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The Relationship between Sustainable Development Index and Financial Development and Globalization in Developed and Developing Countries*

(Research Article)

Gelişmiş ve Gelişmekte Olan Ülkelerde Sürdürülebilir Gelişmişlik Endeksi ile Finansal Gelişmişlik ve Küreselleşme İlişkisi

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ABSTRACT

This study draws attention to the importance of sustainable development goals in the growth of countries along with environmental disasters and climate events in recent years. In addition to the human development indicator, Hickel (2020) created the Sustainable Development Index (SDI), which includes the sustainable development of countries, including life expectancy, education and income, as well as CO_2 emissions and carbon footprint data. This study aims to examine the relationship between SDI, Globalization Index and financial development of developed and developing countries in the 1990-2019. As a result of the Mean Group (MG) test, it is found that the error correction parameter is negative and statistically significant in developed and developing countries. As globalization increases in developed and developing countries, SDI also increases in the long run. Financial development affects SDI negatively in the long run for developed and developing countries. It is predicted that with the inclusion of all countries in the globalization process, it will contribute to the reduction of carbon emissions and the achievement of the goal of sustainable development.

Anahtar Kelimeler:
Sürdürülebilir Gelişmişlik Endeksi, Finansal Gelişmişlik, Panel Veri Analizi ve Küreselleşme

ÖZET

Bu çalışma son yıllarda yaşanan çevresel felaketler ve iklim olayları ile birlikte ülkelerin büyümesinde sürdürülebilir kalkınma hedeflerinin önemine dikkat çekmektedir. Hickel (2020) insani gelişmişlik göstergesine ek olarak yaşam süresi, eğitim ve gelir ile birlikte CO_2 emisyonu ve karbon ayak izi verilerini içeren ülkelerin sürdürülebilir gelişmişliğini içine alan Sürdürülebilir Gelişmişlik Endeksi'ni (SDI) oluşturmuştur. Bu çalışma, 1990-2019 yılları arasında gelişmiş ve gelişmekte olan ülkelerin SDI ile Küreselleşme Endeksi ve finansal gelişmişlik arasındaki ilişkiyi incelemeyi amaçlamaktadır. Ortalama Grup (MG) testi sonucunda gelişmiş ve gelişmekte olan ülkelerde hata düzeltme parametresinin negatif ve istatistiksel olarak anlamlı olduğuna ulaşılmaktadır. Gelişmiş ve gelişmekte olan ülkelerde küreselleşme artıkça uzun dönemde SDI da artmaktadır. Finansal gelişmişlik gelişmiş ve gelişmekte olan ülkeler için uzun dönemde SDI'yı negatif etkilemektedir. Bütün ülkelerin küreselleşme sürecine dahil olması ile karbon emisyonlarının azaltılmasına ve sürdürülebilir kalkınma hedefine ulaşılmasına katkıda bulunulacağı öngörülmektedir.

* This is an improved and revised version of the study that was presented at the 9st International Congress on Accounting and Finance Research.

1. INTRODUCTION

The climate crisis experienced in the whole world has been recently affected by many factors such as the use of non-renewable energy resources, the level of human development (HD), and the economic activities of countries. The term sustainable development (SD), which includes various factors, was first coined in the Brundtland Report published by the World Commission on Environment and Development (WCED) in 1987. Following this definition, its use has become widespread throughout the world. SD is expressed as fulfilling the needs of the present without hindering the needs of future generations. Accordingly, SD includes not only economic growth (EG), but also social, environmental, and cultural development (Brundtland Report, 1987). After these statements, countries began to take measures and plan for SD (Ayres et al., 2001; Kwatra et al., 2020; Pope et al., 2004). The social dimension of sustainability includes poverty reduction, its economic dimension includes the efficient use of resources to benefit the production system in the long-run, where its environmental dimension includes the efficient use of renewable resources in the world, as well as maintaining them without degrading the environment (Goodland & Daly, 1996; Hediger, 2006; Sutton, 2004). It would be incomplete upon considering sustainability merely economically. Sustainability includes observation of the benefits of humans, society, the environment, and living things, and it should be approached from this point of view. It would be extremely incomplete to consider only paper and furniture production by considering the number of trees cut down in the forests. As long as it is evaluated from an environmental and social point of view, apart from the economic return from the production of paper and furniture, the goal of sustainability would be fully realized. Based on the philosophy that natural capital is more valuable than that was produced from human capital, it should be taken into account that by cutting trees; shelter, clean air, and food sources of many living things are taken away (Kwatra et al., 2020).

The motivation of this study is to shed light on countries to achieve SD. Since the needs and SD of developed and developing countries are at different levels, developed and developing countries are categorized into two separate groups in the study. The use of the Sustainable Development Index (SDI), which takes into consideration not only the economic development but also the social and environmental development of the countries, distinguishes the study from other studies. The aim of our study is to reveal the association between SDI and developed and developing countries' globalization and financial development (FD).

2. CONCEPTUAL FRAMEWORK

Since the enactment of the Kyoto Protocol, carbon emissions have been perceived as the main reasons for the emergence of global warming and climate crises (Kandlikar, 1995; Solomon et al., 2009). Among the determining factors of carbon emissions are the usage of globalization, industrialization, renewable energy, urbanization, foreign direct investment (FDI), income inequality, democracy, and FD (Dreher, 2006; Gygli et al., 2019; Hao, 2022; Haseeb et al., 2018; Leitão & Shahbaz, 2013; Liu et al., 2020).

2.1. Sustainable Development Index

Some economists emphasized that in the 20th century, countries' gross national product (GDP) was not the only indicator of national development. It was stated that factors such as health, education, political and social freedoms, which directly affected the level of wealth of the individual, were not taken into account (Ashwin Kumar et al., 2016; Baru, 1998; Hao, 2022; Kelley, 1991; Wang et al., 2018). However, the Human Development Index (HDI) was generated in 1990 (UNDP, 1990). The objective of the generated index is to state that it is not enough to base economic development merely on economic indicators, and generate an index through a natural logarithmic scale that takes into account life expectancy, years of education, and income level. Nonetheless, this index has also been criticized for its shortcomings. Considering the existence of a climate change crisis that is growing and affecting the whole world, it has been stated that the index is limited in determining the development levels of countries without considering the environmental sustainability factor (Kovacevic, 2014; Sagar & Najam, 1998). The aim is to generate an index that includes HD, as well as ecological sustainability and reflects SD. At this point, Hickel (2020) generated SDI by developing HDI, taking into account the carbon emission per capita and the ecological footprint per capita. Apart from the education period, life expectancy and income factors that were taken into account in the generation of the HDI, carbon emissions, and ecological footprint factors were included, and SDI was generated by taking into account a total of five different factors in 163 countries.

2.2. Globalization Index

On the other hand, globalization refers to the political, social, and economic integration of different countries and is seen as one of the main causes of carbon emissions (Dreher, 2006; Gygli et al., 2019; Haseeb et al., 2018; Leitão & Shahbaz, 2013). Concentrating merely on the economic dimension of globalization would be an incomplete perspective. It is crucial to be able to measure the citizens of different countries who are in contact with each other in order to detail the causes and consequences of globalization, including the governments of different countries working collectively, therefore, the Globalization Index (KOF), which takes into account all three dimensions of globalization, is included in the study. Gygli et al. (2019) expanded KOF, which was first coined by Dreher (2006),

by categorizing the economic dimension of globalization into sub-dimensions such as commercial and financial globalization.

Developed and developing countries experience the globalization process differently. Nonetheless, both developed and developing countries are in competition with each other in order to enhance globalization. Therefore, countries should be able to cope with the increasing competition socially, politically, and economically in order to survive. Developing countries aim to increase EG by making improvements in their economic activities, and fostering the level of welfare by eliminating poverty. On the other hand, to gain a competitive advantage, they need to differentiate in industrialization, urbanization, and production. Once all these are done, it is expected that the welfare level of the country would be better-off and it also supports SD and EG (Haseeb et al., 2018). Without taking these steps, the achievement of SD and EG becomes difficult at both macro and micro levels. Impoverishment can be prevented by enhancing the economic activities of countries, improving trade, production, and industrialization, and bringing domestic and foreign investments into the country's economy. Moreover, the energy usage, from the households of the citizens to the production facilities and service areas of the companies, is a common input, and a common cost. This demand for energy increases as countries develop and the amount of carbon emission is observed to be higher in developed countries (Hao, 2022). Therefore, the energy resources used in every country may cause carbon emissions. The globalization process, in particular, has accelerated the process of global warming and the depletion of natural resources (Shahbaz et al., 2015). Three different effects are observed on carbon emissions of globalization: income effect, technical effect, and composition effect. The fact that globalization increases carbon emissions by encouraging production, industry, and trade in countries is referred to as the income effect of globalization. Also, by courtesy of globalization, countries can access technologies that may utilize energy efficiently through international markets. This is referred to as the technical effect of globalization since it can be used to mitigate carbon emissions. The composition effect of globalization is pertinent to the production structure and economic activities of the countries. Once the country's economy shifts from the agriculture sector to the industry sector, a rise in carbon emissions occurs, whereas if it shifts from the industry sector to the service sector, a decline occurs in carbon emissions (Shahbaz et al., 2018).

2.3. Financial Development and Foreign Direct Investments

On the other hand, globalization is one of the most essential factors in terms of FD level of countries, development of economic activities, and EG. Once the rulers of the country wish to increase the investments made in the country, they act in a way that supports FD by allowing the financial markets to welcome foreign capital, and allowing the investments to increase. Financial markets assume essential roles in the SD of both developed and developing countries. Effectively used financial resources provide a socioeconomic environment that encourages SD by allowing countries to invest in the appropriate areas (Furuoka, 2015). The development of financial markets attracts the attention of FDI investors and supports banking activities. Therefore, FD may encourage the establishment of a wide network in international financial markets, the pursuit of less costly financing sources, and the purchase of equipment with renewable energy Technologies (Sadorsky, 2011). Globalization and the level of FD have significant impacts on carbon emissions. As the level of development of financial markets increases, since credit opportunities would increase for companies that tend to reduce their carbon emissions, investments to reduce carbon emissions would be supported.

Unlike other studies, this study investigates the associations among KOF, FDI, GDP per capita, and FD in developing and developed countries by including SDI in the analysis. The study provides extremely important information for both policymakers and decision-makers.

3. LITERATURE REVIEW

Hao (2022) categorized the countries into four different groups by their income levels such as low-income, lower-middle-income, upper-middle-income, and high-income. The study investigated the impacts of countries' renewable energy consumption (REC), HD level, and EG on carbon dioxide (CO2) emissions. It was revealed that FDI and industrialization had positive impacts on CO2 emissions in low- and lower-middle-income groups; whereas negative impacts on high- and upper-medium-income groups. While the use of renewable energy resources adversely affected carbon emissions in high-income country groups, its impact was minimal in low-income country groups. While the HDI positively affected carbon emissions in lower-middle- and upper-middle-income country groups, it had a negative impact in high-income country groups. No impact was observed in the low-income country group. Rani et al. (2022) examined the impact of financial development and globalization on CO2 emissions for SAARC countries for the period 1990-2020. According to the results of the paper, there is a U-shaped relationship between the financial development and globalization index of firms and carbon emissions. Yang et al. (2021) examined the long-run relationship between globalization, financial development, economic growth, energy consumption and urbanization for the Gulf Cooperation Council Countries (GCC) between 1990 and 2017. According to the findings of the study, globalization, financial development and energy consumption significantly deteriorate the environmental quality of countries. Another study investigating the impact of income

levels, development and financial development levels of countries and regions on carbon emissions and sustainable activities was conducted by Chen et al. (2019). In the study, the impact of EG, REC, and non-REC on CO2 emissions in China between 1995-2012 was investigated. By dividing China into three regions, namely, Eastern, Western, and Central; heterogeneity in the data was prevented. According to the results of the study, an inverted U-shaped relationship was found between carbon emissions and EG only in the Eastern region, where CO2 emissions were the at highest level. Liu et al. (2020) explicated the association between CO2 emissions and globalization in G7 countries. It was revealed that an inverted U-shaped relationship existed between carbon emissions and globalization and that all countries would have contributed to the reduction of carbon emissions by being included in the globalization process. Shahbaz et al. (2013) explicated the relationship among carbon emissions, energy intensity, EG, and globalization in the Turkish economy over the period 1970-2010, and it was found that globalization reduced carbon emissions, whereas EG increased carbon emissions. Leitão and Shahbaz (2013) investigated the association among CO2 emissions, EG, energy consumption (EC), urbanization, and globalization in their study for 18 countries over the period 1990-2010. The study detected an inverted U-shaped relationship between CO2 emissions and income, whereas a positive relationship between EC and globalization and CO2 emissions. Therefore, it was revealed that if globalization resources were used efficiently, in other words, if renewable energy resources were used, production would have increased. Haseeb et al. (2018) examined the causality between carbon emissions of developing countries and FD, EG, EC, and globalization. The study results asserted that FD and EC in developing countries were positively related to carbon emissions in the long-run. However, globalization and urbanization were negatively related to carbon emissions. Shahbaz et al. (2015) explicated the relationship among CO2 emissions, coal consumption, and globalization in the Chinese economy between 1971-2012. Throughout the specified periods in China, globalization increased environmental quality by reducing carbon emissions. Besides, coal consumption increased carbon emissions. Khan and Ullah (2019) examined the relationship among social globalization, political globalization, and economic globalization indexes and carbon emissions in Pakistan. It was revealed that all dimensions of globalization positively affected environmental degradation and an inverted U-shaped relationship existed between EG and carbon emissions. Since EC and carbon emissions were also based on the activities of individuals, Wang et al. (2018) investigated the relationship among HDI and REC, EG and carbon emissions. In line with the findings, carbon emissions helped improve the HD process in Pakistan. The use of highly renewable energy resources did not assume a role in the HD process.

Table 1. Summary of Other Studies

Author(s)	Dataset	Variables	Instrumental Variables	Method	Results
Shahbaz et al. (2013)	1970-2010, Turkey	CO_2 emissions, energy intensity, and KOF	GDP	Granger causality	While globalization reduced carbon emissions, EG increased carbon emissions
Leitão and Shahbaz (2013)	1990-2010, 18 countries	CO_2 emissions, KOF, EC, and EG	-	Panel GMM	An inverted U-shaped relationship was found between globalization and carbon emissions
Shahbaz et al. (2015)	1971-2012, China	CO_2 emissions, coal consumption, EG, and KOF	-	Granger causality	Coal consumption greatly increased carbon emissions. Also, globalization reduced carbon emissions by enhancing environmental quality.
Haseeb et al. (2018)	1995-2014, BRICS countries	CO_2 emissions, economic growth, KOF, FD, and EC.	Urbanization	Granger causality	Globalization negatively affected carbon emissions in developing countries. EC and FD positively affected carbon emissions.

Wang et al. (2018)	1990-2014, Pakistan	HDI, EG and REC, and CO_2 emissions	Trade openness and urbanization	Two-Stage Least Squares (2SLS)	Consumption of renewable energy sources did not play a role in the HD process. Moreover, while the level of HD was low, the level of income increased. Carbon emissions also increased the level of HD.
Khan and Ullah (2019)	1975-2014, Pakistan	CO_2 emissions, economic, political, and social globalization indexes	GDP	ARDL	An inverted U-shaped relationship was found between GDP and carbon emissions. All dimensions of globalization were positively related to carbon emissions.
Liu et al. (2020)	1970-2015, G7 countries	CO_2 emissions, KOF, and REC	GDP	Panel Fixed Effects	An inverted U-shaped relationship was identified between globalization and CO_2 emissions. Besides, the increase in REC reduces CO_2 emissions.
Yang et al. (2021)	1990-2017, GCC countries	Ecological footprint, globalization index, FD, GDP, urban population		Panel cointegration test	Globalization, financial development and energy consumption significantly degrade the environmental quality of countries.
Hao (2022)	1990-2019, 105 countries	CO_2 emissions, EG, HDI, REC	Industrialization, FDI, trade openness, GDP	Panel GMM	The level of HD, EG, and REC negatively affected carbon emissions in the high-income country group.
Rani et al. (2022)	1990-2020, SAARC countries	CO_2 emissions, KOF, FD, Government expenditure on education, GDP, Urban population		The panel quantile regression	There is a U-shaped relationship between the financial development and globalization index of firms and carbon emissions.

In sum, the financial development and globalization index of countries are expected to affect the sustainable development level of countries. In our study, unlike the others, the SDI, which reflects the SD level (Hickel, 2020), generated by combining the carbon emissions and carbon footprint variables of the HDI, is included. It is aimed to examine the relationship among SDI and globalization and FD.

4. DATA AND MODEL

In this study, the relationship of SDI with globalization, FD, and FDI is argued. Since there were 22 developed and 16 developing countries and 30-periods in the study, it was deemed appropriate to use panel data analysis. Panel data analysis ise a method in which cross-sectional and time-sectional are evaluated together. With this method, both aggregate and individual result of developed and developing country groups can be obtained and interpreted. Since countries are evaluated as a group in panel data analysis, the relationships between the variables in these tests are less visible than in time series analysis. However, in time series analysis, country groups cannot be interpreted collectively.

The theoretical basis, which is effective in the selection of variables, is discussed with the econometric model prior to the empirical analysis. SDI was developed by Hickel (2020). Hickel (2020) stated that income, education, and health data were insufficient to measure the HD of countries due to the increase in environmental pollution and carbon emissions in recent years, and generated a new index that also takes into account carbon emissions and carbon footprints. Secondary data are used in the study and the sample is selected according to the availability of the dataset. Within the scope of the study, 30-period data from developing and developed countries in the 1990-2019 are used. Developed and developing country groups are determined by the IMF classification. The countries included in the analysis are summarized in Table 2.

Table 2. Developed and Developing Country Groups

Developed Countries				Developing Countries			
1	Austria	**12**	Spain	**1**	Argentina	**12**	Colombia
2	Belgium	**13**	Switzerland	**2**	Turkey	**13**	Malaysia
3	Denmark	**14**	United Kingdom	**3**	Brazil	**14**	Indonesia
4	Finland	**15**	Cyprus	**4**	Russia	**15**	Chinese
5	France	**16**	Malta	**5**	Mexican	**16**	Thailand
6	Germany	**17**	Norway	**6**	India		
7	Greece	**18**	Australia	**7**	Poland		
8	Ireland	**19**	Canada	**8**	Romania		
9	Italy	**20**	Japan	**9**	South Africa		
10	Holland	**21**	New Zerland	**10**	Chile		
11	Portugal	**22**	United States	**11**	Philippines		

The datasets of developed and developing countries are obtained from official websites presented in Table 3.

Table 3. Variables Used in the Model

Symbol	Variable	Source
SDI	Sustainable development index Hickel (2020) $SDI=\frac{Development\ Index}{Ecological\ Impact\ Index}$	https://www.sustainabledevelopmentindex.org/
KOF	Globalization index	KOF Index of Globalization, KOF Swiss Economic Institute
GDP	Gross domestic product per capital (constant 2010 US$)	World Bank Database
FD	Financial development	International Monetary Fund (IMF) Database
FDI	Foreign direct investment/ gross domestic product	World Bank Database

The model, which is established within the scope of the variables in Table 2, is as follows:

$$LNSDI = f\{LNKOF, LNGDP, FD, FDI\} \quad (1)$$

The model investigates the relationship between the sustainable development index (SDI) and the globalization index (KOF), financial development (FD), gross domestic product (GDP) and foreign direct investment (FDI). The model in Equation (1) has been extended to Equation (2) according to panel data analysis.

$$LNSDIit = \beta_0 + \beta_1 LNKOF_{it} + \beta_2 LNGDP_{it} + \beta_3 FD_{it} + \beta_4 FDI_{it} + \varepsilon_{it} \quad (2)$$

In the equation, i represents the cross-section, t denotes the time, and εit stands for the error term. Dependent and independent variables used in Model 2 are examined and developed by examining Shahbaz et al., (2013), Sehrawat and Giri (2014), Haseeb et al., (2018), Liu et al., (2020), Hao (2022) and Din et al., (2022). Although the researchers took into account HDI in the models they employed, SDI is used as the dependent variable. Descriptive statistics values of the datasets used in the model are shown in Table 4.

Table 4. Descriptive Statistics

Variables	Obs	Mean	Std. Dev.	Min.	Max.
		Developed Countries			
LNSDI	660	0.46	0.16	0.15	0.78
LNKOF	660	79.80	7.43	55	91
LNGDP	660	10.46	0.40	9.21	11.38
FD	660	0.66	0.14	0.30	0.95
FDI	660	9.10	35.15	-37.71	449.08
		Developing Countries			
LNSDI	480	0.69	0.07	0.42	0.83
LNKOF	480	61.97	10.22	32	81
LNGDP	480	8.55	0.71	6.26	9.61
FD	480	0.40	0.12	0.12	0.73
FDI	480	2.54	1.94	-2.75	11.74

According to descriptive statistics, the number of observations is 480 in developing countries, and 660 in developed countries. The dataset with the highest mean value from developed and developing countries is LNKOF. Although the variable with the highest standard deviation in developed countries is FDI, the dataset with the highest standard deviation in developing countries is LNKOF.

Tables 5 and 6 examine whether a bilateral correlation association exists between the independent variables in the model, and whether or not a multicollinearity problem occurs. A positive correlation exists between LNKOF and LNGDP in developed and developing countries. A positive correlation was found between LNKOF and FD, as well as between LNGDP and FD, in both country groups. It is detected that a negative association exists between FD and FDI in developed countries. A positive association is found between FD and FDI in developing countries. Since all of the correlation coefficients are lower than 80%, it can be claimed that no multicollinearity exists. Besides, the fact that the VIF test values are lower than 5 in both country groups supports that no multicollinearity problem occurs.

Table 5. Developed Countries Correlation Analysis and VIF Test

	LNKOF	LNGDP	FD	FDI	VIF
LNKOF	1.00				1.83
LNGDP	0.61***	1.00			1.75
FD	0.51***	0.47***	1.00		1.45
FDI	0.01	-0.14***	-0.10***	1.00	1.05

Notes: ***p<0.01, **p<0.05, *p<0.10.

Table 6. Developing Countries Correlation Analysis and VIF Test

	LNKOF	LNGDP	FD	FDI	VIF
LNKOF	1.00				2.17
LNGDP	0.63***	1.00			1.69
FD	0.50***	0.28***	1.00		1.35
FDI	0.35***	0.29***	0.16***	1.00	1.16

Note: *** denotes a 1% significance level.

5. FINDINGS

In panel data models where country groups and time dimensions are used in the same model, usually cross-sectional dependence (CSD) and slope heterogeneity exist. If there is CSD in a series or model, a shock in one country would affect other countries. Moreover, slope heterogeneity arising from the characteristics of the countries may arise. Therefore, prior to model estimation, CSD and heterogeneity tests are performed.

In the study, firstly, Pesaran's (2004) CD test is performed to test whether the series contains CSD. The Pesaran CD null hypothesis (H_0), implying that "there is no CSD" is tested. According to the results of the hypothesis

testing, the appropriate panel unit root test is decided. The Pesaran's CD test results are summarized in Table 7. Accordingly, if H_0 is rejected, the 2nd-generation unit root tests are used; whereas if accepted, the 1st-generation unit root tests are used.

According to the Pesaran's (2004) CD test results, H_0 is rejected in the series included in the analysis for developing and developed countries, and it is concluded that CSD exists. Since the series contains CSD, the stationarity of the series is tested by performing the 2nd-generation unit root test. Pesaran (2007) recommends CADF and CIPS tests as the 2nd-generation unit root test, a method in which the standard ADF (Augmented Dickey-Fuller) regressions, lag levels, and 1st differences of individual series are increased by cross-section averages (Pesaran, 2007). The CIPS panel unit root test is performed to test H_0 implying that "the series contains unit roots", and the results of the series used for developed and developing countries are explained in Table 8.

Table 7. CD Pesaran's Test for CSD

	Developed Countries	Developing Countries
	CD-Test	CD-Test
LNSDI	67.63***	13.25***
LNKOF	80.10***	57.20***
LNGDP	75.29***	55.08***
FD	69.09***	36.00***
FDI	13.07***	9.71***

Note: *** denotes 1% significance level.

Table 8. CIPS Panel Unit Root

	Developed Countries[1]		Developing Countries[2]	
	Level	Δ	Level	Δ
LNSDI	1.561	-3.181***	-1.762	-3.290***
LNKOF	-2.426***	-4.260***	-2.476***	-4.060***
LNGDP	-1.921	-3.243***	-2.211**	-2.826***
FD	-2.203**	-3.791***	-2.715***	-4.002***
FDI	-2.600***	-4.705***	-2.426***	-3.940***

Note: [1] CIPS critical values of developed countries are-2.300,-2.150, and-2.070 at 1%, 5%, and 10%, respectively.
[2] Developing countries' CIPS critical values are-2.380,-2.200, and-2.110 at 1%, 5%, and 10%, respectively. ***p<0.01, **p<0.05, *p<0.10.

According to the CIPS test results presented in Table 8, it is determined that the LNSDI dependent variable is not stationary at the level, but becomes stationary at the 1st difference in developing and developed countries. Meaning, the dependent variable LNSDI is I(1). It is detected that the variables of globalization, FD, and FDI in developed countries are stationary at the level. It is determined that the LNGDP variable is stationary at the difference. It is concluded that the LNSDI variable is I(1) in developing countries. It is found that the independent variables are stationary at the level. Since all the variables are not stationary at the same level, the model is analyzed with the Panel ARDL test.

The Breush-Pagan's (1980) LM test is performed to test whether or not developed and developing countries have CSD prior to estimating the short- and long-term error correction model with the panel ARDL test. The Breush-Pagan's (1980) LM test is performed to test H_0 hypothesis "There is no CSD". The CSD test result report is presented in Table 9.

Table 9. CSD Test

	Developed Countries	Developing Countries
	Statistic	Statistic
LM	361.7***	163.9***
LM_{adj}	5.724***	2.048**
LM_{CD}	8.604***	2.502**

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

In order to determine whether or not CSD exists in the model established for developed and developing countries, LM, LMadj, and LMCD tests are performed and it is found that CSD exists. This result indicates that the shock that may occur in one of the countries within the scope of the model also affects other countries.

Slope heterogeneity is tested with Swamy's Test for the panel data models. This test was developed by Pesaran and Yamagata (2008). H_0: βi=β slope coefficients are heterogeneous" is tested (Pesaran and Yamagata, 2008).

Table 10. Error Term Heterogeneity Test of the Model

	Swamy-S Testi	
	Developed Countries	Developing Countries
	Chi^2	Chi^2
Model	840.84***	576.91***

Note: *** denotes a 1% significance level.

As a result of the test, H_0 is rejected and it is accepted that the parameters vary by unit. In other words, it is concluded that the parameters are heterogeneous.

The ARDL is used since none of the variables used for determining the impact of FD, FDI, and Growth in developing and developed countries on SDI are stationary at the level or difference. The ARDL test is a method used when the dependent variable is in the difference and the other variables are at different levels. In the literature, the mean group (MG) and pooled mean group (PMG) estimators are used to establish the Panel ARDL model. As a result of the lag test performed before the estimator, the lag length of the model is determined as 2. Hausman's (1978) test is performed to decide between MG and PMG estimators, and test whether or not there is homogeneity in the long run. If the p-value of the Hausman test is lower than 0.05, the MG estimator is used, which provides a consistent estimation of the mean values of the long-term coefficients (Pesaran et al., 1999).

According to the Hausman test results applied to developed and developing countries, the Hausman test statistic for developed countries is 15.86, and the probability value is 0.0032>0.05. In developing countries, the Hausman test statistic is 67.75, and the probability value is 0.0000<0.05. It is decided that both country groups are heterogeneous in the long-run by Hausman (1978) and it would be appropriate to use the MG test suggested by Pesaran and Smith (1995).

Table 11. Developed Countries Panel ARDL

	Coef.	Std. Err.
Long-run estimations		
LNKOF	0.9624**	0.4440
LNGDP	1.1679***	0.2195
FD	-0.2410**	0.1189
FDI	0.0225	0.0153
ECT	-0.5518***	0.4440
Short-run estimations		
ΔLNKOF	0.1367	0.3497
ΔLNGDP	-1.4856***	0.2413
ΔFD	0.1445	0.1257
ΔFDI	0.0068	0.0057
Constant	7.6260***	1.6928
Hausman	15.86***	
Error correction terms for each country		
	Coef.	Std. Err.
Austria	-0.3988***	0.0964
Belgium	-0.2084	0.1655
Denmark	-0.6499*	0.3451
Finland	-0.6417***	0.2531

France	-0.1664	0.1671
Germany	-0.2907***	0.1188
Greece	-1.0348***	0.3623
Ireland	-0.3934	0.2479
Italy	-0.2353*	0.1400
The Netherlands	-0.4898***	0.1693
Portugal	-0.1889	0.2601
Spain	-0.4336***	0.1218
Switzerland	-0.1028	0.2137
United Kingdom	-0.2612	0.2273
Cyprus	-0.6795***	0.2280
Malta	-0.6489***	0.2095
Norway	-0.2426	0.1569
Australia	-1.3816***	0.2910
Canada	-0.7154***	0.2771
Japan	-1.1319***	0.2495
New Zerland	-1.1077***	0.2794
United State	-0.7374***	0.2008

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

The error correction coefficient of developed countries is negative and statistically significant at 1%. Any shock would be adjusted at a rate of 55.1% in the first year and in the long-run, system convergences in developed countries would stabilize again within about 2 years. In other words, it states that the short-term deviations among the variables that move together in the long-run in developed countries cease to exist in 2 years, and the variables would be in equilibrium in the long-run.

Upon considering the long-term coefficients, it is determined that the LNKOF and LNGDP variables are statistically significant at the 1% level. FD variable is also found to be statistically significant at the 5% level. It is concluded that the FDI variable is not statistically significant.

In developed countries, in the long run, LNKOF has a statistically significant and positive effect on the Sustainable Development Index at 95% confidence interval. Each 1% increase in LNKOF increases LNSDI by 0.96. LNGDP variable affects LNSDI negatively and statistically significantly in the long run. Each 1% increase in LNGDP in the long run decreases LNSDI by 1.16. Financial development has a statistically significant and negative impact on LNSDI in the long run. A 1% increase in FD decreases LNSDI by 0.24. In the short run, GDP per capita has a negative and statistically significant effect on the sustainable development index at the 1% level. In the short run, a 1% increase in LNGDP decreases LNSDI by 1.48. Other independent variables do not have a statistically significant effect on LNSDI of developed countries in the short run.

The error correction coefficient is negative and statistically significant in developed countries such as Austria, Denmark, Finland, Germany, Spain, Greece, the Netherlands, Malta, Australia, Canada, Japan, Italy, New Zealand, Cyprus, and the USA. Therefore, a long-run association exists among the variables of these countries.

Table 12. Developing Countries Panel ARDL

	Coef.	Std. Err.
Long-run estimations		
LNKOF	0.1512**	0.0621
LNGDP	0.0587	0.0432
FD	-0.1097*	0.0576
FDI	0.0015	0.0015
Error term	-0.2106***	0.0499
Short-run estimations		

ΔLNKOF	0.0686	0.0442
ΔLNGDP	-0.2516*	0.1423
ΔFD	-0.0383	0.0362
ΔFDI	-0.0002	0.0008
Constant	-0.1249	0.2532
Hausman	67.75***	
Error correction terms for each country		
	Coef.	Std. Err.
Argentina	0.0139	0.1217
Turkey	-0.0706	0.1776
Brazil	-0.4091	0.4420
Russia	-0.1140	0.2597
Mexico	-0.4534*	0.2510
India	-0.2430	0.2842
Poland	-0.6494***	0.2320
Romania	-0.0651	0.2121
South Africa	-0.0453	0.2065
Chile	-0.1621	0.3239
Philippines	-0.5439	0.2597
Colombia	-0.0001	0.1772
Malaysia	-0.3251	0.2322
Indonesia	-0.2337*	0.1352
Chinese	-0.1072*	0.0642
Thailand	-0.1678	0.2741

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

The error correction coefficient of developing countries is negative and statistically significant at 1%. This result indicates that KOF and FD are pertinent to SDI in the long-run, and even if it deviates from the equilibrium, it would return to equilibrium within about 5 years. It states that among the variables that move together in the long-run in developing countries, the short-term deviations cease to exist within 5 years, and the variables would be in equilibrium in the long-run.

Upon examining the long-term coefficients, the impact of LNKOF on SDI is positive and statistically significant at the 5% significance level. A 1% increase in LNKOF increases LNSDI by 0.15. The short-term impact of the FD indicator on SDI is negative and statistically significant. In the long run, a 1% increase in FD decreases LNSDI by approximately 0.11. The impacts of other variables on LNSDI in the short-run are statistically insignificant. In the short-run, the GDP per capita has a negative and statistically significant impact on SDI at a 90% confidence level.

In developing countries such as Poland, Mexican, Indonesia, and Chinese, the error correction coefficient is negative and statistically significant. Therefore, a long-run relationship exists among the variables of these countries.

The causal relationships between the independent variables and the dependent variable of developing and developed countries, whose long-term and short-term coefficients are tested with the Panel ARDL, are analyzed with the Dumitrescu and Hurlin's (2012) panel causality test and presented in Table 13. H_0 of Dumitrescu and Hurlin (2012) was established as H_0: $\beta i = 0$ implying that "There is no causal relationship" (Dumitrescu & Hurlin, 2012).

Table 13. Dumitrescu-Hurlin Panel Causality Test

Developed Countries				Developing Countries			
LNSDI	==>	LNKOF	2.9304**	LNSDI	≠>	LNKOF	0.5045

LNKOF	==>	LNSDI	6.9440***	LNKOF	==>	LNSDI	1.7868*
LNSDI	≠≠>	LNGDP	0.9622	LNSDI	≠≠>	LNGDP	0.5525
LNGDP	==>	LNSDI	1.6876*	LNGDP	==>	LNSDI	2.6937***
LNSDI	≠≠>	FD	1.6277	LNSDI	≠≠>	FD	1.5119
FD	==>	LNSDI	8.9784***	FD	≠≠>	LNSDI	0.7996
LNSDI	==>	FDI	1.7378*	LNSDI	==>	FDI	3.4509***
FDI	==>	LNSDI	3.0352***	FDI	==>	LNSDI	1.8316*

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

According to Dumitrescu and Hurlin's (2012) panel causality test results, there is a bilateral causality between LNKOF and LNSDI in developed countries. There is a unilateral causality from LNGDP to LNSDI. There is a unilateral causality from FD to LNSDI. A bilateral causality relationship is found between FDI and LNSDI. In developed countries, KOF and SDI affect each other. GDP per capita and FD affect SDI. FDI and SDI affect each other.

In developing countries, there is a unilateral causality from LNKOF to LNSDI. There is unilateral causality from LNGDP to LNSDI. No causal relationship is found between LNSDI and FD. There is a bilateral causality between LNSDI and FDI. Globalization and GDP per capita affect SDI in developing countries. FDI and SDI affect each other.

6. CONCLUSION

As globalization increases in developed and developing countries, SDI also increases in the long-run. Since globalization offers developing countries the opportunity to purchase renewable energy resources from developed countries, and the rise in SDI in developed countries due to the impact of the globalization process is justified. FD negatively affects SDI in the long-run for developing and developed countries. Accordingly, as the level of FD increases, the financial resources that companies wish to borrow would become less costly, and higher debts would be incurred. Therefore, along with the rise in investments in countries, demand for energy and CO_2 emissions would increase. In developed countries, GDP negatively affects SDI in the short-run, whereas positively in the long-run, in other words, it is revealed that an inverted U-shaped relationship exists. In developing countries, it negatively affects SDI in the short-run. Accordingly, as the income levels of the countries increase, SDI decreases up to a certain point, but increases afterward. Although a positive association between FD and HDI was found by earlier studies (Anwar et al., 2011; Monacelli & Lovino, 2012; Sasa, 2013; Sehrawat & Giri, 2014), a negative relationship was detected between SDI and FD. Accordingly, as the financial development level of countries increases, it is believed that increased investments as a result of the financial resources obtained by firms increase carbon emissions and energy demand and negatively affect SDI. At this point, it is recommended that governments should encourage firms to make sustainable investments.

As the level of SD increases, one of the main reasons for the decline in FD is thought to be the investments that increase carbon emissions. The government should support green investments by prioritizing and providing greater incentives for the consumption of renewable energy resources. R&D activities should be supported in order to reduce the production costs of renewable energy resources by targeting SD. Based on the positive relationship between globalization and the SDI, it is predicted that all countries would be included in the globalization process, contribute to mitigating carbon emissions, and achieve the goal of sustainable development. Developed countries adapt to regulations aimed at sustainable development more easily than developing countries. Therefore, studies should be carried out to reduce the CO_2 emissions and carbon footprint of developing countries. Additionally, they should be supported to invest in renewable energy. However, it is recommended that countries invest in different types of capital instead of financing consumption with the income they obtain from non-renewable resources. In a word, inportance should be given to sustainable human development in order to increase the development of countries.

Sustainable human development ise one of the most important priorities that will be included in the Sustainable Development Goals in 2030. Changes need to happen quickly to comply with these goals.

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