

TOWARDS ORDERLY GREEN TRANSITION

Investment Requirements and Managing Risks to Capital Flows

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The report has benefitted from comments from the IFA Working Group. This final version is now submitted to G20 Finance Ministers and Central Bank Governors at their 3rd meeting in July 2023 for their concurrence.

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Key issues

Foreign private investment will be essential for emerging markets (EMs) to achieve net-zero objectives, especially in countries with small domestic investor bases and limited fiscal capacity.

There is significant potential for EMs to attract green investment, at a time when sustainable investing is increasing. Capital markets, and in particular investment funds, can play an important role in financing the green transition in EMs.

While there are sizeable opportunities for EMs to leverage global capital markets, potential risks associated with the growth of green finance will need to be managed. Geographic rebalancing of portfolios -whether due to regulations, benchmarking, or investor preferences- towards countries with lower climate risk or better green investment opportunities, and away from riskier countries or countries with larger fossil fuel sectors, may affect capital flows.

On the basis of a dataset of the largest 37 000 mutual funds at global level, this report assesses the current state of portfolio investment by these funds in companies involved in carbon solutions, with a focus on EMs.

Security-level analysis of investment funds' holdings shows that only a very limited share of total equity and bond investments goes to companies involved in carbon solutions and, within this share, an even smaller proportion goes to EMs.

Investment funds specialised in green investment are mainly domiciled and invested in the US. The People's Republic of China (hereafter 'China') is by far the largest investment destination for green funds among EMs and hosts a sizeable share of such funds. A country's market capitalisation, the degree of development of the domestic investment funds sector, macroeconomic fundamentals and domestic regulatory environment, as well as competitiveness in a given renewable energy supply chain, are important factors that help to attract investment flows.

Broader EM equity funds, while having more geographically diversified investments, invest little into green companies.

A number of factors act as barriers to the allocation of green investment in EMs: from potentially inappropriate interpretation regarding climate impact of investments based on current ESG ratings and labels, to more structural issues related to EM risk/return profiles and the current functioning of global capital markets, as well as inadequate supply of "ESG rated" green investable assets in EMs. In particular, the current structure of global capital markets favours an uneven distribution of investment, as usually EMs are perceived as riskier investment destinations. Asset allocation relies heavily on indices and ratings that tend to favour large companies in Advanced Economies (AEs).

Overall, lifting one or some of the bottlenecks to green investment in EMs is unlikely to lead to significantly stronger flows. What is needed is a comprehensive approach to the issue, addressing the various factors that slow down green investment in EMs, taking into account the specific conditions in each particular market.

Considering the differences among EMs as recipients of investment by "green" funds, a better understanding is needed on what directs green investment to some countries rather than others, and what drives green investment in AEs, to capture elements that can be also useful for EMs. Another aspect that may become more relevant relates to the volatility and various risks associated with "green" investment flows and how countries can manage them.

1 Introduction

Context

This report presents recent capital flow developments related to green finance and was discussed at the G20 International Financial Architecture (IFA) Working Group meeting on 6-7 June 2023. It was revised to take into account comments made by the IFA Working Group in June. It is now submitted to G20 Financial Ministers and Central Bank Governors for their concurrence in their 3rd meeting in July 2023.

The report has been prepared by the OECD, pursuant to the request of the Indian G20 Presidency to document the lack of green investment flows to Emerging Markets (EMs), which is one of the priority topics of the Presidency under the G20 International Financial Architecture Working Group. It is based on discussions on the priorities with the Indian G20 Presidency and also the work done in the OECD, including presentations in the Advisory Task Force on the OECD Codes of Liberalisation (ATFC) on 17 April 2023. The study is based on data on investment funds obtained from Morningstar. The EM country sample of this study is provided in Annex A.

While the issue of climate and green finance is being deliberated upon in a number of *fora*, this report contributes to the current debate on the topic by focusing on the current and potential role of global capital markets, and notably investment funds, in the financing of climate transition in EMs. It complements a parallel OECD report on “Bottlenecks to access SDG finance in developing countries” to support the work of the G20 Development Working Group under the Indian Presidency (OECD, 2023^[1]). At this stage, the report does not provide specific policy recommendations. Such recommendations, which would likely need to address a broader set of issues, may be discussed subsequently in the appropriate fora.

The need for different forms of cross-border financing

EMs will need significant green finance in the coming years to facilitate a smooth transition towards becoming low-emission economies and to adapt to the physical effects of climate change. EMs currently account for two-thirds of global greenhouse gas emissions (GHG) emissions. However, their historical cumulative emissions and per capita emissions are quite low despite a sizeable population. Nevertheless, they are highly vulnerable to climate hazards, which makes it necessary to address climate risks in EMs urgently.

Green finance is needed to transform capital-intensive sectors such as energy systems, agriculture, transport, infrastructure and water supply.¹ Global infrastructure (energy, transport and water) is responsible for 60% of global carbon emissions (OECD/World Bank/UNEP, 2018^[2]) and is estimated to

¹ One important dimension not covered in this report relates to “transition” finance, which refers to finance for activities that are not green today, and therefore not eligible for green finance, but that are on a pathway to becoming green at some point in the future. EMs would need significant amount of transition finance in the coming years. The OECD Guidance on Transition Finance has recommended anchoring transition finance transactions on credible corporate transition plans (OECD, 2022^[56]).

face an investment gap of USD 6.3 trillion (tln) per year from 2016 to 2030, the majority of which is required in developing and emerging economies (OECD, 2020_[3]). A recent report by the International Energy Agency (IEA) estimates that to stay on track to achieve net-zero greenhouse gas emissions by 2050, investment needs of emerging and developing economies solely in the renewable energy sector could reach USD 1 tln a year by 2030 (IEA, 2021_[4]).

EMs currently rely mainly on domestic public sector financing to fund green investment (Naran et al., 2022_[5]; IEA, 2021_[4]). However, as the fiscal space is shrinking further in both EMs and Advanced Economies (AEs), as a result of the COVID-19 crisis and other current geopolitical developments, public finance alone would not be sufficient. Official lending by bilateral and multilateral development agencies and banks is also likely to be limited (OECD, 2022_[6]). Accordingly, private investment for green transition becomes necessary, though public investment and financing from Development Financial Institutions can play a crucial role in risk sharing and enhance private investment.

Meeting the investment requirements of IEA scenarios, including achieving net-zero, involves a dramatic shift in the types of capital providers in EMs to private sources (IEA, 2021_[4]). According to estimates by the Institute of International Finance (IIF) and McKinsey, private financial institutions could finance about 55% of net-zero investment needs in EMs (IIF/McKinsey, 2022_[7]). A similar figure corresponds to estimates provided by the Independent High-Level Expert Group on Climate Finance, according to which around 55% of the climate financing needed can be covered by private investment, 25% by Multilateral Development Banks (MDBs), and 20% by other actors using innovative instruments for low-cost financing (Songwe, Stern and Bhattacharya, 2022_[8]).

Although emerging and developing countries (even without China) account for around 40% of the global emissions reduction required to move to the sustainable development scenario (SDS) according to the IEA, these countries currently hold only 10% of global financial wealth (IEA, 2021_[4]). Foreign investment will thus be needed in a context of a relatively smaller domestic investor base and limited public capacity. Cross-border capital flows will therefore be particularly important for EMs.

Attracting higher levels of debt and equity finance from private sources will require enhancing the capacity of markets to attract much higher levels of investment from international sources. The IEA estimates that around one-quarter of the primary finance for energy investments in EMs has come from international sources over the period 2015-20 (IEA, 2021_[4]).

Different types of cross-border private financing are available to EMs in the context of green finance, including foreign direct investment (FDI), bank lending, as well as portfolio equity and debt flows by global investors.

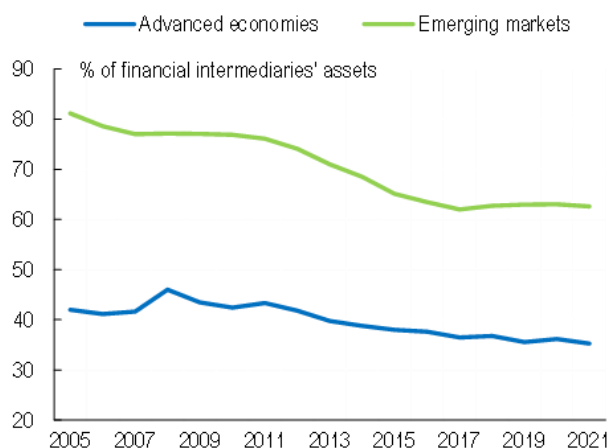
FDI is an important source of financing for EMs. It is a source that has not only been important in size, but also proves more resilient than other types of capital flows. It has been an important enabler of sustainable development, as shown by the OECD FDI qualities indicators (OECD, 2022_[9]). Recent OECD research is showing that greenfield investment in renewable energy has been increasing since 2012, while greenfield investment in fossil fuels shows signs of slowdown. This increase is not limited to OECD countries. In 2021, projects in renewable energy in non-OECD economies accounted for as much as 27% of total announced greenfield investment into non-OECD economies (Knutsson and Ibarlucea Flores, 2022_[10]). Looking at infrastructure, it also appears that the distribution of source and recipient countries of low carbon FDI is significantly skewed. Europe is the prime source and host of it, while East Asia and the Pacific receive only a minuscule 0.1% of global low carbon infrastructure FDI (Mantovani and Röttgers, 2023_[11]). Finally, there is also evidence that the strength of climate policies and openness to cross-border investments are important facilitators of FDI into green sectors (Knutsson and Ibarlucea Flores, 2022_[10]). Even if FDI is refocused on low-carbon assets, it will unlikely be sufficient to fully finance the green transition in EMs. Other sources of financing, and notably portfolio investment flows, would still be needed to meet increasing financing needs (Couto, 2023_[12]). The present report complements existing contributions in this field, by looking at portfolio investment flows.

While there are sizeable opportunities for EMs to leverage global capital markets, the boom of green finance may also present some risks. Geographic rebalancing of portfolios -whether due to regulations or investors preferences- towards other countries with lower climate risk or better green investment opportunities, and away from riskier countries or countries with fossil fuel sectors, may affect capital flows and lead to some capital flow volatility or even long-term structural shifts in capital flows to EMs.

A major development in capital markets and cross-border portfolio flows in recent years is the rise of non-bank financial intermediaries. Investment funds accounted for the largest part of this rise (FSB, 2020^[13]). This growth has been driven by a combination of accommodative monetary policies in AEs, long-term demographic trends, growth of technology and digitalisation; and regulatory reforms targeting in particular core banking institutions (Patalano and Roulet, 2020^[14]). Non-bank financial intermediaries, and especially investment funds, are particularly large players in EMs, where they now represent 40% of financial intermediation (Figure 1.1) and 50% of external financing (FSB, 2022^[15]). This has also been highlighted by the rise of portfolio investment relative to banking liabilities (Figure 1.2). As a result, the sector is an important source of capital that may be leveraged for green finance and is the main focus of this report.² At the same time, NBFi-driven flows can be an important source of systemic risk, an issue that is under discussion in various fora such as the IOSCO and the FSB.

Whereas to achieve climate goals all countries need adequate finance, the focus of this report is on countries falling into the “emerging markets” category, with financial markets at a state of development where they may attract significant capital flows from investment funds. Countries with less developed financial markets may face an even more difficult financing environment but realistically may have to rely primarily on other sources of finance, which are discussed in other G20 workstreams.

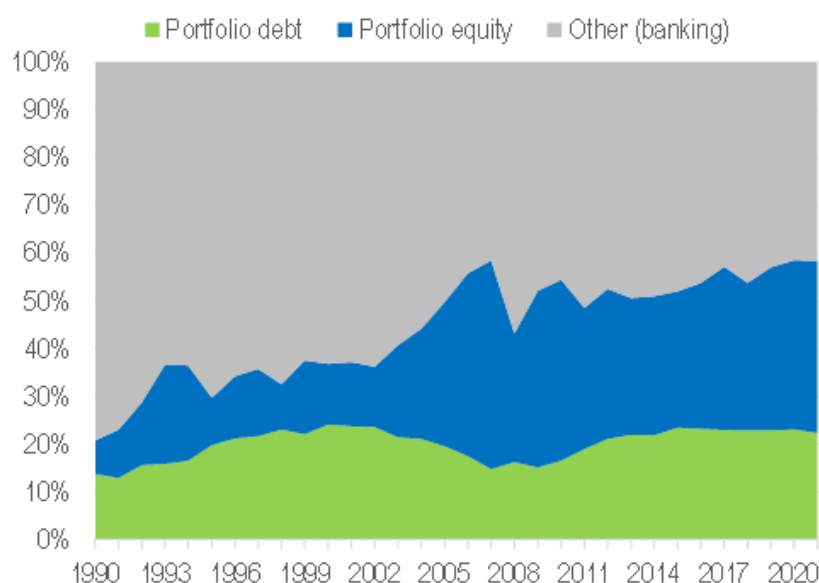
Figure 1.1. Share of banks in financial intermediation



Source: FSB; OECD (2023^[16]), Navigating debt sustainability, structural shifts and economic headwinds Background note for the 22nd Roundtable on Capital Market and Financial Reform in Asia, <https://www.oecd.org/daf/fin/financial-markets/Background-note-for-Roundtable-on-Capital-Market-and-Financial-Reform-in-Asia.pdf>

² A separate stream of OECD research has focused on pension funds and insurance companies investments in infrastructure (Della Croce, 2011^[52]) (Röttgers, Tandon and Kaminker, 2018^[53]) (OECD, 2021^[54]) (OECD, 2022^[55]), which represents only a fraction of investment funds' source of financing. Recent OECD research finds that institutional investors could theoretically allocate a maximum of USD 11.4 trillion to infrastructure assets under current regulations, up from a current allocation of 1.04 trillion (30% of which is currently low carbon) excluding investment in corporate stocks (OECD, 2020^[3]). It also shows that the bulk of investments in green infrastructure occurs through “unlisted” funds which are covered by the present report.

Figure 1.2. Breakdown of EMs' external financing (portfolio and banking liabilities)



Note: Stock of external liabilities of EMs. EM sample defined in Annex A. FDI is excluded.

Source: External Wealth of Nations Database (Lane and Milesi-Ferretti, 2018^[17]), OECD calculations (2023). <https://doi.org/10.1057/s41308>

What role may investment funds play in the climate transition?

Investment funds are intermediaries that pool retail and institutional investors' capital and allocate it in different assets depending on investors' preferences. Such preferences are primarily based on risks and returns of assets but may also include – and have increasingly included – non-financial considerations such as sustainability risks and impacts (Krueger, Sautner and Starks, 2020^[18]). As a result, asset allocation of investment funds may shift towards green transition-aligned investments and away from high-emitting sectors such as fossil fuels. The increased supply of financing will in turn decrease (increase) the cost of capital in green (polluting) sectors.

There are limits, however, to the role that investment funds can play in the climate transition. Investment funds mainly conduct secondary transactions, which are less impactful than direct investment into fixed assets or projects or capital expenditures financed by primary markets. As noted in Jachnik *et al.* (2019^[19]), “secondary transactions (mergers, acquisitions, refinancing, trading of already issued securities, or other financial transactions) result in property (or debt) related to existing assets changing hands, without change in the nature of the tangible fixed asset”. This will be also affected by the ownership structure of a company. The channel towards climate impact is indirect: “Acquisitions and refinancing create exit opportunities for first round investors and, as such, free up financial resources for further investments in new tangible fixed assets. For instance, the purchase (typically at a premium price) of an operational renewable energy power plant by an equity fund from a project developer provides the developer with funds to develop and (at least partly) finance further capital expenditures”. As such, the availability as well as the terms and conditions of finance for investments in new tangible fixed assets in turn influences the relative attractiveness of low and high carbon intensive activities for investors. Another possible channel for climate impact relates to stewardship by investment funds through shareholder engagement and proxy voting. Evidence shows that support for climate-related shareholder resolutions has grown over time, led by sustainable and climate funds (IMF, 2021^[20]), and that Environmental, Social and Governance (ESG) funds vote more independently of management compared to other funds when it comes to environmental and social issues

(Curtis, Fisch and Robertson, 2021^[21]). This channel may, however, be limited by the rise of passive and benchmark-driven investing in recent years. These dynamics and their impact on green finance are discussed in Section 2.

In view of the above, this report is structured as follows: Section 1 presents an overview of the sustainable investing boom, which has reached EMs only marginally. It also provides new data on actual green investments in capital markets with a focus on investment funds and provides evidence that capital flows to green sectors in EMs are still scarce. Section 2 discusses various explanations for the low allocation of green investment in EMs: from issues related to ESG ratings and labels, to more structural issues related to EM risk perceptions and the current functioning of global capital markets. Some possible areas for further work are outlined in Section 3.

2 Green investment flows to EMs

In the analysis that follows, this report leverages a detailed dataset of investment funds' holdings provided by Morningstar Direct, which covers the lion's share of global Assets Under Management (AUM) (See Annex A).³ The analysis is focused on publicly traded debt and equity investments by Open-Ended Funds (OEFs) and Exchange Traded Funds (ETFs). In the first part of this section, the focus is on sustainable/ESG investing, which can be defined as an investment approach that considers environmental, social and governance factors and metrics in portfolio selection and management.⁴ The second part of this section focuses on specific samples of specialised "green" funds as well as EM-dedicated funds.

The analysis in this report focuses on the *supply* of funds for sustainable investment and not on the new types of financial instruments that have been designed to channel funds to sustainable objectives. Companies have started to issue bonds with defined sustainability objectives such as clean transportation, energy efficiency, and climate change adaptation, i.e., green, social and sustainability bonds (GSS), blue bonds and transition bonds, but global issuance remains low. These dynamics are discussed elsewhere (OECD, 2023^[22]; IMF, 2022^[23]).

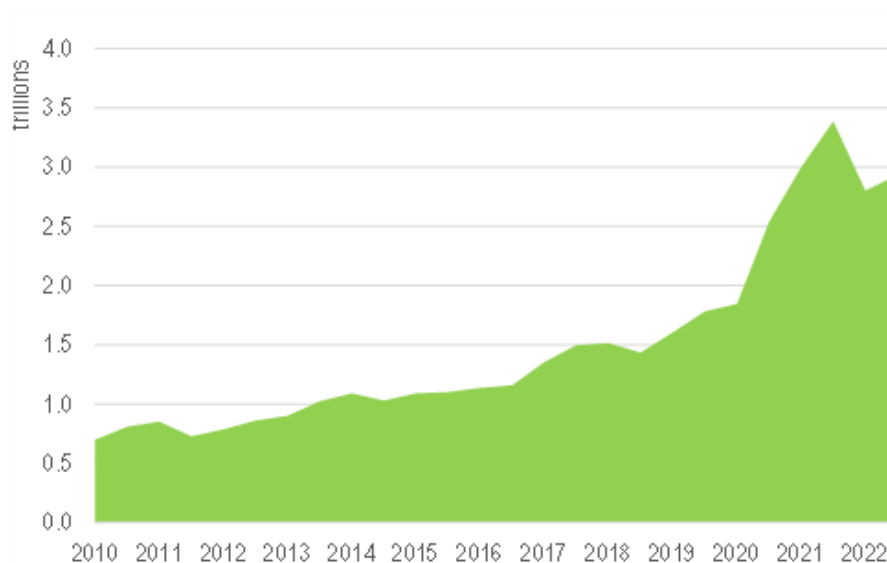
Sustainable investment has significantly increased...

Capital markets have shown strong and growing appetite for sustainable investing. According to a 2020 estimate by the Global Sustainable Investment Alliance (GSIA) using a broad definition, sustainable investment AUM made up more than one third of total AUM in the five largest markets, equivalent to USD 35.3 tln (GSIA, 2021^[24]).

Figure 2.1 and Figure 2.2 illustrate the large growth of sustainable funds in recent years, with AUM tripling over the decade 2010-20 and with an exponential boom in the last three years, peaking at almost USD 3.2 tln at the end of 2021 according to the sustainable fund definition used in this report (See Annex A). There has been a more recent downward adjustment, in line with general financial market declines in 2022, but sustainable investing is expected to continue its growth in the next few years.

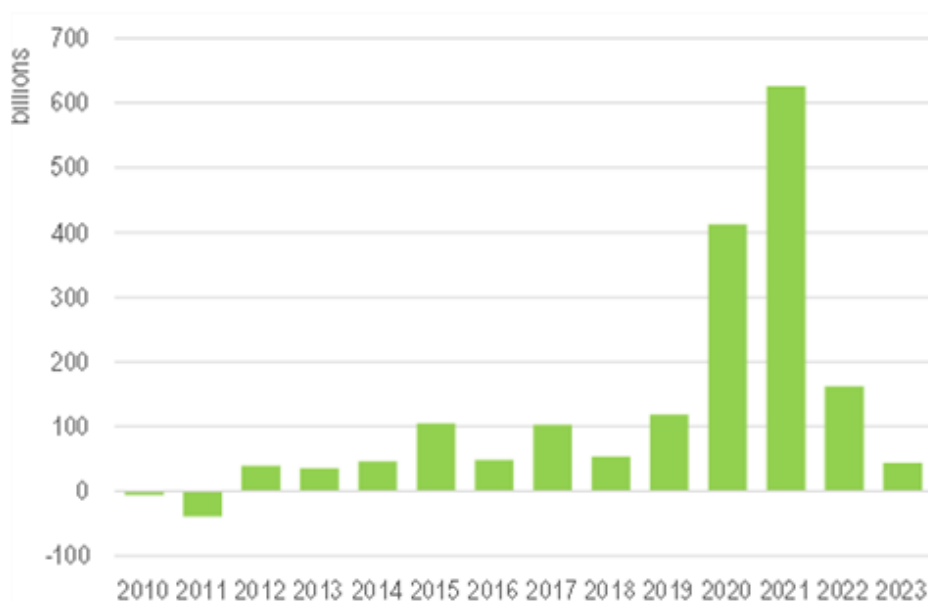
³ To limit the scope of the analysis, only funds with AUM above USD 100 mln are covered, i.e., the 37 000 largest investment funds accounting for 90% of AUM covered by this data provider.

⁴ In the following paragraphs, this report refers to "sustainable" investment as "ESG investment". The "sustainable" classification of investment funds in the sample is based on the name and prospectus (See Annex A).

Figure 2.1. AUM by sustainable funds globally (USD)

Note: Sustainable classification based on name and prospectus. See definition in Annex.

Source: Morningstar, OECD calculations (2023).

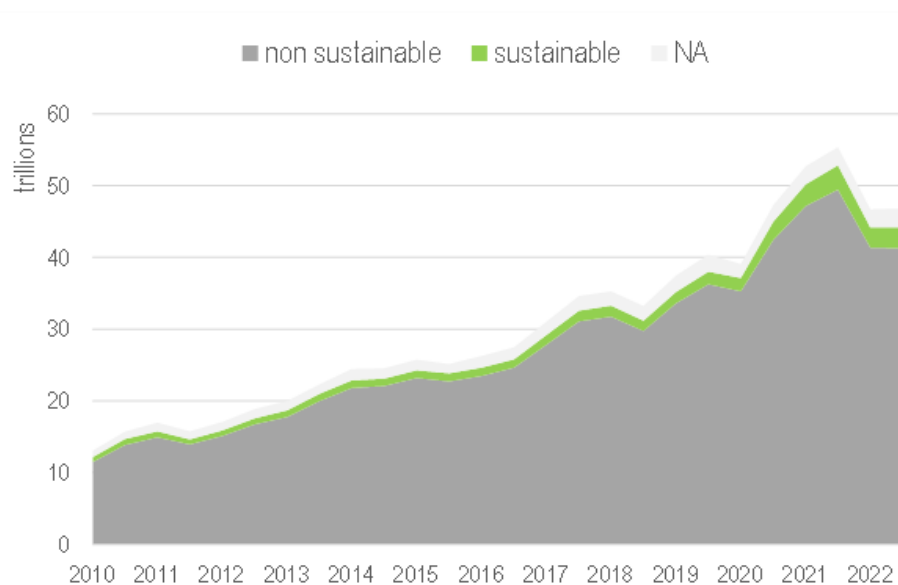
Figure 2.2. Flows into sustainable funds globally (USD)

Note: Sustainable classification based on name and prospectus. See definition in Annex.

Source: Morningstar, OECD calculations (2023)

Despite this rapid growth, there remains ample room for more sustainable investing: sustainable funds still only account for a small percentage of global AUM of investment funds, representing 6.2% of total AUM at end of 2022 (Figure 2.3), a much lower figure than the 36% provided by some estimates using broader definitions of “sustainable investment” (GSIA, 2021^[24]). This points to necessary scrutiny in definitions, names and labels, amid possibilities of “greenwashing” as further discussed in Section 2.

Figure 2.3. AUM by type of global funds (USD)



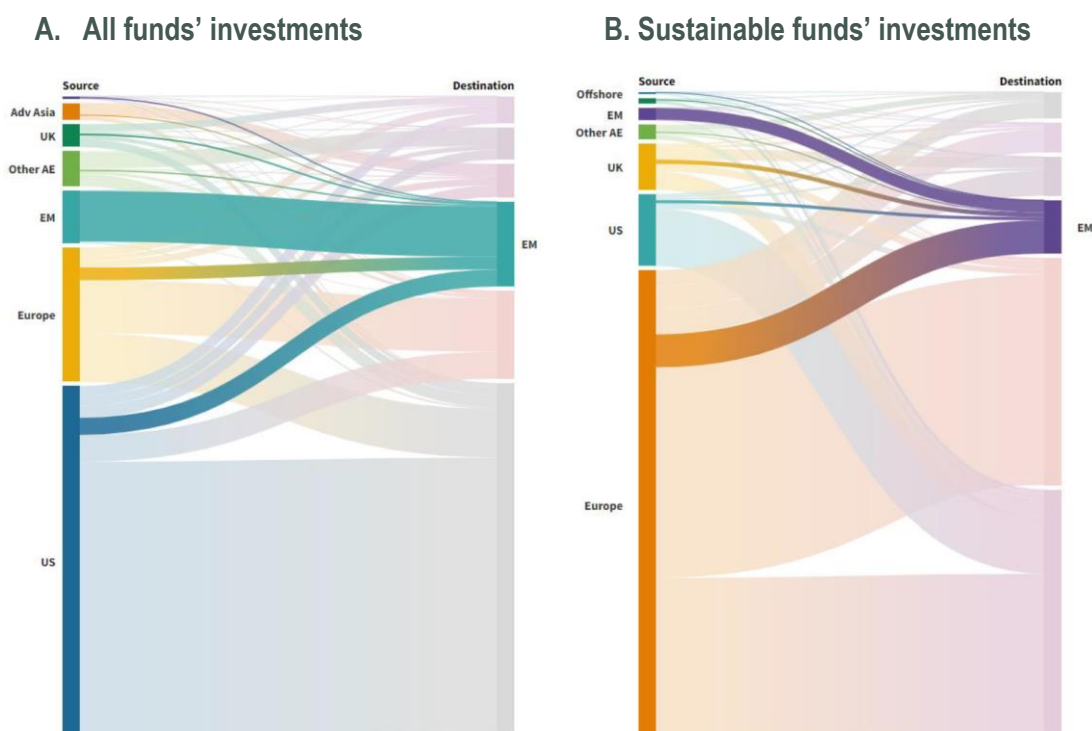
Note: Sustainable classification based on name and prospectus.

Source: Morningstar, OECD calculations (2023)

... but has not reached EMs, yet

Most importantly, there is major room for more geographic diversification of investment towards EMs. Looking at all investment funds (sustainable and non-sustainable), the share of investments that are directed towards EMs represents a small but non-trivial proportion of the total (11% in 2022), equivalent to around USD 5.2 tln (Figure 2.4, Panel A). Out of this 11%, more than half comes from domestic funds or funds domiciled in other EMs (6.5%), followed by US and EU funds, which account for most of the remainder (2.2% and 1.6%, respectively).

Figure 2.4. Origin of funds' investments in EM assets

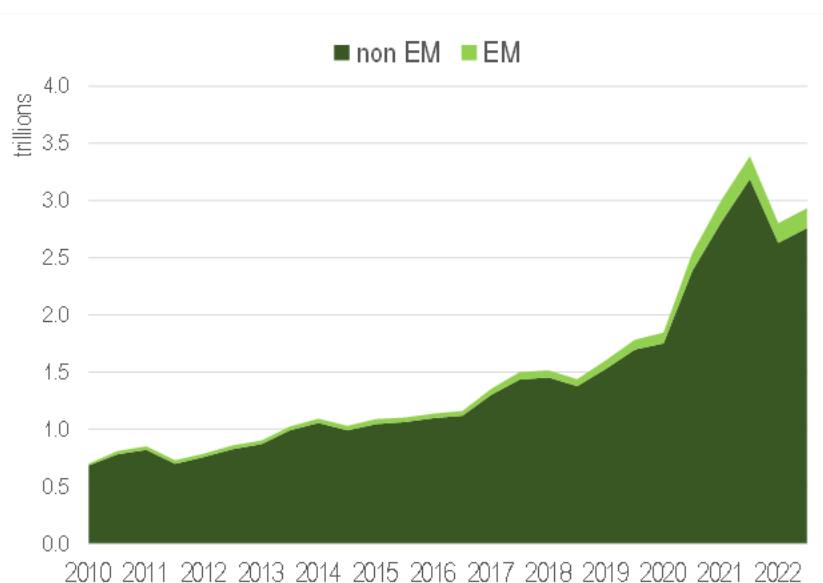


Source: Morningstar, OECD calculations (2023). Note: Panel A maps the global sample of the 37 000 largest funds. Panel B maps the sample of sustainable funds based on name and prospectus. See Annex for sample and data description. Latest portfolio data (retrieved 2023Q1).

Looking at the origin of *sustainable* investment funds in EM assets, Europe is a key source region (60%), followed by EMs, while the United States and other AEs play a smaller role (Figure 2.4, Panel B).

When comparing the share of investment in EMs by conventional and *sustainable* funds, it appears that sustainable funds invest even less in EMs: around 6% at end of 2022, compared to 11% for all funds (Figure 2.4, Panel B and Figure 2.5), a gap that has also been noted in other studies (IMF, 2022^[23]). If sustainable funds simply allocated the same share as conventional funds to EMs, investments to EMs by sustainable funds would almost double (an additional 5% of the total allocated to EMs, i.e., USD 150 bln).

Figure 2.5. AUM of sustainable funds by geographic allocation of holdings



Note: Sustainable classification based on name and prospectus. Definition and country sample is provided in the Annex.

Source: Morningstar, OECD calculations (2023).

Measuring climate impact: defining “green” funds and assets

While the preceding section has highlighted the growing appetite for sustainable investing and room for more, especially in EMs, assessing actual investment in assets with potential climate impact requires a more focused analysis on “green” funds.

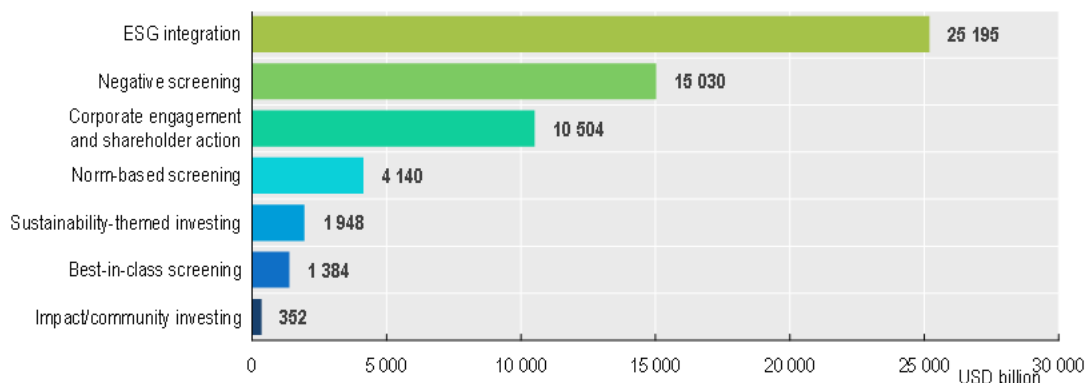
The use of data on sustainable/ESG investment has its limits, which this report tries to overcome. Asset managers may claim to adopt sustainable or ESG conscious strategies, for instance, through a fund’s name or prospectus. But these names, or ESG ratings do not necessarily contribute to more environmental sustainability. This could be either due to investors being misled by labels on financial products (including so-called “greenwashing” or “sustainability-washing”) or because the mandated goals of an investor are not aligned with scientific evidence.

Figure 2.6 shows the assets’ aggregates, where surveyed investors responded to whether they follow any of the sustainable investing strategies shown.⁵ The most widespread strategy is “ESG integration” by asset managers. AUM by investors who claim to employ shareholder power to influence corporate behaviour on ESG-related issues is less than half the amount of assets invested under the “ESG integration” strategy.

⁵ *ESG integration* refers to systematic and explicit inclusion by investment managers of ESG factors into financial analysis; *negative screening* refers to the exclusion from a portfolio of certain sectors, companies, countries or other issuers based on activities considered not investable; *corporate engagement and shareholder action* refers to employing shareholder power to influence corporate behaviour, including through proxy voting that is guided by comprehensive ESG guidelines; *norm-based screening* refers to screening of investments against minimum standards of business practice based on international norms such as those issued by the UN, ILO and OECD; *sustainability-themed investing* refers to investing in themes or assets specifically contributing to sustainable solutions (e.g. sustainable agriculture and gender equity); *best-in-class screening* refers to investment in sectors or companies selected for positive ESG performance relative to industry peers, and that achieve a rating above a defined threshold; *impact/community investing* is defined as investing to achieve positive social and environmental impact.

Strategies that often accept a tangible trade-off between wealth creation and better ESG results, such as impact investing, are much less.

Figure 2.6. Sustainable investing assets by strategy, 2020 (USD, bln)

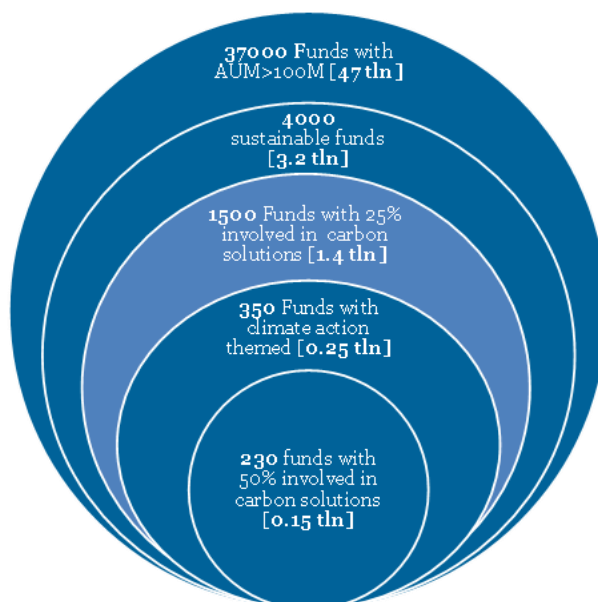


Note: These strategies are not mutually exclusive, funds could follow more than one strategy.

Source: GSIA (2021^[24]), Global Sustainable Investment Review 2020.

Due to greenwashing concerns and the very broad and diverse definitions covered by sustainable/ESG investing, this section analyses specifically “green” funds within the total investment fund sample studied in this report. Figure 2.7 displays the number of funds and the size of AUM that would be covered by different definitions of “green” funds within the total sample of USD 47 tln. Depending on the definitions, the universes differ substantially, and funds invest to very different degrees in green sectors (See Table A.2). This demonstrates the importance of using a precise and robust definition of green funds.

Figure 2.7. Number of funds and AUM (USD) for different “green funds” definitions



Note: See Annex for definitions of the different fund universes.

Source: Morningstar, OECD calculations (2023).

Following OECD (2020^[3]), this report uses a sectoral classification to define green funds and assets as the best approximation of actual climate impact. This goes beyond most existing research, which focuses either on the use of broad ESG/sustainable definitions or focuses on climate labels or carbon emission metrics and is an important contribution of the present report (the Annex provides more details on this choice). In particular, “green” assets are defined using the metric by Morningstar “% of the revenue from involvement in carbon solutions”, which captures the key sectors involved in climate transition, including renewable energy, transport, buildings, and energy efficiency.⁶ Green funds are then classified as holding a certain share of such companies in their portfolio.

According to this definition, there are USD 3.8 tln invested in “green” assets globally by investment funds in the sample, i.e., 7.9% of total global AUM. If the current global allocation to EMs (11%) were allocated in this proportion to “green” assets (assuming such assets were available on the necessary scale), EMs would be expected to receive USD 416 bln in green investments.

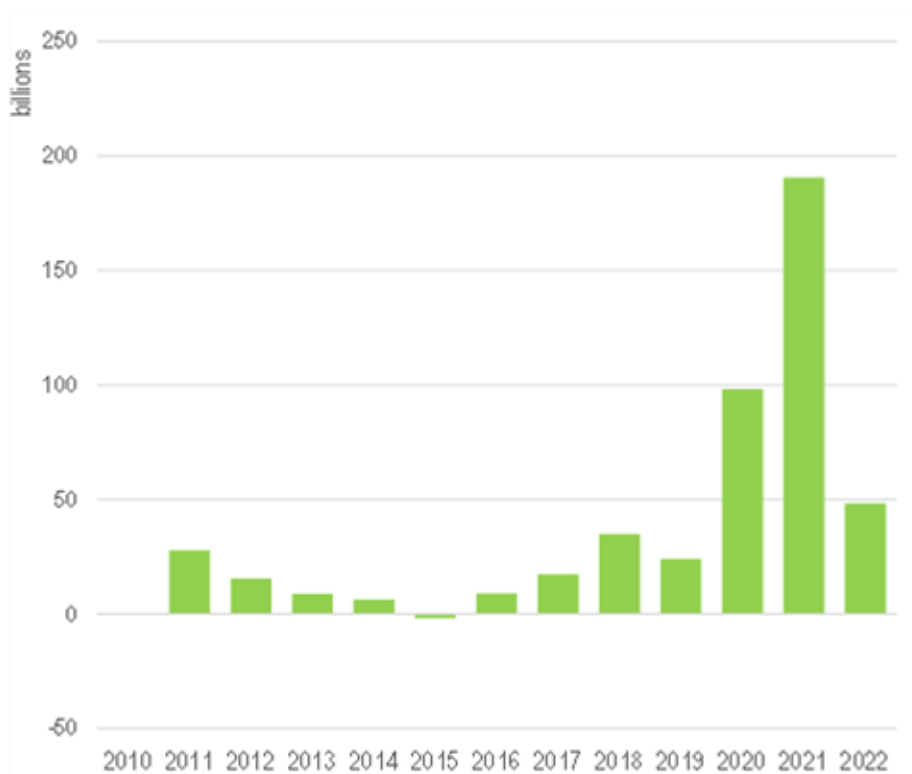
From “green” funds to EMs assets: investments in emerging markets are scarce and unevenly distributed

This section analyses the global portfolio allocation of “green” funds, defined as funds that have more than 25% of assets in companies involved in carbon solutions, a threshold that strikes a reasonable balance between climate impact and the inclusion of a meaningful number of funds (for further details on the methodology applied, see Annex). The sample so-defined captures 1600 funds globally.

Flows to such funds have increased remarkably over 2020-21, peaking at around USD 200 bln in 2021, and slowing down in 2022 (Figure 2.8). Despite this, they experienced inflows in the latter year, while other non-green funds experienced outflows (Figure 2.9).

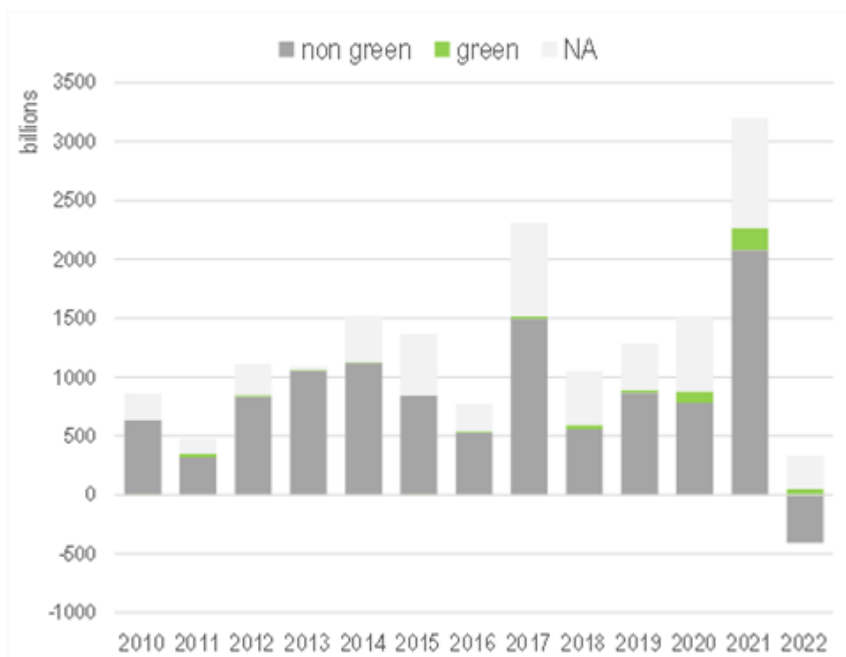
⁶ Carbon solutions include: renewable energy, energy efficiency distribution and management, material, industrial systems and processes, consumer products, green buildings, green transportation, green infrastructure. See Annex A for further details. Companies are classified as green if any revenue is made from carbon solutions. Annex A analyses the distribution of revenues in carbon solutions in companies in the sample and confirm that this is a meaningful definition that does not simply capture greenwashing.

Figure 2.8. Flows to “green” funds (USD bln)



Note: “Green” funds defined as funds with more than 25% of the eligible portfolio involved in carbon solutions.
 Source: Morningstar, OECD calculations (2023).

Figure 2.9. Flows to “green” vs. non green funds (USD bln)



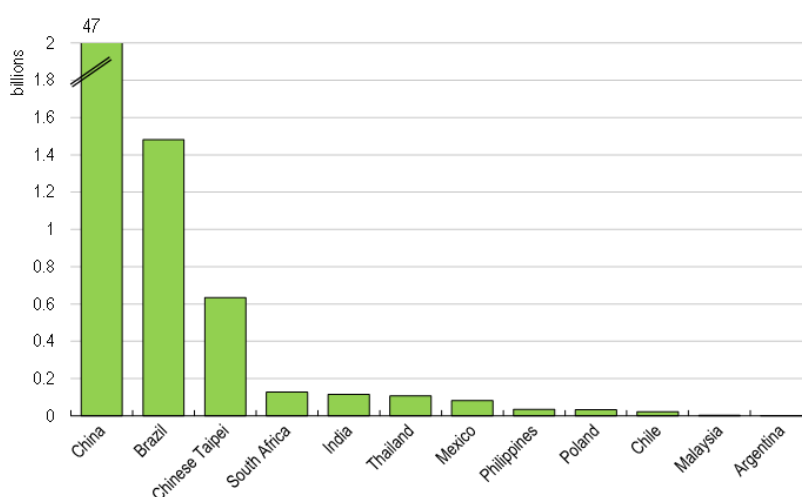
Note: “Green” funds defined as funds with more than 25% of the eligible portfolio involved in carbon solutions.
 Source: Morningstar, OECD calculations (2023).

The rest of this section seeks to directly analyse the green assets held within green funds' portfolios so that the share of non-green assets in each fund's portfolio is excluded from the analysis. The analysis of 78 000 individual positions of the green funds sample allows the disaggregated analysis of the geography of green assets within green funds' portfolios.⁷

Figure 2.10 and Figure 2.11 show the market value of “green” positions by green funds split by the destination of the investment. Green investments appear heavily skewed towards the US, which represents almost 70% of green investments in the sample.

China is by far the next largest investment destination and represents the lion's share of green investments in EMs. Brazil comes a distant second, but still much larger than next EMs on the list – Chinese Taipei, South Africa, Mexico, India, Thailand and Poland (Figure 2.10).⁸ Overall, EMs represent only 13.6% of total green investment by green funds in the sample, and less than 1% excluding China.

Figure 2.10. Market value of green funds' positions in green companies in EM (bln USD)



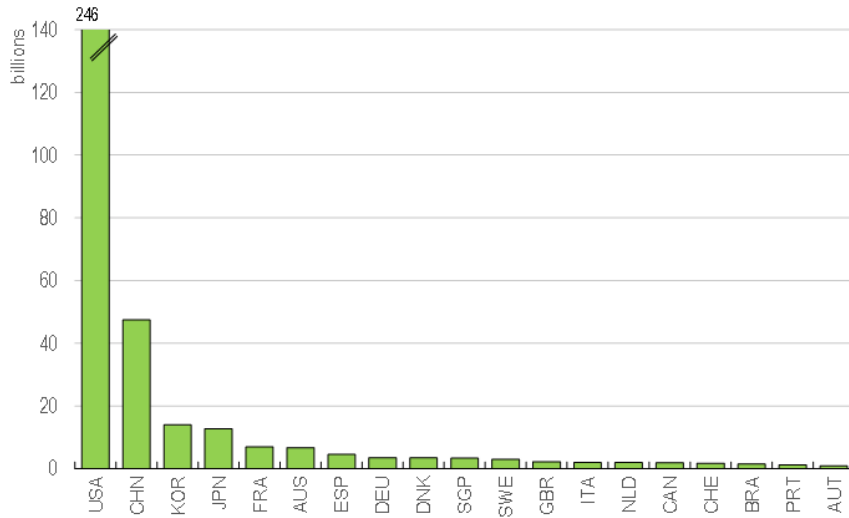
Note: “Green” funds defined as funds with more than 25% of the eligible portfolio involved in carbon solutions. Latest portfolio data (retrieved 2023Q1).

Source: Morningstar, OECD calculations.

⁷ From a universe of 1600 funds, the analysis captures the top 100 holdings of each fund and classifies the holdings as involved in carbon solutions or not. The final sample covers 14000 “green” securities, representing 14000 positions by green funds. Out of these, 3600 represent EM companies. As the analysis in this section only concerns green funds, it does not provide a representative analysis of global green investments but instead of green investments by specialised green investment funds.

⁸ Various scaling, including to GDP, do not substantially change the distribution.

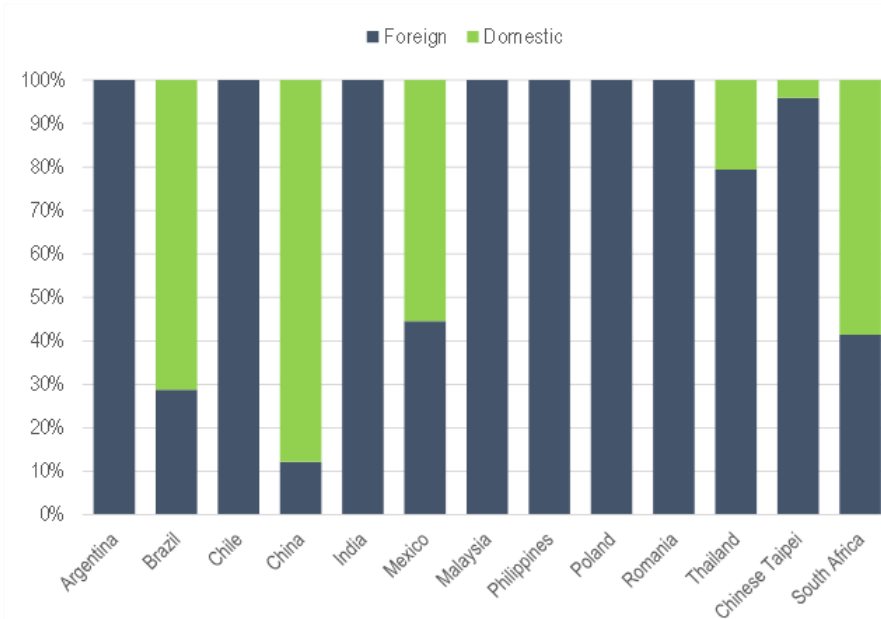
Figure 2.11. Market value of green funds' positions in green companies globally (bln USD)



Note: "Green" funds defined as funds with more than 25% of the eligible portfolio involved in carbon solutions. Latest portfolio data (retrieved 2023Q1).
 Source: Morningstar, OECD calculations.

This highly skewed distribution is partly explained by the US and Chinese shares in global indices as explained in Section 2, but also by the domiciles of green funds. Almost half of the green funds are domiciled in the US, and 13% are domiciled in China. A significant share of these funds has domestic allocation mandates. For other economies, there is important heterogeneity in the origins of green investments: in Argentina, Chile, India, Malaysia, Philippines, Poland and Romania, investments tracked were entirely from foreign green funds, while in China, Brazil, Mexico, South Africa and, to a lower extent Thailand, the majority of green investments came from domestic green funds (Figure 2.12).

Figure 2.12. Origin of green funds investing in EM green assets (%)



Source: Morningstar, OECD calculations.

Not surprisingly, countries such as China with big market capitalisation and with important domestic investment fund sectors also attract more green investment.

A dive into the type of green assets in the sample shows that carbon solution-oriented investment funds are investing in EMs that play a key role in the supply chain of some renewable energy technology sectors, such as solar photovoltaic panels and electrical vehicle batteries. In particular, they include companies that are competitive in a given renewable energy supply chain with significant concentration (OECD, 2023^[25]).

In China, companies featured in the sample are involved in battery manufacturing, electric cars, photovoltaic technology, and smart homes. In Brazil, they appear to be mainly energy utility companies in generation and distribution. The vast majority of the sample are equities (stocks), with only a few corporate bonds of companies involved in carbon solutions.

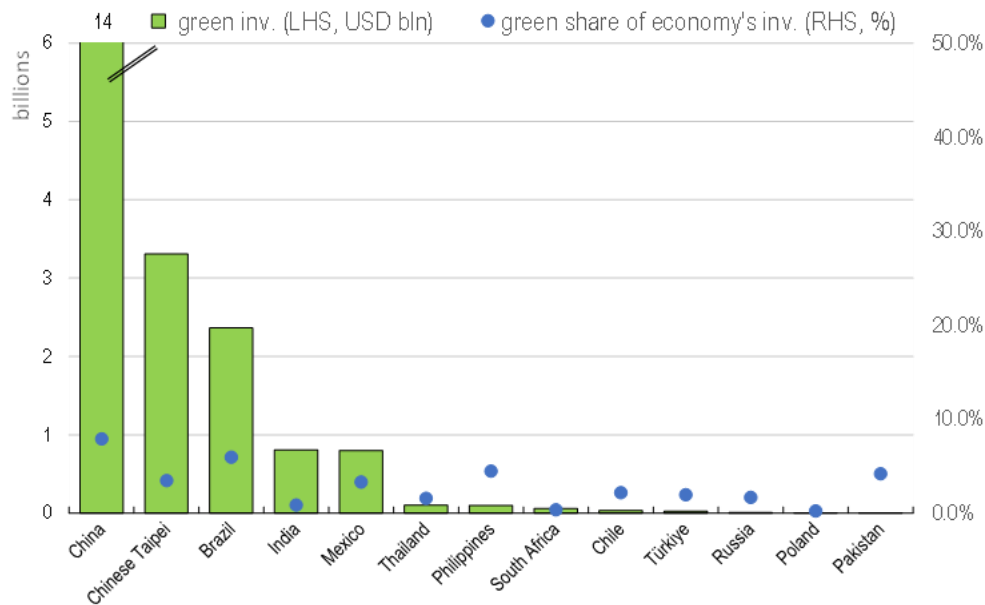
Global EM funds are more diversified but invest little in green assets

While the previous section discussed the global portfolio allocation of more specialised “green” funds and the share of their investment into EMs, this section takes the converse perspective and analyses portfolios of EM-dedicated funds and their investments in green companies. More specifically, it studies the allocation of “global emerging market equity” funds, which represents a sample of 710 funds with AUM greater than USD 100 mln (a total of around USD 1 tln of AUM for the sample).

The average global EM equity fund invests 9.6% of its portfolio into companies involved in carbon solutions. While this is only slightly lower than the average allocation of a conventional fund (10%), it is much lower than the cut-off proposed in this study for definition as a “green fund” (25%, see previous section). Only one fund out of the 710 appears to meet the criterion.

Figure 2.13 shows that green investments by global EM funds are more geographically diversified than those of the specialised green funds that concentrate their investment in the US and China. China remains the most preferred green investment destination (65% of green investments) for global EM funds. Brazil accounts for 10%, while India and Mexico represent 3.5% each, and South Africa receives less than 1% of EM green investments.

Each investment destination receives a very low share of green investments by EM-dedicated funds: most receive less than 3% of green investments as a share of the total they receive, and when higher, it still does not exceed 10%. (Figure 2.13).

Figure 2.13. Market value of global EM equity funds' positions in green companies in EM

Note: Sample of 714 global EM equity funds. LHS represents absolute value of green investments in each destination. RHS represents share of green investments (% total investments by global EM funds in this economy). Latest portfolio data (retrieved 2023Q1). Source: Morningstar, OECD calculations.

Key take-aways

The analysis shows that flows by investment funds towards green assets in EMs are overall very low and concentrated in few countries. Investment funds specialised in green investment are mainly domiciled and invest in the US and China. Broader EM equity funds invest little into green companies. There could be room for further geographical diversification by foreign investors, provided the supply of investable green assets in EMs also increases on the necessary scale.

The green investments that EMs do receive primarily go to those EMs with deeper financial markets and large domestic investor bases, and those offering profitable green projects and competitive green manufacturing supply chains, notably EMs with key market players in a renewable energy value chain (e.g., solar photovoltaic panels, electrical vehicle batteries).

3 Drivers of low allocation of green investment to EMs

Risk perceptions and challenges posed by investments in EMs

The capacity to mobilise capital differs between countries and sectors and their associated perceived risks. EM investing is generally perceived as riskier than investing in AEs, and investment in green sectors as riskier than in non-green sectors, which leads to compounding effects.

A key barrier to private investment in EMs is the high risk perceived by private investors in terms of projects' commercial viability and return profile, even for projects with impact goals, as highlighted by a recent survey conducted by the OECD (2023^[26]).

The economy-wide cost of capital, whether for debt or equity, remains much higher in EMs than in AEs. For instance, the average difference between EM and US sovereign bonds yields in USD was 2.4% in 2022 (narrowing from 3.4% in 2020). At the end of 2022, the USD corporate bond spread with US Treasuries was 395 bp for EM corporates vs. 138 for US corporates (a spread of 2.6%).⁹

Section 1 has shown that a large part of investment funds' asset allocation, at least in bigger EMs is still domestic, which relates to the well-known "home bias" extensively covered in the literature (Chan, Covrig and Ng, 2005^[27]). To some degree this home bias may in fact be a "home currency bias" (Burger, Warnock and Warnock, 2018^[28]; Maggiori, Neiman and Schreger, 2020^[29]). This highlights the importance of the currency denomination of assets and currency risk in attracting capital for green companies in EMs. Currency risk will arise in particular if financing is foreign currency denominated while project revenue is in local currency. For many EMs, especially those with a small domestic investor base, investments will mainly be from cross-border investors.

Determinants of the allocation of investments are well known and include strong institutions and governance, notably investor protection, strong enforcement and high-quality accounting disclosures (La Porta et al., 2000^[30]; Papaioannou, 2009^[31]). Weaker rule of law in contract enforcement and property rights can raise the risk of losses in disputes. Low political stability can similarly raise expropriation risks. Whereas policy uncertainty, perceived, or otherwise, is an important driver of the higher cost of capital in EMs (Kalemli-Özcan and Varela, 2021^[32]), a lack of clear, consistent, and supportive government policy, preferably aligned with net zero commitments, can raise green investment risks in all countries.

EM allocation is also higher in countries with more open capital accounts (Aggarwal, Klapper and Wysocki, 2005^[33]; Chan, Covrig and Ng, 2005^[27]), and the same has been found for green investment (Knutsson and Ibarlucea Flores, 2022^[10]). More generally, barriers to external investments and impediments to repatriating returns can be obstacles to investment, including green investment. Global portfolios mostly include firms that are large, have few restrictions on foreign ownership, and are cross-listed on US exchanges (Edison and Warnock, 2004^[34]; Ferreira and Matos, 2008^[35]).

⁹ As represented in the ICE BofA Emerging Markets Corporate Plus Index and the ICE BofA US Corporate Index.

Challenges faced by EMs together with the specific risks of investing in green sectors leads to what may be called “nested barriers” to low carbon investment (Granoff, Hogarth and Miller, 2016^[37]) and an increased perception of risk by global investors. In more uncertain countries, investors in capital markets tend to demand high returns for the perceived risks, making some economically interesting projects not viable (Ameli, Kothari and Grubb, 2021^[36]).

Structural trends in global capital markets

In addition, there are structural barriers to green investments in EMs from the functioning and structure of global capital markets. Fixing problems in the specific ESG segments alone may not be sufficient if more fundamental trends in capital markets impede such investments. Four factors are important in that context: i) the share of free float in equity markets; ii) index-driven investing; iii) high concentration in company ownership; and iv) the role of company size in driving investments.

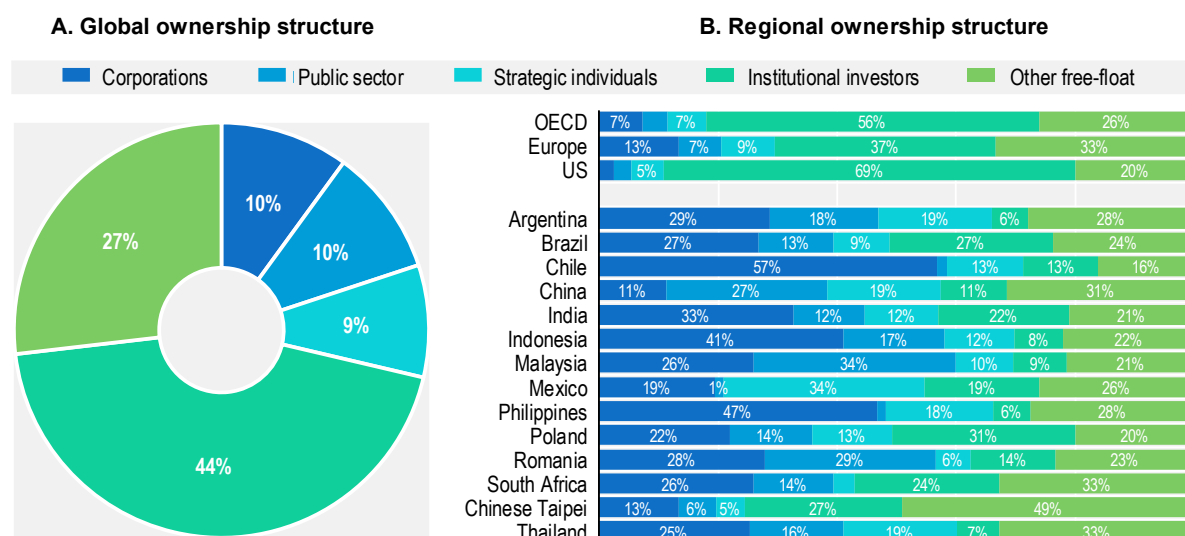
A first stylised fact relates to the differences in the relative importance of the various investor categories across countries in the equity market (De La Cruz, Medina and Tang, 2019^[38]). At the end of 2021, there were almost 42 000 listed companies in the world with a combined market value of USD 122 tln, the largest asset class in the world, with institutional investors holding 44% of the global market capitalisation (Figure 3.1 Panel A). Also, in recent decades, most advanced markets have seen a significant increase in various forms of institutional ownership at the expense of direct ownership by households (Figure 3.1, Panel B).

Looking at EMs, the differences with OECD countries and the United States are striking: the share of institutional investor ownership is much lower in EMs, with a higher share owned by corporations, as well as strategic individual investors. The dominance of investors such as corporations, the public sector and strategic individuals is reflected in the high ownership concentration in these markets and the relatively low share of listed equity available to institutional investors.

Secondly, institutional investors largely allocate their assets through indices. Both active and passive management styles use indices in their asset allocation. Active managers may have some freedom to deviate from the index, but their asset allocation still remains influenced by it. Given their importance in global markets, this has large consequences on how capital is allocated in the economy more broadly. Companies in EMs have concentrated ownership with low free-float levels. In the construction of indices, index-providers take into account the size of the company and free-float levels. Therefore, EM companies may have a limited inclusion in investable indices due to their low free-float levels.¹⁰

¹⁰ When a company is owned by controlling owners such as a corporation, public sector or strategic individuals, these shares are not counted in the total free-float. Therefore, from the figures only institutional investors' holding and other free-float correspond to total free-float.

Figure 3.1. Listed companies' ownership structure, end-2021



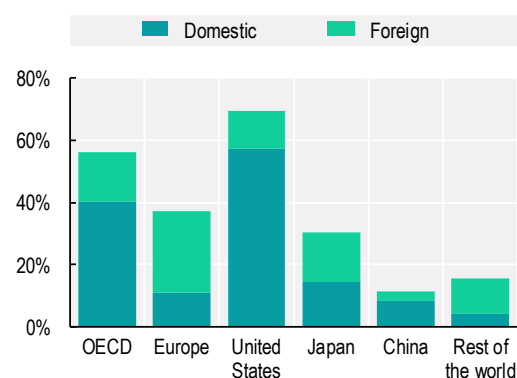
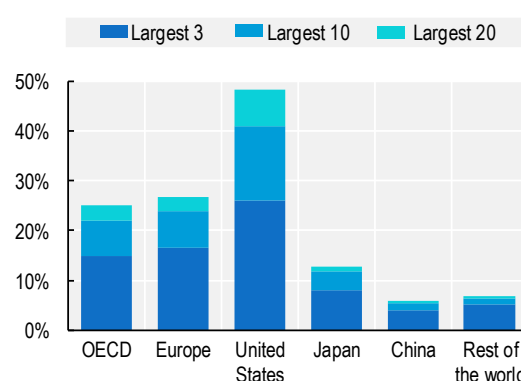
Note: The data shown here builds on firm-level ownership information of 29 453 companies representing 98% of the global market capitalisation. From the 41 780 listed companies by the end of 2021, only the companies reported here have ownership information available. The data in the figure covers 92 markets and is compiled from several financial databases and publicly available company sources. The category “Other free-float” refers to the shares in the hands of investors that are not required to disclose their holdings. It includes the direct holdings of retail investors who are not required to disclose their ownership and institutional investors that do not exceed the required thresholds for public disclosure of their holdings

Source: OECD Capital Market Series dataset, Factset, Refinitiv, Bloomberg

Similar dynamics exist in corporate bond markets, where institutional investors represent the largest holders (e.g., 86% of the outstanding amount of corporate bonds in the US and Japan). Investment allocation to corporate bonds is normally driven by credit rating category, and more recently is also based on bonds being classified as sustainable or not. Like the equity asset allocation process using investable indices, the use of credit ratings to allocate funds when investing in corporate bonds has significant capital allocation effects, which favours the companies and issuers included in indices and with a certain credit rating. EMs' corporate bonds normally have lower credit rating (riskier profile) compared to AEs' corporate bonds. The fact that institutional investors may not be allowed to invest in lower-rated bonds, by mandate restrictions or by regulations, reduce the amount invested in EMs' corporate bonds.

Benchmark-driven investment is especially prevalent in emerging markets (Arslanalp et al., 2020^[39]). Passive funds made up around 45% of EM equity funds in 2019 and 17% of EM bond funds, while assets benchmarked against EM indices have tripled since 2010 (FSB, 2022^[15]).

Cross-border investments by institutional investors thus largely reflect investable indices composition. For example, in the US 83% of all institutional ownership in the stock market is held by domestic institutions (Figure 3.2, Panel A). This is to an important extent driven by the high share that US stock markets represent in most investable indices, for example, around 67% in the MSCI World Index. Therefore, large markets with a high representation in investable indices attract most of the funds, leaving institutional investors in smaller markets, such as many EMs, off the radar.

Figure 3.2. Institutional investor ownership, end-2021**A. Domestic and non-domestic institutional investors' ownership****B. Largest institutional investors' holdings at the company level**

Note: The figure on the right shows the average institutional investors' ownership in small and large companies. Small (large) companies are those with a market capitalisation below (above) the median of the country/region.

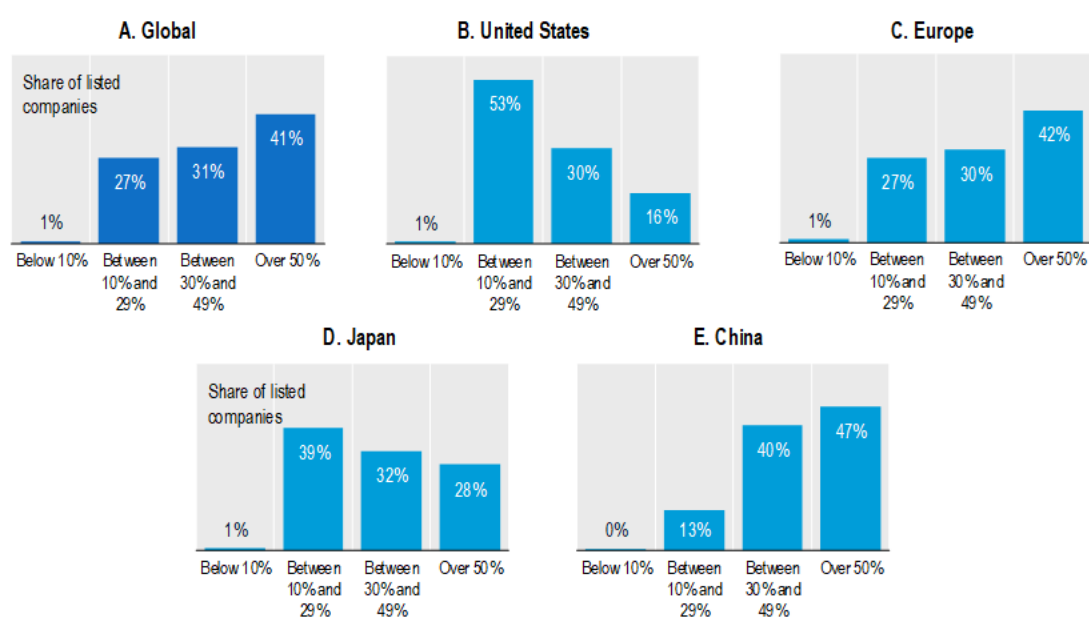
Source: OECD Capital Market Series dataset, Factset, Refinitiv, Bloomberg.

A third feature that also may affect ESG and green investing is the high degree of concentration observed at company level in equity markets (Figure 3.2, Panel B). Institutional investors are not only important at market level, but also hold significant stakes at company level. This concentration is partly due to index-driven investing by institutional investors, and indices favour large companies with high free-float levels. This has resulted in a growing amount of capital allocated to a decreasing number of companies.

These concentration patterns are widespread in global equity markets and do not only refer to institutional investors. EM companies tend to have controlling shareholders, either other corporations, the public sector or strategic individuals. Figure 3.3 shows the share of companies with different levels of ownership concentration in each market.

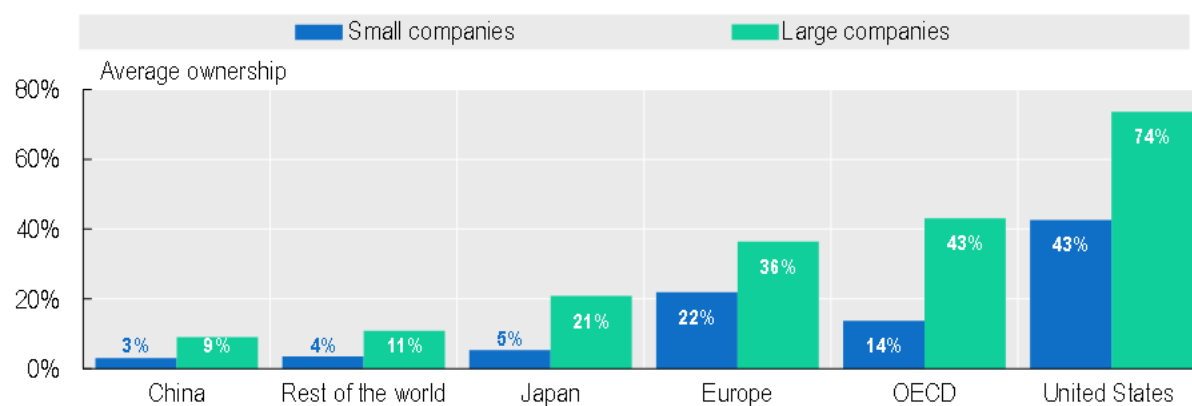
The fourth important fact is the role of company size as investment determinant. Company size is indeed a key criterion for inclusion in an index and, in the case of bond issuers, for a better credit rating. Figure 20 shows the holdings of institutional investors in large and small companies. The shift from retail direct investments to indirect investments via large institutional investors that use indices in their asset allocation has created a bias towards large, listed companies. The average share of institutional ownership in large, listed companies is significantly higher than their ownership in smaller companies.

Figure 3.3. Share of companies with different levels of ownership concentration by top 3 shareholders, end-2021



Note: The figures show the share of companies where the 3 largest owners hold different levels of the equity capital for the universe of 29 453 listed companies. For example, the 3 largest shareholders own more than 50% of the equity capital in 41% of listed companies globally. Source: OECD Capital Market Series dataset, Factset, Refinitiv, Bloomberg.

Figure 3.4. Institutional investor's holding in small and large companies, end-2021



Source: OECD Capital Market Series dataset, Factset, Refinitiv, Bloomberg.

The fact that institutional investors follow index investment strategies and that indices favour large firms results in an increasing volume of funds being allocated to the same companies. Since most indices weight companies according to their market capitalisation and free-float levels, being a large firm with higher free float alone will result in a higher weighting in the index.

Indices built on other criteria, such as ESG criteria, select an even smaller number of companies from the same pool of companies that are already included in major indices. This investment bias stemming from index investing leaves smaller and growth firms off the radar of institutional investors, which could be a disadvantage to green companies in EMs.

ESG ratings, green labels and disclosure

There are also bottlenecks linked to ESG/green ratings and broader issues of transparency and disclosures.

A key criterion applied by investors and other market participants to make investment decisions is the use of ESG ratings, which to date are predominantly focused on financial materiality and based on the existence of policies or disclosures related to ESG issues rather than actual environmental and social performance.

ESG ratings may not be measuring what they should. The ESG concept is in itself very broad, as discussed in Section 1 and this issue is complicated by a lack of transparency around the diverse metrics and methodologies used to assess green performance.

OECD research (OECD, 2022^[40]; Boffo, Marshall and Patalano, 2021^[41]) finds limited correlation between greenhouse gas emissions, carbon emission intensity and high E pillar scores, with high E pillar scores positively correlated with high greenhouse gas emissions in some cases. Past efforts to reduce carbon footprint and intensity do not appear to be factored into the assessment of firms' ability to deliver on forward-looking commitments. Furthermore, there is little correlation with environmental R&D or the use of renewable energy. Also, the E pillar is typically a small component of the overall ESG score.

On the other hand, E pillar scores appear to be correlated with factors that are not directly related to environmental issues. Environmental pillar scores show greater correlation with market capitalisation, for instance. Table 1 below shows size and performance for companies with high ESG scores and low ESG scores. Unsurprisingly, companies with high-ESG scores are on average larger in terms of market capitalisation than the ones with lower scores and have better financial performance.

An additional concern for EMs is that obtaining ESG ratings may entail additional cost -for example related to certifications, which small issuers, or issuers in shallow financial markets, may consider expensive.

Table 3.1. Size and performance indicators for companies by ESG score

Average of 2017-2021	Low ESG scored companies	High ESG scored companies
ESG Score (out of 100)	26	56
Market capitalisation (USD billion)	1.2	4.4
ROE (%)	3.6	4.6
ROA (%)	8.7	10.6

Source: OECD (2022^[42]), Climate Change and Corporate Governance, <https://doi.org/10.1787/272d85c3-en>

E pillar scores - and aggregate ESG ratings even more so – may therefore not be suitable for investors seeking to better align their portfolios with low carbon economies, and a poor guide for selecting investments with climate impact in their current form (OECD, 2022^[40]; Dalya Elmalt, Igan and Kirti, 2021^[43]).

All these problems may increase the high-risk profile of companies and assets in EMs and put them at a disadvantage when attracting such ESG-labelled investments due to systematically lower ESG scores (IMF, 2022^[23]). This has further been stressed in the context of sovereign ESG ratings, in which about 90% of a country's sovereign ESG score is determined by its GDP and level of development. Failure to account for this bias in investment decisions could potentially divert flows to high income countries at the expense of less developed countries (World Bank, 2020^[44]).

More broadly, the focus on risks rather than impact at the core of ratings design may also be detrimental to EMs if these ratings precipitate capital withdrawal from countries where physical climate impact are highest. Relatedly, there is evidence that vulnerability to the direct effects of climate change increases the

cost of sovereign borrowing, which appears to matter much more than climate risk resilience in determining cost of borrowing (Beirne, Renzhi and Volz, 2021^[45]).

Other related issues come from fund labels and names. Empirical research has demonstrated that labels have important consequences, with significant inflows (outflows) into funds that (did not) receive the labels (Ceccarelli, Ramelli and Wagner, 2020^[46]; Hartzmark and Sussman, 2019^[47]).¹¹

As discussed in Section 1, names may not be a good proxy for “green” funds, and from the point of view of investors there are also questions related to greenwashing and misleading marketing of products. Work is being conducted by supervisors to limit these risks, e.g., the work by the European Securities and Markets Authority (ESMA) (2022^[48]).

Disclosure around ESG ratings and green labels is particularly limited in EMs though the situation is gradually improving. The IEA recently found that well below 50% of all major companies in emerging and developing countries (those with revenues above USD 1 billion) disclose energy- and emissions-related metrics (IEA, 2021^[4]). To the extent that these metrics are necessary for labels and ratings and if remaining EM assets are not significantly worse according to such metrics, greater disclosure would enhance the pool of investable assets.

Key take-aways

Structural issues in global capital markets act as barriers to higher flows to EMs, including in green sectors, such as: i) concentration of ownership, including by institutional investors and strategic individuals, and its impact on free-float levels ii) asset allocation strategies by institutional investors through indices, and iii) bias towards large companies for inclusion in an index, and iv) overall macroeconomic and political stability of the investment destination country as well as its sovereign rating.

Other bottlenecks include risk perceptions related to investments towards EMs and to the green sectors, both of which could be considered riskier than non-EMs and non-green investments. This shows the importance of foundational capital markets reforms and sound macroeconomic policies to support green investment.

Recently developed ESG/green ratings add an additional level of complexity, due to issues related to measurement¹², transparency and disclosure. ESG data, metrics, and ratings may be misused or misunderstood.

These structural issues will need to be taken into account when trying to design policies to attract more green investment flows to EMs. Overall, lifting one of the barriers to green investment in EMs is unlikely to lead to significantly stronger flows. What is needed is a comprehensive approach to the issue, addressing the various factors that slow down green investment in EMs, considering the specific conditions in each particular market.

¹¹ As mentioned in Section 1 and in Annex A, asset allocation into carbon solutions by “sustainable” and “climate”-named funds are still relatively small, with a respective fund average of 13.9 and 37.8% for the two fund universes (Table A2).

¹² Notably, on the methodologies to generate the “E” pillar score.

4 Further areas of work

Stemming from the analysis presented in this report, policy options that could be discussed and considered as next steps in the appropriate fora, may include:

In relation to capital flows and financial market structure:

- Further analysis at a granular level to compare EMs and better understand what drives green investment to some countries rather than others, and to some sectors rather than others. This analysis could be enriched including not only EMs but also AEs, from which some lessons could be learnt.
- Evaluation of the potential volatility and reallocation of capital flows from and to specific sectors or countries due to physical or transition risks.
- Acceleration of capital market development in EMs, including through the development over time of a broad and diversified domestic investor base.
- The role of de-risking and risk-sharing through financing from public and development financial institutions to green projects for crowding in green private investments.
- Broader studies on how capital markets can allocate financing to innovative growth companies and EMs in a more efficient way in light of existing constraints related to the structure of capital markets.

In relation to ESG ratings:

- Fostering of data quality, disclosure and transparency on ESGs and green investments.
- Improvement and greater transparency of ESG ratings, notably methodologies to generate E pillar scores that clearly align with financial materiality and environmental materiality in a mutually exclusive and transparent manner.
- Capacity building among a number of actors, from the financial sector to ESG rating companies, and institutional investors.

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Annex A. Methodology and data

Morningstar dataset

The report uses Morningstar dataset that provides data on investment funds characteristics and holdings. It is the most comprehensive dataset of investment funds at this granularity, covering more than 120 000 unique open-end funds and exchange traded funds (ETFs) for a total AUM of around USD 52 tln, which represents the lion's share of the investment fund universe (USD 71 tln reported by the Investment Company Institute (2022^[49])). In panel data, Morningstar also has the advantage to be survivorship-bias free. To allow for a reasonable number of funds for the analysis, the dataset is filtered to include only funds that have AUM above USD 100 mln (around 37000 funds), still capturing the lion's share of the covered AUM (USD 47 tln out of the USD 52 tln).

Emerging market sample

Out of the country allocation tracked by Morningstar, this report defines emerging markets to include Argentina, Brazil, Chile, China, Colombia, Hungary, India, Indonesia, Malaysia, Mexico, Pakistan, Philippines, Poland, Russian Federation, South Africa, Chinese Taipei, Thailand, Türkiye, Venezuela and Viet Nam.

Defining “green” funds

Several approaches can be explored to define green funds, ranging from self-labelling, carbon emissions, sectoral/product exclusion or inclusion, corporate engagement etc.

Most existing studies look at sustainable or ESG investments. This report also provides estimates of investments by sustainable funds to demonstrate the appetite for sustainable investing. The definition of sustainable fund is from Morningstar, defined as follows: “A fund will be considered a sustainable investment product if the in the prospectus or other regulatory filings it is described as focusing on sustainability, impact investing, or environmental, social or governance factors. Funds must claim to have a sustainability objective, and/or use binding ESG criteria for their investment selection. Funds that employ only limited exclusions or only consider ESG factors in a non-binding way are not considered to be a sustainable investment product.” This report demonstrates that this classification doesn't prove a good proxy for tracking the climate impact of funds.

Most existing studies also use names and prospectuses of funds, however this approach has also important limitations as also argued in this report. The same goes for ESG-named funds like climate or green-named ones. To compare climate-themed funds with the preferred green funds sample, the Morningstar “Climate action” dummy is used to define climate-themed funds, defined as having the investment product “concerned with the global effort to curb the Earth's temperature rise and cope with unavoidable consequences. It includes measures to promote clean energy, limiting greenhouse gas emissions, and climate change adaptation measures. It will encompass funds that are defined as Climate Solutions or Clean Energy/Tech. Climate Solutions funds target companies that are contributing to the

transition to a low-carbon economy through their products and services and that will benefit from this transition.”

Nor is a “low carbon” approach based on portfolio emissions favored to define green funds as it also appears a bad proxy for climate impact. Some industries key to climate transition are high emitters and, on the other hand, for instance tech firms, which are notoriously “low carbon” emitters should not be misrepresented as climate transition actors.

Instead, a sectoral approach is adopted to defining green funds as the best approach to get closer to actual climate impact and transition as suggested by OECD (2020^[3]). In the same vein, exclusion that would avoid negative climate impact (do no harm) metrics are not chosen as they do not capture positive impact towards the transition. OECD (2020^[3]) maps sectors that qualify as ‘green’ under select sustainable finance taxonomies, green bond standards and/or guidelines in selected OECD and G20 jurisdictions to identify lowest common denominator towards a consensus definition of green sectors. These include renewable energy, most forms of public transport and energy efficiency.

The Morningstar metric of involvement in carbon solutions adopts a closely related sectoral classification. The variable is defined as:

“The percentage of the covered portfolio that is exposed to corporations that make any revenue from carbon solutions:

- Renewable Energy Generation,
- Renewable Energy Supporting Products/Services,
- Energy Efficiency Distribution and Management, Material, Industrial Systems and Processes, Consumer Products,
- Green Buildings Development & Management, Technologies and Materials,
- Green Transportation Vehicles, Technologies, Services, Infrastructure”.

The “any revenue” cut-off is meaningful and does not simply capture greenwashing as demonstrated by the distribution across all funds. As shown in Table A.1, it appears that there exist basically no assets representing companies making less than 5% of their revenues from carbon solutions in the portfolios of the fund sample, and it appears that the highest average in funds’ portfolio are companies with more than 50% of their revenue in carbon solutions.

Table A.1. Distribution of the revenues from carbon solutions of firms in funds’ portfolios (%)

	Carbon Solutions Percentage of Covered Portfolio with Less than 5 % Involved	Carbon Solutions Percentage of Covered Portfolio with 5 to 10 % Involved	Carbon Solutions Percentage of Covered Portfolio with 10 to 25 % Involved	Carbon Solutions Percentage of Covered Portfolio with 25 to 50 % Involved	Carbon Solutions Percentage of Covered Portfolio with Greater than 50 % Involved
Sample Average	0	2.4	2.19	1.75	3.68
Sample 25th Percentile	0	3.12	2.76	2.26	4.5
Sample 50th Percentile	0	1.96	1.41	1.07	2.08
Sample 75th Percentile	0	0.03	0	0	0.03

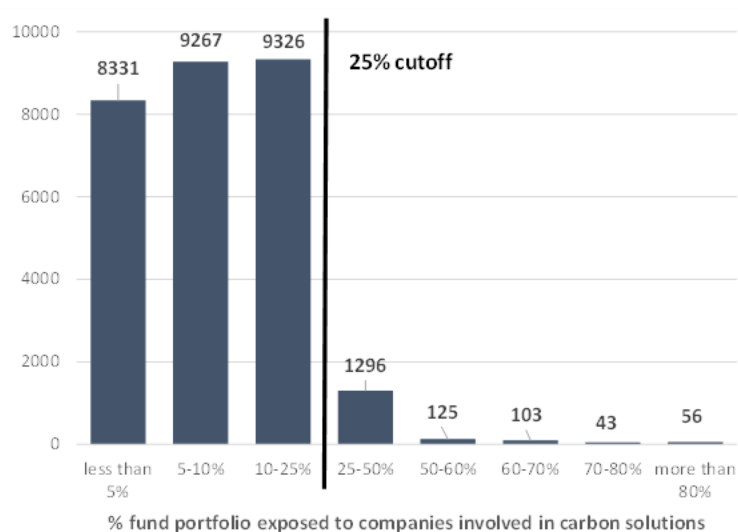
Note: Global sample of the 37000 largest funds.

Moreover, the variable has very good data availability across the sample, covering more than 28500 unique funds (85% of the total sample), and with a median of 89% of each fund's eligible portfolio covered by Morningstar as falling within the carbon solution category or not.

To define a fund as green, a threshold has to be chosen regarding the share of the portfolio that represents companies involved in carbon solutions. A 25% threshold is adopted to define the universe of “green funds”.

Figure A.1 displays the distribution of funds according to the share of companies involved in carbon solutions in the fund's portfolio.

Figure A.1. Distribution of funds according to the share of companies involved in carbon solutions in portfolio



Analysing the portfolios of funds under these different definitions (Table A.2), sustainable investment funds invest on average around 14% of the portfolio in carbon solutions, a rather small proportion despite their sustainable branding. Funds which are “climate action” themed (a more specific label) invest more than one-third (almost 38%) of their portfolios in carbon solutions. The more direct classification of green funds proposed in this report (i.e., the % of portfolio involved in carbon solutions, with illustrative cut-offs of 25% and 50% of the portfolio) provides groupings with much higher average involvement than self-labelled funds.

Table A.2. Average Characteristics of funds across definitions

Universe of funds:	All funds	Sustainable	Carbon Solutions 25%	Climate action themed	Carbon Solutions 50%
#	36716	3964	1486	347	232
AUM (tln)	47	3.2	1.4	0.3	0.2
% Foreign assets	37.9	61.6	34.1	57.9	31.5
% EM assets	27.4	8.9	38.2	26.4	42.8
% Equity assets	50.7	60.3	74.7	76	84.2
% Carbon solutions	9.9	13.9	39.4	37.8	65.1

Note: Bottom four rows represent the unweighted average share of AUM in a fund's portfolio. Source: Morningstar, OECD calculations (2023).

Reconstructing the country cross-border flows and holdings

To reconstruct the country-level cross-border flows and positions, each fund's equity and fixed income country allocation is accessed, and each fund's monthly AUM and flows calculated for each country. Depending on the domicile of the fund, the flows and holdings will be classified as domestic or cross-border.

As discussed at length in Maggiori et al (2020^[29]), Morningstar cannot provide information of the nationality of investors in the fund. However, by comparing Morningstar data with bilateral balance of payments data on outward flows in foreign investment fund shares and inward flows in domestic investment fund shares, Maggiori et al (2020) find that it is reasonable to assume that the domicile of the fund is also the jurisdiction of residency of its investors - with the exception of Ireland, Luxembourg, Cayman Islands, etc. In key charts, Ireland- and Luxembourg-domiciled funds are included within the "Europe" grouping, where most of their investors are expected to be located.

Security level analysis

Morningstar provides detailed data on funds' individual holdings, which can then be classified according to the carbon solution involvement of the entity linked to the security. The analysis is restricted to the top 100 holdings of each fund in the sample under consideration. This provides a reasonably representative cut off as the median number of holdings in the total sample is 77 and portfolios of funds are highly skewed with weights of top holdings representing the lion share of the portfolio's market value. This has been confirmed by research on portfolio concentration of funds (Sapp and Yan, 2008^[50]; Kacperczyk, Sialm and Zheng, 2005^[51]). The dataset provides the market value of each position, defined as "the nominal market economic delivery of the security incorporating the price, embedded leverage and optionality of the security. For simple securities that do not have any implied leverage (such as Equities and Bonds) this is the fair market value. Positions which create implied leverage are represented inclusive of the calculated implied leverage. The implied leverage is included as either a positional or portfolio "cash-offset". For an Equity Future the market value is the contract size multiplied by the contract price". Each individual position's market value is converted into USD for comparability.

