Scaling Up Private Climate Finance in Emerging Market and Developing Economies: Challenges and Opportunities—Online Annex

Online Annex 2.1. Data Sources and Description

Online Table 2.1.1. Data Description and Sources

Variable	Description	Source
Sustainability-linked loan	Loan instruments where borrowers set a contractual target for the achievement of a sustainability goal (e.g., greenhouse gas emission [GHG] reduction).	Bloomberg Finance L.P.
Sustainability-linked bond	Bond instruments where issuing entities set a contractual target for the achievement of a sustainability goal (e.g., greenhouse gas emission reduction).	Bloomberg Finance L.P.
Sustainability bond	Bond instruments where proceeds are to be used for a combination of green and social projects.	Bloomberg Finance L.P.
Social bond	Bond instruments where proceeds are to be used for social projects (e.g., building of affordable housing).	Bloomberg Finance L.P.
Green loan	Loan instruments where proceeds are to be used for projects intended to deliver a positive environmental impact (e.g., renewable energy, green buildings).	Bloomberg Finance L.P.
Green bond	Bond instruments where proceeds are to be used for projects intended to deliver a positive environmental impact (e.g., renewable energy, green buildings).	Bloomberg Finance L.P.
Sustainable Instrument	Financial instruments including sustainability-linked loan, sustainability-linked bond, sustainability bond, social bond, green loan, and green bond.	Bloomberg Finance L.P.
Territorial GHG Emission	Total territorial emissions of Kyoto greenhouse gas excluding land use, land use change, and forestry in gigaton (Gt) CO2 equivalent. Territory-based emissions, or production emissions, are those that take place within a country's territorial boundaries and include exports but omit imports.	Eora Global Supply Chain Database; PRIMAP-hist
GDP	Gross domestic product in US dollars.	WEO Database
Maturity	The initial length of time that will be taken by the borrower/issuer to repay the loan/bond.	Bloomberg Finance L.P.; IMF staff calculations
Private sustainable bond	Sustainable bonds issued by financial institutions and nonfinancial companies in the industrial, renewable energy, and utilities sectors.	Bloomberg Finance L.P.; IMF staff calculations
Sovereign sustainable bond	Sustainable bonds issued by central government.	Bloomberg Finance L.P.; IMF staff calculations
Other government-related sustainable bond	Sustainable bonds issued by agencies and local authorities, as well as covered bonds.	Bloomberg Finance L.P.; IMF staff calculations
Environmental sector fund equity	A fund is labeled an “environmental sector fund” when its strategies invest in environmentally oriented industries, such as renewable energy or water.	Morningstar

Environmental impact fund equity	A fund is labeled an environmental impact fund when its strategies intend to invest in companies with a positive environmental record or are specifically involved in industries that positively impact the environment. This also includes strategies that invest in securities whose use of proceeds contributes to positive environmental impact.	Morningstar
Low-carbon/fossil-fuel-free fund equity	A fund is labeled a low-carbon/fossil-fuel-free fund when its strategies seek to make a measurable impact through their investments in or tilt toward companies with small or decreasing carbon footprints or low carbon risk, and/or through avoidance of or reduced exposure to fossil fuels.	Morningstar
Total EMDEs fund equity	Total equity assets under management allocated to emerging market and developing economies (EMDEs) for funds in the sample.	Morningstar
Total AEs fund equity	Total equity assets under management allocated to advanced economies (AEs) for funds in the sample.	Morningstar
Mitigation climate finance flow	An activity classifies as "mitigation climate flow" if it contributes to reducing or avoiding GHG emissions or enhances GHG sequestration through the enhancement of sinks and reservoirs.	Climate Policy Initiative (2021)
Adaptation climate finance flow	An activity classifies as “adaptation climate flow” if it aims to reduce the vulnerability of human or natural systems to the impacts of climate change and climate-related risks, by maintaining or increasing adaptive capacity and resilience.	Climate Policy Initiative (2021)
Private mitigation/adaptation climate finance flows	Mitigation/adaptation climate finance flows to private recipients, which refer to privately owned companies (including finance institutions, privately owned special purpose vehicles, non-governmental organizations), etc.	Climate Policy Initiative (2021)
Public: multilateral DFIs mitigation/adaptation climate finance flows	Mitigation/adaptation climate finance flows to public multilateral development finance institutions’ (DFIs’) recipients.	Climate Policy Initiative (2021)
Public: others mitigation/adaptation climate finance flows	Mitigation/adaptation climate finance flows to public recipients other than multilateral DFIs (including commercial financial institutions, corporations, funds), etc.	Climate Policy Initiative (2021)
Vulnerability score	GDP-weighted average vulnerability score, which measures a country's exposure, sensitivity and capacity to adapt to the negative effects of climate change. Lower scores are better.	Notre Dame Global Adaptation Initiative; WEO Database; IMF staff calculations
Annual infrastructure investment needs (preferred scenario)	Annual infrastructure investment need is calculated under the preferred scenario, which is compatible with full decarbonization by the end of the century (and need not cost more than more-polluting alternatives), thereby achieving climate change stabilization at 2°C.	World Bank, *Beyond the Gap* report
Price rate of carbon price initiatives	Price rate is the cost per metric ton of carbon dioxide equivalent emissions, including both carbon tax and the emissions trading system (ETS).	World Bank Carbon Pricing Database; IMF staff calculations

National GHG emissions coverage of carbon price initiatives	The coverage of each carbon pricing initiative and is presented as a share of annual national GHG emissions for 2021 based on data from the Emission Database for Paris Reality Check (PRIMAP-hist).	Paris Reality Check (PRIMAP-hist); Eora Database; Emission Database for Global Atmospheric Research; World Bank Carbon Pricing Database; IMF staff calculations
Government	These include bilateral climate-related development finance reported to the OECD-DAC Creditor Reporting System (OECD 2021) to track official development assistance (ODA) and other official flows (OOF) in 2021 and domestic financing through public budgets carried out by central, state, or local governments and their agencies.	Climate Policy Initiative (2021)
National DFIs	Development Finance Institutions (DFIs) owned by a single country and whose finance is directed domestically. These are distinct from state-owned FIs in that they have a specific development mandate in their operations.	Climate Policy Initiative (2021)
Bilateral DFIs	Development Finance Institutions (DFIs) chartered by a single country that direct finance flows internationally.	Climate Policy Initiative (2021)
Multilateral DFIs	Development Finance Institutions (DFIs) chartered by multiple countries.	Climate Policy Initiative (2021)
Multilateral funds	Multilateral climate funds including commitments only from DFIs' own resources.	Climate Policy Initiative (2021)
State-owned FI	Institutions if they are at least majority owned by a government or government agency.	Climate Policy Initiative (2021)
Commercial FIs	Providers of private debt capital (and occasionally other instruments), including commercial and investment banks.	Climate Policy Initiative (2021)
Funds	Private equity, venture capital, and infrastructure funds.	Climate Policy Initiative (2021)
Households and individuals	Family-level economic entities, which include high-net-worth individuals and their intermediaries (e.g., family offices investing on their behalf).	Climate Policy Initiative (2021)
Corporations	Corporations, which can have activities in the energy sector, in other sectors, or in both (e.g., a large water utility company installing both hydropower generation and water treatment facilities).	Climate Policy Initiative (2021)
Grants	Transfers made in cash, goods, or services for which no repayment is required.	Climate Policy Initiative (2021)
Low-cost project debt	A debt evidenced by a note that specifies, in particular, the principal amount, interest rate, and date of repayment and is extended at terms preferable to those prevailing on the market.	Climate Policy Initiative (2021)
Project-level market rate debt	A debt evidenced by a note that specifies, in particular, the principal amount, interest rate, and date of repayment and is extended at regular market conditions.	Climate Policy Initiative (2021)
Project-level equity	A stock or any other security representing an ownership interest.	Climate Policy Initiative (2021)
Debt	Direct debt investment by a company or financial institution.	Climate Policy Initiative (2021)
Equity	Direct equity investment by a company or financial institution.	Climate Policy Initiative (2021)

Assessment of infrastructure needs and gaps

The methodology used in the chapter to calculate infrastructure investment needs is based on the World Bank's *Beyond the Gap* report (2019). The so-called preferred scenario ("ambitious goals, high efficiency") used in the chapter involves climate-related spending for mitigation and adaptation purposes, compatible with full decarbonization by the end of the century (which need not cost more than more-polluting alternatives), thereby achieving climate change stabilization at 2°C. In addition to strictly climate-related infrastructure investment, the methodology involves spending efficiency (and still depends on the quality of the policies accompanying the investment); increased, equitable, and sustainable utilization of infrastructure; adaptation measures for infrastructure (e.g., coastal flood protection); and steady flow of resources for operations and maintenance. The methodology assumes that the development of appropriate institutions and governance mechanisms to deliver maintenance is as necessary as the funding stream for an effective protection-based adaptation strategy, as well as for a mitigation strategy. The methodology designates the electricity and transport sectors for mitigation finance and the water supply and sanitation, flood protection, and irrigation sectors for adaptation finance. The infrastructure investment needs are given either in US dollars or as a percentage of GDP, and they include all low- and middle-income countries. The infrastructure investment needs are in 2015 dollars, are discounted with a 6 percent discount rate, and are annualized between 2015 and 2030. The infrastructure investment needs as a percentage of GDP are an average between 2015 and 2030 of annual costs divided by annual GDP. The GDP varies across sectoral analyses depending on calibration year, but the GDP growth rates are all based on the Organisation for Economic Co-operation and Development quantifications of the various shared socioeconomic pathways.

Notre Dame Global Adaptation Index—vulnerability score

The vulnerability score used in this chapter stems from the Notre Dame Global Adaptation Index (ND-GAIN). The vulnerability score measures propensity or predisposition of human societies to be negatively impacted by climate hazards. It assesses the vulnerability of a country by considering six life-supporting sectors: food, water, health, ecosystem services, human habitat, and infrastructure. Each sector is in turn represented by six indicators that represent three cross-cutting components: the exposure of the sector to climate-related or climate-exacerbated hazards, the sensitivity of that sector to the impacts of the hazard, and the adaptive capacity of the sector to cope or adapt to these impacts. We calculate the GDP-weighted average vulnerability score in each region.

World Bank carbon pricing data

The carbon pricing data set sample provides up-to-date information on existing carbon pricing initiatives around the world sourced from the World Bank. Our sample includes both national and subnational implemented carbon pricing initiatives showing the greenhouse-gas-emission coverage and price rate per metric ton of CO_2 equivalent emission. For the greenhouse-gas-emission coverage, the data are originally presented as a percentage of 2015 global greenhouse gas emissions, and we adjust those as a percentage of 2021 national greenhouse gas emissions. For the subnational initiatives, we aggregated the coverage into the national level. Uruguay is not

included in the calculation because of missing emission coverage data. For the average price rate, if one country has implemented multiple national and subnational carbon price initiatives, we calculated the average price rate. There are also circumstances where one initiative has several price rates corresponding to different covered sectors; then we include only one price rate per initiative in the calculation. Specifically, the price rate for Argentina includes only "most liquid fuels"; the price rate for Mexico is the "upper rate." For the average price rate across advanced economies, we use the "fossil fuels" price rate for Denmark, "transport fuels" price rate for Finland, "transport fuels" price rate for Iceland, "gasoline" price rate for Luxembourg, and "general tax rate" for Norway. Price rates are not necessarily comparable between carbon pricing initiatives because of differences in the number of sectors covered and allocation methods applied, specific exemptions, and different compensation methods.

ESG score data description

The total number of firms worldwide in the database was 10,142 as of 2020—the latest available data at the time of analysis. About 6,200 also have a Refinitiv ESG score in the respective year. In general, the separate E, S, and G scores (pillars) have coverage that is essentially the same as the aggregate ESG score.

In 2020, the regional coverage in terms of market capitalization was 73 percent of firms from advanced economies (20 percent from Europe) and 23 percent from emerging market and developing economies.

The methodology adopted by Refinitiv for scoring firms is relatively complex, as it combines a vast amount of different types of data and different aggregation systems (see Refinitiv 2022). First, the database is based on 450 data points (or metrics), which can be Boolean indicators and numeric indicators, such as ratios and analytics. Of these 450 metrics, 186 comparable measures are actually used for the ESG scoring. Depending on the firm's industry, a subset of these indicators is then aggregated, using different weightings, into 10 categories. The 10 categories, in turn, are aggregated further to compute the three (E, S, and G) pillars.

ESG investment fund sample description

The investment fund data set comprises about 117,000 existing open-end and exchange-traded funds sourced from Morningstar. In our sample, funds are included only if assets under management exceed $100 million, which reduces the sample to about 36,000 funds. The sample period extends from 2010:Q1 to 2022:Q2. Their aggregate assets under management amounted to about $46 trillion (versus $52 trillion in the entire Morningstar data set) as of end-June 2022. The analysis uses the Morningstar definition of ESG funds, and the data sample comprises 3,600 ESG funds and 7,900 EMDE-dedicated funds. Funds with a global investment strategy ("global funds") comprise a large share of the funds in the data sample, at about 8,900.

The Morningstar definition of ESG funds comprises the following types of funds (see Morningstar 2020):

- *ESG Incorporation Funds*, which use ESG criteria as a central part or binding factors of their security-selection and portfolio-construction process.
- *Impact Funds*, which seek to make a measurable impact that is often focused on specific themes or uses the 17 UN Sustainable Development Goals as a framework for evaluating the overall impact of the portfolio.
- *Environmental Sector Funds*, which invest in environmentally oriented industries, such as renewable energy or water.

Region and country classification

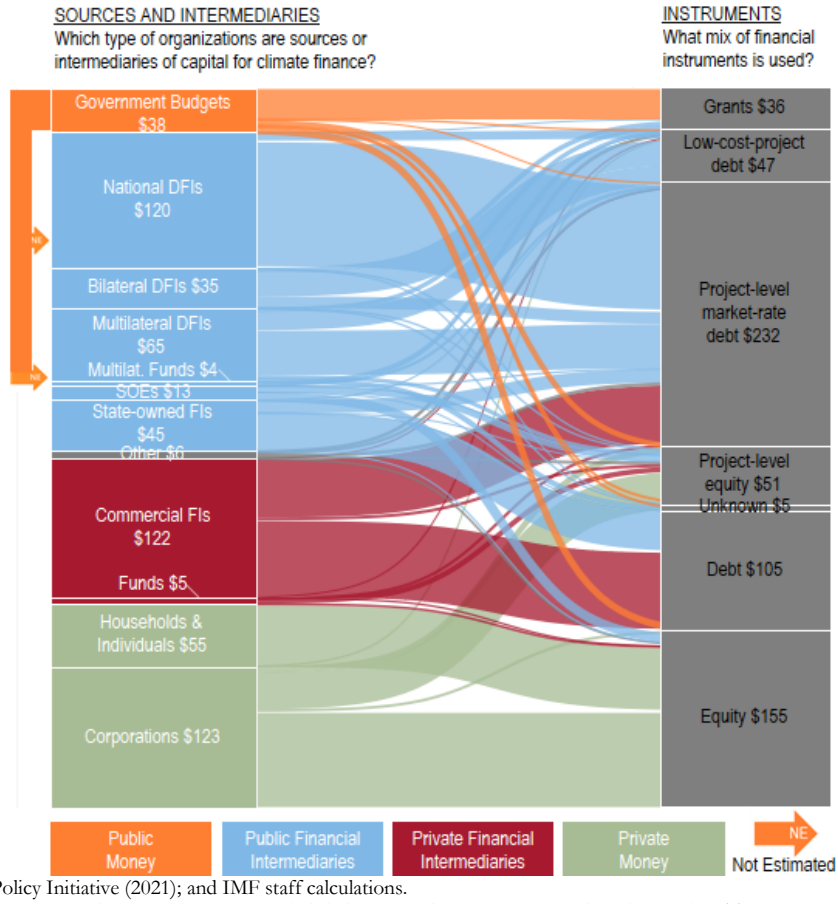
The definitions of emerging market and developing economies (EMDEs) and advanced economies (AEs) vary slightly across different data sets. In most cases, they strictly follow the *World Economic Outlook* (WEO) definitions of EMDEs and AEs.[1] Morningstar has a different classification system: some countries in Europe are classified as EMDEs, but the WEO identifies them as AEs, such as Estonia, Latvia, and Lithuania. Also, Morningstar includes small island states, which are not covered by the WEO definition.

[1] The *World Economic Outlook* definition of emerging market and developing economies and advanced economies can be found here: World Economic Outlook Database April 2022 -- WEO Groups and Aggregates Information (imf.org).

Online Annex 2.2. Global Climate Finance Flows

Figure 2.2.1. Climate Finance Flows in Mitigation and Adaptation
(Billions of US dollars)

The climate finance market is characterized by a complex ecosystem of participants and instruments beyond those that are sustainable finance instruments (as in Chapter 2, Figure 2.1, panel 1). The private sector's role in climate finance is debt-dominated.



Sources: Climate Policy Initiative (2021); and IMF staff calculations.
Note: Data are the average of 2019 and 2020. Detailed definitions of variables can be found in Online Table 2.1.1 DFIs = development finance institutions; FIs = financial institutions; SOEs = state-owned enterprises.

Online Annex 2.3. Transition Taxonomies

Taxonomies have been developing primarily in Asia (ASEAN, Malaysia, Bangladesh, Mongolia, Indonesia, Vietnam, Singapore, Philippines, Thailand, India) but also in South Africa, Colombia, Mexico, Chile, Brazil, and Sri Lanka. Those include so-called green taxonomies (e.g., South Africa) but also "transition finance" taxonomies.

Transition finance taxonomies determine whether and how assets are aligned with emission reduction goals while taking into consideration different transition paths across sectors and economic activities, as well as across countries. In contrast to purely green taxonomies, transition taxonomies do not set climate and/or environmental criteria only for activities that respect the Paris Agreement objectives (e.g., a threshold of carbon intensity in the cement sector that complies with the 1.5 degrees Celsius goal) but set intermediate steps and/or greenhouse-gas-emissions pathways to illustrate the different steps of the transition process. The adopted criteria essential for the economic activities to decarbonize in line with global goals are aimed at achieving those objectives in the most transparent manner, thanks to a so-called traffic light system (or color scheme). This system distinguishes different levels of climate performance in a sector-agnostic way; it therefore also embeds economic activities that, as of now, cause substantial environmental harm—meaning they must decommission and/or transition.

In existing taxonomies in EMDEs (mainly the ASEAN taxonomy and national taxonomies in Singapore, Malaysia, and Indonesia), which often follow the broader philosophy of the proposals of the European Platform on Sustainable Finance for transition taxonomies ("The Extended Environmental Taxonomy," published in March 2022—following a report published in March 2021 on transition finance), categories include all or part of the following:

- Red (significant harm): Activities that significantly harm climate and that should either (1) be abandoned (e.g., energy generation from solid fossil fuels), with the decommissioning of all activities in turn qualifying as environmentally sustainable (in order to facilitate finance for the decommissioning) or (2) may transition to achieve substantial decarbonization (e.g., cement), therefore having to improve in order to halt significant harm.
- Amber (intermediate performance): Activities that significantly impact climate but that do not significantly harm (nor substantially contribute to) climate and/or environmental sustainability objectives. Such activities include (1) those that are not currently zero (or near zero) emissions but that are following a decarbonization pathway aligned with the trajectory required by the Paris Agreement; (2) those facing significant barriers to decarbonization—because low-emission alternatives are not yet available or economically viable and therefore do not currently have a viable well-established technological pathway toward decarbonization but are making all available/possible short-term emission reductions while zero-emission alternatives are being developed (e.g., zero-emission marine transport); and (3) interim solutions, embedding activities that generate less greenhouse gas compared with an alternative and need to be carried out for a limited period of time while alternative low-carbon technologies are developed into viable and scalable solutions (e.g., electricity generation from existing natural gas plants with carbon capture and storage technologies).

- Green (sustainable activities): Activities that fulfill all environmental sustainability requirements under the taxonomy. This category may include activities with low environmental impact—which do not have the potential to contribute substantially to, nor significantly harm, environmental sustainability.

Among the most important criteria are "do no significant harm" (or a similar concept) and the existence of remedial efforts to transition, with a focus on innovation for hard-to-abate sectors (e.g., carbon capture and storage technologies, restoration of gas pipelines to reduce methane leakage, fuel shifting in shipping).

Given that most mandatory disclosure requirements (currently limited to nonfinancial large companies) have been taken up since the mid-2000s mostly in Asia (China, Indonesia, Malaysia, India, Pakistan, Philippines, Singapore—though projects and/or existing regulations are also taking place in Türkiye, South Africa, Chile, and Peru), these transition taxonomies may allow for (1) the concept of "improvement" for carbon-intensive sectors and activities (or even hard-to-abate sectors), especially those not currently with zero or near zero emissions, facing significant barriers to decarbonization and/or providing interim solutions for a limited period; and (2) the publication of transition plans and the use of science-based pathways. The latter may allow companies to set midterm targets, identify pathways to meet climate objectives, and establish implementation plans to meet the targets over a defined period of time.

Figure 2.3.1. Main Categories of Transition Taxonomies in EMDEs

Transition taxonomies follow a so-called pathway approach, from a red category (significant harm) over an amber category (intermediate performance), to a green category (sustainability).

Source: IMF staff illustration.

Online Annex 2.4. Innovative Financing Instruments

1. *Structured finance vehicles* can purchase EMDE green bonds and target large institutional investors. These investors require scale and diversification, which necessitates EMDE assets to be pooled. EMDE banks supply the underlying assets in the form of green bonds issued to finance loans to firms for climate-related projects.[2] Properly certified green bonds ensure that the loans fund environmentally beneficial projects. The required scale and the use of green bonds mean that this instrument can be used in larger EMDEs with a well-functioning bond market. To fulfill institutional investors' strict rating and credit risk requirements, "de-risking" is required—typically in the form of equity investments or credit risk guarantees by the public sector.
2. *Blended finance* combines public and donor capital with private capital to mobilize and scale up climate private finance. The objective is to support the development of projects in EMDEs and de-risk investments for private capital. Blended finance can take various forms, including grants, equity, or mezzanine finance (a hybrid of equity and debt) provided by multilateral development banks, and guarantees. In the case of green infrastructure projects, for example, blended finance can help alleviate the high risks in the initial phase of a project when it is still being set up but is not yet operational—particularly if new types of green technologies are employed. Given that infrastructure often supplies a public service, in some cases involving natural monopolies (such as water supply), political risks also loom large. Blended finance can alleviate both political and financial risks.
3. *Outcome-based sustainable debt instruments,* such as sustainability-linked bonds and loans, include an incentive mechanism to address information asymmetries between issuers and investors (such as "greenwashing," when sustainability benefits of investments are not as high as issuers claim). Issuers pay a penalty (receive a bonus) if predefined sustainability performance targets are missed (have been achieved).
4. In *"pay-for-success" private financing* for public sector projects, third-party investors, including private investors, provide the initial investment and develop a project. The public sector then purchases the project for an amount agreed on in advance and linked to the project's sustainability performance (measured according to performance indicators also agreed on in advance). This shifts the burden and risks of inefficient project development, for which capacity in poorer countries is often lacking, to private third parties. The purchase price is set such that private investors generate substantial returns if the performance targets are (over-)fulfilled. This instrument could have an important use in adaptation finance, where private finance is otherwise difficult to attract.[3]

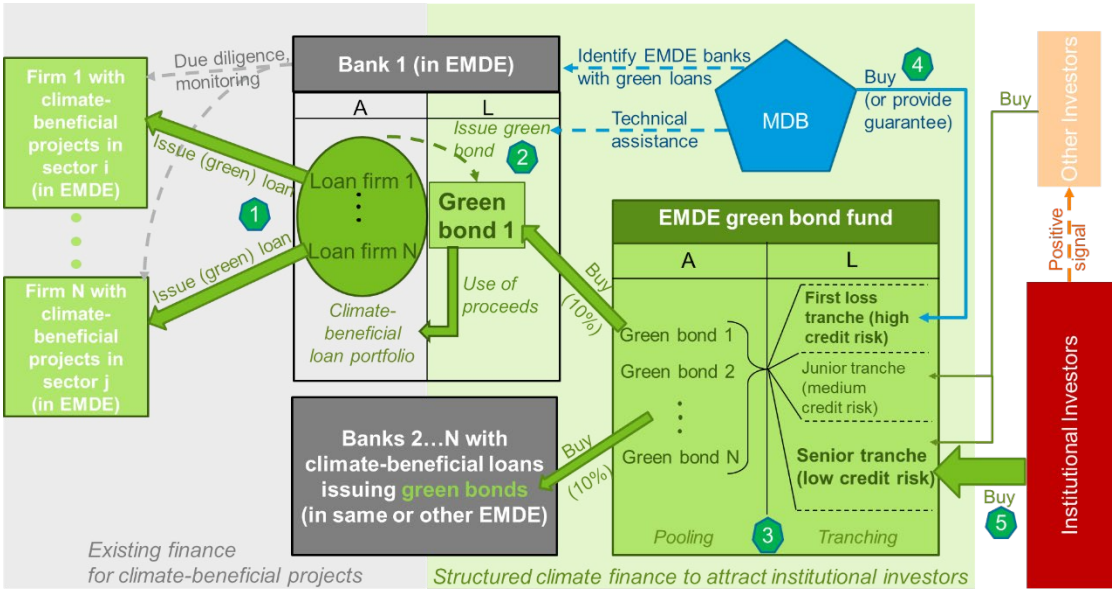
[2] Given that the issuance of green bonds can take time, initially these funds also accept conventional bonds and then substitute them with green bonds over the life cycle of the fund.

[3] Penalties and bonuses have an exactly symmetric effect on the incentives of the issuer. See Berrada and others (2022).

Online Annex 2.5. The IFC-Amundi Green Bond Fund

The deal between the International Finance Corporation (IFC), a multilateral development bank (MDB) that is part of the World Bank Group, and Amundi, an asset manager, is an important (and still rare) example of a structured climate finance instrument designed to tap the vast resources of institutional investors (Figure 2.5.1, red box on the right).

Figure 2.5.1. The IFC-Amundi Deal and the Role of MDBs



Source: IMF staff illustration.

There are various steps involved, however, to transform climate-beneficial (green) EMDE financing into an investable asset for pension funds or insurance companies. Starting from the left of Figure 2.5.1, a first step (see numbers in green heptagons) and the starting point is loans by EMDE banks that finance firms with climate-beneficial projects. Relying on EMDE banks serves two purposes—it utilizes the expertise of local banks and allows achievement of scale in a shorter period of time, by building on their already existing customer base and loan portfolios. The EMDE banks then issue a traditional green bond, earmarking the proceeds for the financing of their green loan portfolio (step 2).

As a third step, a share of the bank-issued bonds is bought by a closed-end investment fund—in this case, the Amundi Planet Emerging Green One (AP EGO) fund—and pooled together across banks in different countries. This reduces idiosyncratic credit risks of individual bank issuers and serves to diversify country risk. The fund then structures its shares into different tranches—including a higher-risk junior (equity) tranche and a lower-risk senior tranche.

To reduce the credit risks of the fund (i.e., the pool of EMDE bank bonds) to a level acceptable to institutional investors, the MDB (i.e., the IFC) buys an equity stake (junior tranche) in the green bond funds (step 4). This effectively serves as a loss-absorption buffer and thereby lowers the credit risk for the other more senior tranches. Alternatively, an MDB or donor could purchase a credit risk guarantee, which is envisioned by a fund that is being set up in

cooperation with Blue like an Orange, a specialized investment fund, and AXA, an insurance company. In the case of the AP EGO fund, the multiplication factor between the use of the IFC's own resource and private financing by institutional investors is very high (about 16x; see Bolton, Musca and Samama 2020). This is partly due to the fact that the average credit rating and bank bonds are already fairly close to investment grade. Hence, a relatively small credit cushion is required to lift the rating of the more senior fund tranches to a level required by institutional investors. The fund is "closed-end," meaning that it has a fixed size: capital does not go into or out of the fund once it is established. In the case of the AP EGO fund, the fund has a fixed lifetime, which ends by the time all purchased EMDE green bonds mature.

As a last step (step 5), institutional investors, in the case of the AP EGO fund mostly pension funds, can then buy the more senior tranches of the fund. Having pension funds as investors in the fund, and thereby EMDE bank-issued bonds, has the additional and crucial benefit of sending a positive signal to other investors. To avoid concentration risks, the green bond fund buys only a minor share of the bonds issued by any given bank (in the case of the AP EGO fund, at most 10 percent). Other investors' interest in the newly issued green bonds is likely to increase with the seal of approval from institutional investors with typically very high investment standards—including for sustainability.

The role of the MDB (i.e., the IFC) is crucial and much broader than credit risk reduction alone. Further important roles are the identification of EMDE banks with a green loan portfolio and the provision of technical assistance for these banks to issue a green bond. MDBs have vast experience in operating in a range of EMDEs and can utilize their expertise to identify potential banks across a number of countries. Initially the AP EGO fund held conventional bonds, but those are successively replaced with green bonds as the involved banks built expertise—with the help of the IFC—in how to issue a green bond adhering to international best practices. The "green" label of the bonds, certified by internationally recognized so-called second-party opinion providers, reassures the investors of the climate benefits of the assets held by the fund.

This type of structured and blended finance approach is particularly suitable for larger emerging markets, given the scale requirements of institutional investors. It also requires the ability of banks to issue bonds—either in local or foreign markets. Relying on tradable assets is another factor that supports scalability, as those assets are standardized and can be purchased and sold more easily by a broader range of investors.

Although the starting point for this type of structured and blended finance is already existing bank loans, there is nevertheless a high potential to channel more capital toward climate finance in EMDEs (termed "additionality" in development finance). For one, it can attract a new type of very large and long-term investors (in the case of the AP EGO fund, this includes large foreign investors) that would otherwise not be able to consider climate investment in EMDEs. By generating such new investor interest, banks in EMDEs receive a strong signal that there is a stable source of finance for green loans, and EMDE firms, in turn, see that there is a higher supply of loans for green projects. A replication of this type of green bond fund structure both appears feasible and could potentially create a substantial and persistent push for climate finance in EMDEs.

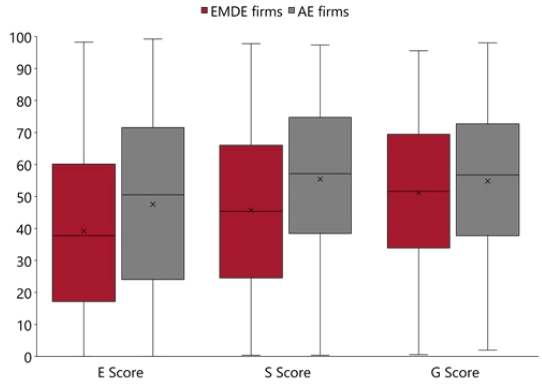
Online Annex 2.6. ESG Scores—Additional Stylized Facts and Analysis

The systematically lower ESG scores of EMDE firms are a salient feature in the ESG ratings data used for the analysis in this GFSR (Refinitiv ESG). The lower scores are clearly present for headline ESG scores (Table 2.6.1, models 1 and 2), as well as for the individual E, S, and G pillar scores (Figure 2.6.1, panel 1).

Figure 2.6.1. ESG Scores Are Lower for EMDE Firms

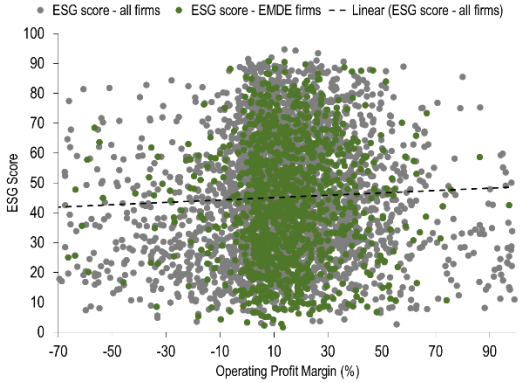
ESG scores are lower for EMDE firms for each of the main E,S, and G pillar scores.

1. Box Plots of Pillar Scores—EMDE versus Other Firms (ESG score)



ESG scores are significantly positively correlated with firm profitability, but this cannot explain the lower scores of EMDE firms.

2. ESG Scores versus Firm Profitability (Percent, end of year; for 2022 end of June)



Sources: Refinitiv; and IMF staff calculations.

Note: Panel 1 shows the box plot of ESG scores for EMDE versus AE firms. The upper and lower bounds of the boxes represent the quartile interval, the middle horizontal line is the median, and the x is the arithmetic mean. The vertical lines depict the range of scores, which genearlly is between 0 (the worst score) and 100 (the best possible score). AE firms exclude US firms for Refinitiv data, as it imposes a penality for not reporting ESG-relevant data in company publications. The Refinitiv data suggest that a lack of ESG public disclosure is much more prevalent among US firms than among firms in other countries—including EMDEs. AE = advanced economy; EMDE = emerging market and developing economy; ESG = environmental, social, governance.

To understand whether firm characteristics can explain the lower score of EMDE firms, characteristics that are known to influence ESG scores are jointly included in a panel regression:

$$ESG\ Score_{i,t} = \mu + \beta \times EMDE\ firm_i + \gamma \times X_{i,t} + d_{s,t} + \varepsilon_{i,t},$$

where i denotes the individual firms (about 6,200 listed firms), and t is the year (2010–21). $EMDE\ firm_i$ is a dummy equal to 1 if firm i is located in an emerging market or developing economy. X represents firm-level and time-varying control variables (size, profitability), and d represents sector and time dummies.

In addition to the strong positive relationship with firm size documented in Chapter 2, the data also show a significant positive relationship with firm profitability (Figure 2.6.1, panel 2)—but this does not explain the significantly lower ESG scores for EMDE firms (Table 2.6.1, model 2). Further, the positive relationship between firm profitability and ESG scores disappears if various other controls are included.

On average, the overall ESG scores for EMDE firms are about 2.4 points lower than those of other firms (Table 2.6.1, model 1). This negative difference becomes larger and statistically more significant after controlling for relevant firm characteristics. Controlling for firm subindustry (and a time fixed effect), EMDE firm scores are an average 3.6 points lower. This difference

grows to almost 5 points in model (5), which controls for firm size (market cap and total assets) and operating profit margin as well as for year × industry fixed effects. The results suggest that EMDE firms within the same sector in the same year, adjusted for size and profitability, have a lower ESG score.

Table 2.6.1. Regression Results—ESG Scores and EMDE Firms

Model	(1)	(2)	(3)	(4)	(5)
D(EMDE Firm)	-2.432*	-3.605**	-4.467**	-4.685***	-4.852***
	(0.0950)	(0.0274)	(0.0123)	(0.000690)	(0.000772)
Log(Market Cap)				2.495***	2.899***
				(0.000266)	(0.000361)
Log(Total Assets)				4.837***	4.637***
				(3.31e-07)	(1.22e-06)
Operating Profit Margin			0.0712*		-0.0252
			(0.0577)		(0.303)
Observations	61,131	61,131	57,517	60,243	56,963
R-squared (adjusted)	0.002	0.029	0.024	0.316	0.304
Year Fixed Effects	No	Yes	Yes	Yes	No
Industry Fixed Effects	No	Yes	Yes	Yes	No
Year X Industry Fixed Effects	No	No	No	No	Yes

Sources: Refinitiv ESG; and IMF staff calculations.
Note: Robust *p*-values are in parentheses, clustered by firm subindustry and year. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

The analogous results hold true for E scores only (Table 2.6.2). On average, the E scores for EMDE firms are about 6-7 points lower than those other firms, which is a substantially larger difference than for the overall ESG score. For climate-conscious investors, focusing on the E score alone will hence not alleviate the issue of lower scores for EMDE issuers.

The robust results are strongly suggestive of a disadvantage in ESG scores for EMDE firms. This, however, leaves open the question of why scores for EMDE firms are systematically lower. One possible explanation is a lack of reporting of relevant ESG data, which in the case of the Refinitiv ESG scores results in a penalty—firms that do not disclose data points that are relevant for the ESG score for a given industry in effect get a lower score. ESG scores for EMDE firms may also be lower because of systematic difference in actual ESG performance in specific areas. In the data however, it is not possible to distinguish between a lower score because of non-reporting and a lower score because of worse ESG characteristics.

Table 2.6.2. Regression Results—E Scores and EMDE Firms

Model	(1)	(2)	(3)	(4)	(5)
D(EMDE Firm)	-5.639***	-6.754***	-7.362***	-6.152***	-6.177***
	(0.00834)	(0.00464)	(0.00186)	(0.000367)	(0.000380)
Log(Market Cap)				1.582***	1.952***
				(0.00414)	(0.00281)
Log(Total Assets)				7.976***	7.869***
				(5.86e-09)	(4.21e-09)
Operating Profit Margin			0.0499		-0.0502
			(0.344)		(0.261)
Observations	49,473	49,473	47,972	48,856	47,562
R-squared (adjusted)	0.008	0.032	0.034	0.311	0.312
Year Fixed Effects	No	Yes	Yes	Yes	No
Industry Fixed Effects	No	Yes	Yes	Yes	No
Year X Industry Fixed Effects	No	No	No	No	Yes

Sources: Refinitiv ESG; and IMF staff calculations.
Note: Robust *p*-values are in parentheses, clustered by firm subindustry and year. Regressions include all firms with non-zero E scores. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Online Annex 2.7. ESG Funds—Additional Stylized Facts

The systematically lower ESG scores of EMDE firms are mirrored in the allocation of ESG funds. This is true for both EMDE *bond* holdings and *equity* holdings[4] (Figure 2.7.1, panel 1). In the first half of 2022 the difference in EMDE equity allocations narrowed substantially, however. This largely reflected strong outflows from EMDE-dedicated funds, of which there are few among ESG funds (see Chapter 2, Figure 2.6, panel 4).

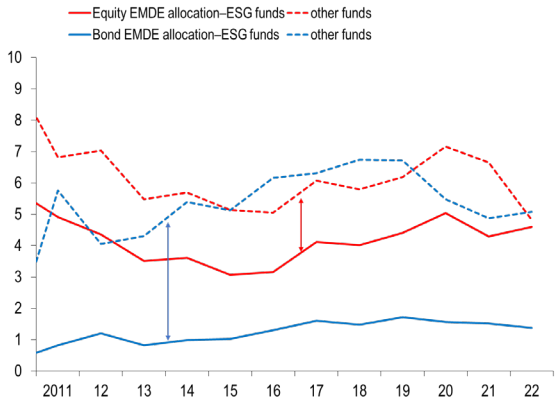
EMDE-dedicated funds, which by definition have a very high allocation to EMDE assets, are driving a large part of the difference between the EMDE allocations of ESG and other (non-ESG) funds. At end-June 2022, this difference in EMDE total EMDE asset allocations (EMDE equities and bonds) stood at 5.8 percentage points. More than half of this difference (3.2 percentage points) was driven by funds dedicated to investing in EMDEs.

But also when looking at global funds that invest in both AE and EMDE assets (and hence have no geographic dedication), there is still a substantive difference in EMDE holdings between ESG and other funds (Figure 2.7.1, panel 2). Naturally, it is less pronounced (the difference at end-June 2022 was 1.7 percentage points) than for the whole sample of funds, but the difference remains persistent and sizable.

Figure 2.7.1. Average EMDE Allocations by ESG and Other Funds

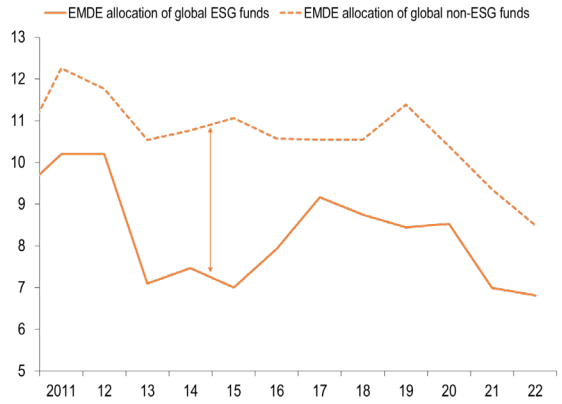
EMDE allocations are lower for ESG funds, both for equities and bonds, though the difference in equity allocations has shrunk in 2022.

1. EMDE equity and Bond Allocations for ESG versus Other Funds (Percent, end of year; for 2022 end of June)



EMDE allocations are also lower for global funds that invest in both EMDEs and advanced economies.

2. EMDE allocations (equities and bonds) of global funds (Percent, end of year; for 2022 end of June)



Sources: Morningstar; and IMF staff calculations.
Note: Panels 1 and 2 show the fund size-weighted shares of EMDE allocations. Panel 2 restricts the sample to funds with a global investment focus and that have nonzero allocations to both advanced and emerging market and developing economies.

[4] In addition, funds have potentially large cash holdings, which by assumption are neither included in advanced nor emerging market and developing economy allocations.

Online Annex 2.8. Sovereign Sustainable Bond Issuance—Additional Analysis

To further analyze whether sovereign issuance of sustainable bonds has a positive effect on corporate sustainable bond issuance, various controls are introduced:

$$\frac{Corp\ Sus\ issuance_{c,t}}{GDP_{c,t}} = \mu + \beta \times D(Sov\ sust\ debut_{c,t+1\to T}) + d_c + d_t + \frac{\Delta Priv\ Debt_{c,t-1}}{GDP_{c,t-1}} + \varepsilon_{i,t},$$

where c stands for country and t for time (year). $\frac{Corp\ Sus\ issuance_{c,t}}{GDP_{c,t}}$ is the aggregate issuance of corporate sustainable debt in a given year divided by annual GDP (in percent). $D\left(Sov\ sust\ debut_{c,t+1\to T}\right)$ is a dummy that is equal to 1 after the sovereign in country c has issued a sustainable bond (until the end of the sample in 2021).

The controls are country dummies (d_c) and time dummies (d_t), which can control for a common (global) trend in sustainable bond issuance. Introducing these controls in models (2) and (3) in Table 2.8.1 reduces the absolute effect of sovereign bond issuance by about half, but sovereign sustainable bond issuance retains a highly statistically significant and positive effect on corporate bond issuance. The effect of sovereign issuance remains strongly positive, even when accounting for possible momentum in the growth of private debt more generally in model (4), proxied by the lagged change in private debt to GDP $\left(\frac{\Delta Priv\ Debt_{c,t-1}}{GDP_{c,t-1}}\right)$.

Table 2.8.1. Regression Results—The Effect of Sovereign Sustainable Debt Issuance on Corporate Issuance

Model	(1)	(2)	(3)	(4)
Sovereign Sustainable Debut	0.569***	0.265***	0.305***	0.278***
	(0.000)	(0.000)	(0.000)	(0.000)
Private Debt to GDP (t–1)				0.000382
				(0.801)
Observations	858	858	858	806
Country Dummy	No	No	Yes	Yes
Time Dummy	No	Yes	Yes	Yes
R-squared adjusted	0.0858	0.198	0.251	0.255

Sources: Bloomberg Finance L.P.; IMF, *World Economic Outlook;* and IMF staff calculations.
Note: *p*-values are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

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