

Financial Sector Policies to Unlock Private Climate Finance in Emerging Market and Developing Economies—Online Annexes

Online Annex 3.1.: Estimates for Climate Investment Needs

Estimates of climate investment needs are based on large and complex climate models (usually, integrated assessment models), which require a host of assumptions about how technologies and the associated costs of employing them will develop. Depending on the scenario used, which dictates the trajectory of GHG emission reductions, these models typically allow to back out the investments needed in various technologies, sectors, and regions to achieve the targeted emission trajectory. The complexity of these models (typically a suite of interlinked models) and the host of required detailed assumptions (demographic and energy demand projections, technological development, etc.), result in an inherent uncertainty around the resulting estimates.

There is a range of climate investment needs based on various models with different assumptions and methodologies. These estimates differ in sectoral and technology breakdowns, time frames, regional considerations, top-down vs. bottom-up approaches, boundaries of investment needs (full vs. incremental costs, exclusion or inclusion of consumer-level investments) as well as the climate scenarios and temperature targets considered.

According to the IPCC (2022), modelling mainly focusses on technology costs, but less on country heterogeneity due to limitations in the spatiotemporal granularity of the models in infrastructure financing gaps, qualitative and development-related aspects of needs, risks, access to capital, evolution of electricity costs, and weight given to learning by doing processes and economies of scale. In addition, these models can capture the interplays between the baseline economic growth rates, the link between economic growth and energy demand, the evolution of key macroeconomic parameters (e.g., fossil fuel prices, interest rates), the level of integration between climate policies and sectoral policies and their efficiency, and the impact of climate policies on growth.

The International Energy Agency (IEA), International Renewable Energy Agency (IRENA), and other research institutions regularly publish reports that provide insights into climate investment requirements based on different scenarios and considerations, with a focus on the energy sector. The investment needs calculations in this chapter have been primarily derived from the following three reports: IEA (2021) and IRENA (2023) for global needs by technology, and IEA (2023) for Emerging and Developing Economies' (EMDE) climate investment needs by technology. The estimates cover only mitigation needs.

Online Annex Table 3.1.1. Estimates for Climate Investment Needs		
Relevant technologies to reach net-zero GHG emissions by 2050	Financing needs by 2030 according to existing net-zero scenarios	EMDE-specific financing needs
	(Trillions of US dollars, per annum)	(Trillions of US dollars, per annum)
Total	4.983 (IEA), 4.580 (IRENA)	1.987 (IEA) 1.224, ex. China (IEA)
1. Electricity system <i>(renewable-based electricity generation, storage and distribution)</i>	2.419 (IEA), 2.088 (IRENA)	1.212 (IEA)
of which: storage and distribution	0.582 (IEA)	0.397 (IEA)
2. Electrification in end-use sectors and Energy efficiency	1.334 (IEA), 2.227 (IRENA)	0.636 (IEA)
3. CCUS and other negative emission technologies <i>(including BECCS)</i>	0.205 (IEA), 0.102 (IRENA)	N/A
4. Others <i>(including hydrogen production and its derivatives, geothermal, solar thermal, and marine, fossil fuels (in existing oil and gas fields), nuclear)</i>	1.025 (IEA), 0.163 (IRENA)	0.139 (IEA)

Other estimates have been calculated by other organizations:

- Based on the IEA and IRENA data and using IAMs (integrated assessment models) and the IPCC AR6 Scenarios Database, the IPCC (2022) has calculated mitigation investment needs (see figure 15.4 in IPCC 2022) with a breakdown of recent average (downstream) mitigation investments and model-based investment requirements for 2020–2030 in scenarios that likely limit warming to 2°C or lower. The IPCC concludes that total investments in mitigation need to increase by around three and six times with significant gaps existing across sectors and regions, amounting to US\$4.5 trillion (averaged until 2030).
- According to Songwe, Stern, and Bhattacharya (2022), EMDEs other than China will need to spend around \$1 trillion per year by 2025, and around \$2.4 trillion per year by 2030, on three priorities: transformation of the energy system, adaptation and resilience, and sustainable agriculture. These estimates are based on Bhattacharya and others (2022) that assesses sector and geographical requirements for investments and actions to keep the target of capping warming at 1.5° C in reach and to meet the goals of the Paris Agreement across all its dimensions (wider scope than climate change mitigation).
- According to McKinsey (2022), capital spending on physical assets for energy and land-use systems in the net-zero transition between 2021 and 2050 would amount to about \$275 trillion, or \$9.2 trillion per year on average. The methodology is based on the NGFS

Net Zero 2050 scenario and covers the most carbon-intensive sectors (power, industry including steel and cement production, mobility, buildings, agriculture and food, and forestry and other land use, as well as fossil fuels). To estimate financing needs, the methodology analyzes effects of the transition and of climate change in 69 countries that represent the bulk of global GDP.

Online Annex 3.2.: Projections for the Private Sector Share in Climate Finance

The methodology used to calculate the private sector share uses four data sources: (i) Climate Policy Initiative, CPI (2022)¹ for current climate finance flows; (ii) IEA (2023) for the projected investment needs for 2030 in EMDEs; (iii) IMF Investment and Capital Stock Dataset, 1960-2019, IMF (2021a) for calculating general government investment as a percent of GDP till 2019; and (iv) IMF WEO (2023)² for the growth rate of general government net acquisition of nonfinancial assets and GDP.

The private sector shares³ for EMDEs (including and excluding China) in 2020 are taken as given. CPI estimates suggest that the total EMDEs climate flows in 2020 were US\$0.37 trillion with a private sector share of about 40 percent. In EMDEs excluding China, the total flows were US\$0.15 trillion, of which 43 percent was from the private sector.

The private sector share in 2030 is calculated as a residual of investment not covered by the public sector. To do so, we first determine the current public climate finance share – public climate investment as a percent of total public investment – and then project it forward to 2030. The latest available climate flows data from CPI are for 2020 for flows to EMDEs (including and excluding China). The current *public* flows relative to total public investments present the current public climate finance share. As a next step, we calculate projections for total public investment until 2030. The GDP weighted average of general government investment as a percent of GDP in 2019 is taken from the IMF Investment and Capital Stock Dataset for 1960-2019. To project the public investment share to GDP forward, we apply the projected growth rate of government net acquisition of nonfinancial assets (IMF WEO) until 2030. The ratio for 2030 is then multiplied by the (inflation adjusted) GDP projection for 2030 (IMF WEO) to calculate gross public investment. To calculate public climate investment, we make an assumption about the share of public investment devoted to climate. We consider three scenarios which determine the range of estimates for the private share shown in the main chapter. Using the assumption of the climate investment share in total public investment, we can back out the total projected amount of public climate investment. This is then subtracted from the investment needs estimates from the IEA to obtain the amount (and share in total climate investment) that private finance and investment would have to cover.

The chapter considers three scenarios for the public sector share of total *climate* investment in 2030: (i) *Lower bound of private sector* scenario assumes that the investment from the *public* sector as a share of total public investment doubles in 2030 from its 2020 share; and (ii) *Upper bound of private sector* scenario assumes that for the global estimate the investment from the *public* sector as

¹ The baseline for calculating the increase in climate mitigation investment by 2030 are based on the climate finance flows given by CPI (2022). We would like to note that climate investment needs can also be met by regular finance, in addition to the climate finance flows tracked by CPI.

² The WEO has projections till 2028, for extending the GDP, General government net acquisition of nonfinancial assets, and total investment series, we applied the average growth rate of last 10 years to project the data for 2029 and 2030.

³ The term “private finance” refers to financial flows not related to the public sector. Public sector sources are public institutions such as governments (all levels), multilateral development banks, national development banks, state-owned banks, and other state-owned entities.

a share of total public investment stays the same as compared with its 2020 share. (iii) *baseline scenario* assumes that the share of climate investment in total *public* investment is 1.5 times (midpoint of lower and upper bound) of its 2020 value. The residual needs will be supplied by the private sector. All the 2030 estimates are in real PPP (USD 2020) terms, as the latest available data for climate finance flows by CPI are as of 2020. The deflator from WEO is calculated by dividing nominal GDP by real GDP (both in PPP terms), rebasing it to 2020. The same deflator is used on the total public investment series and GDP projections to express the figures in 2020 real terms.

Step 1: In tables 3.2.1 and 3.2. below, we start with the CPI finance flows data (shown in black) for 2020 split between private and public sector, and calculate the series for gross public investment (shown in blue) as described above.

Step 2: We then calculate

$$\begin{aligned} \text{climate investment share in gross public investment in 2020} &= (\text{Public share} * \text{Total climate finance flow}) / \text{Total gross public investment} \\ &= (1 - 40.5\%) * 0.372 / 3.144 = 7.05\% \end{aligned}$$

Step 3: For the baseline in 2030

$$\begin{aligned} \text{climate investment share of gross public investment in 2030 (shown in red)} &= \text{climate investment share in gross public investment in 2020} * \text{Baseline public climate investment share in total public investment} \\ &= 7.05\% * 1.5 = 10.57\% \end{aligned}$$

Step 4: Next we calculate the

$$\begin{aligned} \text{public sector share in 2030} &= \text{climate investment share of gross public investment in 2030} * \text{Total gross public investment} / \text{Investment needs estimate} \\ &= 10.57\% * \$3.385 / \$1.99 = 18\%. \end{aligned}$$

Step 5: Calculate the

$$\begin{aligned} \text{Private sector share in 2030} &= (1 - \text{Public sector share in 2030}) \\ &= 100\% - 18\% = 82\% \end{aligned}$$

Step 6: Change the assumptions in step 3 based on the scenarios and repeat steps 3-5 to calculate the upper and lower bounds.

The main difference between the calculations for EMDEs, after including China are:

- the climate finance flow increased from US\$ 0.146 trillion to US\$ 0.372 trillion in 2020.
- the gross public investment in 2020 increased from US\$ 1.636 trillion to US\$ 3.143 trillion in 2020.

Online Annex Table 3.2.1. EMDE (including China) Calculations

2020 (nominal)

	Private	Public	Total	Private
Climate investment flows from CPI	US\$ 0.151 tn	US\$ 0.222 tn	US\$ 0.372 tn	40%
Gross public investment (<i>General government investment, gross fixed capital formation</i>)		US\$ 3.143 tn		
Climate investment share in gross public investment (in percent)		7.05%		

2030 (inflation adjusted (2020 terms) - deflator from WEO)

Climate investment needs - <u>total</u> from the IEA	US\$ 1.629 tn (high US\$ 1.749 tn, low US\$ 1.510 tn)	US\$ 0.358 tn (high US\$ 0.180 tn, low US\$0.090 tn)	US\$ 1.987 tn	82 % (high 88 %, low 76 %)
Gross public investment (<i>General government investment, gross fixed capital formation</i>),		US\$ 3.385 tn		
Assumption: climate investment share of gross public investment is the 1.5 times share of 2020 (2 times share of 2020, 2020 share), (in percent)		10.57 % (high 14.10 %, low 7.05 %)		

Note: Numbers in black are given data and estimates, assumptions are in red, and calculations are in blue. The arrows correspond to the calculation steps above.

Online Annex Table 3.2.2. EMDE (excluding China) Calculations

2020 (nominal)

	Private	Public	Total	Private
Climate investment flows from CPI	US\$ 0.062 tn	US\$ 0.084 tn	US\$ 0.146 tn	43%
Gross public investment (<i>General government investment, gross fixed capital formation</i>)		US\$ 1.636 tn		
Climate investment share in gross public investment (in percent)		5.11%		

2030 (inflation adjusted (2020 terms) - deflator from WEO)

Climate investment needs - <u>total</u> from the IEA	US\$ 1.089 tn (high US\$ 1.134 tn, low US\$ 1.044 tn)	US\$ 0.135 tn (high US\$ 0.180 tn, low US\$0.090 tn)	US\$ 1.224 tn	89% (high 93%, low 85%)
Gross public investment (<i>General government investment, gross fixed capital formation</i>),		US\$ 1.762 tn		
Assumption: climate investment share of gross public investment is the 1.5 times share of 2020 (2 times share of 2020, 2020 share), (in percent)		7.67 % (high 10.22 %, low 5.11 %)		

Note: Numbers in black are given data and estimates, assumptions are in red, and calculations are in blue. The arrows correspond to the calculation steps above.

In the context of evolving climate finance flow data, the analysis seeks to gauge the relative sensitivity of Climate Policy Initiative's (CPI) data. The current study uses the 2020 climate finance flows data.

The following summary of estimates is derived from the 2019 and the average of 2019-20 flows, which shows that these estimates are not very sensitive to the flows data:

Online Annex Table 3.2.3. Sensitivity Analysis to Climate Finance Flows in EMDEs (including and excluding China)

Private Sector Share in total Climate Investment needs by 2030 - EMDEs (incl. China)

	Lower bound	Baseline	Upper bound
2020 flows (Current)	76.0%	82.0%	88.0%
2019 flows	78.4%	83.8%	89.2%
2019 & 2020 (Average flows)	77.2%	82.9%	88.6%

Private Sector Share in total Climate Investment needs by 2030 - EMDEs (excl. China)

	Lower bound	Baseline	Upper bound
2020 flows (Current)	85%	89%	93%
2019 flows	92%	94%	96%
2019 & 2020 (Average flows)	89%	92%	94%

Online Annex 3.3.: Sovereign Ratings

Online Annex Table 3.3.1. Sovereign Rating for Emerging Markets and Developing Economies

		Number of countries	Share of total emerging markets
Emerging markets	Investment grade rating	12	60%
	Speculative grade rating	8	40%
	No rating	0	0%
		Number of countries	Share of total developing economies
Developing economies	Investment grade rating	10	8.0%
	Speculative grade rating	73	58.4%
	No rating	42	33.6%

Source: Bloomberg Finance L.P.; CountryEconomy; and IMF staff calculations.
 Note: Speculative grade rating is defined as either two or all available ratings are below BBB- (S&P and Fitch) or Baa3 (Moody's).

Online Annex 3.4.: Assessment Methodology for G-SIBs’ Climate Policies and G-SIB Syndicated Loan Analysis

To investigate the ambition of major banks’ and insurers’ climate policies, the chapter applies the methodology described below to assess the criteria adopted by banks and insurers in their fossil fuel (coal, oil, and natural gas) lending, investment, and underwriting activities. The assessment of banks (Figure 3.5., panel 1) is based on the 30 Global Systemically Important Banks’ (G-SIBs) disclosed sectoral policies (or absence thereof). The analysis has been based on the 2022 list of G-SIBs, available on the website of the Financial Stability Board, and based on end-2021 data (FSB 2022). The assessment of insurers is based on the disclosed sectoral policies (or absence thereof) of major global insurers (based on the 2016 list of Global Systemically Important Insurers (FSB 2016)).

Online Annex Table 3.4.1. Banks Coal Policy Assessment		
	Criteria for the assessment of coal policies	Methodology for the assessment of G-SIBs
Banks	<p>Net-zero aligned coal phaseout policy</p> <p><i>Do policies have a robust coal phaseout strategy, based on a 25% threshold for companies’ revenues directly derived from coal (extraction and/or power generation)? Do policies include a clear timeline in line with scientific recommendations (2030 in EU and OECD countries, 2040 in the rest of the world), and possibly other criteria as recommended in the literature (exit plan involving just transition considerations, exclusion of coal infrastructure developers, etc.)?</i></p>	<p>A strong level of ambition (“Ambitious”) corresponds to banks including a full phaseout strategy in their policies, in line with the 2030/2040 timeline. Some banks may adopt a progressive phaseout approach, for instance based on the revenues of the coal company. Some others may require a full exit plan from their clients (including, but not limited to, retirement, repurposing of coal-fired power plants, and just transition issues).</p> <p>A moderate level of ambition (“Relative”) corresponds to banks applying their policy to a subset of the coal industry (usually, coal mining) and/or with notable exceptions (for instance in the presence of a coal company’s credible transition plan or those with a diversification strategy).</p> <p>The “Weak criteria” category corresponds to the announcement of a coal phaseout, without any further details, or with a 2050 (or later) timeline.</p> <p>“No policy” means that no policy has been disclosed by the bank.</p>
	<p>Exclusion of project finance to coal mines/plants/infrastructure</p> <p><i>Do policies exclude coal mines/plants/infrastructure direct financing?</i></p>	<p>A strong level of ambition (“Ambitious”) corresponds to banks explicitly including in their policies the exclusion of project finance for coal mines and plants, new coal infrastructure or with minimal exceptions (if supplemented by carbon capture and storage technologies).</p> <p>A moderate level of ambition (“Relative”) corresponds to banks applying their policy usually to new coal infrastructure only, often with notable exceptions (e.g., application to coal infrastructure located in advanced economies only, application to supercritical coal-fired power plants only, etc.).</p>

		<p>The “Weak criteria” category corresponds to the policy applying to an even more limited set of new coal infrastructure, usually mountaintop removal.</p> <p>“No policy” means that no policy has been disclosed by the bank.</p>
	<p>Limitation of financial services to coal expansion</p> <p><i>Do policies exclude all financial services to companies that are planning new coal mines/plants/infrastructure projects? Are the largest coal producers, and coal-fired power plant operators, excluded from general financing?</i></p>	<p>A strong level of ambition (“Ambitious”) corresponds to banks explicitly including in their exclusion policies a criterion in terms of coal companies’ revenues derived from coal within the range of 20% to 40%.</p> <p>A moderate level of ambition (“Relative”) corresponds to banks applying their policy to a higher revenue threshold (above 40%) and/or to a subset of clients (usually new clients and/or excluding groups of companies and/or limited to companies actively developing coal mines/plants/infrastructure) and/or with notable exceptions (e.g., companies developing carbon capture and storage technologies, or having published a net-zero commitment).</p> <p>The “Weak criteria” category corresponds to a revenue threshold above 60% and/or exclusion only of new clients.</p> <p>“No policy” means that no policy has been disclosed by the bank.</p>

Online Annex Table 3.4.2. Banks Oil and Gas Policy Assessment		
	Criteria for the assessment of oil and gas policies	Methodology for the assessment of G-SIBs
Banks	<p>Net-zero aligned oil and gas policy</p> <p><i>Do policies include the financing of the transition of the oil and gas industry, including: the exclusion of financial services to new oil and gas fields and/or upstream and/or midstream projects in the near-term; the setting of a phaseout timeline for oil and gas upstream/ midstream activities by 2050; potential conditionalities to financial services to oil and gas companies; and peculiar attention paid to unconventional sectors in the oil and gas sector?</i></p>	<p>A strong level of ambition (“Ambitious”) corresponds to banks adopting specific oil and gas policies supported by a timeline and specific indicators including criteria on (a) transition financing in the oil and gas industry (including, but not limited to, criteria for substantially reducing GHG – including methane - emissions, diversifying their core business activity, etc.), (b) exclusion of project financing to new oil and gas infrastructure and/or general purpose financing to companies with active development of oil and gas infrastructure, and (c) attention paid to active development in unconventional oil and gas sectors and the Arctic region.</p> <p>A moderate level of ambition (“Relative”) corresponds to banks applying their policy to a limited set of companies and/or to financial services (for instance, to new oil and gas upstream projects only).</p> <p>The “Weak criteria” category corresponds to banks applying imprecise commitments to oil and gas production and/or a broad engagement strategy with companies committed to aligning with net-zero objectives.</p> <p>“No policy” means that no policy has been disclosed by the bank.</p>

Online Annex Table 3.4.3. Insurers Coal Policy Assessment		
	Criteria for the assessment of coal policies	Methodology for the assessment of globally systemic insurers
Insurers	<p>Net-zero aligned coal phaseout policy</p> <p><i>Do policies have a robust coal phaseout strategy, based on a 25% threshold for companies' revenues directly derived from coal (extraction and/or power generation)? Do policies include a clear timeline in line with scientific recommendations (2030 in EU and OECD countries, 2040 in the rest of the world), and possibly other criteria as recommended by the literature (exit plan involving just transition considerations, exclusion of coal infrastructure developers, etc.)?</i></p>	<p>A strong level of ambition (“Ambitious”) corresponds to banks including a full phaseout strategy in their policies, in line with the 2030/2040 timeline. Some banks may adopt a progressive phaseout approach, for instance based on the revenues of the coal company. Some others may require a full exit plan from their clients (including, but not limited to, retirement, repurposing of coal-fired power plants, and just transition issues).</p> <p>A moderate level of ambition (“Relative”) corresponds to banks applying their policy to a subset of the coal industry (usually, coal mining) and/or with notable exceptions (in the presence of a coal company’s credible transition plan or those with a diversification strategy).</p> <p>The “Weak criteria” category corresponds to the announcement of a coal phaseout, without any further details, or with a 2050 (or later) timeline.</p> <p>“No policy” means that no policy has been disclosed by the bank.</p>
	<p>Restriction on underwriting coal companies</p> <p><i>Do policies restrict, according to explicit criteria, mines/plants/infrastructure underwriting?</i></p>	<p>A strong level of ambition (“Ambitious”) corresponds to insurers explicitly including in their policies the exclusion or restriction of underwriting for coal mines and plants, including new coal infrastructure or with minimal exceptions.</p> <p>A moderate level of ambition (“Relative”) corresponds to insurers applying their policy usually to new coal infrastructure only, with notable exceptions (e.g., application to coal infrastructure located in advanced economies only, application to ultra-supercritical coal-fired power plants only, etc.).</p> <p>The “Weak criteria” category corresponds to imprecise criteria for underwriting (e.g., limited to upstream expansion, without clear metrics) and/or a timeline exceeding scientific recommendations, beyond 2050.</p> <p>“No policy” means that no policy has been disclosed by the insurer.</p>
	<p>Limitation of underwriting services to coal expansion</p> <p><i>Do policies restrict, according to explicit criteria, underwriting to coal companies that are planning new coal mines/plants/infrastructure projects?</i></p>	<p>A strong level of ambition (“Ambitious”) corresponds to insurers explicitly including in their policies the exclusion or restriction of underwriting for coal mines and plants, including new coal infrastructure or with minimal exceptions.</p> <p>A moderate level of ambition (“Relative”) corresponds to insurers applying their policy usually to new coal</p>

		<p>infrastructure only, with notable exceptions (e.g., application to coal companies having joined net-zero initiatives, application to coal infrastructure located in advanced economies only, application to ultra-supercritical coal-fired power plants only, etc.).</p> <p>The “Weak criteria” category corresponds to imprecise criteria for underwriting to coal developers, not supported by revenue or capacity thresholds, or other metrics.</p> <p>“No policy” means that no policy has been disclosed by the insurer.</p>
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Online Annex Table 3.4.4. Insurers Oil and Gas Policy Assessment		
	Criteria for the assessment of oil and gas policies	Methodology for the assessment of globally systemic insurers
Insurers	<p>Oil and gas policy targeting at a minimum oil and gas upstream development.</p> <p><i>Do policies have a transition financing strategy for the oil and gas industry, targeting both at a minimum upstream activity, with a timeline consistent with scientific recommendations, paying particular attention to oil and gas development and to unconventional sectors in the oil and gas industry, and incorporating an engagement strategy based on a phaseout plan?</i></p>	<p>A strong level of ambition (“Ambitious”) corresponds to insurers including at a minimum an exclusion criterion or phaseout criteria for companies with upstream expansion plans.</p> <p>A moderate level of ambition (“Relative”) corresponds to insurers applying their policy only to unconventional sectors of the oil and gas industry.</p> <p>The “Weak criteria” category corresponds to policies applying to oil and gas companies phasing out from oil and gas development only after 2050.</p> <p>“No policy” means that no policy has been disclosed by the insurer.</p>

Syndicated Loan Analysis

Online Annex Table 3.4.5. Variable Description and Data Sources		
Variable	Description	Source
Company primary SIC	The main Standard Industrial Classification (SIC) code assigned to the borrower	Dealogic
Tranche lead bank parent	Name of lead bank parent (bookrunners or MLAs on the deal if there are no bookrunners) for a specific tranche	Dealogic
Tranche value	The tranche amount in US Dollars	Dealogic
Tranche number of lead banks	Number of lead banks (bookrunners or MLAs if there are no bookrunners) involved in the specific tranche	Dealogic
Tranche value per lead bank	The amount of tranche amount in US Dollars per lead bank	Dealogic and IMF staff
Green loans	Dummy variable indicating a loan is a green loan or not	Dealogic and IMF staff
ESG linked loans	Dummy variable indicating a loan is an ESG-linked loan or not	Dealogic and IMF staff

The data for the syndicated loan is collected from the Dealogic syndicated loan database. The sample comprises 2,344 loans to 1,031 companies in fossil fuel industries (see Table 3.4.6 for details) for the 30 G-SIBs that act as lead banks in the origination process.⁴ The sample time frame encompasses the period from January 2015 to end-December 2022. The overall aggregate amounts of syndicated loans in this sample are approximately US\$ 1.53 trillion. Among the syndicated loans in this sample, only 27 loans are sustainable loans including both green loans and ESG-linked loans, with a total aggregate nominal value of US\$ 43 billion. To investigate the ambition of the major banks on climate and the alignment of their policy with syndicated loan origination practices, we categorized sustainable syndicated loans into two buckets based on the ambition of the climate policy (if adopted) of their involved banks (see Tables 3.4.1 and 3.4.2 above for details regarding the methodology used to evaluate banks' climate policy). If one loan contains multiple lead banks, the loan value is equally allocated to each lead bank.

Online Annex Table 3.4.6. Fossil Fuel Standard Industrial Classification Included in the Sample	
SIC Code	Name
1221	Bituminous Coal and Lignite Surface Mining
1222	Bituminous Coal Underground Mining
1241	Coal Mining Services
1311	Crude Petroleum and Natural Gas
1321	Natural Gas Liquids
1381	Drilling Oil and Gas Wells
1382	Oil and Gas Field Exploration Services
1389	Oil and Gas Field Services, Not Elsewhere Classified

⁴ See Financial Stability Board for G-SIBs list [2022 List of Global Systemically Important Banks \(G-SIBs\) \(fsb.org\)](https://www.fsb.org/2022/04/list-of-global-systemically-important-banks-g-sibs/).

Online Annex 3.5.: Sustainable Investment Funds

Online Annex Table 3.5.1. Variable Description and Data Sources		
Variable	Description	Source
Fund-level variables		
Fund flows	Fund flows as a percentage of monthly lagged fund size	Morningstar
Fund Return	Fund return	Morningstar
Fund age	Number of days since the inception of the fund divided by 365	Morningstar and IMF Staff
Fund size	Asset Under Management in US Dollar	Morningstar
Portfolio Carbon Risk Score	Asset-weighted Sustainalytics carbon-risk rating of companies held in a portfolio.	Morningstar
Morningstar Rating	A measure that evaluates a fund's historical risk-adjusted performance relative to similar funds within the same category on a scale of 1 to 5 stars (best performance)	Morningstar
Morningstar Sustainability Rating	A measure that assesses how well a fund's holdings perform on ESG factors represented by a scale of 1 to 5 globes (the strongest ESG characteristics)	Morningstar
Net expense ratio	Percentage of fund assets used to pay for operating expenses and management fees, other than sales and redemption charges	Morningstar
Global Broad Category Group	A classification system to categorize funds into different Category Groups based on their investment strategies and asset classes: "Allocation," "Equity," "Fixed Income," "Money Market," "Alternative," "Commodities," "Miscellaneous," "Convertibles," and "Property"	Morningstar
Domicile	Country where a fund is domiciled	Morningstar
ESG	Dummy variable indicating general ESG Investment products which use ESG criteria as a central focus or binding factor in their security selection and portfolio-construction process	Morningstar
Sustainability Themed	Dummy variable indicating investment products which explicitly target exposure to one or more sustainability themes as part of their investment process	Morningstar
Climate Action ¹	Dummy variable indicating investment products which focus on investing in companies or projects that contribute broadly to the transition to a low carbon economy	Morningstar
Article 8 to 9 upgrade	Dummy variable indicating whether a fund has reclassified its product from article 8 to article 9	Morningstar and IMF Staff
Article 9 to 8 downgrade	Dummy variable indicating whether a fund has reclassified its product from article 9 to article 8	Morningstar and IMF Staff
No Article 8 or 9	Funds with no holding of article 8 or 9 products	Morningstar and IMF Staff

¹ The main chapter uses the term climate impact instead of climate action.

Investment Funds Data Sample Description

The data for the investment fund database is obtained from Morningstar, encompassing 36,587 funds with assets under management exceeding US\$100 million. The sample period spans from January 2010 to April 2023. Among the funds in the sample, 3,357 are classified as ESG funds, 554 as sustainable themed funds, and 349 as climate action funds. As of end-2022, the total assets under management for conventional funds, excluding ESG and sustainable themed funds, amount

to US\$42.6 trillion. Meanwhile, ESG funds have accumulated US\$2.4 trillion in assets under management, sustainable themed funds (excluding climate action funds) have reached US\$137.8 billion, and climate action funds have accumulated US\$226.2 billion in assets under management. These funds are spread across 64 different economies of domicile.

Definition of Fund Labels

Morningstar defines an investment product as sustainable when the utilization of at least one sustainable investing approaches is fundamental to the product's overall investment process, as indicated in its prospectus or other regulatory filings. This definition differs from the one established under the SFDR regulation, which defines “sustainable investments” at a holding level.

Sustainable investments fall into two subgroups. The first subgroup is *general ESG investments*, which emphasizes the comprehensive integration of environmental, social, and corporate governance factors. This is typically achieved by using company specific ESG metrics and exclusions, with these approaches playing a central role in the overall investment process. The second subgroup *sustainability themed investments* explicitly target exposure to one or more sustainability themes as an integral part of their investment process. One specific theme which is pursued by these funds includes *climate impact* (or *climate action*) which pertains to thematic investments that revolve around addressing climate change. This theme encompasses investment products that specifically focus on investing in companies or projects that play a significant role in facilitating the transition to a low-carbon economy.

Transition Score

The Morningstar Portfolio Carbon Risk Score is determined by the asset-weighted Sustainalytics carbon-risk rating of companies within the portfolio. The company carbon-risk rating assesses the residual unmanaged carbon risk for a company after considering its carbon-risk mitigation efforts. Company ratings account for variations in exposure and management across sectors, contributing to the overall risk evaluation. Portfolios with overexposure to energy, utilities, materials, and industrial sectors tend to exhibit elevated levels of carbon risk. However, the actual risk levels can differ depending on the specific companies held within the portfolios.

EU SFDR

The SFDR establishes obligatory ESG disclosure requirements for asset managers (AM) to adhere to, at entity and at product level. Its purpose is to enhance transparency regarding investment strategies and prevent instances of greenwashing or false claims of sustainability. Under the SFDR's “classification” system, funds fall into one of three categories: Article 6, Article 8, or Article 9, based on their characteristics and level of sustainability:

- Article 6: Funds without a specific sustainability focus.
- Article 8: Funds that promote environmental or social characteristics (considered “light green”).

- Article 9: Funds with sustainable investment as their explicit objective (referred to as “dark green”).

Essentially, Article 6 mandates asset managers to disclose the integration of sustainability risks within their funds, regardless of whether the funds are marketed as an ESG investment product. Funds marketed as ESG must be classified as either Article 8 or Article 9, depending on whether they meet the specific requirements for those classifications. Many refer to Article 8 funds as “light green” and Article 9 funds as “dark green” because the criteria to be labeled as an Article 9 funds are more stringent. The first quarter of 2023 saw the implementation of the SFDR Level 2 regulatory technical standards, imposing additional disclosure requirements on asset managers. Given the very recent implementation, this data has not been available for the analysis.

Additional Stylized Facts

This section offers additional insights into the investment strategies of funds regarding the energy sector, considering their mandates and labels. Figure 3.5.1 panel 1 illustrates the investment in the oil and gas production and exploration sector. For clarity, the chart excludes conventional funds. It reveals that all sustainable funds allocated approximately US\$35 billion to this sector by the end of 2022, with climate action funds accounting for US\$1.2 billion of that amount. This allocation seems contradictory to the general mandate of these funds. At the same time, while these funds’ share is overrepresented in the renewable utility sector for instance, nearly 80 percent of the investment in this sector comes from conventional funds that do not necessarily have a mandate in sustainable finance (Figure 3.5.1, panel 2).

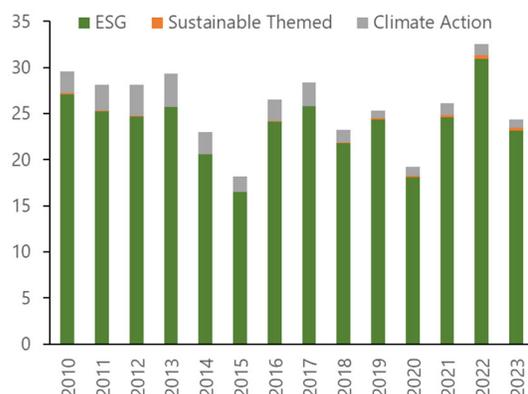
The presented findings, in addition to the facts presented in the chapter, underscore the need for stronger oversight of the green finance industry. Financial market participants are required to disclose information about how they integrate sustainability risks into their investment decision-making process through the SFDR. Market participants must also provide details on the potential impacts of these risks on their investment portfolios. This disclosure aims to improve transparency and enable investors to make more informed decisions about the sustainability aspects of their investments. Examination of the portfolio carbon risk score follows the SFDR reclassification of financial products into “light green,” “dark green,” and “brown” categories (Figure 3.5.1, panel 3). Funds that were reclassified as “dark green” exhibited the lowest carbon risk score, whereas funds without any green products displayed higher transition risk, as indicated by their portfolio carbon risk score. The SFDR's role in promoting transparency and guiding investors towards genuinely sustainable investments becomes even more crucial by examining the flow of sustainable finance by region (Figure 3.5.1, panel 4). For example, the EU stands out as the leading region in terms of green finance, with the United States and China following closely.

Figure 3.5.1. Sustainable Investment Fund Labels Require More Oversight

Sustainable funds continue to invest billions of US dollars in the oil and gas sector...

1. Investment in the Oil and Gas Sector Exploration and Production by Fund Label

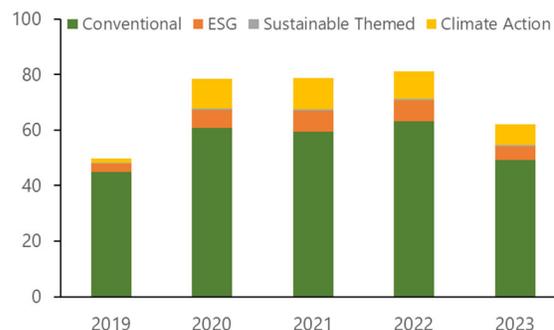
(Billions of US dollars)



...while conventional funds are the main investors in the renewable utility sector ...

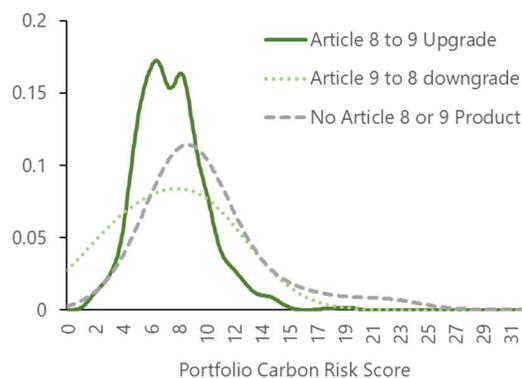
2. Investment in the Renewable Utility Sector by Fund Label

(Billions of US dollars)



Greener funds by label attract more flows.

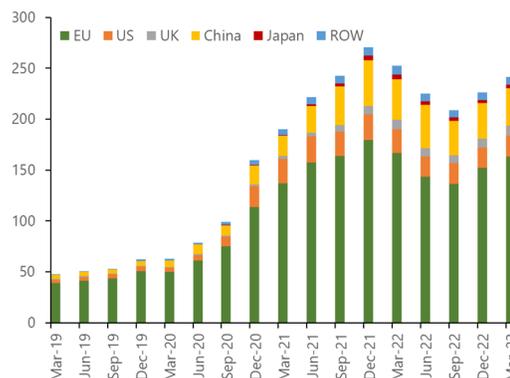
3. Portfolio Carbon Risk Score Distribution, by Fund Reclassification



Climate impact funds domiciled in Europe have thus far attracted the highest investments.

4. Asset Under Management of Climate Impact Funds by Region

(Billions of US dollars)



Sources: Morningstar, and IMF staff calculations.

Note: Panel 1 shows the equity share by fund labels in the oil and gas exploration and production in addition to different subsectors including drilling, services, midstream, and refining. Panel 2 presents the equity share by fund label for the renewable utility sector. Panel 3 exhibits the distribution of portfolio carbon risk score after the introduction of SFDR disclosure requirements in the EU. Finally, panel 4 confirms that Europe is the leader of climate finance as labeled by climate action labels in Morningstar database.

While all types of sustainable investment funds experienced inflows significantly larger than those for conventional funds, among the sustainable funds only those targeting investors in advanced economies, however, experienced higher inflows (Chapter Figure 3.5, panel 2).⁵ Funds with similar labels domiciled in emerging markets, on the other hand, have not systematically benefitted from higher inflows. EMDEs face challenges in attracting green investments due to

⁵ GFSR October 2021, and Capotà et al (2022) confirm a weaker flow-performance relationship for ESG and green-labeled funds compared to conventional funds, suggesting that investors in these funds might have a longer-term investment horizon and better anticipate risk-adjusted performance from ESG and green funds in the future.

their systematically lower ESG scores (IMF, 2022b). Additionally, ESG funds (though not climate impact funds) allocate smaller portions of their investments to EMDEs compared to conventional funds, further contributing to the disadvantage these economies experience in accessing green finance.

Additional Analyses

The following specification is estimated using panel data techniques to examine the relationship between fund labels and fund flows and separately for fund reclassification under the EU SFDR and fund flows:

$$Flow_{i,t} = \beta_1 Flow_{i,t-3} + \beta_2 Return_{i,t-3} + \beta_3 Labels_{i,t} + \beta_4 MS\ Rating_{i,t} + \beta_5 MS\ Sust\ Rating_{i,t} + \beta_6 CRS_{i,t} + Controls_{i,t} + \delta_{c,y} + \delta_{d,y} + \varepsilon_{i,t},$$

where the dependent variable is net capital flow into the fund.

Independent variables are:

1. *Labels_{i,t}*: A vector of dummies capturing the presence of specific sustainability labels for each type of fund (ESG, Sustainability themed, and climate action).
2. *MS Rating_{i,t}*: Morningstar rating based on funds' past performance. A measure that evaluates a fund's historical risk-adjusted performance relative to similar funds within the same category by a scale of 1 to 5 stars (best performance)
3. *MS Sust Rating_{i,t}*: Morningstar sustainability rating which is a measure that assesses how well a fund's holdings perform on ESG factors represented by a scale of 1 to 5 globes (the strongest ESG characteristics)
4. *CRS_{i,t}*: Portfolio carbon risk score which is the asset-weighted Sustainalytics carbon-risk rating of companies held in a portfolio.
5. *Controls_{i,t}*: A vector of fund-level control variables, such as lagged flows (1 quarter), lagged return (1 quarter), the logarithm of fund size, expense ratio, and the logarithm of fund age. These variables are used to account for other factors that may influence fund flows.

Fixed effects are category-year fixed effects and domicile-year fixed effects to control for unobservable factors that may affect fund flows. Standard errors are clustered at the fund level to address potential heteroskedasticity or correlation within funds.

In the alternative equation to estimate the impact of introduction of SFDR new regulations, the vector of dummy variables for labels is replaced by a vector of dummies indicating an upgrade from light green to dark green and downgrade from dark green to light green assets. Each would capture the reclassification with respect to the funds which do not hold any green products.

Data on reclassified funds has been limited; however, initial analysis validates that funds reclassified as “dark green” attract higher inflows compared to funds without any Article 8 or Article 9 products (Figure 3.5.2, panel 2). On the other hand, the same effect is not statistically supported for funds downgraded from Article 9 to Article 8.

Figure 3.5.2. Sustainable Investment Funds Are Growing Fast, But Still Remain Small

Greener funds by label attract more flows.

Funds reclassified as "dark green" attract more flows

1. Sensitivity of Fund Flows to Fund Labels
(Percentage points over conventional funds)

2. Sensitivity of Fund Flows to Reclassified Labels with Respect to Funds with Article 8 or 9 Products



Sources: Morningstar, and IMF staff calculations.

Note: Panel 1 shows the AUM by fund labels as constructed by Morningstar (See annex 3.3 for the definition of labels). In panel 4, the sustainable themed funds exclude climate action funds, and conventional funds exclude both ESG and Sustainable Themed funds, allowing for the assessment of the net impact of each fund label.

Online Annex 3.6.: Firm-Level Climate Impact Scores versus Corporate E(SG) Scores

To investigate the properties of an ESG-like score targeted towards measuring impact, the chapter constructs example impact scores based on the underlying data points that Refinitiv collects for its ESG scores. The calculation of the impact scores, however, departs in three essential ways from the construction of the regular ESG (and the E,S, and G pillar) scores: (i) only data points that are directly related to climate impact are used, which are a subset of datapoints used in the Refinitiv E rating; (ii) the calculation of scores is not an ordinal ranking of firms but tries to reflect the continuous nature of impact and give more weight to continuous (over binary) data points; and (iii) scores are not calculated relative to the firms in the same sector but take into account all firms, thereby allowing a comparison of scores of firms across *all* sectors.

Climate Impact-related Data Points

The example impact scores use the following data points from the set of Refinitiv ESG KPIs (the data points that Refinitiv collects and uses in their ESG ratings):

Online Annex Table 3.6.1. Variable Description		
Data point description	Type of measure	Polarity
Total CO2 and CO2 equivalents direct emission (scope 1) intensity (in tons divided by revenue in millions of US dollars)	Continuous	Negative
Total CO2 and CO2 Scope 3 equivalent emission intensity (unit as above)	Continuous	Negative
The internal price on carbon per ton of CO2 equivalent emissions (converted into US dollars)	Continuous	Positive
Total primary renewable energy purchased and produced divided by total energy use	Continuous	Positive
Total recycled and reused waste produced divided by total waste produced	Continuous	Positive
“Does the company have a policy to improve its energy efficiency?”	Binary	Positive
“Has the company set targets or objectives to be achieved on emission reduction?”	Binary	Positive
“Has the company set targets or objectives to be achieved on energy efficiency?”	Binary	Positive
Total amount of environmental R&D costs divided by revenue	Continuous	Positive
Total amount of NOx emissions emitted (in tons divided by revenue in millions of US dollars)	Continuous	Negative
Total amount of SOx emissions emitted (in tons divided by revenue in millions of US dollars)	Continuous	Negative
Total direct flaring or venting of natural gas emissions (in tons divided by revenue in millions of US dollars)	Continuous	Negative
Total CO2 and CO2 equivalents emission in tons per ton of cement produced	Continuous	Negative
“Does the financial company have a public commitment to divest from fossil fuel?”	Binary	Positive
“Does the company report on initiatives to reduce, reuse, recycle, substitute, or phase out SOx (sulfur oxides) or NOx (nitrogen oxides) emissions?”	Binary	Positive
“Does the company report about take-back procedures and recycling programs to reduce the potential risks of products entering the environment or does the company report about product features or services that will promote responsible and environmentally preferable use?”	Binary	Positive

Source: Refinitiv; IMF staff illustration.

The impact scores hence consider 16 data points in total, of which 10 data points are continuous measures. The data points are a subset of those used by Refinitiv for the E pillar scores. In comparison, the total number of data points used for the Refinitiv E score is 68 (with up to 29 continuous data points), but the selection of data points for the regular E (and ESG) scores depend on the industry. Hence, not all data points are always used.

All above data points are used to the extent possible for the impact scores. The last 8 data points are not collected for firms in all industries and therefore are considered in the calculation of the impact score only if they also enter the Refinitiv ESG score calculation for a firm in a given industry.

Calculation of scores

For continuous data points, the scores are calculated as:

$$Score_{d,i}^P = \left(1 - \frac{Value_{d,i}}{Value_{d,99\%} - Value_{d,1\%}} \right) \times 100$$

$$Score_{d,i}^N = \frac{Value_{d,i}}{Value_{d,99\%} - Value_{d,1\%}} \times 100$$

where $Score_{d,i}^P$ is the score for firm i for a given continuous data point d with positive polarity P (a higher value is better), and $Score_{d,i}^N$ is the score of data points with a negative polarity N (a smaller value is better). To limit the influence of extreme outliers but still maintain the cardinal nature of the scoring formula, the formula uses the cutoff value of the 1st ($Value_{d,1\%}$) and 99th ($Value_{d,99\%}$) percentiles (of the reported carbon intensity of firms, for instance) across *all* firms that report this data. The minimum score is restricted to 0 and the maximum to 100.

The scoring formula above is a substantial deviation from the Refinitiv ESG methodology (and the methodology typically used by ESG providers), which calculates a ranking of firms within the same industry. A ranking, however, does not consider the extent to which a firm is better or worse than its peers. In addition, the scoring formula above is based on the entire cross-section of firms and does not distinguish between industries, so that scores are comparable across all firms.

For binary data points (1 for Yes and 0 for No), which all have a positive polarity, the score is calculated in a similar way as in the Refinitiv ESG methodology:

$$Score_{b,i}^P = \left(\frac{\# \text{ firms with a lower value} + \# \text{ firms with equal value} / 2}{\text{Total number of applicable firms}} \right) \times 100$$

where $Score_{b,i}^P$ is the score for firm i for a given binary data point b with positive polarity P (a value of 1/Yes is better, which applies to all impact-related binary data points). The methodology is different from the Refinitiv one, as the scores are calculated across the entire sample of firms for which the data point is collected.

In line with the Refinitiv ESG methodology, the overall impact score is calculated as the sum of the individual scores divided by the number of datapoints applicable to a given firm:

$$Impact\ Score_i = \sum_{d,b}^{N,P} \omega_{d/b} Score_{d,b,i}^{N,P}$$

However, the impact score puts a higher weight on continuous measures (subscript d for datapoint), set at five times the weight for Boolean data points $\omega_d = 5 \times \omega_b$ with the condition that $\sum_{d,b} \omega_{d/b} = 1$. The higher weight for continuous measures both reflects the higher informational value, as well as the ability of continuous measures to better reflect climate impact compared to binary Yes/No data points. Firms where individual data points are not reported receive a zero score. This is partly in line with the Refinitiv methodology, which however gives a zero score only for missing binary data points but excludes missing continuous data points from the score calculation. The impact scores also embed a penalty for non-reported of continuous data points. Only firms for which at least three data points are reported receive a score.

Relevant properties of the newly constructed example impact scores

The resulting impact scores are significantly different from those of the respective Refinitiv E (all underlying data points of the impact scores also feed into the E pillar score).

An interesting feature of the impact scores compared to the Refinitiv ESG scores is their distribution. ESG scores are close to normally distributed, a feature common across most ESG rating providers including MSCI or Sustainalytics. In the case of Refinitiv, the headline ESG scores and the pillar scores (E, S and G) are effectively a sum of uniform distributions resulting from the scores of individual data points being a ranking across firms. This sum approximates a normal distribution, if enough underlying data points are aggregated and these data points are sufficiently independent from each other (which is usually the case, as the individual data points are designed to reflect distinctively different aspects of the ESG performance of a firm).

A normal distribution of scores, however, can neither reflect current climate performance (the scope one carbon intensity of firms) nor is it close to the impact score (Figure 3.6.1, panel 1). Carbon intensities (and absolute carbon emissions) are relatively low for most firms, but extremely high for a small number of firms. The distribution of carbon emissions is therefore highly skewed with a very long tail at high levels of emission intensity (or absolute emissions). The approximate normal distribution of ESG scores (and of E scores), however, has a roughly equal share of well rated and weakly rated firms.

The climate *impact* scores have a relatively large share of firms with low scores (i.e., a higher probability mass to the right of the graph, as the x-axis in the graph is reversed so that the carbon intensity distribution can be displayed). This is driven by two factors: (i) a relatively large share of firms does not perform as well on the climate impact-related data points; and (ii) data for climate impact-related factors is scarce, which reduces the impact score by construction (similar to the penalty for missing data in the original Refinitiv methodology).

Implications for portfolio allocations of the newly constructed example impact scores

Investment managers typically follow one of three main ESG investment strategies: (i) exclude or underweight firms which do not fulfill a given ESG standard (“exclusion” or “negative screening”); (ii) focus on firms with the best ESG characteristics within a given peer group (“best-in-class”); (iii) or fully integrate ESG risks and opportunities into their financial analysis and investment decisions (“ESG integration”).⁶

As shown in the main chapter, using impact scores would result in very different portfolio allocations than using an E score. Under a “negative screening” whereby the firms with the lowest scores are excluded or under-weighted, very different firms would be affected using an impact versus an E score. The same is true for the analogous “best-in-class” strategy which over-weights firms with the highest scores (Figure 3.6.1, panel 2). Firms that rank within the best five percent using the impact scores, in most cases rank outside the top five percent using the E score (the overlap is about 20 percent, very similar to that for the worst five percent of firms). The rank correlation between the top firms using the impact scores and the rank of firms using the E score is positive (0.16), but low.

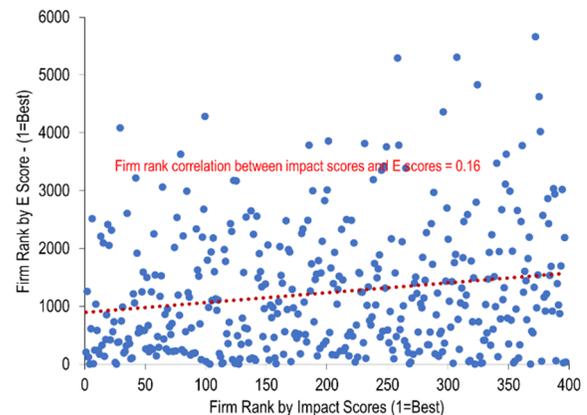
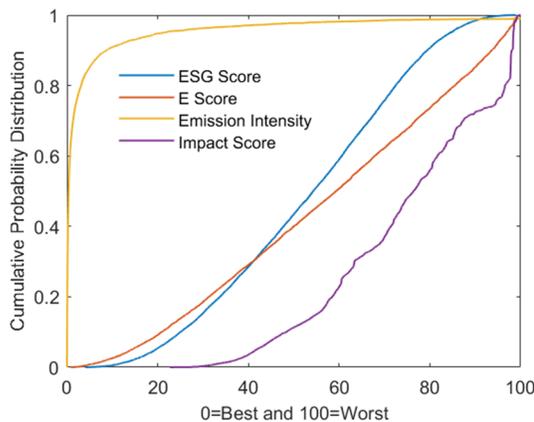
Figure 3.6.1. Impact versus ESG Scores

E(SG) scores tend to be normally distributed, which does not reflect current climate performance or climate impact

Impact scores would result in very different portfolio allocations under a common ESG investment strategy which focusses on the best firms (“best-in-class”).

1. Cumulative Distribution of E(SG) Scores, Emission Intensity and Constructed Impact Scores

2. Firm Rank Under the Constructed Climate Impact Score versus E Score for the Best 5 percent (=400) of Firms



Sources: Refinitiv; IMF Staff calculations.

⁶ See Swiss Sustainable Finance (2017).

Online Annex 3.7.: Region and Country Classification

Online Annex Table 3.7.1. Region and Country Classification	
Country Group	Countries
Emerging market	Argentina, Brazil, Chile, China, Colombia, Egypt, Hungary, India, Indonesia, Iran, Malaysia, Mexico, Philippines, Poland, Russia, Saudi Arabia, South Africa, Thailand, Türkiye, United Arab Emirates.
Developing economies	Afghanistan, Albania, Algeria, Angola, Antigua and Barbuda, Armenia, Aruba, Azerbaijan, Bahrain, Bangladesh, Barbados, Belarus, Belize, Benin, Bhutan, Bolivia, Bosnia and Herzegovina, Botswana, Bulgaria, Burkina Faso, Burundi, Cabo Verde, Cambodia, Cameroon, Central African Republic, Chad, Comoros, Costa Rica, Côte d'Ivoire, Democratic Republic of the Congo, Democratic Republic of Timor-Leste, Djibouti, Dominica, Dominican Republic, Ecuador, El Salvador, Equatorial Guinea, Eritrea, Eswatini, Ethiopia, Fiji, Gabon, Georgia, Ghana, Grenada, Guatemala, Guinea, Guinea-Bissau, Guyana, Haiti, Honduras, Iraq, Jamaica, Jordan, Kazakhstan, Kenya, Kiribati, Kuwait, Kyrgyz Republic, Lebanon, Lesotho, Liberia, Libya, Madagascar, Malawi, Maldives, Mali, Mauritania, Mauritius, Moldova, Mongolia, Morocco, Mozambique, Myanmar, Namibia, Nepal, Nicaragua, Niger, Nigeria, North Macedonia, Oman, Pakistan, Palau, Panama, Papua New Guinea, Paraguay, People's Republic of Montenegro, Peru, Qatar, Republic of the Congo, Romania, Rwanda, St. Kitts and Nevis, St. Lucia, Samoa, São Tomé and Príncipe, Senegal, Serbia, Seychelles, Sierra Leone, Solomon Islands, Somalia, Sri Lanka, Sudan, Suriname, Syria, Tajikistan, Tanzania, The Bahamas, The Gambia, Togo, Tonga, Trinidad and Tobago, Tunisia, Turkmenistan, Uganda, Ukraine, Uruguay, Uzbekistan, Vanuatu, Venezuela, Vietnam, Yemen, Zambia, Zimbabwe.
Export-oriented countries	Australia, Indonesia, Russia, South Africa.
European Union	Cyprus, Czech Republic, Finland, Germany, Greece, Ireland, Italy, Poland.
High income	Australia, Austria, Belgium, Canada, Chile, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Latvia, Lithuania, Luxembourg, Malta, Mauritius, Netherlands, New Zealand, Norway, Oman, Panama, Poland, Portugal, Qatar, Romania, Saudi Arabia, Singapore, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Trinidad and Tobago, United Arab Emirates, United Kingdom, United States, Uruguay.
Upper middle income	Albania, Argentina, Armenia, Azerbaijan, Belarus, Botswana, Brazil, Bulgaria, China, Colombia, Costa Rica, Dominican Republic, Ecuador, Gabon, Georgia, Guatemala, Indonesia, Iraq, Jamaica, Jordan, Kazakhstan, Malaysia, Mauritius, Mexico, Namibia, North Macedonia, Paraguay, Peru, Russia, Serbia, South Africa, Suriname, Thailand, Türkiye, Venezuela.
Lower middle income	Angola, Bangladesh, Benin, Bolivia, Cambodia, Cameroon, Egypt, El Salvador, Ghana, Honduras, India, Lao P.D.R., Moldova, Kenya, Mongolia, Morocco, Nicaragua, Nigeria, Pakistan, Philippines, Republic of the Congo, Senegal, Sri Lanka, Tanzania, Tunisia, Ukraine, Vietnam, Zambia.
Low income	Burkina Faso, Democratic Republic of the Congo, Ethiopia, Mali, Mozambique, Niger, Rwanda, Tajikistan, Togo, Uganda.
Note: The exact sample composition varies across empirical analyses based on data availability.	

Online Annex Table 3.7.2 Jurisdictions Included in IEA Reports for Estimating Climate Investment Needs	
Report	Jurisdictions
IEA NZE 2050	Afghanistan, Albania, Algeria, Angola, Antigua and Barbuda, Argentina, Armenia, Aruba, Australia, Austria, Azerbaijan, The Bahamas, Bahrain, Bangladesh, Barbados, Belarus, Belgium, Belize, Benin, Bhutan, Bolivia, Bosnia and Herzegovina, Botswana, Brazil, Brunei Darussalam, Bulgaria, Burkina Faso, Burundi, Cambodia, Cameroon, Canada, Cabo Verde, Central African Republic, Chad, Chile, China, Colombia, Comoros, Democratic Republic of the Congo, Republic of the Congo, Costa Rica, Côte d'Ivoire, Croatia, Cyprus, Czech Republic, Denmark, Djibouti, Dominica, Dominican Republic, Ecuador, Egypt, El Salvador, Equatorial Guinea, Eritrea, Estonia, Eswatini, Ethiopia, Fiji, Finland, France, Gabon, The Gambia, Georgia, Germany, Ghana, Greece, Grenada, Guatemala, Guinea, Guinea-Bissau, Guyana, Haiti, Honduras, Hong Kong SAR, Hungary, Iceland, India, Indonesia, Iran, Iraq, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kazakhstan, Kenya, Kiribati, Korea, Kosovo, Kuwait, Kyrgyz Republic, Lao P.D.R., Latvia, Lebanon, Lesotho, Liberia, Libya, Lithuania, Luxembourg, Macao SAR, Madagascar, Malawi, Malaysia, Maldives, Mali, Malta, Mauritania, Mauritius, Mexico, Moldova, Mongolia, Rep. of Montenegro, Morocco, Mozambique, Myanmar, Namibia, Nepal, Netherlands, New Zealand, Nicaragua, Niger, Nigeria, North Macedonia, Norway, Oman, Pakistan, Palau, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Portugal, Qatar, Romania, Russia, Rwanda, Samoa, São Tomé and Príncipe, Saudi Arabia, Senegal, Serbia, Seychelles, Sierra Leone, Singapore, Slovak Republic, Slovenia, Solomon Islands, Somalia, South Africa, South Sudan, Spain, Sri Lanka, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Sudan, Suriname, Sweden, Switzerland, Syria, Tajikistan, Taiwan Province of China, Tanzania, Thailand, Dem. Rep. of Timor-Leste, Togo, Tonga, Trinidad and Tobago, Tunisia, Türkiye, Turkmenistan, Uganda, Ukraine, United Arab Emirates, United Kingdom, United States, Uruguay, Uzbekistan, Vanuatu, Venezuela, Vietnam, Yemen, Zambia, Zimbabwe.

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