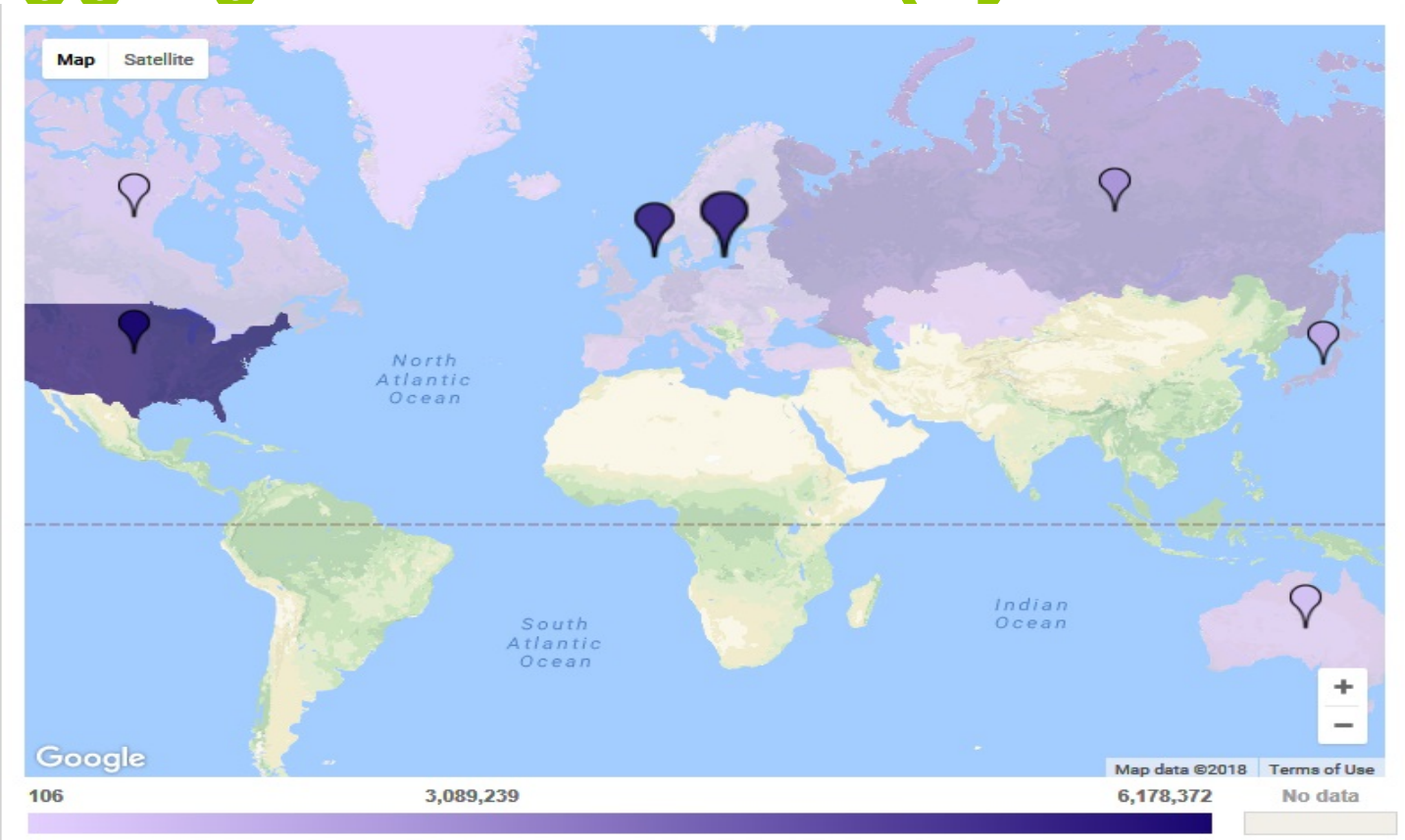


Source: http://di.unfccc.int/global_map

United Nations Framework Convention on Climate Change (UNFCCC) 1994

- **The United Nations Framework Convention on Climate Change (UNFCCC)** entered into force on 21 March 1994.
- **The 197 countries** that have ratified the Convention are called Parties to the Convention.
- The objective of the Convention is to ***"stabilize greenhouse gas concentrations at a level that would prevent dangerous anthropogenic (human induced) interference with the climate system."***

Global Map - Annex I Aggregate GHGs 1997 (Kyoto Protocol)

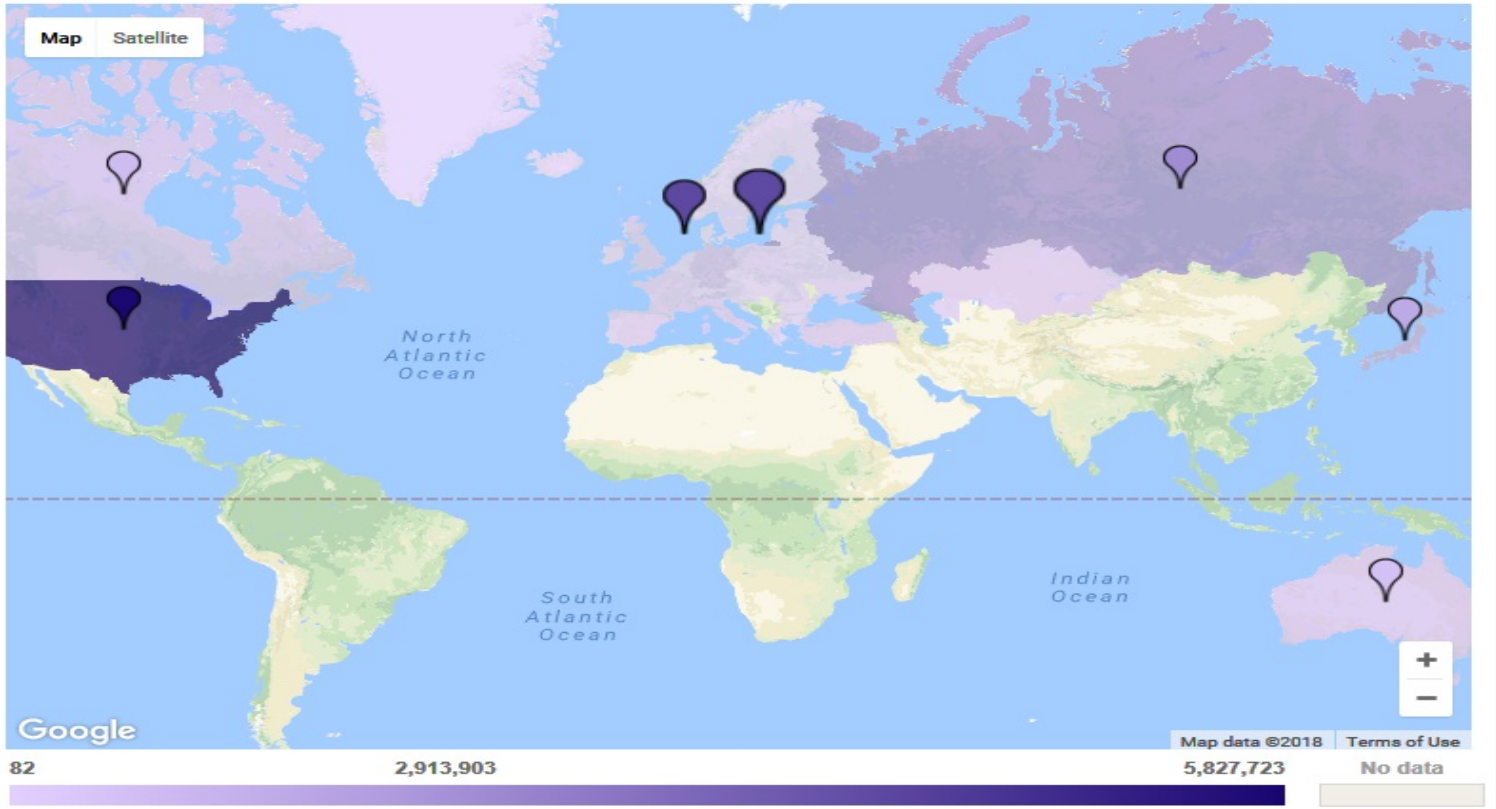


Source: http://di.unfccc.int/global_map

The Kyoto Protocol 1997

- **The Kyoto Protocol** is an international agreement linked to the UNFCCC, which commits its Parties by setting internationally binding emission reduction targets.
- Recognizing that developed countries are principally responsible for the current high levels of GHG emissions in the atmosphere
- The Protocol places a heavier burden on developed nations under the principle of ***"common but differentiated responsibilities."***

Global Map - Annex I Aggregate GHGs 2015 (Paris Accord)

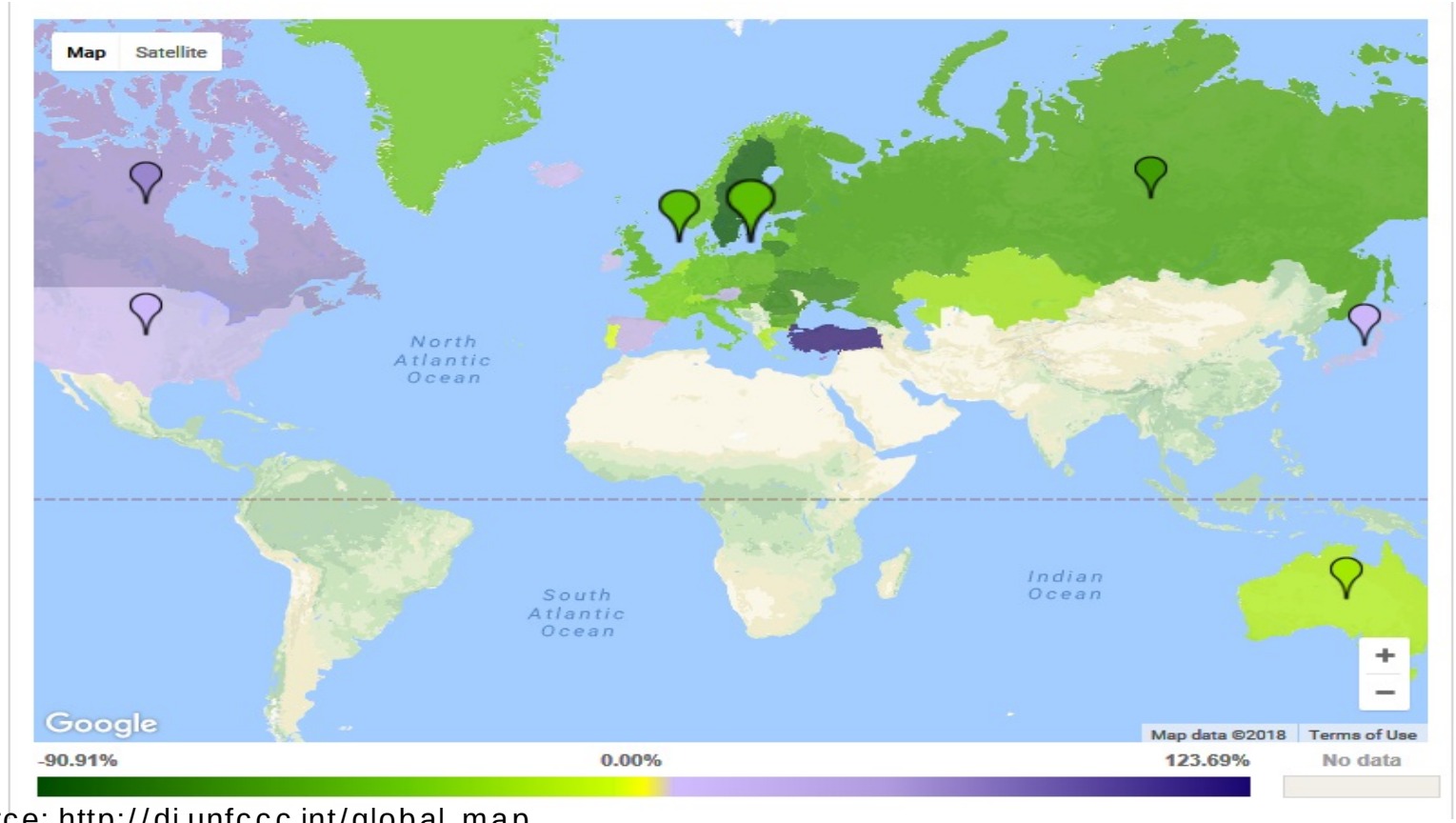


Source: http://di.unfccc.int/global_map

The Paris Agreement 2015

- **The Paris Agreement** requires all Parties to put forward their best efforts through ***"nationally determined contributions"*** (NDCs) and to strengthen these efforts in the years ahead.
- This includes requirements that all Parties report regularly on their emissions and on their implementation efforts.

Global Map - Annex I Aggregate GHGs 1990-2015 (% growth)



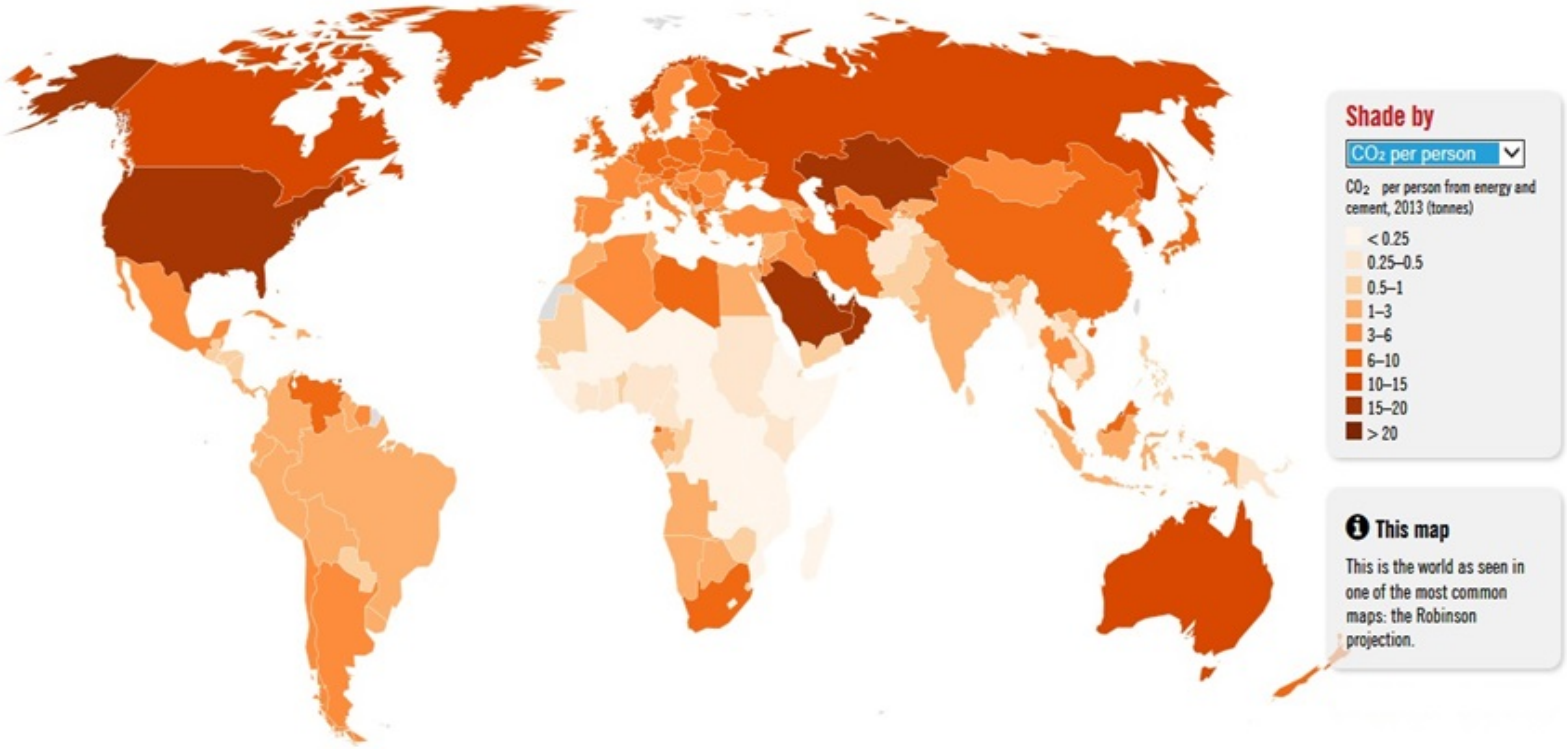
Source: http://di.unfccc.int/global_map

Total Emissions of CO2 - Annex I (% change from 1990 to 2015)

1	New Zealand	-340.67%	16	Denmark	-32.19%	31	Switzerland	-13.72%
2	Sweden	-147.76%	17	United Kingdom	-32.03%	32	Greece	-11.50%
3	Lithuania	-81.20%	18	Monaco	-27.37%	33	Australia	-9.12%
4	Romania	-69.64%	19	Latvia	-25.50%	34	Portugal	-6.95%
5	Ukraine	-68.21%	20	Italy	-25.44%	35	Kazakhstan	-4.45%
6	Belarus	-62.91%	21	Luxembourg	-24.93%	36	Netherlands	2.01%
7	Estonia	-61.74%	22	European Union	-24.52%	37	Japan	6.46%
8	Finland	-60.92%	23	EU (KP)	-24.41%	38	United States	7.92%
9	Russia	-59.01%	24	Germany	-23.89%	39	Ireland	9.87%
10	Hungary	-51.98%	25	Croatia	-23.48%	40	Spain	13.09%
11	Slovakia	-48.27%	26	Norway	-20.13%	41	Iceland	14.81%
12	Bulgaria	-44.09%	27	Malta	-19.04%	42	Austria	23.52%
13	Poland	-38.16%	28	France	-18.48%	43	Canada	47.11%
14	Czech Rep.	-37.41%	29	Liechtenstein	-17.33%	44	Cyprus	48.60%
15	Slovenia	-32.76%	30	Belgium	-16.36%	45	Turkey	170.76%

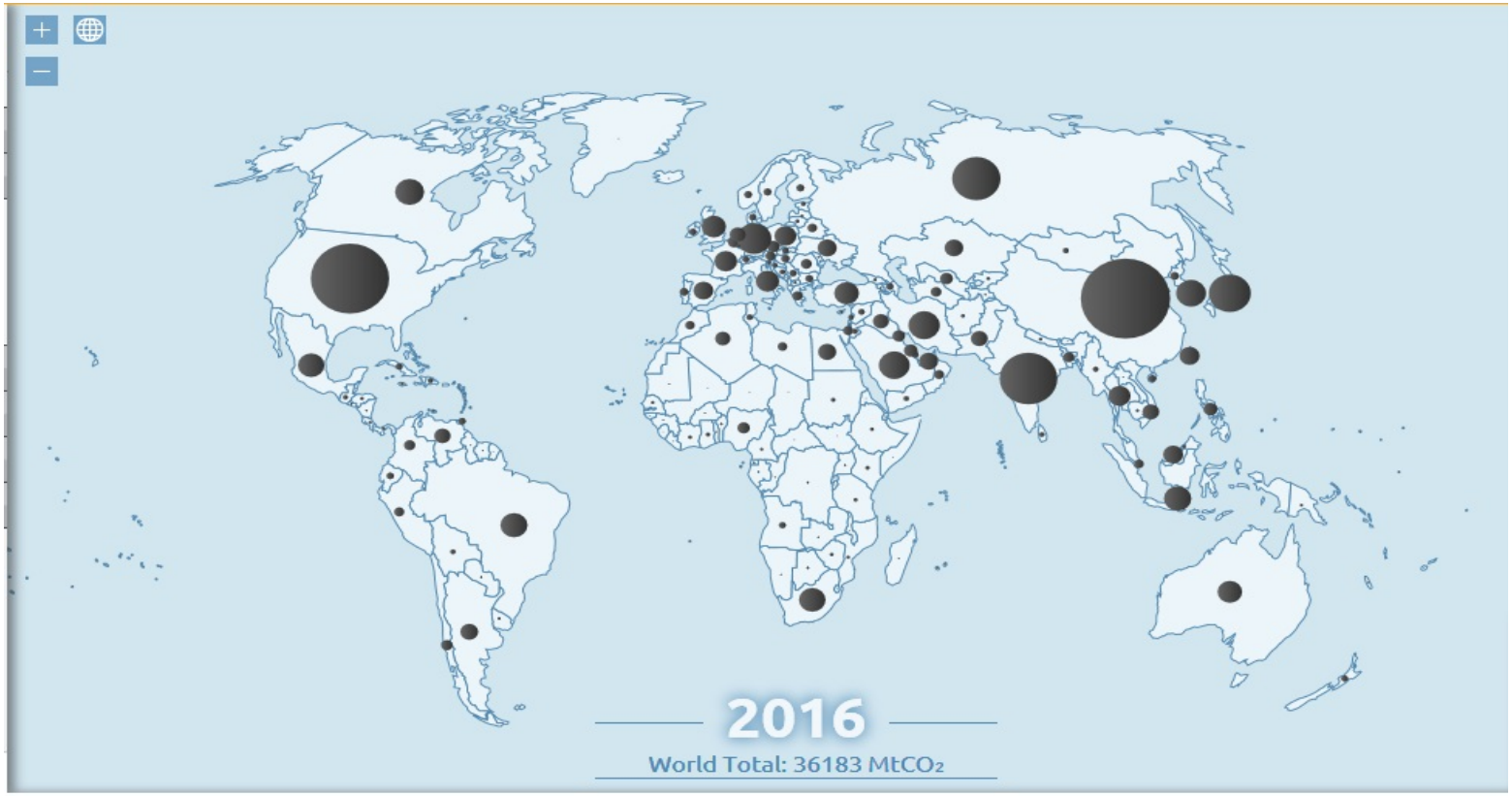
Source: http://di.unfccc.int/global_map

Global Carbon Map – All Nations
CO2 per person 2013 (tonnes)



Source: http://www.carbonmap.org/#intro

Global Carbon Map – All Nations CO2 in total 2016 (metric tonnes)



Source: http://www.globalcarbonatlas.org/en/CO2-emissions

Recommendations

- **To All Nations, It is Our Responsibility to Save the Earth**
  - **"We are the earth."** Everything in the planet shares a common origin-matter simply evolved in many ways, and this fact should encourage all capable entities to decrease the pace of global warming, as we are all affected by it.
- **To All Businesses, It is Our Responsibility to Take Right Actions**
  - **Businesses in developed countries are moving environmentally damaging operations to developing nations. For far reaching emission reductions, however, the efforts need to be global rather than localized.**

Conclusion: It Begins with Us

- Together we must make the urgent leap to clean and safe renewable energy.
- **It begins with us.** This statement must be ringing true **across all nations and among all stakeholders** of the earth, as requesting that nations, local governments, corporations and localities commit to the Paris Agreement.
- Climate change is a global problem, but **there is a lot we can do about it in our daily life.**

The Impact of Grants and Loans on Economic Growth in Sub-Saharan Africa

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The Impact of Grants and Loanson Economic Growth in Sub-Saharan Africa

ABSTRACT

This paper investigates the question of aid effectiveness on economic growth in Sub-Saharan Africa by disaggregating aid into grants and loans during 1990-2015. The estimation results indicate that grants have a positive and statistically significant impact on economic growth in Sub-Saharan Africa during the sample period, while loans do not have a statistically significant effect on it. The results also show that openness in trade and investment is positively related to economic growth significantly. When we break down the panel data into MICs and LICs, grants effectiveness on growth in MICs is revealed to be larger than that in LICs, and there is diminishing returns to grants in MICs. Unlike the case of LICs, inflation and education significantly affect economic growth in MICs. In particular, foreign direct investment affects economic growth significantly in MICs while domestic investment affects economic growth significantly in LICs.

Keywords: grants, loans, economic growth, Sub-Saharan Africa, MICs, LICs

I. Introduction

The aid effectiveness on growth is one of the most debated issues in economic research. Without remarkable differences in the data used, and with some differences in techniques of analysis, various authors have come up with contrasting findings (Wako, 2018). There are three possible findings regarding the aid effectiveness on growth: first, aid has no impact on economic growth; second, aid has a positive impact on growth; third, aid positively affects economic growth conditional upon good policies and institutions. However, only a limited number of studies have been conducted on the comparative analysis of grants and loans. Over recent decades, Sub-Saharan Africa have continued to show relatively slow economic growth, although developing economies on the other continents have in general shown good performance.[1]

This paper examines the impact of grants and loans on economic growth by focusing on Sub-Saharan Africa during 1990-2015. Despite an extensive empirical literature in this area, existing studies have not addressed directly aid effectiveness by disaggregating aid into grants and loans. As a first step, this paper estimates the impact of grants and loans on economic growth in selected 26 countries of Sub-Saharan Africa. In the second step, we attempt to examine the aid-growth nexus by breaking down Sub-Saharan Africa into Low Income Countries (LICs) and Middle Income Countries (MICs) based on the World Bank's classification.[2] This paper examines the Barro (1996)-type growth framework using dynamic and static panel data techniques including the System Generalized Method of Moments (GMM-SYS) and the Fixed Effect (FE) model.

[1] In our sample, the average per capita real GDP growth rate was 2.1% per annum in Sub-Saharan Africa during 1990-2015 (see Table A2 on the descriptive summary of the concerned variables).

[2] According to the classification of the World Bank (2017), low income economies: Gross National Income (GNI) per capita ≤ $1,005, lower middle income economies: $1,006 ≤ GNI per capita ≤ $3,955, upper middle income economies: $3,956 ≤ GNI per capita ≤ $12,235.

Unlike previous works, this paper deals with three issues that have been insufficiently analyzed in the aid effectiveness literature. First, most previous studies covered the whole group of developing countries, paying limited attention to the analysis of regional experiences. This paper contributes to the aid effectiveness literature by focusing on Sub-Saharan Africa which is still facing the dilemma of poverty. Second, the majority of aid effectiveness studies have analyzed the impact of aid as a whole, thus neglecting the fact that different aid modalities may have dissimilar impacts on growth. In contrast, we analyze aid effectiveness on economic growth by disaggregating aid into grants and loans. Third, this paper focuses on the impact of aid on economic growth by breaking down the panel data of selected 26 Sub-Saharan African countries into MICs and LICs according to the difference of income levels.

This paper contributes to the aid effectiveness in Sub-Saharan Africa by disaggregating aid into grants and loans over the sample period. The estimation results show that grants have a positive and statistically significant effect on economic growth, although loans do not have a statistically significant effect. The results also show that openness in trade (EXP) and investment (both FDI and GCF) is positively related to economic growth significantly. When we break down the panel data into MICs and LICs, the FE estimation results show that grants effectiveness on growth in MICs is revealed to be larger than that in LICs. Moreover, there is diminishing returns to grants in MICs. In particular, inflation and education significantly affect economic growth in MICs, while it is not statistically significant in LICs. Furthermore, foreign direct investment affects economic growth significantly in MICs while domestic investment affects economic growth significantly in LICs.

The remainder of this paper is organized as follows. Section II reviews the relevant literature. Section III shows the model specification and data. Section IV presents the empirical results, and Section V provides concluding remarks.

II. Literature Review

The effectiveness of foreign aid in promoting economic growth has been the subject of many studies since the 1960s. Empirical studies report numerous conflicting results. These empirical studies have used different growth models to answer the question of whether aid contributes to economic growth. Most of the aid effectiveness studies before 1990 have some references to the Harrod-Domar type model, which assumes that aid is exogenous and contributes to growth through the stock of capital. The two gap model pioneered by Chenery and Strout (1966) states that aid can relieve the difficulties of developing countries with respect to the savings-investment gap and foreign exchange gap. Bacha (1990) identified that aid can relax three specific constraints faced by developing countries: the limit on investment due to limited domestic savings, the limited ability to import capital goods if export earnings are low, and fiscal constraints on investment. Morrissey (2001) explains several mechanisms through which foreign aid can contribute to economic growth: (1) it can increase investment in physical and human capital as well as the capacity to import capital goods and technology, and (2) it is associated with technology transfer that increases capital productivity and promotes endogenous technological change. Aid can also fund government spending and compensate for the limited government tax base (Gomanee *et al*., 2005). Since the early 1990s, the most widely used empirical tool in economic growth theory has been the Barro-type growth model, which has some relation to the neoclassical growth model. The model suggests possible explanatory variables, but the actual choice of variables is strongly influenced by data availability, and does have a large element of *ad hoc* choice (Doucouliagos and Paldam, 2008).

The aid effectiveness on economic growth has long been a subject of controversy. Despite many empirical studies, there is still disagreement among economists concerning the nature of this relationship. Many studies conclude that there is lack of robust evidence of positive

growth effects from aid: for instance, Boone (1994), Doucouliagos and Paldam (2009); Easterly (2003); Easterly *et al*. (2004); Knack (2001); Kosack (2003); Rajan and Subramanian (2008); Svensson (2000). Unlike the works criticizing aid effectiveness, many other studies find that aid has had a positive effect on growth: for instance, Arndt *et al.* (2015); Bruckner (2013); Clemens *et al.* (2012); Doucouliagos and Paldam (2011); Fayissa and El-Kaissy (1999); Hansen and Tarp (2000, 2001); Lensink and White (2000).

Besides the direct impact of aid on growth, some studies have also considered that aid impact depends on recipient countries' circumstances, identifying a non-linear relationship between aid and growth: for instance, Burnside and Dollar (2000); Collier and Dollar (2002); and Collier and Hoeffler (2004); Easterly (2002); Easterly *et al*. (2004); Hansen and Tarp (2000, 2001); Karras (2006). Burnside and Dollar (2000) launched the debate on conditional aid effectiveness. They found that while aid has no effect on growth on average, aid works in a good policy environment. Subsequent studies such as Collier and Dollar (2002) and Collier and Hoeffler (2004) reported similar results. However, Burnside and Dollar's (2000) research has been strongly criticized. Hansen and Tarp (2000, 2001) firstly found that aid increases growth in recipient countries and that this positive effect is not conditional upon a good policy environment. Easterly (2002) and Easterly *et al*. (2004) argued that Burnside and Dollar's results are sensitive to small changes in time period and countries included. Similar results are reported by Askarov and Doucouliagos (2015) and Karras (2006).

Some scholars such as Cordella and Ulku (2004), Marchesi and Alessandro (2013), and Tezanos *et al.* (2013) tried to compare grants with loans. Cordella and Ulku (2004) used a data set consisting of 69 countries during 1975-1995. The ordinary least squares (OLS) estimation results showed that with a larger grant element, the economic growth rate is likely to increase. The GMM estimation results also showed that the coefficient for the larger grants is significant and positive, while the sum of official grants and grant element of loans is

revealed to be negative and significant. Tezanos *et al.* (2013) used a data set of Latin America and Caribbean countries during the period 1992-2007. They found that the impact of concessional loans is greater than the impact of grants. As a result, the conclusions on the effect of grants and loans are split and appear to depend on the data set analyzed.

The aid effectiveness in African countries have long been a subject of economic research: for instance, Chang and Mendy (2012); Gomanee *et al*. (2005); Wako (2018); Wamboye *et al.* (2013). Chang and Mendy (2012) found that foreign aid, gross national savings and investment have negative relationships to both GDP growth and GDP in Africa. Gomanee *et al*. (2005) used the net Official Development Assistance (ODA) (excluding food aid, emergency relief and technical assistance) and grants in testing aid effectiveness in 25 sub-Saharan African countries. They concluded that the positive and significant effects of grants and loans on economic growth are almost identical. Wako (2018) analyzed the growth effect of aid by assessing the intermediary role of institutions and the importance of recipient and donor heterogeneity. Wamboye *et al.* (2013) provided compelling evidence to show that both quantity and quality of aid disbursed to Africa's least developed countries matter and that these effects differ based on a country's legal origin.

III. Model Specification and Data

In this section, we use the Barro-type growth model (1996) in order to reveal the aid-growth relationship. The key variables of interest are grants and loans. The model also incorporates inflation rate, openness, domestic investment, foreign direct investment, population growth, life expectancy, and school enrollment as control variables.

First, we introduce an autoregressive element in order to take growth dynamics into

account. Let per capita real GDP growth rate in year t depend on that in previous years by including the lagged dependent variable, Y_{it-1}, among the explanatory variables.

A dynamic panel data model has the following form:

$$GDP_{it} = \beta_0 + \lambda GDP_{it-1} + \beta_1 GRA_{it-1} + \beta_2 LOA_{it-1} + \beta_3 GRA_{it-1}^2 + \phi Z_{it} + \varepsilon_{it} \quad (1)$$

where *GDP*, *GRA*, *LOA* denote per capita real GDP growth rate (annual %), grants (% of GDP), loans (% of GDP), respectively. *Z* is the vector of commonly used control variables, in which *INF* is GDP deflator (annual %), *EXP* is exports of goods and services (% of GDP), *GCF* is gross capital formation (% of GDP), *FDI* is foreign direct investment (net inflows, % of GDP), *LE* is life expectancy at birth (total years), *POP* is population growth rate (annual %), and *SEC* is school enrollment, secondary (%, gross). The subscripts i and t denote indexes for country and year, respectively. Specifically, following the recommendation of Clemens *et al*. (2012), we take the lagged terms of grants and loans to accommodate endogeneity.[3] Finally, ε_{it} is the error term and includes a time-constant country effect μ_i, a time-specific effect τ_t, and an idiosyncratic error term ν_{it}. That is,

$$\varepsilon_{it} = \mu_i + \tau_t + \nu_{it} \quad (2)$$

where ε_{it} is independently and identically distributed over the whole sample with variance δ_ε^2.

Second, the following static panel-data model will be estimated, as it is commonly used in the empirical literature.

[3] Clemens *et al.* (2012) noted the importance of modelling the lags involved in aid effectiveness. That is, it may take time for aid to affect growth.

$$GDP_{it} = \beta_0 + \beta_1 GRA_{it-1} + \beta_2 LOA_{it-1} + \beta_3 GRA_{it-1}^{2} + \phi Z_{it} + \varepsilon_{it} \quad (3)$$

The variables appearing in equation (3) are the same as those in equation (1).

The data used in this analysis are primarily from three sources. Data for income, investment, economic growth and the other country characteristics are drawn from the World Development Indicators of the World Bank. Aid data are obtained from the OECD. The current paper uses country-level data from 1990 to 2015 and covers 26 selected Sub-Saharan African countries based on data availability. The appendix reports the list of 26 Sub-Saharan Africa and the descriptive statistics of the variables used in the analysis.

IV. Empirical Results

This section presents empirical evidence of the panel data using different estimation techniques in order to find the appropriate specification for analyzing the aid-growth relationship in 26 Sub-Saharan Africa. In the panel analysis, estimating a dynamic equation by OLS will structurally overestimate the autoregressive coefficient, while FE estimation tends to underestimate it. The inconsistency of the OLS and FE estimators can be improved by applying the GMM estimator.[4]

Table 1 presents the estimation results for 26 Sub-Saharan Africa as a whole. The current paper compares different estimation techniques in order to find the most consistent estimates

[4] With many panels and few periods, the GMM-SYS econometric technique is used to find the most appropriate specification for analyzing the aid-growth relationship, which improves the GMM-DIF estimation. This estimation technique combines the first difference of the strictly exogenous variable as the standard instrument to remove the panel level effects, and the lags of the level or the difference of the dependent variable as GMM-type instruments to instrument the lagged dependent variables (Blundell and Bond, 1998).

for equation (1). Table 1 reports the OLS estimation (columns (1) and (2)), the FE estimation (columns (3) and (4)), and the GMM-SYS estimation (columns (5) and (6)) by estimating the dynamic equation (1). The estimation results show that the lagged grants has a statistically significant and positive coefficient except column (6), while the lagged loans has a statistically non-significant coefficient except column (5). The grants-squared term has not the expected negative coefficient and it is not statistically significant except column (2). Of the control variables, EXP, FDI, and GCF have the expected positive coefficient at the 1% level of significance in all estimates. In general, grants seem to have a significant positive impact on the per capita real GDP growth, while there are not diminishing returns to grants in selected Sub-Saharan Africa over the period 1990 to 2015.

More specifically, the econometric literature on the consistency of the estimators suggests comparing the magnitude of the coefficient of the lagged dependent variable. In examining the consistency of the GMM-SYS estimators, FE and OLS estimators are the points of reference. The OLS biases $\hat{\lambda}$, the estimated coefficient for lagged per capita real GDP growth rate, upwards, while the FE estimator biases $\hat{\lambda}$ downwards compared to GMM-SYS (Blundell and Bond, 1998). The results expected in OLS and FE are confirmed by those shown in columns (1) and (3) in Table 1. That is, the OLS regression shows a relatively high coefficient for lagged per capita real GDP growth rate, .249; meanwhile, the FE regression yields a relatively low coefficient, .126.

[Table 1 about here]

The GMM-SYS estimation results for 26 Sub-Saharan Africa indicate that the lagged

grants have a positive coefficient at the 1% level of significance, while the lagged loans have a positive coefficient at the 10% level of significance. This finding indicates that grants are shown to have a positive impact on economic growth, while there are not diminishing returns to grants in 26 Sub-Saharan Africa over the sample period. This paper also reports the other supplementary results pertaining to the growth effects of the control variables such as INF, EXP, GCF, FDI, LE, POP, and SEC on economic growth in 26 Sub-Saharan Africa. GMM-SYS estimation results reported in column (5) show that both EXP and FDI have positive effects on economic growth. They also show that each unit of export index increases economic growth by 25.0%, while each unit of foreign direct investment index increases economic growth by 4.8%. This finding indicates that as globalization variables, EXP as well as FDI have a positive effect on economic growth in Sub-Saharan Africa. Table 1 also shows that GCF has a positive and statistically significant effect on economic growth in column (5). Each unit of domestic investment index measured by GCF is revealed to raise economic growth rate by 1.7%. Of the other control variables, LE, POP, SEC have not statistically significant effect on economic growth, while INF has statistically significant but no impact on economic growth in Sub-Saharan Africa. The GMM-SYS estimation results show the existence of negative first order autocorrelations and the absence of second order autocorrelations in all columns. It indicates that the model is correctly specified. For the two-step estimators, the validity of the additional set of instruments in GMM-SYS is not rejected by the standard Sagan test for over-identifying restrictions. This result implies that the instruments are appropriate.

Furthermore, this paper analyses the impact of grants and loans on economic growth by disaggregating selected 26 Sub-Saharan Africa into 13 least income countries and 13 middle income countries in order to gain further insight into the issue under consideration. In this case, each dataset includes a limited number of panels and many periods in terms of observations, that is, 13 and 13 countries, respectively, and 25 years. If the number of

observations over time is large and that of cross-section units is small, there is likely to be little difference in the values of the parameters estimated by the FE model and random effects (RE) model. The choice then depends on computational convenience, which is likely to be in favour of the FE model (Gujarati, 2015: 338). In this study, we also consider a static specification in equation (3) and use the static FE model to find the most appropriate specification in analyzing the aid–growth relationship.

Table 2 provides the FE estimation results for the LICs. Lagged grants have a positive and statistically significant impact on economic growth, while lagged loans are not statistically significant at any reasonable level of significance. Table 2 shows that each unit of the lagged grants raises annual real per capita GDP growth by 29.1%, while there is no evidence of diminishing returns to grants. The results show that the lagged loans have a negative coefficient, while they are not statistically significant in any specification. These findings in LICs suggest that grants have a strongly positive relationship with economic growth, while loans do not have a statistically significant effect on economic growth.

[Table 2 about here]

The estimation results also show that openness measured by EXP as well as domestic investment measured by GCF have a positive and statistically significant effect on economic growth. Each unit of openness measured by EXP increases economic growth by 19.0-21.0%, while domestic investment measured by GCF increases economic growth by 1.0-1.3%. Table 2 also shows that LE has a positive coefficient at the 10% of significance except column (2). Each unit of LE increases economic growth by 17.2-18.4%. FDI, SEC, and INF are not statistically significant in all specifications at any reasonable level of significance. POP has a

positive coefficient, but is not statistically significant in columns (1) and (4). This indicates that FDI, SEC, and INF do not have any significant impact on economic growth in LICs.

Table 3 provides the FE estimation results for the MICs. Lagged grants have a positive and statistically significant impact on economic growth, while lagged loans are not statistically significant at any reasonable level of significance. The grants-squared term have the expected negative coefficients and they are statistically significant in all estimates. The estimation results show that each unit of the lagged grants raises annual real per capita GDP growth by 33.8-118.9%, while there is a strong evidence of diminishing returns to grants. The results also show that the lagged loans have a negative or positive coefficient, while they are not statistically significant in any specification. These findings in MICs suggest that grants have a strongly positive relationship with economic growth, while there are diminishing returns to grants. However, loans are revealed not to have a statistically significant effect on economic growth.

We also control for the other explanatory variables. The estimation results show that both EXP and FDI have positive effects on economic growth. They also show that each unit of export index increases economic growth by 29.6-35.0%, while each unit of foreign direct investment index increases economic growth by 10.3-15.2%. This finding indicates that both EXP and FDI as globalization variables have a positive effect on economic growth in MICs. The estimation results also show that education measured by SEC index has a significantly positive effect on economic growth. Each unit of SEC index is revealed to increase the economic growth rate by 22.7-28.2%. This result implies that education measured by SEC in general has a positive and significant impact on economic growth in MICs. In particular, INF has a significantly negative impact on economic growth in MICs. Each unit of INF index is revealed to decrease the economic growth rate by 5.5-6.6%. POP is revealed to have positive coefficients, but are not statistically significant in all specifications at any reasonable level of

significance. This indicates that POP do not have a statistically significant effect on economic growth in MICs.

[Table 3 about here]

When the estimation results from MICs are compared with those from LICs, the findings can be summarized as follows. First, the estimated coefficients of lagged grant in MICs are larger than those in LICs by more than 4.7 % point. This implies that grants effectiveness in MICs is larger than that in LICs. However, there is no significant evidence of loans effectiveness in both MICs and LICs. Second, unlike the case of LICs, there is statistically significant diminishing returns to grants in MICs. Third, inflation (INF) has a negative and significant effect on economic growth in MICs, while it is not statistically significant in LICs. Fourth, education (SEC) significantly affects economic growth in MICs, while it is not statistically significant in LICs. Fifth, unlike the case of LICs, foreign direct investment (FDI) significantly affects economic growth in MICs, while unlike the case of MICs, domestic investment (GCF) significantly affects economic growth in LICs.

V. Concluding remarks

Unlike most of the previous studies examining aid effectiveness on economic growth, the current paper focuses on Sub-Saharan Africa in order to capture the peculiarities of their growth dynamics. It also distinguishes grants from loans in the sense that they may have different impacts on economic growth. The GMM-SYS estimation results in Sub-Saharan Africa show that unlike the case of loans, grants have a statistically significant effect on

economic growth in Sub-Saharan Africa during the period 1990-2015. The results also show that openness in trade and investment is positively related to economic growth significantly.

In order to gain further insight, this paper also analyses the impact of grants and loans on economic growth by breaking down the Sub-Saharan Africa into MICs and LICs. When the estimation results from MICs are compared with those from LICs, the main findings are as follows: First, grants effectiveness in MICs is revealed to be larger than that in LICs. Moreover, there is statistically significant evidence of diminishing returns to grants in MICs. However, there is no significant evidence of loans effectiveness in both MICs and LICs. Second, openness is also revealed to have a significant impact on economic growth in both MICs and LICs. Third, inflation and education significantly affect economic growth in MICs, while it is not statistically significant in LICs. Fourth, foreign direct investment affects economic growth significantly in MICs, while domestic investment affects economic growth significantly in LICs.

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Table 1. The Impact of Grants and Loans on Economic Growth in Sub-Saharan Africa

	Dependent variable: GDP_{it}					
	OLS		FE		GMM-SYS	
	(1)	(2)	(3)	(4)	(5)	(6)
GDP_{it-1}	.249*** (.0373)	.273*** (.0381)	.126*** (.0390)	.134*** (.0405)	.154*** (.0175)	.130*** (.0326)
GRA_{it-1}	.261*** (.0436)	.044*** (.0865)	.333*** (.0497)	.265*** (.1026)	.521*** (.1033)	.363 (.2377)
LOA_{it-1}	-.085 (.2135)	-.108 (.2124)	.008 (.2119)	-.001 (.2123)	.253* (.1326)	.191 (.1202)
GRA_{it-1}^{2}		.004*** (.0014)		.001 (0015)		.000 (.0020)
INF_{it}	-.000 (.0003)	-.000 (.0003)	-.000 (.0003)	-.000 (.0003)	.000*** (.0000)	.000** (.0000)
EXP_{it}	.069*** (.0164)	.060*** (.0167)	.260*** (.0357)	.255*** (.0366)	.250*** (.0313)	.249*** (.0358)
GCF_{it}	.019*** (.0059)	.017*** (.0059)	.017*** (.0058)	.017*** (.0059)	.017*** (.0059)	.017 (.0143)
FDI_{it}	.149*** (.0332)	.156*** (.0331)	.125*** (.0343)	.128*** (.0346)	.048*** (.0058)	.051*** (.0073)
LE_{it}	-.009 (.0527)	.002 (.0526)	-.028 (.0948)	-.031 (.0949)	.356 (.2410)	.017 (.3890)
POP_{it}	.359 (.3411)	.424 (.3398)	.479 (.4196)	.519 (.4232)	-.779 (1.3234)	1.489 (2.3770)
SEC_{it}	.052 (.0201)	.007 (.0210)	.099** (.0397)	.091** (.0409)	-.063 (.0695)	-.050 (.0724)
Constant	-4.410*** (2.8503)	-3.307*** (2.8591)	-12.841*** (4.3834)	-12.023*** (4.5176)	-24.516** (10.7499)	-11.7578 (17.3073)
Sargan					1.000	1.000
m1					-1.9135*	-1.8588*
m2					-1.1165	-1.0677
Observations	642	642	642	642	642	642
R-square	0.2594	0.2692	0.2157	0.2164		
F-statistic	22.10***	21.09***	16.67***	15.19***		

Wald χ^2					7287.59***	5299.82***
GMM-type Instruments for differenced equation					L(2)GDP	L(2)GDP
GMM-type Instruments for level equation					LDGRA LDLOA DINF DEXP DGCF DFDI DLE DPOP DSEC	LDGRA LDLOA LDGRA2 DINF DEXP DGCF DFDI DLE DPOP DSEC
Standard Instruments					LDGDP	LDGDP

Notes: 1. Standard errors in parentheses.

2. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

3. D in front of a variable denotes the first differenced form.

4. L in front of a variable shows its lagged term.

Table 2. The Impact of Grants and Loans on Economic Growth in LICs

	Dependent variable: GDP_{it}				
	(1)	(2)	(3)	(4)	(5)
GRA_{it-1}	.291*** (.0427)		-.020 (.1047)	.291*** (.0427)	-.045 (.1053)
LOA_{it-1}		-.023 (.1869)		-.018 (.1744)	-.075 (.1726)
GRA_{it-1}^{2}			.004*** (.0013)	.	.004*** (.0013)
INF_{it}	-.000 (.0002)	-.000 (.0002)	-.000 (.0002)	-.000 (.0002)	-.000 (.0009)
EXP_{it}	.210*** (.0505)	.190*** (.0546)	.203*** (.0498)	.209*** (.0512)	.200*** (.0504)
GCF_{it}	.013*** (.0048)	.011** (.0052)	.010** (.0048)	.013*** (.0049)	.010** (.0049)
FDI_{it}	.087 (.0593)	.067 (.0636)	.092 (.0584)	.086 (.0594)	.091 (.0585)
LE_{it}	.184* (.0942)	.013 (.0993)	.173* (.0928)	.183* (.0944)	.172* (.0930)
POP_{it}	.380 (.3309)	.627* (.3532)	.578* (.3315)	.380 (.3315)	.582* (.3321)
SEC_{it}	.000 (.0420)	-.027 (.0450)	-.056 (.0448)	.001 (.0422)	-.055 (.0449)
Constant	-17.147*** (4.1899)	-4.640 (4.0514)	-13.376*** (4.2863)	-17.127*** (4.2014)	-13.239*** (4.3034)
Observations	325	325	325	325	325
R-square	0.2187	0.0992	0.2449	0.2187	0.2454
F-statistic	10.63***	4.19***	10.92***	9.42***	9.82***

Notes: 1. Standard errors in parentheses.

2. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

Table 3. The Impact of Grants and Loans on Economic Growth in MICs

	Dependent variable: GDP_{it}				
	(1)	(2)	(3)	(4)	(5)
GRA_{it-1}	.352*** (.1181)		1.189*** (.2560)	.338*** (.1200)	1.147*** (.2588)
LOA_{it-1}		.219 (.5660)		-.025 (.5661)	.237 (.5605)
GRA_{it-1}^{2}			-.027*** (.0073)		-.026*** (.0074)
INF_{it}	-.061** (.0294)	-.055* (.0038)	-.066** (.0288)	-.057* (.0297)	-.062** (.0292)
EXP_{it}	.350*** (.0512)	.296*** (.0502)	.305*** (.0517)	.344*** (.0525)	.307*** (.0526)
GCF_{it}	-.000 (.0033)	.031** (.0149)	-.002 (.0033)	.029** (.0147)	.023 (.0145)
FDI_{it}	.147** (.0456)	.152*** (.0468)	.120*** (.0453)	.124*** (.0473)	.103** (.0468)
LE_{it}	-.276 (.1853)	-.370* (.1862)	-.306* (.1818)	-.274 (.1872)	-.308* (.1840)
POP_{it}	1.681 (1.6115)	.980 (1.6579)	1.121 (1.5862)	1.195 (1.6406)	.727 (1.6155)
SEC_{it}	.227*** (.0748)	.232*** (.0764)	.279*** (.0746)	.228*** (.0755)	.282*** (.0757)
Constant	-13.596 (9.2466)	-3.633 (8.9445)	-12.490 (9.0662)	-12.568 (9.3932)	-11.840 (9.2200)
Observations	322	317	322	317	317
R-square	0.2197	0.2126	0.2531	0.2332	0.2641
F-statistic	10.59***	9.99***	11.30***	9.97***	10.55***

Notes: 1. Standard errors in parentheses.

2. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

<Appendix>

Table A1. List of Selected Sub-Saharan Africa Countries

26 Selected Sub-Saharan Africa Countries	
LICs	MICs
Benin	Botswana
Burkina Faso	Cameroon
Chad	Congo
Comoros	Equatorial Guinea
D. R. of the Congo	Gabon
Madagascar	Kenya
Mali	Mauritania
Mozambique	Mauritius
Rwanda	Namibia
Senegal	Nigeria
Tanzania	South Africa
Togo	Sudan
Uganda	Swaziland

Table A2. Descriptive statistics: Selected Sub-Saharan Africa Countries (1990-2015)

Variable	Obs.	Mean	Std. Dev.	Min	Max
26 Selected Sub-Saharan Africa Countries					
GDP	676	2.0898	8.2184	-47.8056	140.5011
GRA_{t-1}	647	6.3331	7.8490	0.0252	92.1479
LOA_{t-1}	647	-0.0348	1.3619	-8.5896	19.0461
INF	676	67.6036	1050.848	-31.5659	26762.02
EXP	676	33.1749	20.8959	3.3350	124.3932
GCF	676	2.7403	110.4935	-2562.384	429.0563
FDI	676	3.9422	9.5792	-8.5894	161.8238
LE	676	55.6743	6.6831	27.6127	74.3532
POP	676	2.6517	0.9929	-6.1849	7.9179
SEC	676	36.3852	21.8039	4.9	99
13 LICs					
GDP	338	1.4283	5.7525	-47.8056	36.9809
GRA_{t-1}	325	9.5205	8.7337	0.8663	92.1479
LOA_{t-1}	325	-0.1153	1.6892	-8.5896	19.0461
INF	338	124.2704	1484.732	-12.9066	26762.02
EXP	338	21.5643	9.4324	5.1508	52.7087
GCF	338	3.3873	60.7330	-558.5404	386.1356
FDI	338	3.0741	5.5479	-4.8523	46.4937
LE	338	54.0312	6.5014	27.6127	66.6614
POP	338	2.8761	1.0494	-6.1849	7.9179
SEC	338	23.6586	13.3996	4.9	61
13 MICs					
GDP	338	2.7513	10.0655	-12.9453	140.5011
GRA_{t-1}	322	3.1160	5.1307	0.0252	48.5286
LOA_{t-1}	317	0.0477	0.9075	-6.2103	5.0651
INF	338	10.9369	19.3724	-31.5659	159.267
EXP	338	44.7855	22.6977	3.3350	124.3932
GCF	338	2.0933	144.099	-2562.384	429.0563
FDI	338	4.8103	12.3087	-8.5894	161.8238
LE	338	57.3174	6.4635	45.8034	74.3532
POP	338	2.4273	0.8787	0.1324	4.6059
SEC	338	49.1117	21.1611	13.1471	99