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New measurement of sovereign ESG index

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ABSTRACT

In view of the progressive development of the ESG concept, this paper measures the sovereign ESG index of 171 countries worldwide over the period 1990–2020 by employing the entropy weight method based on relevant indicators from the World Bank's Sovereign ESG Database. The graphical analysis of the index leads to the preliminary conclusion that countries with higher economic levels tend to start earlier and focus more on ESG development, while low-income countries invest less in sustainable development and may have focused their development on the economy in the early stages of globalization. This research aims to contribute a set of instrumental data reflecting the current status and evolution of global sovereign ESG development, and to provide an important reference for studies related to sovereign ESG development and indicator system design.

1. Introduction

With climate deterioration, ecological changes, and greenhouse gas emissions becoming more problematic, the perception of sustainable development is gradually being embraced by investors. In the 1960s and 1970s, a range of environmental and social issues erupted in the US and Europe, leading to the emergence of the concept of corporate social responsibility (CSR). As times have changed, the concept of CSR has been further broadened to include the concept of environment, social, and governance (ESG) which focuses on non-financial corporate evaluation. This concept has driven the corporate transition from the pursuit of only maximizing self-interest to maximizing social value. As green investments are widely sought after by capital markets, it is increasingly common for organizations to examine how to better assess corporate ESG profiles and integrate ESG information into investment decisions. The measurement of ESG involves a range of indicators in various dimensions. Therefore, it is vital to build a scientific ESG indicator system. Such influential organizations include Bloomberg, MSCI, and Thomson Reuters.

By constructing indicators to quantify the impact of ESG, it has enabled extensive empirical research on ESG at the micro level. Gillan et al. (2021) found that most of the studies have confirmed that ESG can increase the core value of an enterprise and reduce the risks faced by the firm in its operations. Feng et al. (2022) investigate whether the main drivers of ESG evolution are the demands of the market and investors or the demands of the corporations themselves and conclude that ESG is negatively related to equity returns in the long run. The importance of ESG at the micro-firm level has been demonstrated, but ESG at the level of macroeconomic entities has been significantly under-researched. Gratcheva et al. (2021) suggest that a framework for ESG adapted to the sovereign context requires to be developed. Based on panel data from OECD members, Guo et al. (2021) constructs a sovereign ESG index using principal component analysis and explores the impact of sovereign ESG ratings on international trade. Some institutions have also started to develop assessment methodologies and index products for sustainable development of countries, such as MSCI. However, the current mainstream ESG systems are still constructed based on corporate ESG data. In general, progress in global sovereign ESG rating research remains at an early stage. There is currently no global standard for sovereign ESG assessment methodologies due to differences in the specific content of the ESG framework and index calculation methods between different institutions. As a result, some research on sovereign ESG has been limited to theoretical elaboration and policy analysis, rather than introducing the concept of sovereign ESG into the empirical analysis.

Therefore, this paper adopts the entropy weighting method to measure the sovereign ESG index of 171 countries around the world from 1990 to 2020 based on the relevant indicators from the World Bank's sovereign ESG database. The paper conducts a preliminary analysis of the calculated indexes by plotting the spatial distribution, the density distribution of different organizations, etc. and then derives the following conclusions: First, low-income countries focused their development on the economy in the early stages of globalization and invested a lower proportion in sustainable development, while countries with high economic levels tended to place more emphasis on ESG development. Second, China experienced a high growth rate in ESG after 2005, with the

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main contribution coming from the improvement of the governance pillar. Third, the top 10 countries in the 2020 Sovereign ESG Index have consistently maintained a sustainable growth momentum over the past 30 years. Fourth, Europe was the first region to start focusing on ESG development, with Africa consistently lagging behind other continents in terms of ESG level. This research aims to contribute a set of instrumental data reflecting the current status and evolution of global sovereign ESG development, and to provide an important reference for research related to sovereign ESG development and indicator system design.

The remainder of the paper is organized in the following manner. Section 2 describes the data sources and the methodology used in measuring the sovereign ESG index. Section 3 provides a preliminary analysis of the calculated index. Section 4 provides conclusions and policy implications and offers recommendations for subsequent sovereign ESG research.

2. Data and method

2.1. Data

To comprehensively assess the status and evolution of macro ESG development, this paper uses the World Bank's Sovereign ESG Database[1] and selects observational panel data for 171 countries worldwide over the period 1990 to 2020 as a sample from which to calculate a sovereign ESG index. The specific countries are shown in Appendix Table 1.

The World Bank has constructed a methodology and framework for sovereign ESG indicators but has not directly assigned a comprehensive sovereign ESG index. In contrast to the indicator systems developed by other institutions or experts, the World Bank's framework is more integrated and reasonable, as it spans three categories including environmental, social and governance and covers 17 core sustainability themes. The Environment pillar mainly focuses on internalizing environmental externalities arising from economic activity and includes issues such as sustainable energy access. As the Social pillar, it concerns the population's basic needs, equity, and poverty reduction, guaranteeing a country's long-term economic growth. The Governance pillar focuses more on issues such as government efficiency and social stability, and how to measure the capacity of a nation's economic, legal, and political systems and its ability to deal with social and environmental challenges. In accordance with the basic principle of systematicity, after balancing the significance and availability of indicators, this paper eliminates indicators with serious data deficiencies based on the World Bank's indicator system. Finally, it establishes a sovereign ESG indicator system consisting of 63 indicators.

2.2. Methods

Although the indicators of the different dimensions of sovereign ESG contain helpful information about a country's performance in a specific aspect of ESG, the usage of one indicator or one dimension of indicators alone might lead to a one-sided interpretation of the current situation of sovereign ESG development. Therefore, this paper synthesizes the World Bank's system of indicators for sovereign ESG data into a sovereign ESG index by referring to the methodology for calculating corporate ESG indices. Due to missing observations of sovereign ESG indicators from the World Bank, this paper first uses the mean-filling method based on panel data to supplement the missing observations before further analysis.

2.2.1. Indicator normalization

This paper next standardizes indicators that differ in character and unit of measure. Min-max normalization is a method that enables data to be fitted to predefined bounds (Patro and Sahu 2015). It is generally required that the standardization function chosen be strictly monotonic and independent to the indicator's positive or negative attributes. This paper classifies the indicators by subjective assignment. In particular, the indicators are classified into positive and negative groups according to their impact on ESG and the results of the assignment are presented in the. For positive indicators, the formula chosen is as below:

$$p = \frac{x - x_{min}}{x_{max} - x_{min}} (1)$$

Moreover, negative observations are normalized by:

$$p = \frac{x_{min} - x}{x_{min} - x_{max}} (2)$$

where x_{min} and x_{max} denote the minimum and maximum values of an indicator, respectively. In addition, we included a minimal bias in p to avoid the possible presence of zero values in the normalized data.

2.2.2. Entropy weight method

After data pre-processing and standardization of the indicators, the weights to synthesize the different indicators must be determined. This paper proceeds to adopt entropy weight method to identify the weights, which is an objective assignment method (Benedetto et al., 2016; Jin et al., 2020). The weights of each indicator are derived by the entropy weight method, and finally, the indicators are synthesized to obtain the ESG index. The entropy weight method is widely used in the field of comprehensive evaluation. Its fundamental principle in determining weights is to objectively assign weights according to the information entropy of an indicator. If the information entropy of an indicator is small, it shows the higher dispersion of the data and reflects the more significant amount of information it contains. Therefore, this indicator should be given a more enormous weight (Zhu et al., 2020). The entropy weight method avoids the subjective bias of hierarchical analysis and expert scoring methods, as well as the lack of information caused by principal component analysis (Zhao et al., 2018). With reference to the procedure of Liu et al. (2017), the entropy value of the k th indicator is defined below:

$$entropy_k = -\frac{1}{ln(q)} \sum_i \sum_j s_{ijk}\, ln\left(s_{ijk}\right) (3)$$

where $s_{ijk} = \frac{p_{ijk}}{\sum_i \sum_j p_{ijk}}$, and q represents the multiplication of the number of countries in the sample and the number of years observed, and p_{ijk} denotes the value of i th year, j th country, and k th indicator. Then the weight of the k th indicator is calculated by:

$$weight_k = \frac{utility_k}{\sum_k utility_k} (4)$$

where $utility_k = 1 - entropy_k$ denotes information utility value. The purpose of our calculation of information utility value is to make the initial calculation of the entropy value positively correlated with the indicator weights. Since in a statistical sense, the entropy value is negatively correlated with the amount of information. As a result, the weights of the indicators were calculated as shown in. After determining the indicator weights, the final composite sovereign ESG index for each country from 1990 to 2020 can be calculated using the following equation:

$$esg_{ij} = \sum_k weight_k p_{ijk} (5)$$

2.2.3. Kernel density estimation

Kernel density estimation (KDE) refers to the method of estimating unknown probability density functions by fitting observed data points using kernel functions (Graham et al., 2022; Kamalov, 2020). This article applies the Gaussian KDE approach to investigate the dynamics of the distribution of sovereign ESG development levels in different economic

[1] World Bank's Sovereign ESG Database: https://datatopics.worldbank.org/esg/framework.html.

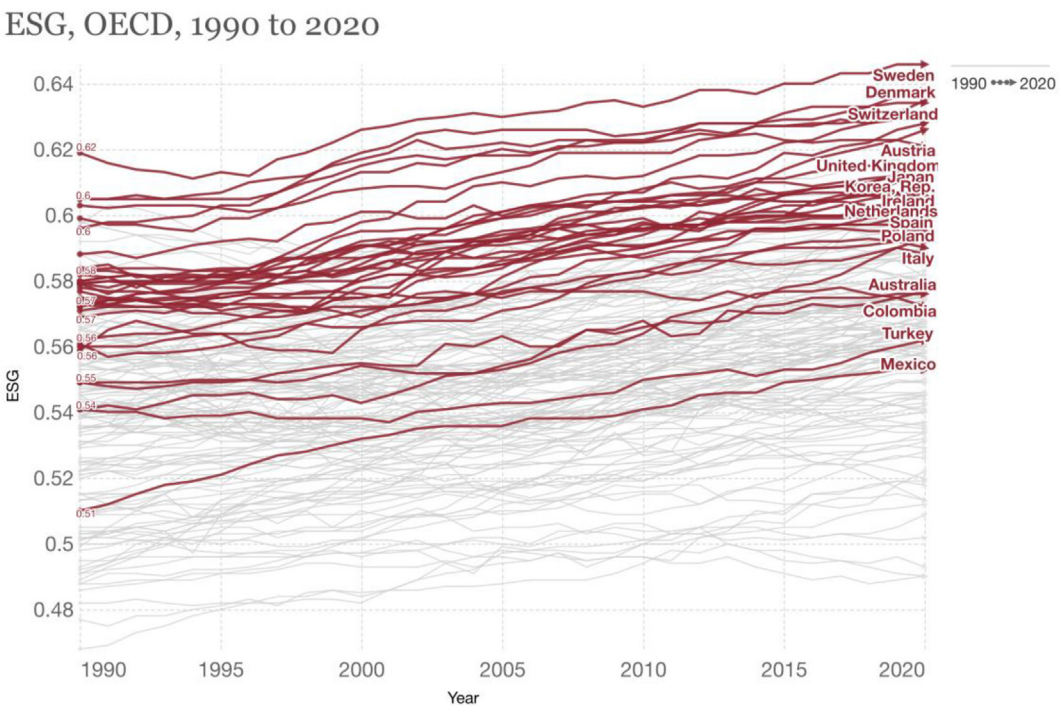

Fig. 1. The ESG Index for 171 countries from 1990 to 2020 (OECD members represented in red and non-OECD members in grey). Notes: The figure is powered by ourworldindata.org.

regions around the world. Let $(x_1, x_2, \ldots, x_n)$ be n sample points that are independently and identically distributed and the probability density function of which is f and b is the bandwidth. The specific formula for KDE is therefore

$$\widehat{f}(x) = \frac{1}{nb}\sum_{i=1}^{n} K\left(\frac{x - x_i}{b}\right) (6)$$

where $K(.)$ is the Gaussian kernel $K(y) = \frac{1}{\sqrt{2\pi}} e^{-\frac{y^2}{2}}$.

3. Results

Fig. 1 illustrates the evolution of the ESG Index for 171 countries over a period of 30 years, with the 38 members of the OECD represented in red and non-OECD countries in grey. In general, the sovereign ESG indices of the OECD member countries are trending upwards and are concentrated in the top half of the trend chart, with Sweden consistently leading the pack and Mexico, which had a low ESG score in 1990, but has also improved substantially over the 30-year period. The causal relationship between economic growth and ESG levels in OECD members has been widely discussed in academia. Naomi and Akbar (2021) suggests that better economic development discourages corruption and promotes improved ESG performance.

Fig. 2 depicts the evolution of the ESG index for the five permanent members of the United Nations from 1990 to 2020. These line charts illustrate the general upward trend of these five countries, with the UK, France, and the US maintaining steady growth in ESG levels and remaining in the top tier. While China and Russia lagged behind the first tier in terms of sustainable development until 2005, China's ESG line shifted dramatically after 2005 - its ESG index started to rapidly increase from 0.54 in 1990 to 0.6 in 2020 and surpassed that of the US in 2020, making China the first tier country after the UK and France. These achievements are attributed to the efforts made by China in the early 21st century to maintain rapid economic development, improve governance efficiency, enhance environmental conservation and curb ecological degradation.

The line chart in Fig. 3 illustrates the trend of the top ten countries in the world in 2020 (Sweden, Estonia, Luxembourg, Denmark, Finland, Iceland, New Zealand, Norway, Switzerland, and Austria) in terms of their sovereign ESG scores from 1990 to 2020. All ten countries exhibit strong sovereign ESG growth, with Sweden leading the ESG index; all but New Zealand, the other nine countries belong to Europe, which can be seen to be consistently at the forefront of the world in terms of sustainability. In the last 30 years, the European Union has established an extensive and rigorous system of environmental governance in Europe. Moreover, this system has been expanded to encompass the way in which environmental policy is decided within Europe, including the EU and each of its members (Weale et al., 2002).

Limited by space, this paper only demonstrates the spatial distribution of the sovereign ESG index in 1990 and 2020 and analyses the evolution of global ESG across three decades of time span. As shown in Fig. 4, the color scale is divided into five segments corresponding to the five ESG index classes of [0–0.52], [0.52–0.55], [0.55–0.57], [0.57–0.59] and [0.59-infinity], with darker colors signifying higher ESG indices for the country and grey areas denoting countries with missing data. In 1990, ESG development was generally weak globally, with Europe, such as Iceland, Norway, Finland, Sweden, Austria, Switzerland, and the Pacific region of New Zealand leading the way, with ESG indices above 0.59 in 1990 and remaining high in 2020. The US, Canada, and Costa Rica in North America, most countries in Europe, Brazil and Chile in South America, and China, South Korea, and Japan in Asia are among the top countries with sovereign ESG indices exceeding 0.59 in 2020. Among them, China has developed rapidly, jumping across two echelons from [0.52–0.55] to [0.59-infinity] within 30 years. Some African countries such as Libya, Egypt, Sudan, Ched, Somalia, Mauritania, and Yemen in the Arabian Peninsula are lagging behind in terms of ESG development, remaining at the same level as 30 years ago by 2020. Abernethy, Maisels, and White (2016) mentioned that Central Africa is still experiencing climate change and drought, deforestation, energy production, urbanization, and other environmental governance issues. These factors are constraining ESG development in Africa.

Having observed in our previous analysis that China's sovereign ESG levels evolved rapidly from 1990 to 2020, we used stacked bar charts to

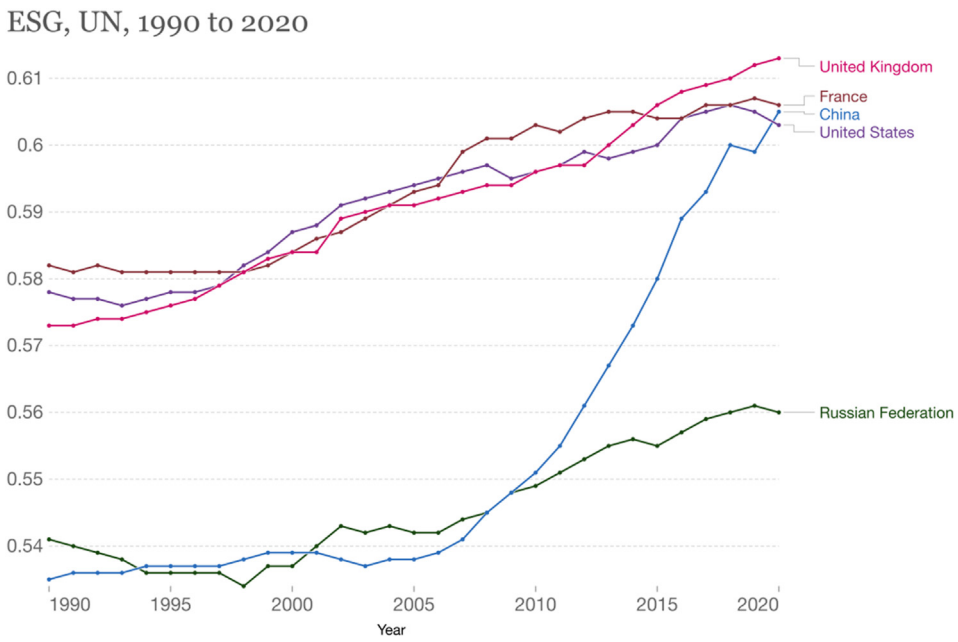

Fig. 2. ESG index for the five permanent members of the United Nations from 1990 to 2020. Notes: The figure is powered by ourworldindata.org.

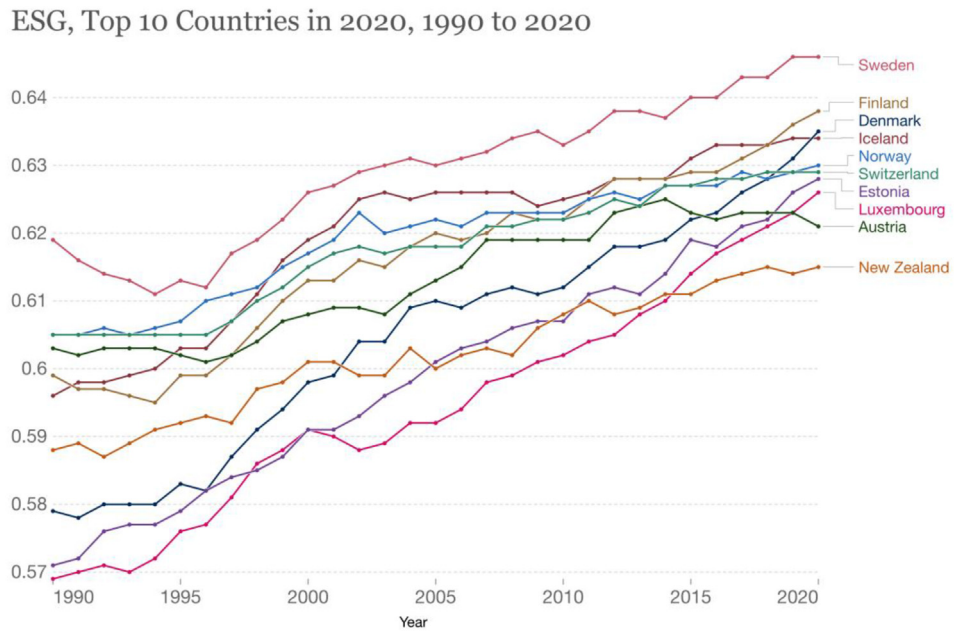

Fig. 3. The trend of the top 10 countries in the world in 2020. Notes: The figure is powered by ourworldindata.org.

plot the components of its sovereign ESG index - Environment, Society, and Governance - separately, and then analyzed the specific trends in these component scores. As shown in Fig. 5, the index for the Environment remained stable, the score for Society grew slightly, while the score for Governance displayed a clear pattern of growth. Jiao et al. (2015) indicate that the relationship between corporate technological innovation and legal environment in China is moderated by government ownership, with a significant positive effect.

Fig. 6 presents six characteristic economic categories based on different divisions for comparison and analysis of the dynamics of the distribution of sovereign ESG development levels for each group of countries from 1990 to 2020. As can be viewed in Fig. 6 a, the distribution of OPEC members has only one dominant peak from 1990 to 2020, with a stable position at [0.50–0.58], indicating a slow ESG transition in OPEC countries. Crude oil exporters, especially OPEC countries, might endure tougher regimes of energy transition than other countries due to the high dependence of their economies on crude oil revenues (Onifade et al., 2021). As illustrated in Fig. 6b and Fig. 6 c, the kernel density distribution of high and low-income groups has been created for cross observation, based on the UN income classification criteria. Before 2000, the extent of ESG development in low-income countries varied considerably. After 2000, the low-income group appears polarized, with the main peak at 0.52 and a lateral front at 0.48 with a leftward trend, probably due to some low-income countries

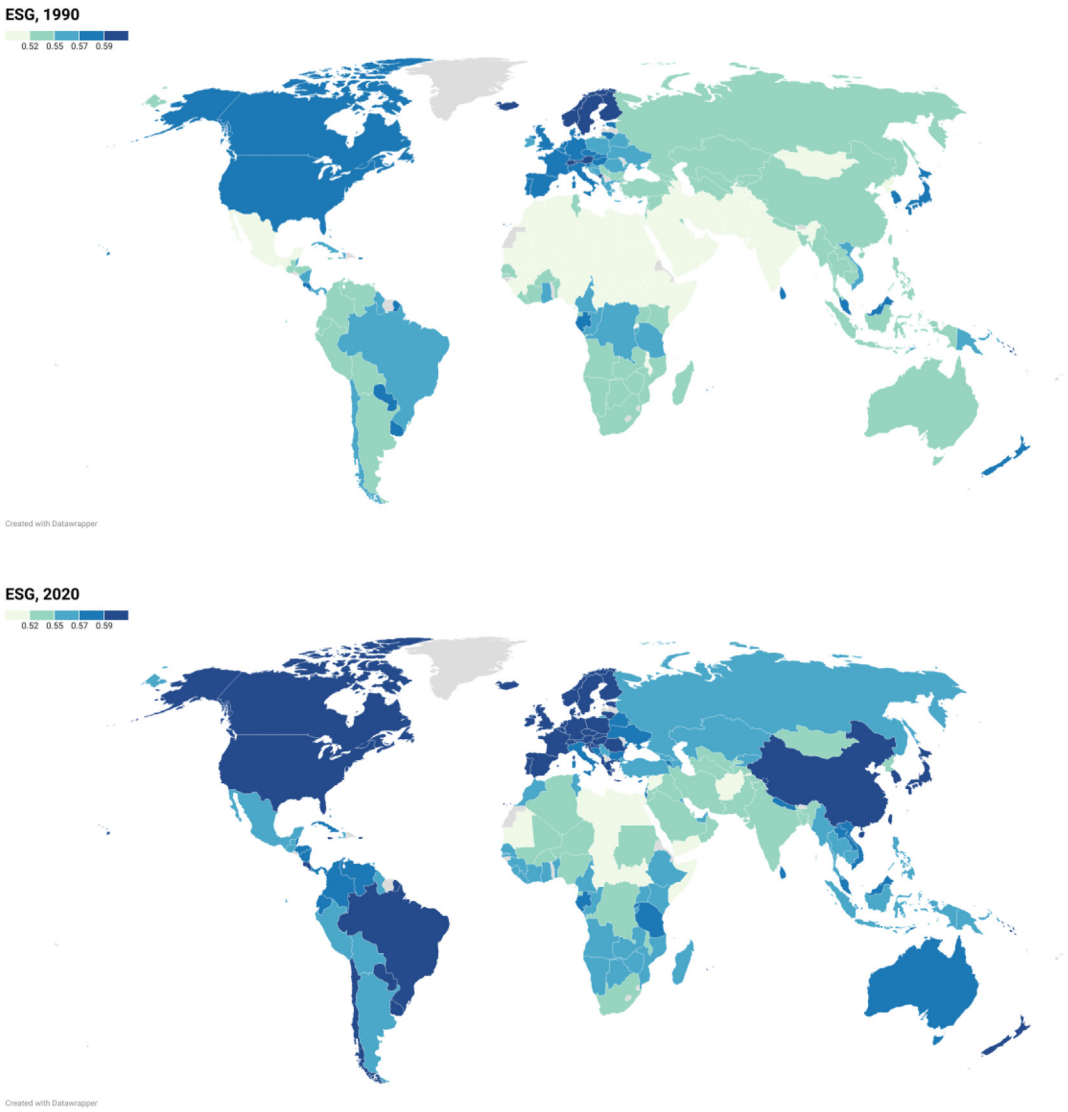

Fig. 4. The geography distribution of the sovereign ESG index in 1990 and 2020. Notes: The figure is created with Datawrapper.

prioritizing economic development at the expense of ESG development. After 2010, the extremes converge towards the middle, with global integration driving the growth of low-income countries and also their ESG development. ESG levels in high-income countries were seriously polarized in 1990, with the main peak at 0.58 and two lateral fronts at 0.52 and 0.62 respectively. The right drag-tail and left drag-tail tended to converge towards the middle after 2000, indicating that high-income countries began to raise their ESG development levels at a certain stage of economic development. Panayotou (2000) believes that there is not a constant relationship between a country's economic progress and environmental quality. This relationship changes when the country's income rises to a level at which it can afford more efficient infrastructure and a cleaner environment. As Fig. 6 d shows, the ESG development of Shanghai Cooperation Organization (SCO) members suffers from a severe polarization in 1990–1992, with the main peak at 0.57. Since then, the ESG level of SCO has converged to 0.54, indicating that the development of SCO countries was not focused around ESG during the early stages of globalization. The early period of unplanned expansion and laissez-faire economic activity in industrialized countries has been replaced by the boom in collective urban environmental management in cities. In contrast, this process is decelerating in many developing countries due to the pressures and priorities of economic globalization. As the volume of consumers and their expectations increase, cities in developing countries are exacerbating the degradation of natural systems (McMichael, 2000). These are being reflected in the changing dynamics of ESG distribution. As Fig. 6 e illustrates, the ESG distribution of OECD members in 1990 displayed a four-peaked structure and the concentration of the ESG index in most countries was 0.95. After 1995 there was a gradual divergence, with the ESG index becoming higher in some countries and lower in others, indicating a disagreement within the OECD on the direction of development. Fig. 6 f depicts the dynamics of the distribution of the ESG index for 171 countries worldwide. As can be observed from the year-on-year upward pattern of the main peak of the distribution curve, global ESG levels are evolving.

4. Conclusion

This paper contributes an instrumental set of data to evaluate the current status and evolution of global sovereign ESG development for subsequent studies by using the entropy weight method to construct a sovereign ESG index based on observed panel data for 171 countries worldwide from 1990 to 2020 as a sample. The preliminary data analysis led to the following conclusions: First, low-income countries focused their development on the economy in the early stages of globalization

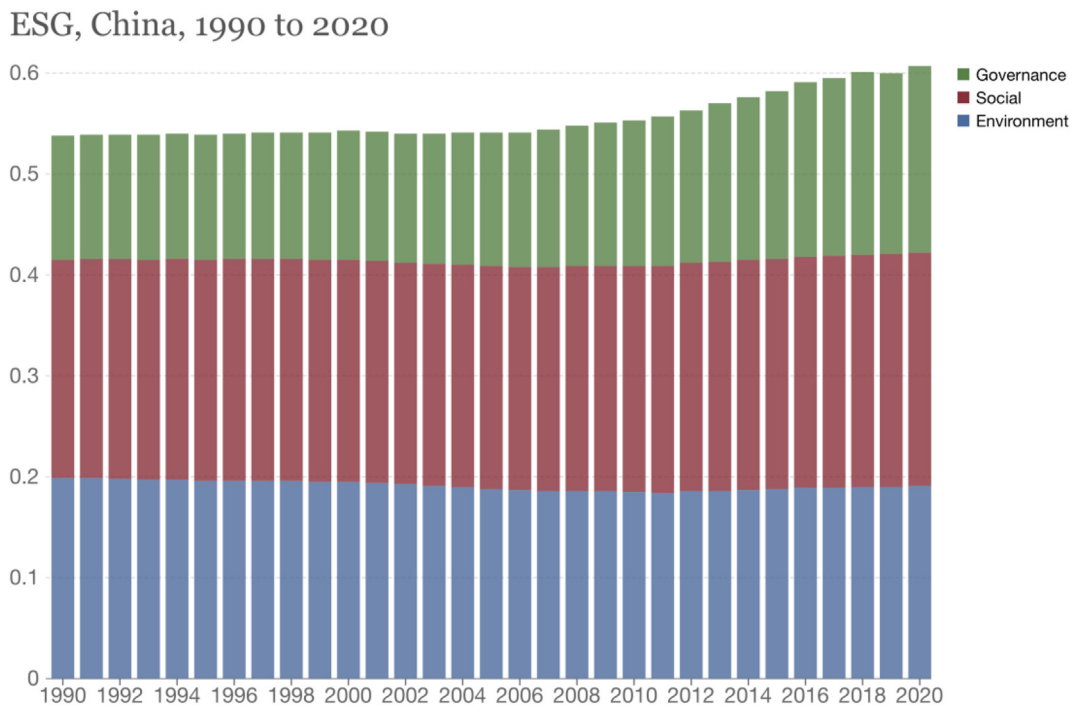

Fig. 5. Stacked bar of China's sovereign ESG from 1990 to 2020. Notes: The figure is powered by ourworldindata.org.

and invested a lower proportion in sustainable development, while countries with high economic levels tended to place more emphasis on ESG development. Second, China experienced a high growth rate in ESG after 2005, with the main contribution coming from the improvement of the governance pillar. Third, the top 10 countries in the 2020 Sovereign ESG Index have consistently maintained a sustainable growth momentum over the past 30 years. Fourth, Europe was the first region to start focusing on ESG development, with Africa consistently lagging behind other continents in terms of ESG level.

Given the results derived above, this paper proposes the following three policy recommendations for the development of global sovereign ESG. First, "How to realize the industrialization process?" is one of the crucial issues for African countries and other low-income countries. If governments focus heavily on the 'E' and exclude all fossil fuel investments, the 'S' will probably be affected, and it will take longer to lift people out of poverty. African governments must therefore trade off between the three components of the ESG strategy they adopt. This paper recommends that African governments integrate ESG analysis into their decision-making process, using abundant natural or human capital to attract responsible investors and promote socio-economic development. Second, governments in developed countries or countries with high levels of ESG should take on a more vital social responsibility to integrate ESG awareness into their investments abroad to promote global sustainable development. Third, the Chinese government has made significant progress in the 'G', while changes in other areas have been less visible. Given the global consensus on sustainable development, the Chinese government should establish and improve an institutionalized ESG framework and align it with international standards to provide a theoretical basis for comprehensive ESG improvement.

There are still some limitations to this paper that could be expanded upon in future research in the following areas. Firstly, this paper only measures sovereign ESG using the entropy weight method. Therefore, other methods such as principal component analysis are available for re-measurement in subsequent studies to guarantee the reliability of the results. Secondly, this article only provides a measure of sovereign ESG countries without further exploring its drivers, which is one of the directions for our follow-up research. Finally, this paper has only selected data from 171 economies worldwide for measurement, and there are some countries that are missing, which can be subsequently included in the sample for re-measurement.

Declaration of competing interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

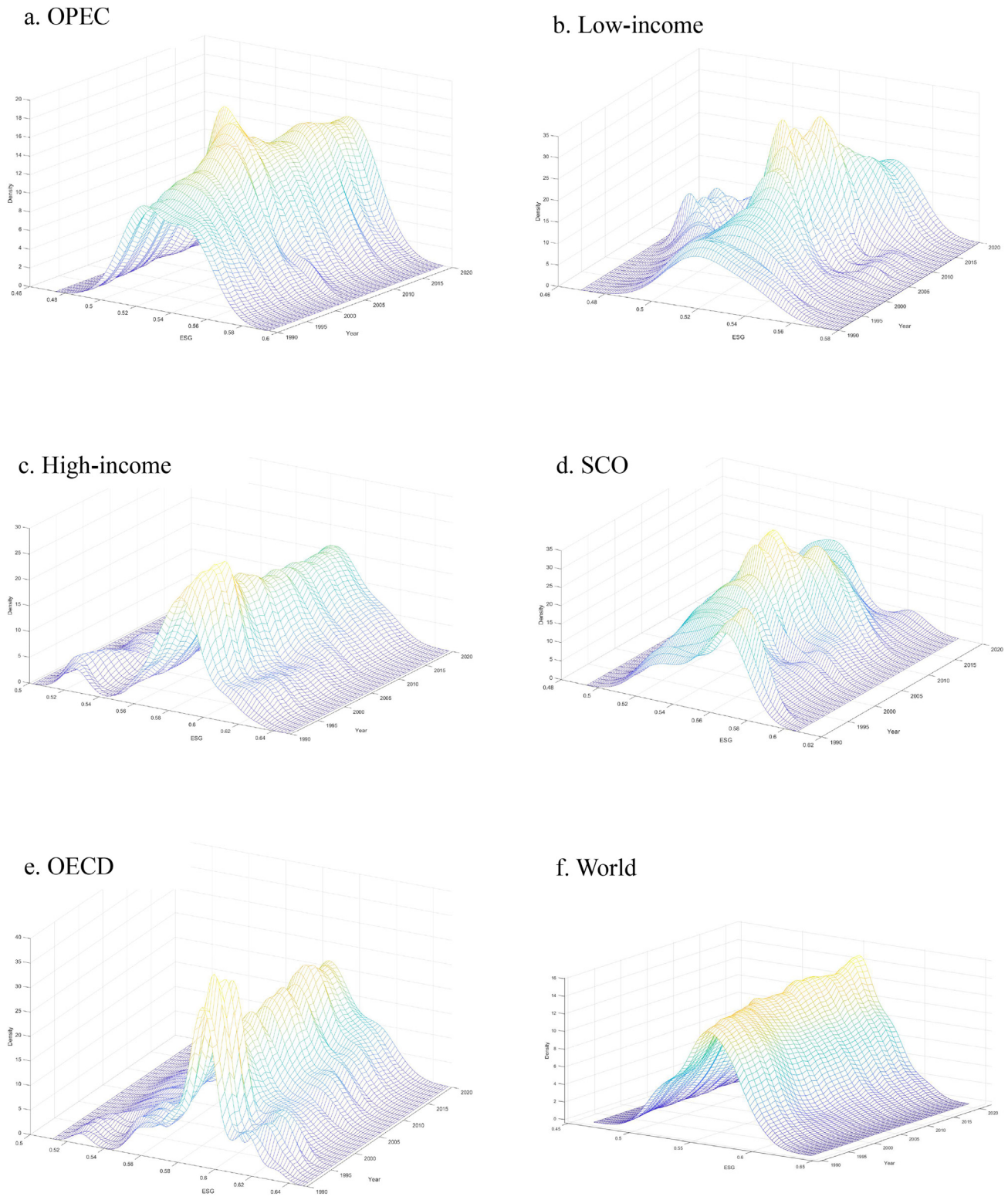

Fig. 6. Density distribution of different organizations or categories. Notes: The *x*-axis of this series of graphs is ESG index, the *y*-axis is the year from 1990 to 2020, and the *z*-axis is the density of the distribution, with larger density representing a higher concentration of countries at ESG score equal to x and year equal to y.

Appendix

Table A1
171 countries and mean of ESG from 1990 to 2020

Country	Mean of ESG	Country	Mean of ESG	Country	Mean of ESG
Sweden	0.629	Malaysia	0.568	Angola	0.544
Iceland	0.620	Nepal	0.567	Kazakhstan	0.544
Norway	0.619	Bulgaria	0.567	Congo, Dem. Rep.	0.543
Switzerland	0.617	Cabo Verde	0.567	Tonga	0.543
Finland	0.616	Samoa	0.566	Serbia	0.542
Austria	0.613	Mozambique	0.566	Azerbaijan	0.542
Denmark	0.605	Nicaragua	0.566	Namibia	0.541
New Zealand	0.602	Marshall Islands	0.565	Kenya	0.541
Estonia	0.599	Tanzania	0.565	Nauru	0.541
Japan	0.597	Maldives	0.563	Guinea	0.539
Uruguay	0.597	Honduras	0.562	Uganda	0.539
Germany	0.597	Jamaica	0.562	Kuwait	0.539
Luxembourg	0.595	Belarus	0.562	Burkina Faso	0.538
Netherlands	0.595	Brunei Darussalam	0.561	Rwanda	0.537
Slovenia	0.594	Cuba	0.561	Gambia	0.537
Costa Rica	0.594	Australia	0.560	Mexico	0.535
France	0.593	Israel	0.560	Senegal	0.535
Dominica	0.593	Ghana	0.559	Morocco	0.534
Andorra	0.592	Micronesia	0.559	Ethiopia	0.534
United States	0.591	Ukraine	0.559	Lebanon	0.534
United Kingdom	0.591	Venezuela	0.559	Syrian Arab Republic	0.534
Canada	0.591	Georgia	0.558	Cote d'Ivoire	0.533
Portugal	0.590	Kyrgyz Republic	0.557	Uzbekistan	0.533
South Korea	0.589	Guyana	0.557	Turkmenistan	0.533
St. Vincent	0.588	Colombia	0.557	Bangladesh	0.532
Lithuania	0.588	Ecuador	0.557	Sierra Leone	0.531
St. Kitts and Nevis	0.587	Timor-Leste	0.556	Botswana	0.531
Hungary	0.587	Cambodia	0.556	Equatorial Guinea	0.531
Spain	0.587	Congo, Rep.	0.555	Nigeria	0.530
Belgium	0.586	Myanmar	0.555	South Africa	0.530
Slovakia	0.585	Armenia	0.555	United Arab Emirates	0.530
Solomon Islands	0.585	Lao PDR	0.554	Malawi	0.529
Czech Republic	0.582	Bolivia	0.554	North Korea	0.528
Paraguay	0.581	Sao Tome and Principe	0.554	Tajikistan	0.527
Romania	0.580	Bosnia and Herzegovina	0.553	India	0.525
Bahamas	0.580	China	0.553	Mali	0.524
Ireland	0.579	Haiti	0.553	Qatar	0.522
Italy	0.579	Cameroon	0.553	Jordan	0.521
Croatia	0.579	Trinidad and Tobago	0.553	Saudi Arabia	0.520
Montenegro	0.578	Burundi	0.552	Oman	0.520
Cyprus	0.576	Argentina	0.552	Pakistan	0.516
Gabon	0.576	Guatemala	0.552	Sudan	0.516
Vietnam	0.575	Philippines	0.551	Mongolia	0.515
Chile	0.575	Zambia	0.550	Iran	0.515
Brazil	0.575	Liberia	0.550	Algeria	0.515
Antigua and Barbuda	0.575	Thailand	0.550	Bahrain	0.513
Poland	0.575	Comoros	0.549	Central African Republic	0.511
Belize	0.574	Tuvalu	0.549	Niger	0.507
Greece	0.574	Benin	0.549	Mauritania	0.506
Panama	0.573	Tunisia	0.547	Egypt	0.500
St. Lucia	0.572	Peru	0.547	Somalia	0.500
Albania	0.572	Indonesia	0.547	Libya	0.498
Mauritius	0.572	Papua New Guinea	0.547	Chad	0.497
Malta	0.571	Madagascar	0.546	Iraq	0.495
Monaco	0.570	Russian Federation	0.546	Afghanistan	0.494
Sri Lanka	0.570	Zimbabwe	0.546	Yemen	0.492
Singapore	0.568	Turkey	0.545	South Sudan	0.489

Table A2
Sovereign ESG Data Framework

Category	Theme	Indicator	Sign(±)	Weight
Environment Pillar (23) (37.82%)	Emissions & pollution (5)	CO2 emissions (metric tons per capita)	−1	1.39%
		GHG net emissions/removals by LUCF (Mt of CO2 equivalent)	−1	1.39%
		Methane emissions (metric tons of CO2 equivalent per capita)	−1	1.37%
		Nitrous oxide emissions (metric tons of CO2 equivalent per capita)	−1	1.40%
		PM2.5 air pollution, mean annual exposure (micrograms per cubic meter)	−1	1.45%
	Natural capital endowment & management (6)	Adjusted savings: natural resources depletion (% of GNI)	−1	1.36%
		Adjusted savings: net forest depletion (% of GNI)	−1	1.38%
		Annual freshwater withdrawals, total (% of internal resources)	−1	1.38%
		Forest area (% of land area)	1	2.50%
		Mammal species, threatened	−1	1.40%
		Terrestrial and marine protected areas (% of total territorial area)	1	1.38%
	Energy use & security (7)	Electricity production from coal sources (% of total)	−1	1.42%
		Energy imports, net (% of energy use)	−1	1.45%
		Energy intensity level of primary energy (MJ/$2017 PPP GDP)	−1	1.36%
		Energy use (kg of oil equivalent per capita)	−1	1.39%
		Fossil fuel energy consumption (% of total)	−1	1.79%
		Renewable electricity output (% of total electricity output)	1	1.73%
		Renewable energy consumption (% of total final energy consumption)	1	3.08%
	Environment/climate risk & resilience (2)	Droughts, floods, extreme temperatures (% of population, average 1990–2009)	−1	1.47%
		Population density (people per sq. km of land area)	−1	1.37%
	Food security (3)	Agricultural land (% of land area)	1	2.02%
		Agriculture, forestry, and fishing, value added (% of GDP)	1	2.69%
		Food production index (2014–2016 = 100)	1	1.66%
Category	Theme	Indicator	Sign(±)	Weight
Social Pillar (22) (32.77%)	Education & skills (3)	Government expenditure on education, total (% of government expenditure)	1	1.40%
		Literacy rate, adult total (% of people ages 15 and above)	1	1.43%
		School enrollment, primary (% gross)	1	1.36%
	Employment (3)	Children in employment, total (% of children ages 7–14)	−1	1.38%
		Labor force participation rate, total (% of total population ages 15–64) (modeled ILO estimate)	1	1.62%
		Unemployment, total (% of total labor force) (modeled ILO estimate)	−1	1.46%
	Demography (3)	Fertility rate, total (births per woman)	−1	1.56%
		Life expectancy at birth, total (years)	1	1.44%
		Population ages 65 and above (% of total population)	−1	1.48%
	Health & nutrition (5)	Cause of death, by communicable diseases and maternal, prenatal and nutrition conditions (% of total)	−1	1.70%
		Mortality rate, under-5 (per 1000 live births)	−1	1.42%
		Prevalence of overweight (% of adults)	−1	1.62%
		Prevalence of undernourishment (% of population)	−1	1.39%
		Hospital beds (per 1000 people)	1	1.40%
	Poverty & Inequality (4)	Annualized average growth rate in per capita real survey mean consumption or income, total population (%)	1	1.54%
		GINI index (World Bank estimate)	−1	1.38%
		Income share held by lowest 20%	1	1.39%
		Poverty headcount ratio at national poverty lines (% of population)	−1	1.41%
	Access to services (4)	Access to clean fuels and technologies for cooking (% of population)	1	1.91%
		Access to electricity (% of population)	1	1.48%
		People using safely managed drinking water services (% of population)	1	1.55%
		People using safely managed sanitation services (% of population)	1	1.45%
Category	Theme	Indicator	Sign(±)	Weight
Governance Pillar (18) (29.40%)	Human rights (2)	Strength of legal rights index (0 = weak to 12 = strong)	1	1.36%
		Voice and Accountability: Estimate	1	1.60%
	Government effectiveness (2)	Government Effectiveness: Estimate	1	1.57%
		Regulatory Quality: Estimate	1	1.57%
	Stability & rule of law (4)	Control of Corruption: Estimate	1	1.54%
		Net migration	−1	1.37%
		Political Stability and Absence of Violence/Terrorism: Estimate	1	1.49%
		Rule of Law: Estimate	1	1.43%
	Economic environment (3)	Ease of doing business rank (1 = most business-friendly regulations)	1	2.07%
		GDP growth (annual %)	1	1.36%
		Individuals using the Internet (% of population)	1	2.28%
	Gender (4)	Proportion of seats held by women in national parliaments (%)	1	1.37%
		Ratio of female to male labor force participation rate (%) (modeled ILO estimate)	1	1.60%
		School enrollment, primary and secondary (gross), gender parity index (GPI)	1	1.37%
		Unmet need for contraception (% of married women ages 15–49)	−1	1.37%
	Innovation (3)	Patent applications, residents	1	3.21%
		Research and development expenditure (% of GDP)	1	1.38%
		Scientific and technical journal articles	1	1.46%

Notes: The Sovereign ESG Data Framework is derived from the World Bank. Sign(±) denotes the fundamental attribute of the indicator. Indicators with Sign equal to +1 are positively correlated with sovereign ESG and indicators with sign equal to −1 are negatively correlated with sovereign ESG. Weight represents the weight of each indicator calculated by the entropy weight method.

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