“Transparency and information asymmetry in the financial market: Strategic dependencies between sustainability disclosure, SDG achievement and financial and information efficiency”

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TRANSPARENCY AND INFORMATION ASYMMETRY IN THE FINANCIAL MARKET: STRATEGIC DEPENDENCIES BETWEEN SUSTAINABILITY DISCLOSURE, SDG ACHIEVEMENT AND FINANCIAL AND INFORMATION EFFICIENCY

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Abstract

In today's financial world, the pursuit of sustainable development has evolved from an ethical imperative to a strategic necessity. It has spurred corporations to enhance transparency regarding their non-financial and responsible or ESG practices. This paper aims to formalize the strategic dependencies between sustainability disclosure, SDG achievement, and the financial and information efficiency of the financial market. The research methods are normality tests, canonical correlation analysis, and multivariate multiple and univariate regression analysis. The object of the study is 137 countries. The time period is 2022. The results confirmed that a positive strong correlation was found between sustainability disclosure and the achievement of the SDGs on the one hand and financial and information efficiency of the financial market on the other. Identifying the direction of the relationship also confirmed two-way positive dependencies between the indicators, in particular, the SDG Index will have the most significant impact on the growth of GDP per capita, the change in the Economic Sustainability Competitiveness Index on the growth of the United Nations Global Compact participants. The specified connection can be used as the basis for the formation of the concept of ensuring transparency and leveling information asymmetry in the activities of enterprises.

Keywords sustainable development, responsible investments, ESG, disclosure, UN Global Compact, competitiveness, GDP

JEL Classification Q01, E44

INTRODUCTION

Increased awareness of a company's social responsibility and its broader impact on society and the environment is reshaping the old-fashioned rules of doing business. Sustainability disclosure and responsible or environmental, social, and governance (ESG) investment practices have become integral to this new order, creating a more positive environment for ensuring transparency and leveling information asymmetry in enterprise activities.

These changes are deeply connected to the progress of the 17 United Nations Sustainable Development Goals (SDGs) and its 169 targets till 2030 that provide a globally recognized framework for addressing pressing global challenges, including poverty, inequality, climate

change, environmental degradation, peace, and justice. Within the current challenges and regress in achieving the SDGs brought mainly about by the COVID-19 pandemic and geopolitical instability, the role of businesses in driving progress and accumulating financial resources becomes even more vital. According to the UN report (UN, 2023), approximately 30% of the targets have either shown no movement or have regressed below the baseline established in 2015. To support the SDGs, a substantial increase in financing is proposed, with an annual SDG stimulus of USD 500 billion.

That is why, nowadays it is essential to stimulate the spread of the initiatives that are reshaping the regulatory landscape regarding responsible or ESG investments by directing financial flows towards strategies that prioritize sustainable practices. Currently, ESG and sustainable financing are identified as having the highest regulatory changes in the last years (KPMG, 2022). UN Principles for Responsible Investment (UNPRI, 2023) reports about more than 730 changes made to regulatory documents in the world's 50 largest economies over the last decade. The continuation and strengthening of such trends will contribute to the formation of the financial and informational efficiency that are essential for the proper functioning of financial markets in current circumstances. It fosters aligning business practices with broader societal and environmental goals, contributing to sustainable development, reducing risks, and creating a more ethical and resilient financial system.

1. LITERATURE REVIEW AND HYPOTHESIS

In contrast to the approaches of regulators, who relatively recently paid attention to the transparency and reporting of sustainable development companies as prerequisites for the development of responsible investment, research on the theoretical foundations of this issue began a long time ago (Arrow, 1970; Akerlof, 1963; Stiglitz & Weiss, 1981). Those studies explore the consequences of information asymmetry and imperfect information in different market contexts, leading to market inefficiencies, adverse selection, and moral hazard problems.

One of the aspects of creating a transparent environment for investing in the financial market in general and responsible investing, in particular, is the publication of sustainable development reports. Research on this reporting is interdisciplinary and is at the intersection of accounting, finance, and management sciences (Osobajo et al., 2022; Pasko et al., 2021; Pasko et al., 2022; Diwan & Amarayil Sreeraman, 2023).

Various international frameworks and standards have emerged to guide sustainability reporting, enhancing consistency and comparability (Matos, 2020; Singhania & Saini, 2021; Afolabi et al., 2022; Makarenko & Makarenko, 2022). Prominent examples include the Global Reporting Initiative (GRI), the Sustainability Accounting Standards Board (SASB), and Task Force on Climate-related Financial Disclosures (TCFD). Despite the positive dynamics towards the spread and development of sustainable reporting, the issue of the lack of a unified standard and the corresponding data mismatch remains relevant (Plastun et al., 2019b; Davies et al., 2020; Dumrose et al., 2022; Zenkina, 2023) and has risks in the form of "greenwashing" (Yu et al., 2020; Lokuwaduge & De Silva, 2022).

Some studies (Khaled & Mohamed, 2021; Soni, 2023; Radu et al., 2023) highlighted the increasing importance of ESG disclosures in emerging markets and their potential to contribute to progress on sustainable development goals. The Addis Ababa Summit in 2015 recognized the critical roles of both companies providing sustainable development values and the investment community offering responsible or ESG investment practices in financing sustainable development (UN, 2015). As investors increasingly recognize their importance, the allocation of capital to ESG-focused investments has surged. The predictions of a substantial increase in the share of ESG assets in total assets under management by 2025–2026, as mentioned by Deloitte (Taylor & Collins, 2022), highlight the significance of this shift. This synergy between the corporate sector and responsible investors is essential for mobilizing the financial resources needed to achieve the SDGs and address the world's most pressing global challenges.

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Aggregated results of meta-reviews and empirical studies also indicate the existence of a positive relationship between the disclosure of information on sustainable development (greater transparency) and the performance of companies in the long term (Plastun et al., 2019a; Lopatta et al., 2022; Suresha al., 2022) and information efficiency of financial markets (DasGupta, 2022; Chen & Xie, 2022; Ahmad et al., 2021).

Such conclusions testify to the need to form conceptual foundations for ensuring the transparency of reporting on the sustainable development of companies as a basis for market transparency, minimizing information asymmetry and moral risks among participants in financial markets with a segment of responsible investment. An essential emphasis among such conclusions is the consideration of the impact of transparent companies on ensuring the integral progress of the country in achieving the SDGs, since by integrating them along with CSR and ESG criteria in their activities, companies directly make a significant contribution to such progress. Such conceptual foundations are essential for developing countries whose financial markets are at the stage of formation, in particular for Ukraine.

This article aims to formalize the strategic dependencies between sustainability disclosure, SDG achievement, and the financial and information efficiency of the financial market. The research hypothesis is the following:

H1: There is a positive link between sustainability disclosure, SDG achievement, and the financial and information efficiency of the financial market.

2. METHODOLOGY

To conduct this study, two blocks of indicators are formed, the first of which concerns sustainability disclosure and SDG achievement and is expressed in the form of the number of signatories of the United Nations Global Compact (UNGC) and SDG Index to assess the progress made by countries towards the SDGs. The second block concerns the financial and informational efficiency of the financial market and is expressed through the Economic Sustainability Competitiveness Index and GDP per capita (Table 1). The sources of information are the Sustainable Development Report by Sachs et al. (2023), UN Global Compact dataset, the Global Sustainable Competitiveness Report by Swiss-Korean joint-venture "SolAbility", and the International Monetary Fund dataset. A sample of 137 countries (Appendix A, Table A1) is formed based on the available statistical data on all indicators. The time period of the study is 2022. All calculations are carried out using the STATA SE12.0 software package.

The research methods are Normality tests (Shapiro-Wilk test, Shapiro-Francia test), canonical correlation analysis and multivariate multiple and univariate regression analysis. Canonical Correlation Analysis (CCA), which was first proposed by Hotelling (1936), is a multivariate statistical method used to investigate the relationship between two sets of variables (conventionally between X and Y). It aims to identify linear combinations of variables from each set that have the highest correlation among themselves (Hardoon et al., 2024).

During CCA, a vector or canonical dimension U is conditionally associated with a block of variables X, and a vector V is associated with a block Y, which are orthogonal linear combinations of variables in the given two sets that best explain inter- and intra-set variability (Sherry & Henson, 2005). Together, each pair of canonical dimensions forms canonical functions, the number of which varies depending on the number of elements in the smaller set. Accordingly, within the scope of this study, their number is determined at the level of two, each of which has two canonical pairs.

Table 1. Input data characteristics

Block of indicators	Indicators	Symbol	Data Source
Regarding the sustainability disclosure and SDG achievement (Block X)	UNGC participants score	ungcp	UN Global Compact
	SDG Index Score	sdgi	Sustainable Development Report
Regarding the financial and the informational efficiency of the financial market (Block Y)	Economic Sustainability Competitiveness Index	esci	Global Sustainable Competitiveness Report
	GDP per capita, current prices	gdppc	International Monetary Fund

The goal of CCA is to determine the linear combination that maximizes the canonical correlation for each canonical pair. At the same time, this canonical correlation (p_i) is calculated as the covariance (*cov*) between U_i and V_i, divided by the square root of the product of variances (var) of U_i and V_i. (Hardoon et al., 2024):

$$p_i = cov\left(U_i V_i\right) / \sqrt{var\left(U_i\right) var\left(V_i\right)} \quad (1)$$

Redundancy indices (RD_i) are additionally given, indicating how much the change in the variance of one set of variables is caused by another (Kim & Cipolla, 2008).

Establishing the nature of the relationship between two sets of variables while using CCA can serve as a basis for further regression analysis. During this study, it is proposed to use multidimensional multiple regression analysis, which allows to reveal the relationship between several dependent variables (Y_1, Y_2, … Y_n) and a common set of predictors, in mathematical form it has the following form (Hair et al., 2019):

$$\begin{cases} Y_1 = \beta_{01+}\beta_{11}x_1 + \beta_{21}x_2 + \beta_{n1}x_n + \varepsilon_1 \\ Y_2 = \beta_{02+}\beta_{12}x_1 + \beta_{22}x_2 + \beta_{n2}x_n + \varepsilon_2 \\ \ldots\ldots \\ Y_m = \beta_{0m+}\beta_{1m}x_1 + \beta_{2m}x_2 + \beta_{nm}x_n + \varepsilon_m \end{cases}, \quad (2)$$

3. RESULTS AND DISCUSSION

From the descriptive statistics (Table 2), it becomes evident that most variables have slight signs of right- or left-sided asymmetry and a narrow distribution, indicating a threat to normality. The variables are logarithmically transformed to eliminate potential problems with the normal distribution of the data. Further testing of data for normal distribution included graphical analysis and the Shapiro-Francia test.

Wilks' lambda criterion allows rejecting the null hypothesis that there is no connection between the two sets (Table 3) and prove that the first canonical function is statistically significant. The obtained coefficients indicate that a one-unit increase in the sustainability index will lead to a fivefold increase in the first canonical function, all other variables being held constant.

All standardized canonical coefficients are statistically significant and, therefore, impacted the formation of canonical correlation (Table 4). In addition, they are similar to the previous unstandardized coefficients and have the exact nature of influence.

The previous steps provide a basis for investigating direct correlations between variables within

Table 2. Descriptive statistics for the input dataset

Variables	Mean	Standard deviation	Min	Max	Skewness	Kurtosis
sdgi	67.92	10.33	39.05	86.51	–0.58	2.70
ungcp	158.64	352.85	1.00	2243.00	3.86	19.68
esci	43.22	7.58	28.40	61.60	0.31	2.23
gdppc	18323.90	25074.72	309.11	127579.80	2.02	6.97

Table 3. Evaluation of canonical functions

Variables		Coefficient	Wilks' lambda				
			Statistic	df_1	df_2	F	Prob>F
Canonical function no. 1							
u1	lsdgi	5.67	0.28	4.00	266.00	60.30	0.00e*
	lungcp	0.07					
v1	lesci	2.16					
	lgdppc	0.47					
Canonical function no. 2							
u2-	lsdgi	–4.03	1.00	1.00	134.00	0.01	0.94e
	lungcp	0.57					
v2-	lesci	7.55					
	lgdppc	–0.79					

Note: * – statistically significant at the level (p) < 0,05.

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Table 4. Estimation of standardized canonical coefficients

Variables		Coef.	Std. Err.	t	P > |t|	95% Conf. Interval	
u1	lsdgi	5.668	0.370	15.310	0.000*	4.936	6.400
	lungcp	0.069	0.030	2.280	0.024*	0.009	0.129
v1	lesci	2.161	0.418	5.170	0.000*	1.335	2.988
	lgdppc	0.468	0.049	9.590	0.000*	0.371	0.565

Note: * – statistically significant at the level (p) <0,05.

Table 5. Evaluation of canonical correlation coefficients

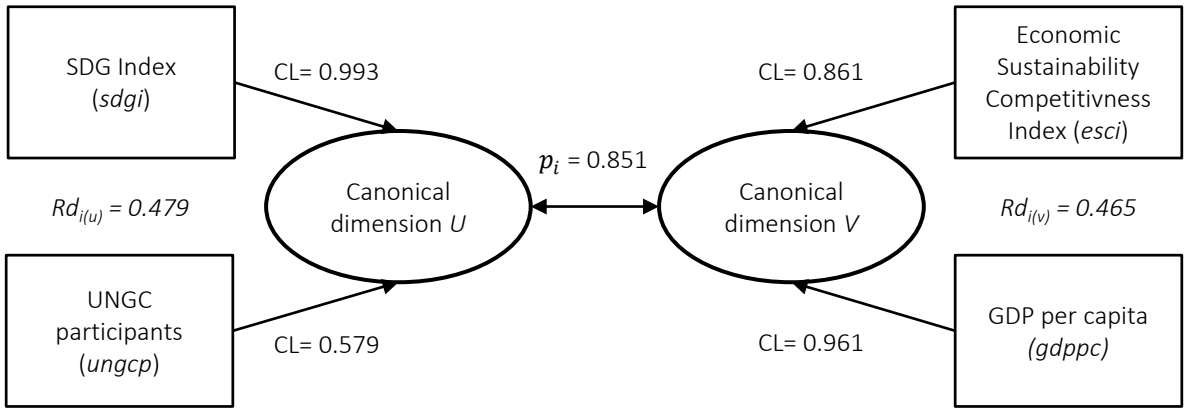
Combinations	Correlation matrices		
Between *u* variables		lsdgi	lungcp
	lsdgi	1.00	–
	lungcp	0.48	1.00
Between *v* variables		lesci	lgdppc
	lesci	1.00	–
	lgdppc	0.69	1.00
Between *u* and *v* variables		lsdgi	lungcp
	lesci	0.727	0.427
	lgdppc	0.813	0.473

u- and *v*-variables and between them directly. The results are shown in Table 5.

Correlation coefficients indicate a positive medium or high level of connection between the variables. In particular, there is a direct moderate relationship between the SDG achievement index and the number of UNGC signatories (the correlation coefficient is 0.48), and between the business sustainability index and GDP per capita, this relationship is direct and tight (0.69). The SDG achievement index has a positive strong effect on the business sustainability index and GDP per capita, while the number of UNGC signatories has a positive but moderate effect.

In a generalized form, the form of the revealed relationships within the canonical correlation analysis between variables is shown in Figure 1.

The results show that in the first set of variables, the SDG achievement index has a more significant influence on the canonical dimension *U*, in the second set of variables – GDP per capita. There is a positive and robust density between the canonical



Note: * *CL* – canonical loads, RD_i – redundancy index, p_i – canonical correlation coefficient.

Figure 1. Relationships between sustainability disclosure, SDG achievement and financial and information efficiency of the financial market within the CCA

dimensions (p_i =0.85), more than 50% of the variance in the original set of *u* variables is explained by the *v* variables. All this confirms the first working hypothesis within the scope of this study (*H1*).

The obtained data proved the presence of a medium and strong relationship between the variables, the measurement of which will be obtained using multivariate multiple and univariate regression. The results are presented in Table 6.

The obtained results showed that the predictors explain 71.4% of the variance for the SDG achievement index and 24.4% for the number of UNGC signatories. A change in the Economic Sustainability Competitiveness Index by one unit will increase the SDG Index by 0.298 units. A change in GDP per capita by one unit will increase the SDG Index by 0.065 units and the number of UNGC signatories by 0.453 units. Instead, a change in the SDG Index by one unit will increase the Economic Sustainability Competitiveness Index by 0.725 units and GDP per capita growth by 6,966 units. A change in UNGC participants by one unit will increase GDP per capita by 0.083 units.

At the same time, a change in the number of UNGC signatories per unit will lead to an increase in the SDG achievement index by 0.039 units, and vice versa, an increase in the SDG achievement index per unit will lead to an increase in the number of UNGC signatories by 5,818 units, a positive inverse relationship is also observed for financial and the informational efficiency of the financial market indicators.

Among the key areas of such a concept, it is proposed to consider the following (in descending order of priority):

1. Improving the regulatory framework: Harmonization of national accounting systems with standardized universally recognized benchmarks in the compilation and submission of reports on sustainable development and responsible investment and the establishment of precise requirements regarding the mandatory/voluntary disclosure of such information.

2. Supporting the convergence of sustainable development reporting standards, rating, and development of information products in this area at the national and global levels. The development of standardized approaches to the disclosure of information on sustainable de-

Table 6. Results of multivariate multiple and univariate regression

Variables		Coef.	Std. Err.	t	P > |t|	95% Conf. Interval	
Dependent	Independent						
lsdgi (R^2=0.714)	lesci	0.298	0.059	5.020	0.000*	0.180	0.415
	lgdppc	0.065	0.007	9.350	0.000*	0.051	0.078
	_cons	2.515	0.186	13.530	0.000*	2.147	2.882
lungcp (R^2=0.244)	lesci	2.204	1.177	1.870	0.063	–0.125	4.533
	lgdppc	0.453	0.138	3.290	0.001*	0.181	0.725
	_cons	–8.958	3.691	–2.430	0.017*	–16.258	–1.659
lesci (R^2=0.536)	lsdgi	0.725	0.072	10.110	0.000*	0.583	0.866
	lungcp	0.009	0.006	1.560	0.121	–0.002	0.021
	_cons	0.673	0.293	2.300	0.023*	0.094	1.252
lgdppc (R^2=0.670)	lsdgi	6.966	0.517	13.460	0.000*	5.942	7.989
	lungcp	0.083	0.042	1.970	0.0410*	0.000	0.167
	_cons	–20.708	2.114	–9.800	0.000*	–24.889	–16.527
lsdgi (R^2=0.227)	lungcp	0.039	0.006	6.300	0.000*	0.027	0.051
	_cons	4.076	0.024	169.620	0.000*	4.028	4.123
lungcp (R^2=0.227)	lsdgi	5.818	0.923	6.300	0.000*	3.992	7.643
	_cons	–21.140	3.886	–5.440	0.000*	–28.825	–13.456
lesci (R^2=0.467)	lgdppc	0.080	0.007	10.970	0.000*	0.066	0.095
	_cons	3.040	0.066	46.260	0.000*	2.910	3.170
lgdppc (R^2=0. 467)	lesci	5.878	0.536	10.970	0.000*	4.818	6.937
	_cons	–13.182	2.012	–6.550	0.000*	–17.160	–9.204

Note: * – statistically significant at the level (p) < 0,05.

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velopment will help to avoid phenomena such as "whitewashing" or "window dressing" (various types of "washing" and "window dressing") and create a basis for scoring and rating companies according to ESG, CSR and CSR criteria. In turn, this will contribute to monitoring and accelerating progress under the SDGs and increasing the information efficiency of financial markets and the financial efficiency of the companies themselves.

3. Strengthening the role of financial intermediaries: Banks, investment funds and other financial market participants have great potential in the development of the responsible investment segment, primarily due to the promotion of investment products with an ESG component, leveling of risks of sustainable development and overcoming the investment gap in the Central Bank. Their active participation in implementing the principles of responsible investment should be promoted, in particular by considering ESG criteria when making investment decisions.

4. Propaganda and education in the field of sustainable development and responsible investment allow for information campaigns and educational events aimed at raising the awareness of the public, investors, and businesses about the importance of sustainable development and responsible investment, proper disclosure of information on CSR initiatives to ensure progress in the field of CSR. This will help create a favorable atmosphere for the development of transparent practices and the involvement of a more significant number of participants in these processes, particularly in the example of the signatories of the UN Global Compact.

The obtained results showed that the predictors explain 71.4% of the variance for the SDG achievement index and 24.4% for the number of UNGC signatories. A change in the Economic Sustainability Competitiveness Index by one unit will increase the SDG Index by 0.298 units. A change in GDP per capita by one unit will increase the SDG Index by 0.065 units and the number of UNGC signatories by 0.453 units. Instead, a change in the SDG Index by one unit will increase the Economic Sustainability Competitiveness Index by 0.725 units and GDP per capita growth by 6,966 units. A change in UNGC participants by one unit will increase GDP per capita by 0.083 units.

At the same time, a change in the number of UNGC signatories per unit will lead to an increase in the SDG achievement index by 0.039 units, and vice versa, an increase in the SDG achievement index per unit will lead to an increase in the number of UNGC signatories by 5,818 units, a positive inverse relationship is also observed for financial and the informational efficiency of the financial market indicators.

Many studies aim to identify the relationship between the achievement of individual SDGs and other economic and social variables. In particular, Del-Aguila-Arcentales et al. (2022) proved that economic SDGs had a positive influence on the continuation of entrepreneurship and competitiveness. At the same time, the model is built in such a way that social and environmental SDGs influence economic indicators through economic SDGs. Adrangi and Kerr (2022) singled out separate SDG dimensions regarding Emissions, Energy Access, Hunger, Gender Equity and similar in their relationship with the GDP growth rate for BRICS countries. This research suggests that a myopic focus on GDP growth may not align with the objectives of the United Nations' Sustainable Development Goals, particularly in the context of emerging economies. It highlights the importance of considering social and environmental well-being alongside economic growth and calls for policies that promote sustainability, even if they result in slower GDP growth.

Orzes et al. (2020) investigate the relationship between adopting the United Nations Global Compact (UNGC) and firm performance. The study finds a significant positive impact of UNGC adoption on two key performance metrics: sales growth and profitability.

In contrast to the above studies, this one is personally focused on the complex impact of sustainability disclosure and general SDG achievement on the financial and informational efficiency of the financial market, which allows for more comprehensive transparency and leveling of information asymmetry in the activities of enterprises and the financial market as a whole.

CONCLUSION

The purpose of the study was to formalize the strategic dependencies between sustainability disclosure, SDG achievement, and the financial and information efficiency of the financial market.

The results indicate the existence of a two-way connection between the achievement of the SDGs, the disclosure of information on sustainable development in the reporting of enterprises, their financial efficiency, and the information efficiency of the financial market. The specified relationship can be used as a basis for the formation of the concept of ensuring transparency and leveling information asymmetry in the activities of enterprises. Currently, the impact of the level of disclosure of information on sustainable development by companies, expressed in the number of UNGC signatories, has a positive but moderate effect on other studied variables, which indicates the need for additional moves in the promotion of initiatives regarding the transparency of enterprises and their reporting on sustainable development.

The indicated areas are aimed at forming a transparent system of reporting on the sustainable development of companies and increasing market transparency, minimizing information asymmetry and moral risks among financial market participants. These steps contribute to a fairer and more efficient market environment and promote responsible investing.

AUTHOR CONTRIBUTIONS

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APPENDIX A

Table A1. Geography of the sample

Region	Countries
Africa	Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Congo (Dem. Rep.), Cote d'Ivoire, Djibouti, Egypt, Ethiopia, Gabon, Gambia (The), Ghana, Guinea, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritius, Morocco, Mozambique, Nigeria, Senegal, Sierra Leone, South Africa, South Sudan, Sudan, Tanzania, Togo, Tunisia, Uganda, Zambia, Zimbabwe
Asia	Armenia, Azerbaijan, Bahrain, Bangladesh, Brunei Darussalam, Cambodia, China, India, Indonesia, Iran, Iraq, Israel, Japan, Jordan, Kazakhstan, Kyrgyz Republic, Malaysia, Maldives, Mongolia, Nepal, Oman, Pakistan, Papua New Guinea, Philippines, Qatar, Saudi Arabia, Singapore, Sri Lanka, Tajikistan, Thailand, Turkey, United Arab Emirates, Uzbekistan, Yemen (Rep.)
Europe	Albania, Austria, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Georgia, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Moldova, Montenegro, Netherlands, North Macedonia, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Ukraine, United Kingdom
North America	Canada, United States
South America	Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Guyana, Jamaica, Paraguay, Peru, Venezuela
Oceania	Australia, Fiji, New Zealand
Central America	Costa Rica, Dominican Republic, El Salvador, Honduras, Nicaragua, Panama