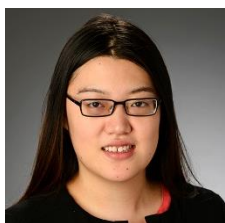


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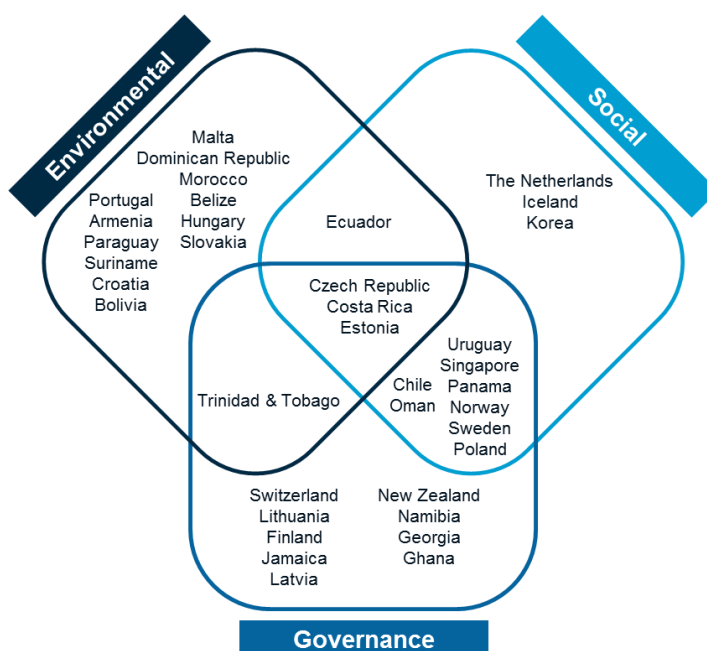
Yi Lu,
Analyst,
Global Macroeconomic Research

Our Sovereign ESG Framework

Environmental, Social, and Governance (ESG) issues are increasingly being recognized as important factors for socio-economic development and stability. Against this background, this paper outlines the methodology underlying PGIM Fixed Income's framework for assessing countries' ESG performance. It finds that developed market (DM) countries tend to outperform their emerging market (EM) peers who in turn tend to outperform frontier market (FM) countries. These results strongly suggest that ESG performance largely reflects considerable income disparities across these cohorts. Therefore, any meaningful performance analysis needs to be done within a country's relevant income cohort.

Furthermore, when we adjust for income discrepancies across these peer groups, some FM countries tend to fare better than expected while most of ESG outperformers tend to be in DM Europe. A grouping of positive ESG outliers is shown in the following diagram. Our ESG assessment serves as an integral input into PGIM Fixed Income's sovereign ratings framework and our investment process.¹ As such, it provides another critical input to achieving our mission of generating superior, risk-adjusted returns.

POSITIVE ESG OUTLIERS



A Systematic Approach

Any framework to assess ESG-related qualities needs to balance the objective of providing a comprehensive and consistent assessment with the challenges of data availability and reliability. Such constraints can quickly become binding when attempting to measure intangible variables, such as good governance or tolerance and social inclusiveness. At the same time, proper variable selection is critical to ensure that the rank sufficiently captures meaningful differences in ESG performance.

These considerations call for a systematic approach. PGIM Fixed Income has developed a proprietary index that provides an ESG-based ranking of countries, referred to as PGIM Fixed Income's ESG Rank. The index methodology closely follows the approach underlying the construction of PGIM Fixed Income's Fundamental Macro Rank (FMR). This rank compares macroeconomic strengths and vulnerabilities across different cohorts of countries.²

ESG Rank—A Synopsis of Methodological Considerations

- **Constructing a meaningful ESG Rank:** Following the methodology used for the FMR, a non-parametric approach is used to construct our ESG Rank, given the inherent difficulty in aggregating data on issues as diverse as longevity and governance. Under this approach, no normative assumption is placed on what constitutes an appropriate value for any of the chosen ESG indicators. Instead, for any indicator, countries are ranked on their performance relative to the chosen peer group. Furthermore, the variables that underlie our ESG rank do not all follow a single statistical distribution and, therefore, no statistical properties are imposed on the sample. Instead, our non-parametric approach aggregates data “from good to bad” based on each ESG variable’s relative rank within the sample. In other words, a country’s ESG rank is a relative concept that is highly likely to change—possibly to a considerable extent—if its cohort changes.
- **Selecting relevant information to construct meaningful rankings for the three individual variables, namely E, S, and G:** Upon an extensive review of the literature, numerous challenges in index construction became readily apparent, beginning with data availability, timeliness of data, as well as the highly specialized expertise needed to construct meaningful indices. These issues were particularly pronounced in regard to E and S, and somewhat less so for G. The variables underlying our ESG framework are all chosen from well-conceived academic datasets and policy studies. However, rather than importing these datasets in their entirety, we have stripped out any data overlap and limited cross-correlations to the extent possible. The following table shows the categories under the three individual variables that were used to construct the rankings.

² For a comprehensive discussion of PGIM Fixed Income's sovereign ratings methodology, please see “PGIM Fixed Income's Sovereign Ratings Framework,” by Gerwin Bell and Jürgen Odenius, February 2014.

PGIM FIXED INCOME ESG

| Environmental | Social | Governance |
|---|--|---|
| <ul style="list-style-type: none"> ▶ Air quality ▶ Water and Sanitation ▶ Climate and Energy ▶ Biodiversity and Habitat | <ul style="list-style-type: none"> ▶ Nutrition and Basic Medical Care ▶ Personal Safety ▶ Access to Basic Knowledge ▶ Access to Information and Communications ▶ Health and Wellness ▶ Tolerance and Inclusion | <ul style="list-style-type: none"> ▶ Voice and Accountability ▶ Political Stability and Absence of Violence ▶ Government Effectiveness ▶ Regulatory Quality ▶ Rule of Law ▶ Control of Corruption |

- We identified the **Environmental Performance Index (EPI)** as both comprehensive and meaningful. After some 15 years of considerable academic work, the latest vintage of the EPI resulted from a collaboration of researchers at Yale University, Columbia University, and the World Economic Forum.³ Based on a host of underlying indicators, the EPI measures environmental health and ecosystem vitality. Environmental health measures the protection of human health from environmental harm, while ecosystem vitality measures ecosystem protection and resource management. “These two objectives are further divided into nine issue categories that span high-priority environmental policy issues, including air quality, forests, fisheries, and climate and energy, among others. The issue categories are extensive but not comprehensive.”⁴ However, in order to achieve a certain parsimony of the framework, we test for correlation and eliminate those variables underlying the EPI that exhibit high correlations with the variables selected for S and G. As a result, we end up choosing four variables from the EPI data set and rank countries for each one of these variables from “good” to “bad.” Aggregating these variables, we derive an overall country rank for sub-index E.
- The **Social Progress Index (SPI)**⁵ is an academic initiative that is spearheaded by Michael Porter at Harvard Business school. It provides a wealth of information on social development, such as (i) basic human needs; (ii) foundations of well-being; and (iii) opportunity. These sub-indices comprise variables that tend to measure social well-being, be it in the form of nutrition, medical care and health, safety, personal rights and educational opportunities. Some of the variables underlying the SPI measure environmental quality and sustainability. Again, to avoid any overlap between indicators underlying S and E, these variables and other highly-correlated variables are stripped out from the SPI data set. As a result, there are six variables that are used to build a sub-index for S.
- Despite well-known criticism, the **Worldwide Governance Indicators (WGI)** are widely recognized as a primary data source for governance issues.⁶ The World Bank collects these indices in collaboration with the Brookings Institution and the Natural Resource Governance Institute. Based on a large number of underlying variables, these indices provide country rankings for six categories, namely (i) voice and accountability; (ii) political stability and absence of violence; (iii) government effectiveness; (iv) regulatory quality; (v) rule of law; and (vi) control of corruption.⁷ Equally weighting these six sub-indices, we construct a headline index in order to arrive at country rank for G.

³ Specifically, the Yale Center for Environmental Law and Policy (YCELP) and the Center for International Earth Science Information Network (CIESIN) at Columbia University, in collaboration with the Samuel Family Foundation and the World Economic Forum.

⁴ See appendix for EPI detailed categories. Additional information can be found at <http://epi.yale.edu/our-methods>.

⁵ See appendix for SPI detailed categories. Additional information can be found at <http://www.socialprogressimperative.org/global-index>.

⁶ For an overview of the criticism of the WGI, see “The Worldwide Governance Indicators Project: Answering the Critics,” World Bank, March 1, 2007..

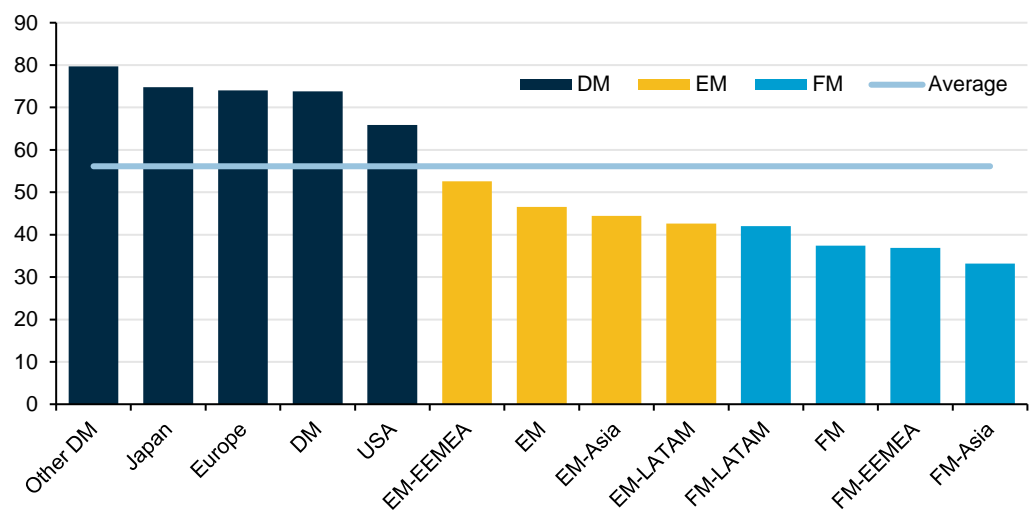
⁷ See <http://info.worldbank.org/governance/wgi/index.aspx#home>.

Following the methodological considerations outlined in the preceding box, a set of carefully chosen indicators is selected to construct our ESG rank. In order to avoid any subjective biases, the three E, S, and G sub-indices are equally weighted. For every one of the underlying indicators, countries' performance is ranked from high to low. A country's overall rank results from the aggregation across all indicators. It is important to note that—despite best efforts to achieve a meaningful selection—our selection of indicators continues to evolve in order to further improve the comprehensiveness of the exercise, data availability permitting.

ESG Rank—Key Findings

Chart 1 shows relative ESG rankings. The rank is normalized, and the higher a country's rank, the better its ESG performance. Not surprisingly, DM tends to outperform EM, and, in turn, EM tends to outperform FM. As shown in Chart Panel 1, these findings broadly carry over to the performance on the E, S, and G sub-index level.

CHART 1:
ESG PERFORMANCE

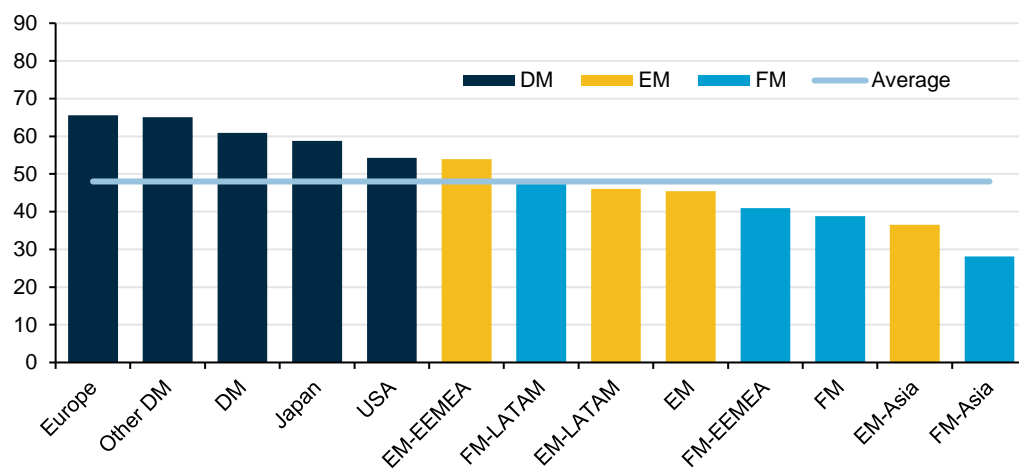


Source: PGIM Fixed Income, Yale EPI, World Bank WGI, Social Progress Imperative

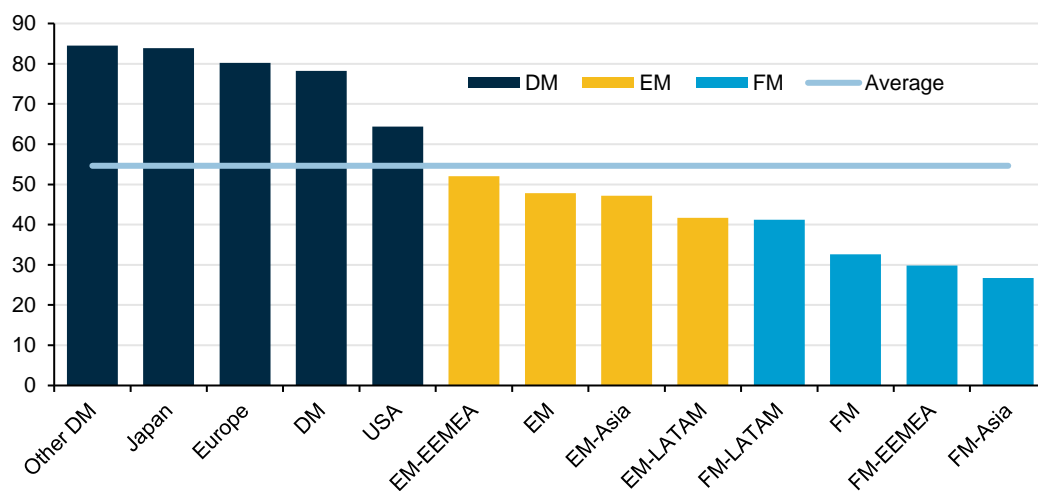
The following stands out as far as EMs and FMs are concerned:

- Emerging Eastern Europe, Middle East, and Africa (EM-EEMEA) outperforms Emerging Latin America (EM-LATAM) and Emerging Asia (EM-Asia) on all three sub-indices. Furthermore, EM LATAM fares relatively poorly on governance issues.
- Understandably, the FMs tend to rank at the bottom of the scale. In particular, the FMs in Asia trail their FM peers, whereas FMs in Latin America tend to outperform.
- EM Asia underperforms its EM peers on environmental issues, mainly due to underperformance in air quality.

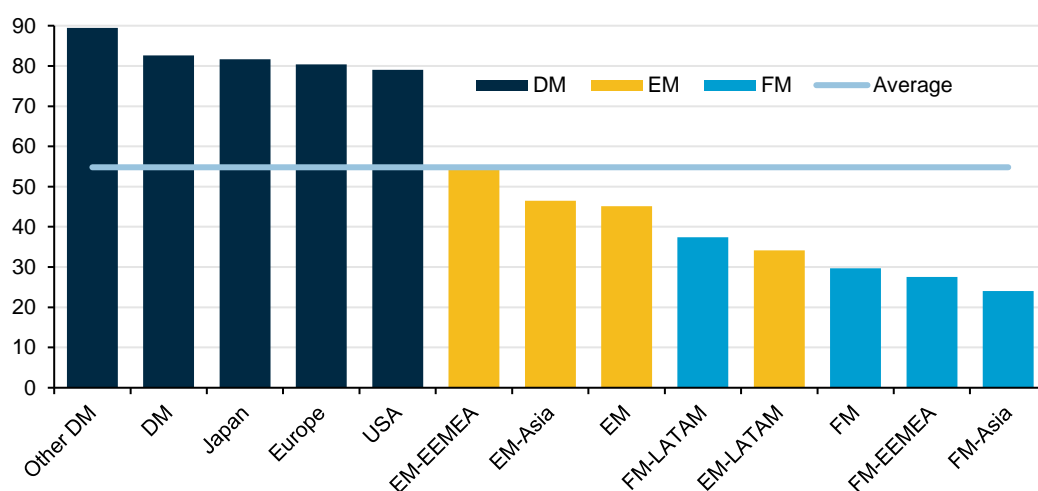
Chart Panel 1: ESG Performance Overview

CHART 1A:
ENVIRONMENT
RANK

Source: PGIM Fixed Income, Yale EPI

CHART 1B:
SOCIAL
RANK

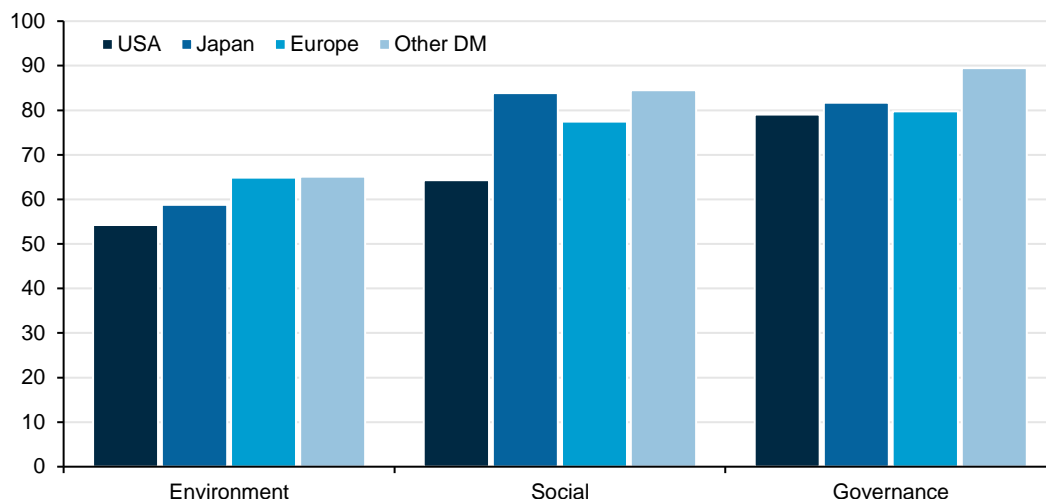
Source: PGIM Fixed Income, Social Progress Imperative

CHART 1C:
GOVERNANCE
RANK

Source: PGIM Fixed Income, World Bank WGI

Within DM, Europe is broadly on par with Japan, but outperforms the U.S., as shown in Chart 2. While there is limited differentiation as far as governance is concerned, the U.S. underperforms on several social indicators. Europe also outperforms the U.S. and Japan on environmental issues.

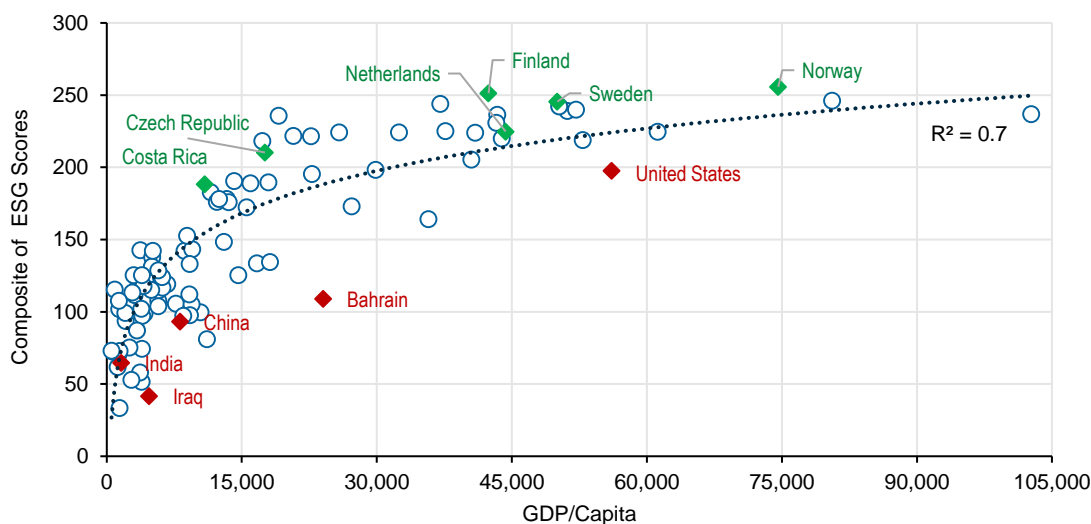
**CHART 2:
DEVELOPED
MARKET ESG**



Source: PGIM Fixed Income, Yale EPI, World Bank WGI, Social Progress Imperative

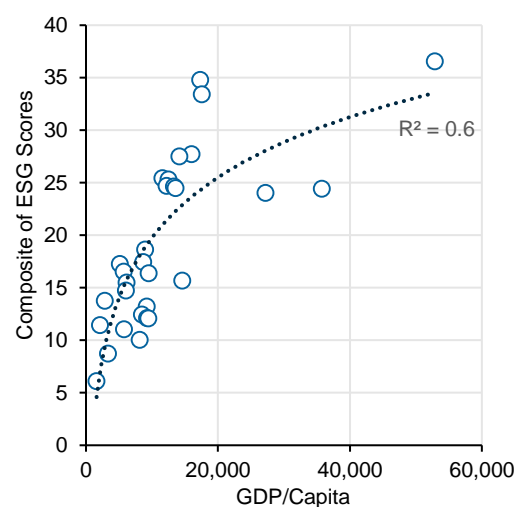
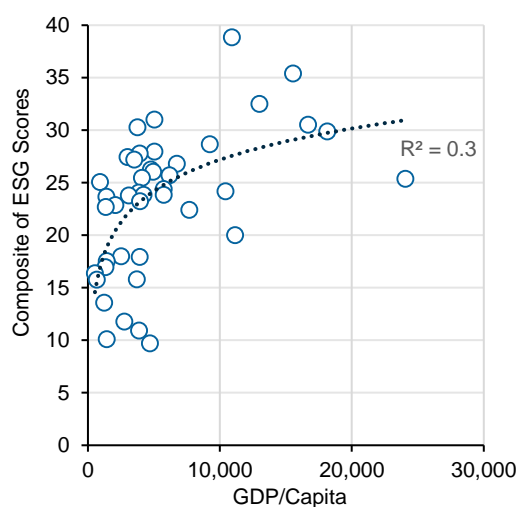
The pronounced concentration of DMs at the top of the ranking points to the importance of institutions, consistent with the long-term relations stressed by Acemoglu and Robinson.⁸ Indeed, this is one reason why ESG matters to investors, as higher long-term growth and development improve sustainable returns. It is therefore not surprising that there is a close correlation between per-capita income and ESG rankings, as shown in chart 3 below. Interestingly, ESG performance is most variable across the FM countries, suggesting that progress with institution building is highly uneven.

**CHART 3:
ALL COUNTRIES:
ESG
PERFORMANCE
AND PER CAPITA
GDP**



⁸ See Daron Acemoglu and James Robinson: "Why Nations Fail: Origins of Power, Poverty and Prosperity," Crown Publishers (Random House), March 2012.

CHARTS 4 AND 5:
FM (L) AND EM (R):
ESG
PERFORMANCE
AND PER CAPITA
GDP



Source: PGIM Fixed Income and Haver Analytics

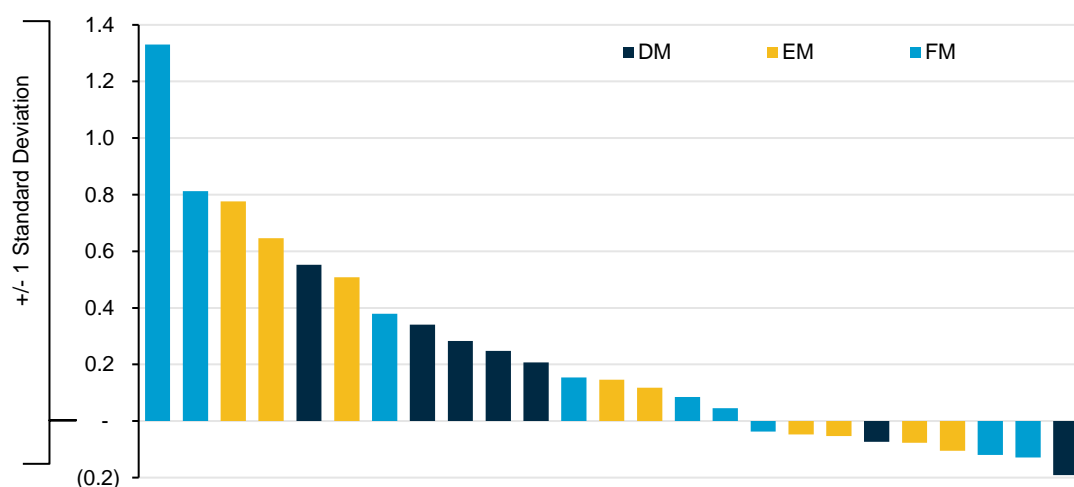
Income Cohorts and ESG Performance

The high correlation between per-capita GDP and ESG performance provides an interesting angle on the latter. It suggests to measure performance within distinct income cohorts. For the purpose of this exercise, we follow conventional practice and group countries into DM, EM, and FM as a proximate mapping into per-capita income. While strictly speaking, not all high-income countries are designated as DMs, and this grouping has the additional advantage of following conventions underlying the investable universe.

It turns out that the results are distinctly richer when taking income differences into account. In particular, as shown in chart 6, FMs are exhibiting the highest performance variance. This suggests that there prevails a high variance in making good use of scarce resources, with some FMs putting their limited means to remarkably good use. In contrast, some others exhibit a high degree of ineffectiveness, thereby creating substantial opportunity costs in terms of lower-than-attainable quality of life, as captured by ESG indicators.

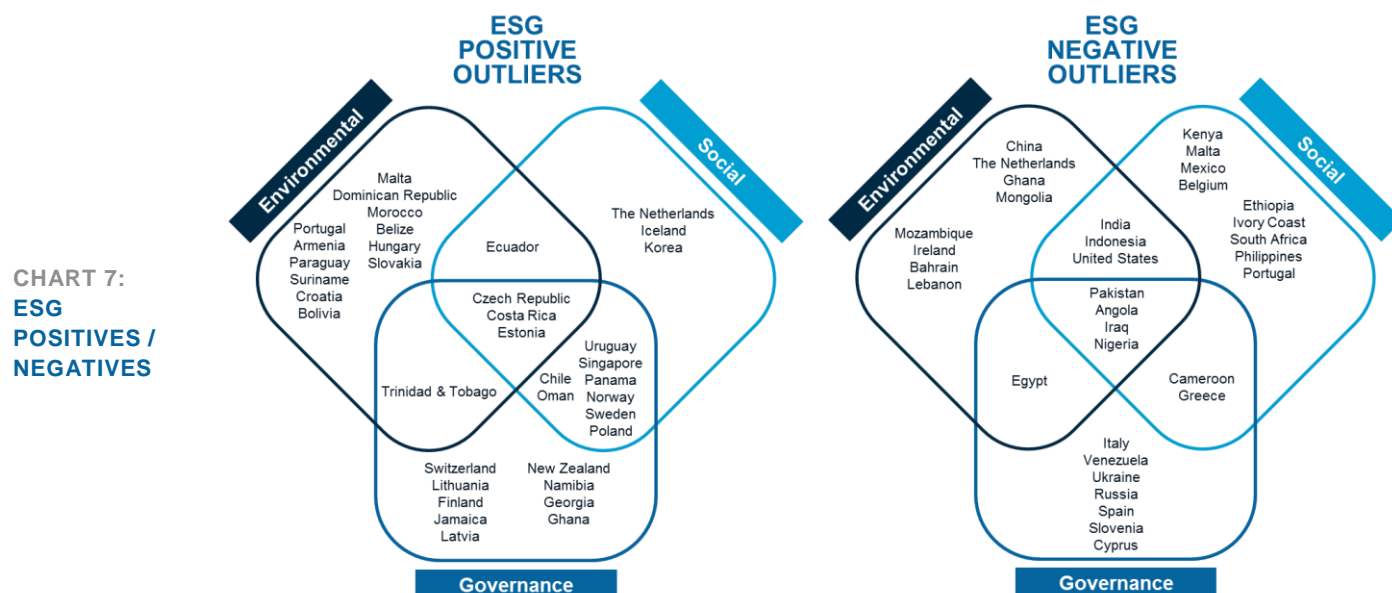
As far as the DMs are concerned, the variance of their ESG performance is distinctly lower than for the EMs and FMs. While this reflects an advanced standard, any deviation from this standard has turned select DMs into statistical outliers.

CHART 6:
ESG PERFORMANCE
OUTLIERS



Source: PGIM Fixed Income, Yale EPI, World Bank WGI, Social Progress Imperative. Outliers exhibit deviations from the cohort's mean of at least one standard of deviation.

Based on three respective income cohorts, chart 7 identifies positive outliers on the left and underperforming outliers on the right.⁹ Out of an overall sample of about 100 countries, there are 37 countries that are positive outliers for one or more of the three ESG variables. The European countries stand out as strong performers, with 19 countries outperforming at least on one variable and five European countries outperforming on two variables. Costa Rica, Estonia and Czech Republic outperform on all three variables, as shown in chart 7.



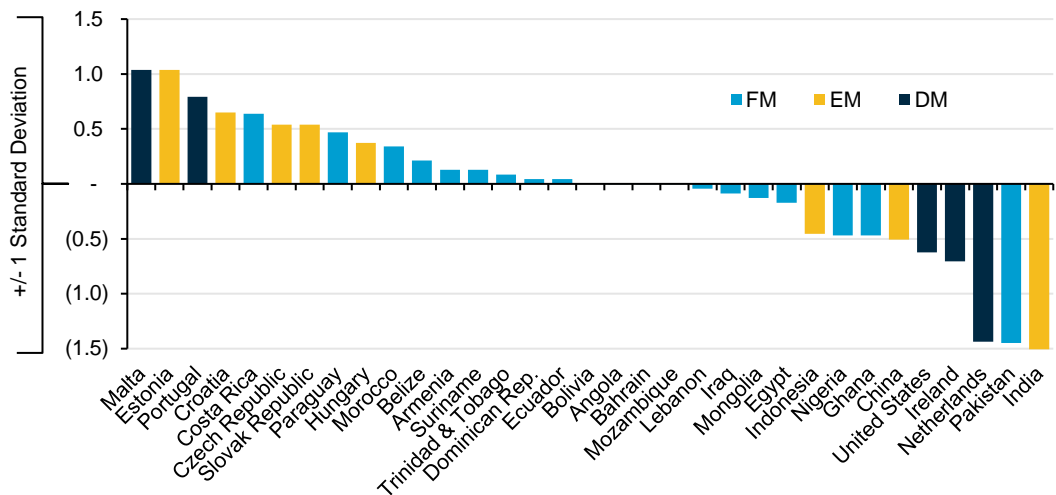
Source: PGIM Fixed Income, Yale EPI, World Bank WGI, Social Progress Imperative

Likewise, there are 34 countries that are underperformers for one or more of the three ESG variables. Among the European countries, Ireland and the Netherlands underperform in terms of the environment, while Greece, Italy, Slovenia, Cyprus and Spain underperform on governance issues. It is noteworthy that the U.S. underperforms on social and environmental issues, in part reflecting a high incidence of obesity and tree cover loss. Pakistan, Angola, Iraq and Nigeria underperform on all three variables. India and Indonesia both underperform on E and S. Governance issues are also pronounced in Cameroon, Egypt, Russia, Ukraine, and Venezuela. Chart panel 2 provides the underpinnings for these results.

⁹ Within any income cohort, outliers exhibit deviations from the cohort's mean of at least one standard of deviation.

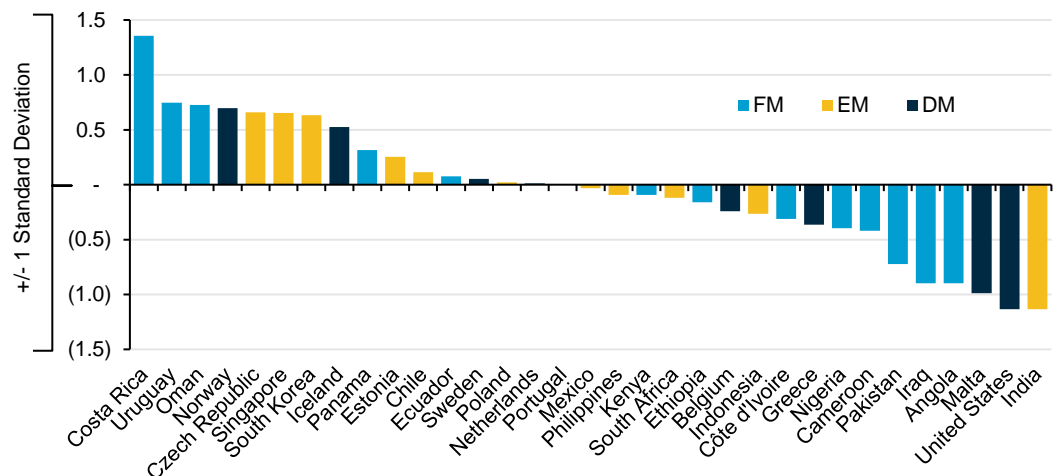
Chart Panel 2: ESG Performance Outliers

**CHART 2A:
ENVIRONMENTAL
PERFORMANCE
OUTLIERS**



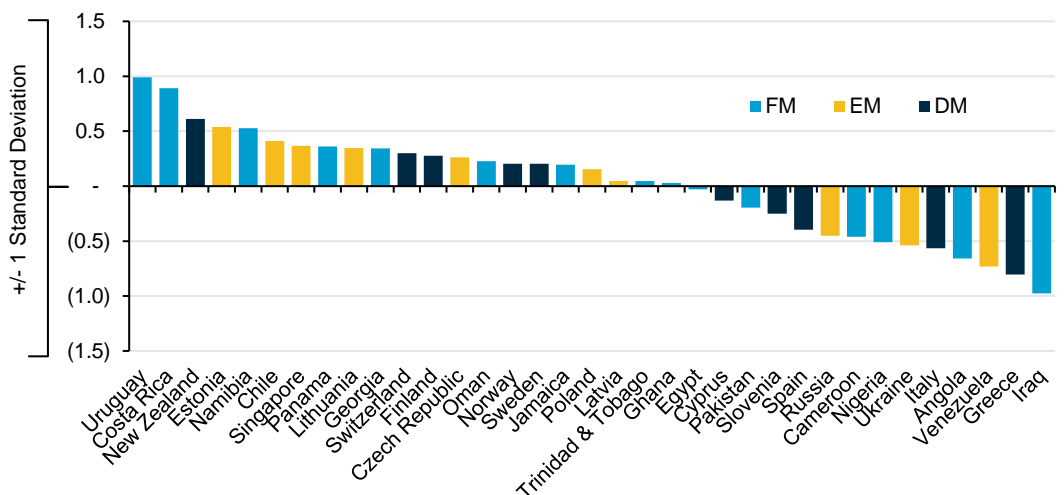
Source: PGIM Fixed Income, Yale EPI, World Bank WGI, Social Progress Imperative. Outliers exhibit deviations from the cohort's mean of at least one standard of deviation.

**CHART 2B:
SOCIAL
PERFORMANCE
OUTLIERS**



Source: PGIM Fixed Income, Yale EPI, World Bank WGI, Social Progress Imperative. Outliers exhibit deviations from the cohort's mean of at least one standard of deviation.

**CHART 2C:
GOVERNANCE
OUTLIERS**



Source: PGIM Fixed Income, Yale EPI, World Bank WGI, Social Progress Imperative. Outliers exhibit deviations from the cohort's mean of at least one standard of deviation.

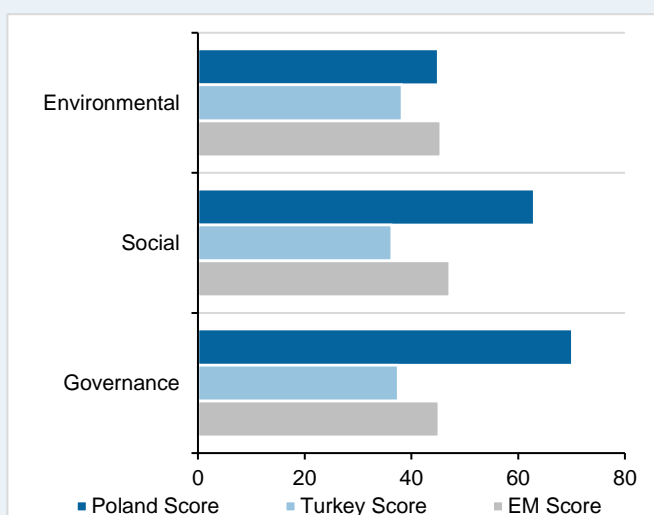
Country Analysis—ESG Performance

PGIM Fixed Income's ESG framework allows for a detailed analysis of the specific factors driving a country's ESG performance. As an illustrative example, the charts below compare the performance of Poland, an outperformer in EM-EEMEA, with that of Turkey, an underperformer. The charts below provide a break-down of the sub-indices into their constituent variables.

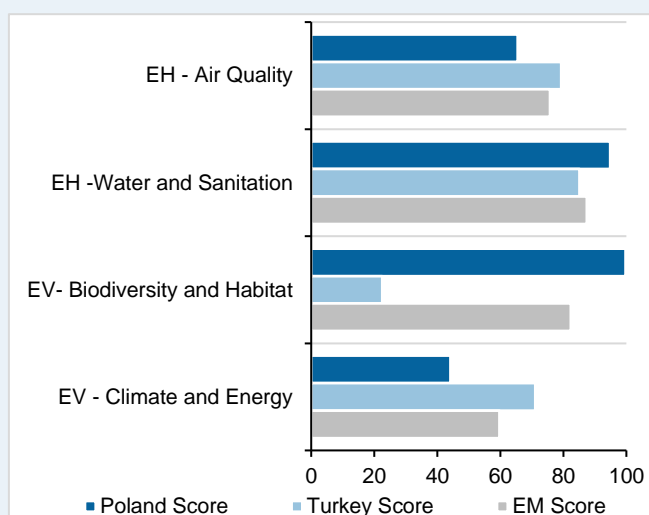
- It turns out that the performance gap is highest as far as governance issues are concerned, including for voice and accountability issues as well as those for political stability.
- Social performance in Turkey also trails that of Poland by a significant margin, in large part reflecting personal safety issues and tolerance issues.
- As far as the environment is concerned, overall performance does not deviate significantly across Poland and Turkey, although there are some significant differences on the variable level, including for biodiversity.

Poland vs Turkey—ESG Performance

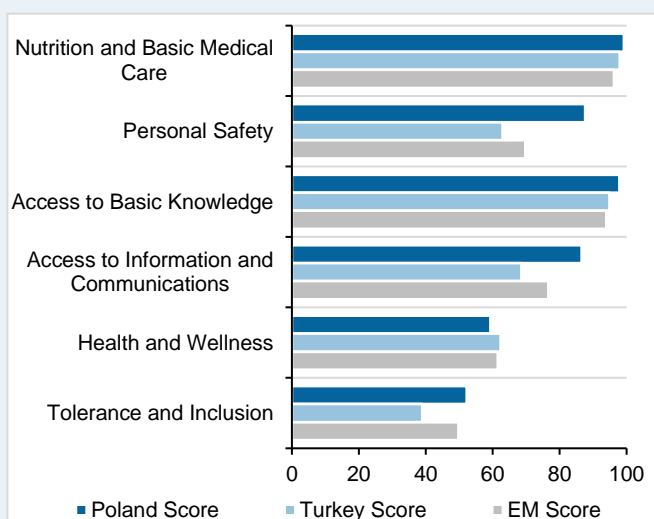
ESG



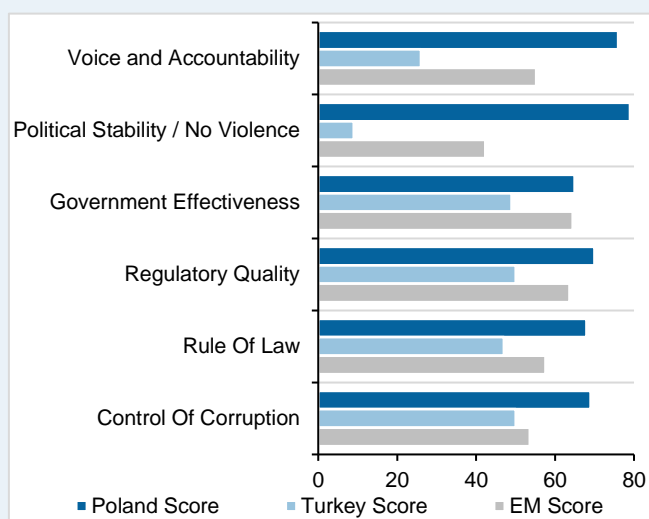
Environment



Social



Governance



Source: PGIM Fixed Income

ESG Rankings and Sovereign Ratings

ESG considerations, especially governance considerations, have always been part and parcel of our sovereign ratings framework. In an attempt to build on these efforts, our ESG Rank now provides a framework that formalizes our ESG assessment across some 100 sovereigns that we currently rate. As discussed in an earlier paper, our ratings framework is comprised of a quantitative model and a qualitative assessment. Similar to the ESG ranking, the quantitative model devises a sovereign macro rank, based on countries' fundamental macroeconomic strengths and vulnerabilities.

Ever mindful of the fact that the underlying quantitative framework is unlikely to capture all relevant information in a sufficiently forward looking way, a qualitative assessment is introduced to complement the quantitative exercise. This pillar focuses on relevant qualitative aspects that drive policy making, namely pertinent institutional, social, and governance aspects. It is here where PGIM Fixed Income's ESG Rank enters and informs our qualitative assessment and, therefore, our sovereign ratings.

Conclusions

ESG issues have long been recognized as important factors for socio-economic stability. To the extent possible, our ESG framework provides a comprehensive and consistent basis for assessing countries' ESG performance. It turns out that ESG performance is strongly correlated with the overall degree of development, as approximated by per-capita income. In other words, DMs tend to exhibit a stronger ESG performance than EMs and, in turn, EMs tend to show a stronger performance than FMs. This result strongly suggests that building reliable institutions, providing good governance, enhancing social welfare all while protecting the environment is a tall order and requires putting substantial resources to good use.

However, when assessing ESG performance within cohorts of comparable income, we find that the "performance bias" of the DMs tends to disappear, although European countries still tend to score fairly highly. In particular, some of the FMs are among the positive outliers, in contrast to common skepticism towards this asset class. In this context, Costa Rica stands out as outperforming on all three of the ESG criteria.

Although ESG considerations have consistently entered our sovereign ratings process, this ESG framework allows us to formalize our approach and to systematically include ESG assessments into our ratings process. That said, we remain mindful of the many challenges involved in drawing meaningful ESG conclusions and will carefully monitor the performance of our framework and make further adjustments as needed.

1. DM Country Outliers by Category¹⁰

| ENVIRONMENTAL | | |
|-----------------|-----------------|---|
| Above | Below | Comments |
| Malta | | Score on average exposures to NO2 is above average. |
| Portugal | | Nitrogen balance is above average. |
| | Ireland | Nitrogen balance underperforms peer group. |
| | The Netherlands | Fish stock score is below average. |
| | United States | Tree cover loss trails average. |
| SOCIAL | | |
| Above | Below | Comments |
| Iceland | | Child mortality rate trends above average. |
| Norway | | Obesity rate outperforms peer group. |
| Sweden | | Gender parity in secondary enrollment outperforms peer group. |
| The Netherlands | | Obesity rate outperforms peer group. |
| | Belgium | Higher suicide rate relative to peer group. |
| | Greece | Religious tolerance underperforms peer group. |
| | Malta | Obesity rate underperforms peer group. |
| | Portugal | Gender parity in secondary school is below average. |
| | United States | Obesity rate underperforms peer group. |
| GOVERNANCE | | |
| Above | Below | Comments |
| Finland | | Political stability outperforms peer group. |
| New Zealand | | Political stability outperforms peer group. |
| Norway | | Political stability outperforms peer group. |
| Sweden | | Political stability trends above average. |
| Switzerland | | Political stability trends above average. |
| | Spain | Regulatory quality trails average. |
| | Slovenia | Regulatory quality trails average. |
| | Cyprus | Government effectiveness trails average. |
| | Italy | Control of corruptions underperforms peer group. |
| | Greece | Political stability trails average. |

¹⁰ Countries outperforming by at least one standard deviation denotes as "above/below". No denotation for countries whose scores are within one standard deviation.

2. EM Country Outliers by Category

| ENVIRONMENTAL | | |
|-----------------|--------------|--|
| Above | Below | Comments |
| Croatia | | Tree cover loss outperforms peer group. |
| Czech Republic | | Czech Republic outperforms on all ESG scores. |
| Estonia | | Estonia outperforms on all ESG scores. |
| Hungary | | Species protection outperforms peer group. |
| Slovak Republic | | Species protection trends above average. |
| | China | Air pollution—average exposure to PM2.5 underperforms peer group. |
| | Indonesia | Tree cover loss underperforms peer group. |
| | India | Air pollution—average exposure to PM2.5 trails average. |
| SOCIAL | | |
| Above | Below | Comments |
| Chile | | Level of violent crime outperforms peer group. |
| Czech Republic | | |
| Estonia | | |
| Poland | | Discrimination & violence against minorities outperforms peer group. |
| Singapore | | Tolerance for immigrants outperforms peer group. |
| South Korea | | Press freedom index outperforms peer group. |
| | Indonesia | Tolerance for immigrants trails peer group. |
| | India | Community safety net trails peer group. |
| | Mexico | Religious tolerance trails average. |
| | Philippines | Premature deaths from non-communicable diseases trails average. |
| | South Africa | Deaths from infectious diseases underperforms peer group. |
| GOVERNANCE | | |
| Above | Below | Comments |
| Chile | | Level of political stability outperforms peer group. |
| Czech Republic | | |
| Estonia | | |
| Latvia | | Political stability trends above average. |
| Lithuania | | Political stability trends above average. |
| Poland | | Political stability trends above average. |
| Singapore | | Political stability trends above average. |
| | Ukraine | Political stability trails average. |
| | Venezuela | Regulatory quality underperforms peer group. |
| | Russia | Control of corruptions underperforms peer group. |

3. FM Country Outliers by Category

| ENVIRONMENTAL | | |
|--------------------|---------------|--|
| Above | Below | Comments |
| Armenia | | Tree cover loss outperforms peer group. |
| Belize | | Nitrogen balance trends above average. |
| Bolivia | | Household air quality outperforms peer group. |
| Costa Rica | | Costa Rica outperforms peer group in each category. |
| Dominican Republic | | Fish stocks outperforms peer group. |
| Ecuador | | Tree cover loss outperforms peer group. |
| Suriname | | Tree cover loss trends above average. |
| Morocco | | Fish stocks outperforms peer group. |
| Paraguay | | Nitrogen balance outperforms peer group. |
| Trinidad & Tobago | | Species protection outperforms peer group. |
| | Angola | |
| | Bahrain | Nitrogen use efficiency trails average. |
| | Egypt | Air pollution—average exposure to PM2.5 trails peer group. |
| | Ghana | Access to sanitation is below average. |
| | Iraq | |
| | Lebanon | Score on marine protected areas underperforms peer group. |
| | Mongolia | Nitrogen use efficiency underperforms peer group. |
| | Mozambique | Household air quality underperforms peer group. |
| | Nigeria | |
| | Pakistan | |
| SOCIAL | | |
| Above | Below | Comments |
| Costa Rica | | |
| Ecuador | | Secondary school enrollment outperforms peer group. |
| Oman | | Discrimination & violence against minorities outperforms peer group. |
| Panama | | Perceived criminality outperforms peer group. |
| Uruguay | | Undernourishment outperforms peer group. |
| | Angola | |
| | Cameroon | Maternal mortality rate underperforms peer group. |
| | Côte d'Ivoire | Maternal mortality rate underperforms peer group. |
| | Ethiopia | Undernourishment trails peer group. |
| | Iraq | |
| | Kenya | Maternal mortality rate underperforms peer group. |
| | Nigeria | |
| | Pakistan | |
| GOVERNANCE | | |
| Above | Below | Comments |
| Costa Rica | | |
| Georgia | | Control of corruptions outperforms peer group. |
| Ghana | | Press freedom is above average. |
| Jamaica | | Press freedom trends above average. |
| Namibia | | Political stability outperforms peer group. |
| Oman | | Political stability outperforms peer group. |
| Panama | | Political stability outperforms peer group. |
| Trinidad & Tobago | | Political stability outperforms peer group. |
| Uruguay | | Political stability outperforms peer group. |
| | Cameroon | Control of corruptions underperforms peer group. |
| | Egypt | Political stability trails peer group. |
| | Angola | |
| | Nigeria | |
| | Pakistan | |
| | Iraq | |

Notes

Notice: Important Information

Source(s) of data (unless otherwise noted): PGIM Fixed Income as of April 2017.

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