“SDGs and ESG disclosure regulation: is there an impact? Evidence from Top-50 world economies”

AUTHORS	Alex Plastun https://orcid.org/0000-0001-8208-7135 https://publons.com/researcher/1449372/alex-plastun/ Inna Makarenko https://orcid.org/0000-0001-7326-5374 http://www.researcherid.com/rid/AAE-8453-2020 Lyudmila Khomutenko http://orcid.org/0000-0002-9443-4330 http://www.researcherid.com/rid/P-6162-2014 Oksana Osetrova https://orcid.org/0000-0002-7598-1144 http://www.researcherid.com/rid/V-2479-2017 Pavlo Shcherbakov https://orcid.org/0000-0001-5509-2553

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Alex Plastun (Ukraine), **Inna Makarenko** (Ukraine), **Lyudmila Khomutenko** (Ukraine), **Oksana Osetrova** (Ukraine), **Pavlo Shcherbakov** (Ukraine)

SDGS AND ESG DISCLOSURE REGULATION: IS THERE AN IMPACT? EVIDENCE FROM TOP-50 WORLD ECONOMIES

Abstract

This paper explores the influence of the ESG disclosure regulation (government corporate ESG disclosure and non-government corporate ESG disclosure) on the ranking in 50 largest economies. Applying various statistical methods and techniques, including both parametrical (Student's t-test, ANOVA analysis) and non-parametrical (Mann-Whitney U test) tests, simple average analysis, OLS with dummy variables method and multiple linear regression analysis, as well as correlation analysis and Granger causality test, several hypotheses are tested. The hypotheses stipulate whether or not ESG disclosure regulation differs in developed and emerging countries and whether or not ESG disclosure regulation influences the country's SDGI ranking, as well as the ranking of the country among 50 largest economies. According to the results, the differences in ESG disclosure regulation are statistically significant in developed and emerging countries. The level of ESG disclosure compliance is higher in developed countries. ESG disclosure regulation influences the position of the country in SDGI and 50 largest economies rankings. The more country complies with ESG disclosure criteria, the better position in rankings is. Incorporation of ESG criteria is an important evolutionary step in economic development of the country. It allows increasing position of the country in 50 largest economies and SDGI ranking. Thus, ESG disclosure regulation is vital for the development of the country in the modern world.

Keywords ESG disclosure, sustainable development goals (SDGs), regulation

JEL Classification M40, M41

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Alex Plastun, Doctor of Economics, Professor, Chair of International Economics Department, Sumy State University, Ukraine.

Inna Makarenko, Doctor of Economics, Associate Professor, Accounting and Tax Department, Sumy State University, Ukraine. (Corresponding author)

Lyudmila Khomutenko, Ph.D., Associate Professor, Sumy State University, Ukraine.

Oksana Osetrova, Dr., Professor, Oles Honchar Dnipro National University, Ukraine.

Pavlo Shcherbakov, Ph.D., Associate Professor, Dnipropetrovsk Regional Institute of Public Administration, National Academy for Public Administration under the President of Ukraine, Ukraine.

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INTRODUCTION

The introduction of 17 UN Sustainable Development Goals (SDGs) and their 169 targets and 230 indicators at the 2015 New York Summit was an important step forward for humanity towards sustainable development. By 2030, they set key benchmarks and indicators at the global level for poverty reduction, gender equality, and education for all, the well-being and health of humankind, sustainable economic, urban, and infrastructure development, and the preservation of the environment and all resources. The development of tools to achieve these benchmarks lies in the coordination of national efforts (in the form of roadmaps for SDGs of each country and progress reports) and global multi-stakeholder partnerships, regardless of the status of a developed or developing country.

One of the tools for achieving the SDGs is to strengthen the regulatory requirements for the disclosure of information by companies on environmental (E), social (S), and governance (G) (ESG) criteria. Ensuring the transparency of the business environment and reporting on the incorporation of CSR into the activities of companies is the key to effective monitoring of progress in achieving SDGs in the corporate sector.

The last decade has been marked by the dynamic development of regulatory disclosure tools based on ESG criteria and SDGs. More than 300 of such instruments, governmental and non-governmental, mandatory and voluntary, have been introduced in 50 largest countries by GDP (both developed and developing (UNPRI, 2016b).

The study of the experience of the world's 50 largest economies shows the significant attention of regulators in these countries to the formation of national regulation of ESG disclosure according to SDGs.

Ukraine's adoption of a national SDGs target system in 2017 unites it with the global community. However, the level of SDGs progress in our country compared to 50 leading countries in the world is low – 46th place out of 149 countries in 2016 Global SDG Indicators Database (SDG Indicators, 2016). Approval of Decree of the president of Ukraine No. 722/2019 from 30/09/2019 "About the Sustainable Development Goals of Ukraine for the period up to 2030," Order of the Cabinet of Ministers of Ukraine "On approval of the Concept for the implementation of state policy in the field of promoting the development of socially responsible business in Ukraine for the period up to 2030" and Decree of the President of Ukraine No. 722/2019 from 30/09/2019 "About the Sustainable Development Strategy "Ukraine – 2020" remain a minimal step on Ukraine's path to the SDGs.

Therefore, the study of the impact of regulatory tools for ESG disclosure in the largest world economies and the level of achievement of the SDGs by them is an important scientific and applied task. To see whether or not there are differences in ESG disclosure regulation in developed and emerging countries and whether or not ESG disclosure regulation influence SDGI ranking and position in 50 largest economies ranking the following hypotheses are tested in this study:

H1: The level of ESG disclosure compliance is higher in developed countries.

H2: SDGI ranking of the country is influenced by ESG disclosure regulation.

H3: ESG disclosure regulation influences the ranking of the country among 50 largest economies.

H4: ESG disclosure regulation influence on SDGI ranking is different for government and non-government disclosure.

1. LITERATURE REVIEW

ESG and SDGs information disclosure and its regulation have a short history in the works of scientists given their dissemination since 2015 at the global level. Since then, SDGs have been studied mainly in the context of investor decision-making for responsible investment and benchmarking in financial markets, taking into account generally accepted guidelines in the field of sustainable development.

Thus, Trabacchi and Buchner (2019) provide evidence in SDG-informed capital allocation decision-making for investors and valuable instruments for investing capital into activities supporting the SDGs.

Leleux and van der Kaaij (2019) describe the connection between SDGs and ESG ratings and how stock markets evaluate the latter.

On the level of individual companies, ESG disclosure regulation and SDGs were investigated by Indahl and Jacobsen (2019). They describe Nordic private equity firm, Summa Equity, which received the ESG award at the 2019 Private Equity Awards in London. This firm uses SDGs and ESG for communication with stakeholders and emphasizes its fundamental role in value creation potential, social benefits, risk mitigation for PE.

On the country level, ESG disclosure regulation and SDGs were investigated by Bala (2018) in the context of various regulatory frameworks of Bangladesh.

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Phan, De Luca, and Iaia (2020) found a positive experience of disclosing non-financial information according to some of the SDGs matters in the Italian context. The study of 111 Italian listed companies that issued their non-financial (ESG) disclosure shows that larger companies and/or companies with higher risk profiles (Beta) have already started to improve their disclosure.

The approaches to ESG disclosure in the United States and six other countries (South Africa, Brazil, the European Union, the United Kingdom, Hong Kong, and mainland China) were investigated by Ho and Park, (2019). They argue "that optimal approaches for improving the quality and utility of non-financial information must draw on the comparative advantages of both public and private forms of disclosure regulation" (Ho & Park, 2020, p. 250).

In the EU, in Communication from the Commission – Guidelines on Non-Financial Reporting (methodology for reporting non-financial information) C/2017/4234 17 UN SDGs – are cited as one of the important methodologies for preparing such reports alongside the widely accepted standards of the Global Reporting Initiative (GRI) and the International Council on Integrated Reporting (IIRC).

The latter organization recommends structuring the disclosure of information by companies in terms of 6 types of capital used by it – financial, manufactured, intellectual, human, social, and natural. One cannot disagree with the opinion of Adams (2017) on the suitability of these types of capital for some or a complete set of SDGs. This compliance significantly improves the quality of information disclosure by companies in terms of sustainable development and ESG criteria (Table 1).

Table 1. Relevant SDGs by type of entities capitals

Source: Adams (2017).

Capital	SDGs
Financial	14 (3-17)
Manufactured	10 (2, 4, 6, 7, 9, 11-14, 17)
Intellectual	9 (3, 6, 7,10, 12-14, 16, 17)
Human	12 (3-7, 8, 10, 12-14, 16, 17)
Social	17 (1-17)
Natural	9 (2, 6, 7, 11-14, 16, 17)

Adams (2020) emphasizes the importance of promoting Sustainable Development Goal Disclosure (SDGD) Recommendations agreed by the most reputable accounting organizations, standards such as:

- The Association of Chartered Certified Accountants (ACCA),
- Chartered Accountants ANZ,
- the Institute of Chartered Accountants of Scotland (ICAS)
- the International Federation of Accountants (IFAC),
- the International Integrated Reporting Council (IIRC)
- the World Benchmarking Alliance (WBA).

Thus, the attention to the SDGs as a basis for the presentation of information on ESG criteria is growing both in academia and at the level of international organizations for accounting standardization.

At the same time, in the analyzed works, the authors focus on the role of SDGs mostly as a basis for decision-making by investors or information disclosure. Moreover, the level of research based on this is individual – at the level of investors or companies that integrate SDGs into their business strategy and responsible behavior. Studies of the relationship between the national levels are poorly understood. The current work is a continuation of our previous research on ESG disclosure regulation relationship with the countries' competitiveness (Plastun, Makarenko, Kravchenko, Ovcharova, & Oleksich, 2019). There are two types of ESG disclosure regulation: government and non-government.

The dominant drivers of ESG disclosure promotion are government disclosure requirements. Non-government disclosure requirements, in particular exchange requirements, are clearly the next step in regulating such disclosure. Among 20 countries with the highest SDGs score, mandatory or voluntary government or non-government

Table 2. Countries with the biggest progress in achieving SDGs and their share of ESG disclosure in annual company reports in 2016–2017

Source: Compiled by the authors from KPMG (2017), UNPRI (2016a,c), SDG Indicators (2016).

Country	SDGI_Rank	SDGI_Score	% of ESG disclosed CSR reports	ESG disclosure drivers	
				Government	Non-government (stock exchange)
Sweden	1	84.53	88.0	Mandatory Voluntary	–
Denmark	2	83.88	94.0	Mandatory Voluntary	Mandatory
Norway	3	82.31	89.0	Mandatory Voluntary	–
Finland	4	81.00	82.0	Mandatory Voluntary	–
Switzerland	5	80.87	82.0	Mandatory Voluntary	Mandatory
Germany	6	80.52	73.0	Mandatory Voluntary	Voluntary
Austria	7	79.07	62.0	Mandatory Voluntary	–
Netherlands	8	78.94	82.0	Mandatory Voluntary	–
Iceland	9	78.41	–	Voluntary	–
United Kingdom	10	78.14	99.0	Mandatory Voluntary	Voluntary
France	11	77.90	94.0	Mandatory	–
Belgium	12	77.43	62.0	Mandatory	
Canada	13	76.85	84.0	Mandatory Voluntary	Mandatory
Ireland	14	76.75	78.0	Mandatory	–
Czech Republic	15	76.73	51.0	Voluntary	–
Luxembourg	16	76.66	59.0	Mandatory	
Slovenia	17	76.62		Mandatory	
Japan	18	74.96	99.0	Mandatory Voluntary	–
Singapore	19	74.61	84.0	Mandatory Voluntary	Mandatory Voluntary
Australia	20	74.53	77.0	Mandatory Voluntary	Mandatory Voluntary

regulations for ESG disclosure were introduced (Table 2).

In this context, the main question needs to be answered – does ESG disclosure regulation affect progress towards the SDGs, what type of regulation, in what way, and in which countries (developed or developing). The answer to this question gives an idea of the future ways to standardize the ESG disclosure of information, increase the transparency of the business environment to ensure progress in achieving SDGs, particularly in Ukraine.

2. DATA AND METHODOLOGY

ESG disclosure data by countries are used in the following dimensions: government corporate ESG disclosure and non-government corporate ESG disclosure (the source of information is UNPRI, 2016a,b,c). SDGI rank and SDGI score are taken from Global SDG Indicators Database (SDG Indicators, 2016). The data source for the information about the ranking in 50 largest economies is UNPRI (2016c). The period of the analysis is 2016 (the latest available period with data for all analyzed indicators). Data are summarized in Table A1.

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To see whether or not ESG disclosure regulation differs in developed and emerging countries and whether or not ESG disclosure regulation influence SDGI ranking and position in 50 largest economies ranking, several hypotheses are tested in this study:

H1: The level of ESG disclosure compliance is higher in developed countries.

H2: SDGI ranking of the country is influenced by ESG disclosure regulation.

H3: ESG disclosure regulation influences the ranking of the country among 50 largest economies.

H4: ESG disclosure regulation influence on SDGI ranking is different for government and non-government disclosure.

To test these hypotheses, both parametrical and non-parametrical tests are used to incorporate possible compliance/incompliance of the data to the normal distribution. For these purpose, the following tests are used: parametrical (Student's *t*-test, ANOVA analysis) and non-parametrical (Mann-Whitney *U* test). Simple average analysis and OLS with dummy variables method are used as additional techniques to avoid possible methodological bias.

The initial data set is divided into the following sub-sets: data for developed countries and data for emerging countries.

The average analysis approach is used to obtain preliminary evidence in favor of differences between analyzed data sets in different dimensions: ESG disclosure regulation, SDGI, and 50 largest economies rankings.

The use of parametric and non-parametric tests allows seeing whether or not differences between analyzed data sets are statistically significant.

To get additional evidence, multiple regressions with a dummy variable are used:

$$Y_i = a_0 + a_1 D_i + \varepsilon_i, \quad (1)$$

where Y_i – the value of ESG criterion for developed country *i*; a_0 – mean ESG criterion value for the developed countries; a_1 – a slope for the dummy variable D_i; D_i – a dummy variable for the emerging countries, equal to 1 for the case of data values from emerging countries and 0 if data values do not correspond to the emerging countries; ε_i – error for the case *i*.

In favor of difference between analyzed data sets evidence the size, sign and statistical significance of the dummy coefficients, correlation analysis, Granger causality test, and multiple regression analysis are used to test Hypotheses 2-4.

3. RESULTS

Let us start with *H1:* The level of ESG disclosure compliance is higher in developed countries.

Average analysis provides clear evidence in favor of higher ESG disclosure compliance in developed countries (Appendix B).

To find whether or not these differences are statistically significant, several statistical tests are performed. OLS with dummy variables method is used as an additional technique. Overall results are presented in Appendix C. Overview of these results is provided in Table 3.

Table 3. Overview of the empirical results for *H1*

Parameter / Methodology	Simple average analysis	Student's *t*-test	ANOVA analysis	Mann-Whitney *U* test	OLS with dummies
SDGI rank 2016	+	+	+	+	+
SDGI score 2016	+	+	+	+	+
Government corporate ESG disclosure	+	+	+	+	+
Non-government corporate ESG disclosure	+	–	+	+	+

Note: "+" – difference between developed countries and emerging countries data sets is detected; "–" – difference between developed countries and emerging countries data sets is not detected.

As can be seen, the level of ESG disclosure compliance is different in developed and emerging countries. In general, it is higher in developed countries. Hypothesis 1 is accepted.

Next, hypotheses *H2-H4* are tested. The authors start with the correlation analysis to find evidence that ESG disclosure regulation influences SDGI ranking and ranking of the country among 50 largest economies. The results are presented in Appendix D.

Overall, there is no stable correlation between ESG disclosure regulation and SDGI ranking or ranking of the country among 50 largest economies.

However, there are a few exceptions. For example, for the case of all data sets, there is a rather strong positive relationship between government corporate ESG disclosure and SDGI ranking. Overall, it looks like SDGI ranking and ranking of the country among 50 largest economies are not influenced by ESG disclosure regulation.

Next, the Granger causality test is performed (see Appendix E). The overview of the Granger causality test results is presented in Table 4.

These findings confirm the results of correlation analysis: causalities between ESG criteria and analyzed indicators (both 50 largest economies and SDGI rankings) are not detected. Usually, parameter Rank acts as the dependent variable. This is indirect evidence in favor of *H2:* SDGI ranking of the country is influenced by ESG disclosure regulation.

Next, hypotheses *H2* and *H4* are tested. For these purpose, multiple regression analysis is used. The results for the models with SDGI score as the dependent variable and ESG criteria as independent variables are summarized in Table 5.

Table 5. Multiple regression analysis: SDGI score (Y) and ESG disclosure regulation (X)

Parameter	All data sets	Developed countries data	Emerging countries data
a_0	55.74 (0.00)	73.89 (0.00)	57.27 (0.72)
Government corporate ESG disclosure, a_1	3.04 (0.00)	0.43 (0.43)	2.01 (0.03)
Non-government corporate ESG disclosure, a_2	0.64 (0.62)	0.57 (0.56)	–2.34 (0.07)
F-test	8.28	0.51	4.63
Multiple R	0.51	0.23	0.51

Models for all data set and for the case of emerging countries are statistically significant. Non-government corporate ESG disclosure has $p < 0.05$ in both cases.

Based on these results, the models with non-government corporate ESG disclosure as an independent variable were developed (Table 6).

As can be seen, F criterion increase in both cases, so the overall quality of these models is higher.

These results clearly show that the use of non-government corporate ESG disclosure influences SDGI score – the more ESG criteria are satisfied, there higher the score is. It should be mentioned that this rule works much better for the case of emerging countries.

Table 4. Overview of the Granger causality test results

Parameters	Ranking in 50 largest economies (Y)	SDGI rank 2016 (Y)	SDGI score 2016 (Y)	Government corporate ESG disclosure (Y)	Non-government corporate ESG disclosure (Y)
Ranking in 50 largest economies (X)	ND	–	–	–	–
SDGI_Rank 2016 (X)	–	ND	ND		
SDGI_Score_2016 (X)	–	ND	ND		
Government corporate ESG disclosure (X)	–	–	–	ND	–
Non-government corporate ESG disclosure (X)	+	–	–	–	ND

Note: "+" – statistically significant dependence between X and Y variables is detected; "–" – statistically significant dependence between X and Y variables is not detected.

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Table 6. Multiple regression analysis: SDGI score (Y) and non-government corporate ESG disclosure regulation (X)

Parameter	All data sets	Case of developing and emerging countries
a_0	56.71 (0.00)	53.54 (0.00)
Non-government corporate ESG disclosure, a_1	3.07 (0.00)	2.17 (0.03)
F-test	16.58	5.44
Multiple R	0.51	0.41

Table 7. Multiple regression analysis: ranking in 50 largest economies (*Y*) and SDGI ranking and ESG disclosure regulation (*X*)

Parameter	All data sets	Developed countries	Emerging countries
a_0	–28.55 (0.73)	–260.51 (0.23)	36.13 (0.72)
SDGI rank 2016, a_1	0.2863 (0.37)	1.1239 (0.28)	0.0082 (0.98)
SDGI score 2016, a_2	0.6485 (0.53)	3.7033 (0.16)	–0.2627 (0.84)
Government corporate ESG disclosure, a_3	–0.1106 (0.93)	–1.7597 (0.28)	2.3870 (0.24)
Non-government corporate ESG disclosure, a_4	–1.4723 (0.46)	–5.8441 (0.09)	1.3131 (0.47)
F-test	0.97	2.63	0.49
Multiple R	0.28	0.63	0.27

On the final stage, *H3* is tested. The following multiple regression model is run: ranking in 50 largest economies as dependent variable and ESG criteria and SDGI ranking as independent variables (Table 7).

As can be seen in the case of ESG criteria and SDGI ranking as independent variables, there are no suitable linear models. Thus, multiple regression analysis is run with only ESG criteria as independent variables (Table 8).

The best model (with statistically significant parameters) is as follows:

$$Y_i = 35.72 - 7.079 \cdot a_1, \quad (2)$$

p-values < 0.05 for all coefficients and F criterion exceeds critical value. Multiple R0.49 where Y_i – is rank in the ranking in 50 largest economies of i-th country; a_1 – non-government corporate ESG disclosure,

As can be seen (Eq. 2), the more ESG criteria are used for disclosure regulation, the higher the country's ranking. Non-government corporate ESG disclosure has the biggest influence.

According to these results, the non-government corporate ESG disclosure is a primary object to start with if the country wants to incorporate ESG disclosure regulation and improve its position in the 50 largest economies ranking.

In general, there is evidence in favor of hypotheses *H2-H4*. ESG disclosure regulation can influence the position of the country in 50 largest economies ranking. The more country complies with ESG disclosure criteria, the better position in the ranking is.

Table 8. Multiple regression analysis: ranking in 50 largest economies (*Y*) and ESG disclosure regulation (*X*)

Parameter	All data sets	Developed countries	Emerging countries
a_0	31.31 (0.0.00)	40.49 (0.0.00)	21.73 (0.00)
Government corporate ESG disclosure, a_1	–0.9248 (0.43)	–1.1907 (0.47)	1.8010 (0.32)
Non-government corporate ESG disclosure, a_2	–1.7855 (0.37)	–7.0236 (0.03)	1.9878 (0.44)
F-test	0.82	3.15	0.75
Multiple R	0.18	0.51	0.23

CONCLUSION

This paper explores the influence of the ESG disclosure regulation on the ranking of 50 largest economies. To do this, several hypotheses are tested: (*H1*) – the level of ESG disclosure compliance is higher in developed countries; (*H2*) – SDGI ranking of the country is influenced by ESG disclosure regulation; (*H3*) – ESG disclosure regulation influences ranking of the country among 50 largest economies; (*H4*) – ESG disclosure regulation influence on SDGI ranking is different for government and non-government disclosure.

Hypotheses are tested using different statistical tests (parametrical and non-parametrical), simple average analysis, OLS with dummy variables method, correlation analysis, Granger causality test, and multiple linear regression analysis.

Based on the results, the following conclusions are obtained:

1. The level of ESG disclosure compliance is different in developed countries and emerging countries.

2. ESG disclosure compliance is higher in developed countries.

3. ESG disclosure regulation influences the position of the country in SDGI ranking and 50 largest economies. The more country complies with ESG disclosure criteria, the better position in the ranking is. This rule works much better for the case of emerging countries.

The results provide additional evidence in favor of differences in ESG disclosure regulation in developed and emerging countries. However, the incorporation of ESG criteria is an important evolutionary step in the country's economic development. It allows increasing the country's position in 50 largest economies and SDGI ranking. Thus, ESG disclosure regulation is vital for the development of the country in the modern world.

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AUTHOR CONTRIBUTIONS

Conceptualization: Alex Plastun, Lyudmila Khomutenko.
Data curation: Lyudmila Khomutenko, Oksana Osetrova.
Formal analysis: Oksana Osetrova, Pavlo Shcherbakov.
Funding acquisition: Alex Plastun.
Investigation: Inna Makarenko.
Methodology: Alex Plastun, Inna Makarenko.
Project administration: Inna Makarenko.
Resources: Lyudmila Khomutenko, Pavlo Shcherbakov.
Software: Alex Plastun.
Supervision: Inna Makarenko.
Validation: Alex Plastun, Lyudmila Khomutenko, Pavlo Shcherbakov.
Visualization: Lyudmila Khomutenko, Oksana Osetrova.
Writing – original draft: Alex Plastun, Lyudmila Khomutenko, Oksana Osetrova, Pavlo Shcherbakov.
Writing – review & editing: Inna Makarenko.

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APPENDIX A

Table A1. Initial data set

SDGI rank (2016)		SDGI score (2016)		Ranking in 50 largest economies		Government corporate ESG disclosure		Non-government corporate ESG disclosure	
DC	DEC	DC	DEC	DC	DEC	DC	DEC	DC	DEC
20	43	75	67	12	21	4	2	4	0
7	118	79	44	29	47	4	2	3	2
12	52	77	64	25	9	4	2	2	3
13	42	77	67	10	42	7	5	3	2
2	76	84	59	37	2	5	5	2	2
4	91	81	57	44	39	6	2	2	2
11	66	78	61	6	32	4	2	2	2
6	37	81	70	4	46	6	4	2	0
–	110	–	48	34	7	0	0	5	0
14	98	77	54	43	16	4	0	0	2
29	79	72	59	36	26	2	0	0	0
35	54	71	64	8	50	5	2	2	3
18	63	75	62	3	35	2	5	2	0
8	56	79	63	17	15	4	2	2	2
3	141	82	36	28	23	3	2	2	3
34	115	71	46	45	41	3	2	0	2
19	81	75	58	38	49	2	4	3	2
33	95	69	56	14	40	6	2	2	2
1	38	84	70	22	24	6	3	2	2
4	47	80	66	19	13	0	5	3	0
10	85	77	58	5	20	7	2	2	0
23	99	71	54	1	33	2	3	3	2
–	27	–	73	–	11	–	2	–	0
–	55	–	59	–	27	–	3	–	2
–	46	–	63	–	18	–	4	–	2
–	58	–	59	–	31	–	2	–	0
–	65	–	57	–	30	–	0	–	2
–	83	–	53	–	48	–	2	–	2
–	46	–	66	–	50	–	5	–	0

Note: DC is used for developed countries; DEC is used for developing and emerging countries.

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APPENDIX B

Average analysis

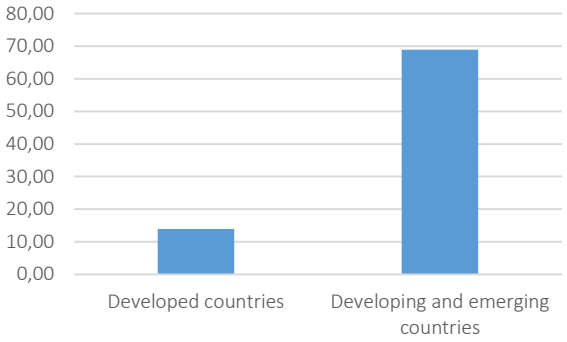

Figure B1. SDGI rank (2016)

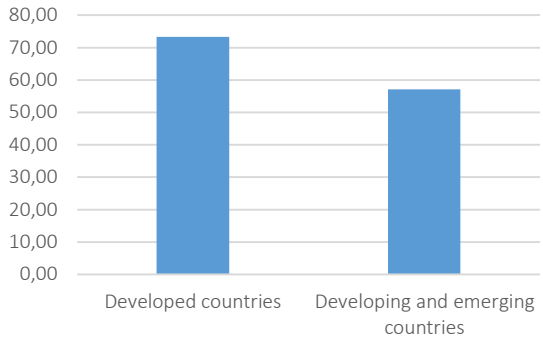

Figure B2. SDGI score (2016)

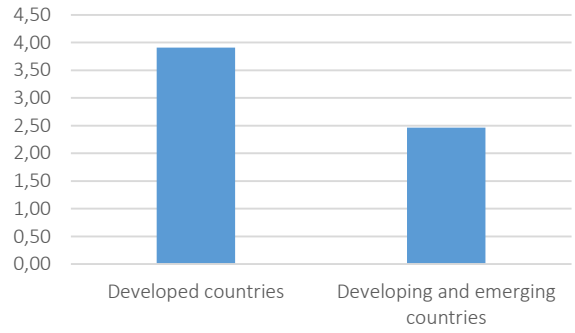

Figure B3. Government corporate ESG disclosure

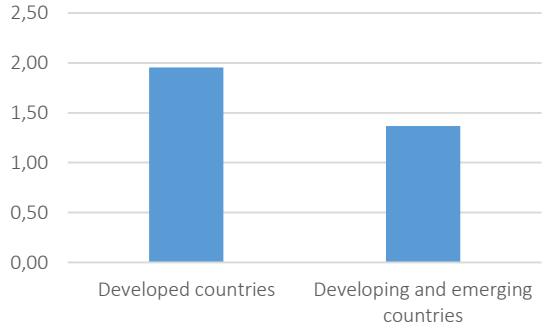

Figure B4. Non-government corporate ESG disclosure

APPENDIX C

Student's *t*-test

Table C1. *T*-test of the differences between developed countries and emerging countries

Parameter	SDGI rank (2016)	SDGI score (2016)	Government corporate ESG disclosure	Non-government corporate ESG disclosure
t-criterion	–9.48	9.01	2.89	1.95
Null hypothesis	Rejected	Rejected	Rejected	Not rejected

Note: t-critical = 1.96 with level of significance $p = 0.95$.

Parametric tests: ANOVA

Table C2. ANOVA test of the differences between developed countries and emerging countries

Parameter	SDGI rank (2016)	SDGI score (2016)	Government corporate ESG disclosure	Non-government corporate ESG disclosure
F	75.01	80.89	10.17	4.35
p-value	0.00	0.00	0.00	0.04
Null hypothesis	Rejected	Rejected	Rejected	Rejected

Note: F-critical = 4.04 with level of significance $p = 0.95$.

Mann-Whitney *U* test

Table C3. Mann-Whitney *U* test of the differences between developed countries and emerging countries

Parameter	SDGI rank (2016)	SDGI score (2016)	Government corporate ESG disclosure	Non-government corporate ESG disclosure
Adjusted H	34.89	34.20	8.32	4.16
d.f.	1	1	1	1
p-value	0.00	0.00	0.00	0.04
Null hypothesis	Rejected	Rejected	Rejected	Rejected

Note: Critical value = 3.84 with level of significance $p = 0.95$.

OLS with dummy variables

Table C4. OLS with dummy variables of the differences between developed countries and emerging countries

Parameter	SDGI rank (2016)	SDGI score (2016)	Government corporate ESG disclosure	Non-government corporate ESG disclosure
a_0	14.57 (0.00)	76.83 (0.00)	4.09 (0.00)	2.05 (0.00)
a_1	56.67 (0.00)	–17.74 (0.00)	–1.54 (0.00)	–0.6338 (0.04)
F-test	75.01	80.89	8.41	5.05
Multiple R	0.78	0.79	0.42	0.03
Null hypothesis	Rejected	Rejected	Rejected	Rejected

Note: p-values are in parentheses.

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APPENDIX D. CORRELATION ANALYSIS

Table D1. Correlation analysis of ESG disclosure regulation and rankings: case of all data sets

Parameter	Ranking in 50 largest economies	SDGI rank 2016	SDGI score 2016	Government corporate ESG disclosure	Non-government corporate ESG disclosure
Ranking in 50 largest economies	1	0.24	–0.22	–0.15	–0.10
SDGI_rank 2016	0.24	1	–0.98	–0.50	–0.12
SDGI_score_2016	–0.22	–0.98	1	0.51	0.10
Government corporate ESG disclosure	–0.15	–0.50	0.51	1	–0.02
Non-government corporate ESG disclosure	–0.10	–0.12	0.10	–0.02	1

Table D2. Correlation analysis of ESG disclosure regulation and rankings: case of developed countries

Parameter	Ranking in 50 largest economies	SDGI rank 2016	SDGI score 2016	Government corporate ESG disclosure	Non-government corporate ESG disclosure
Ranking in 50 largest economies	1	–0.06	0.20	–0.16	–0.49
SDGI_rank 2016	–0.06	1	–0.95	–0.16	0.28
SDGI_score_2016	0.20	–0.95	1	0.19	0.14
Government corporate ESG disclosure	–0.16	–0.16	0.19	1	0.02
Non-government corporate ESG disclosure	–0.49	–0.28	0.14	0.02	1

Table D3. Correlation analysis of ESG disclosure regulation and rankings: case of developing and emerging countries

Parameters	Ranking in 50 largest economies	SDGI rank 2016	SDGI score 2016	Government corporate ESG disclosure	Non-government corporate ESG disclosure
Ranking in 50 largest economies	1	0.09	–0.10	0.18	0.13
SDGI_rank 2016	0.09	1	–0.96	–0.41	0.31
SDGI_score_2016	–0.10	–0.96	1	0.41	–0.35
Government corporate ESG disclosure	0.18	–0.41	0.41	1	–0.10
Non-government corporate ESG disclosure	0.13	0.31	–0.35	–0.10	1

APPENDIX E. GRANGER CAUSALITY TEST

Table E1. Ranking in 50 largest economies (X) and SDGI rank 2016 (Y)

Res. DF	Diff. DF	F	*p*-value
Function: Y = f(X)			
46	–1	0.85	0.36
Function: X = f(Y)			
46	–1	0.60	0.44

Table E2. Ranking in 50 largest economies (X) and SDGI score 2016 (Y)

Res. DF	Diff. DF	F	*p*-value
Function: Y = f(X)			
46	–1	0.50	0.48
Function: X = f(Y)			
46	–1	0.39	0.53

Table E3. Ranking in 50 largest economies (X) and government corporate ESG disclosure (Y)

Res. DF	Diff. DF	F	*p*-value
Function: Y = f(X)			
46	–1	0.51	0.48
Function: X = f(Y)			
46	–1	2.02	0.16

Table E4. Ranking in 50 largest economies (X) and non-government corporate ESG disclosure (Y)

Res. DF	Diff. DF	F	*p*-value
Function: Y = f(X)			
46	–1	2.46	0.12
Function: X = f(Y)			
46	–1	4.00	0.05

Table E5. SDGI rank 2016 (X) and government corporate ESG disclosure (Y)

Res. DF	Diff. DF	F	*p*-value
Function: Y = f(X)			
46	–1	0.02	0.88
Function: X = f(Y)			
46	–1	0.64	0.42

Table E6. SDGI rank 2016 (X) and non-government corporate ESG disclosure (Y)

Res. DF	Diff. DF	F	*p*-value
Function: Y = f(X)			
46	–1	0.59	0.45
Function: X = f(Y)			
476	–1	0.00	0.99

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Table E7. SDGI score 2016 (X) and government corporate ESG disclosure (Y)

Res. DF	Diff. DF	F	*p*-value
Function: Y = f(X)			
46	–1	0.03	0.87
Function: X = f(Y)			
46	–1	1.28	0.26

Table E8. SDGI score 2016 (X) and non-government corporate ESG disclosure (Y)

Res. DF	Diff. DF	F	*p*-value
Function: Y = f(X)			
46	–1	0.45	0.50
Function: X = f(Y)			
46	–1	0.007	0.93

Table E9. Government corporate ESG disclosure (X) and non-government corporate ESG disclosure (Y)

Res. DF	Diff. DF	F	*p*-value
Function: Y = f(X)			
46	–1	0.04	0.83
Function: X = f(Y)			
46	–1	0.04	0.84