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What drives capital to green companies in emerging markets: Evidence from investment funds

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What Drives Capital to Green Companies in Emerging Markets: Evidence from Investment Funds

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This paper investigates the role of investment funds in financing green companies in emerging markets (EMs) and the factors influencing these allocations. Despite a global surge in "sustainable" investing, companies involved in carbon solutions, particularly in EMs, make up a small portion of reported sustainable investments. Using fund and asset-level analyses on a detailed portfolio-level dataset of the 37 000 largest investment funds globally, this paper identifies key characteristics driving green investments, such as younger funds, retail investor funds, funds with domestic mandates and sustainable funds are more inclined to invest in green companies and less in fossil fuels. Inclusion of EM green companies in benchmarks and diversified ownership in listed firms enhance green investments. Greater green allocation in EMs is linked to higher portfolio flow openness and economic freedom, and are also influenced by climate-related factors such as exports in renewable manufacturing.

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Keywords: International portfolio flows, investment funds, asset allocation, green finance, ESG, emerging markets, climate transition, renewable energy.

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Table of contents

Acknowledgements **4**

1 Introduction **7**

2 Data description **10**

Investment fund holdings and security-level analysis 10

Defining "green" assets: getting closer to climate impact 10

3 Estimating the geographic allocation of green investments using security level data **12**

Green investments by specialized green funds 12

Green investments by global EM equity funds 14

4 Drivers of green portfolio allocation: analysing the cross-section of holdings **16**

Investor side: Fund characteristics 16

Recipient side: country characteristics 18

5 Conclusions **22**

References **23**

Annex A. Concepts and definitions **29**

Annex B. Sample, variables and additional regression tables **35**

Notes **38**

FIGURES

Figure 1. Number of funds and AUM (USD) for different "green funds" definitions 11

Figure 2. Market value of green funds' positions in green companies (bln USD) 12

Figure 3. Foreign vs. domestic origin of green funds investing in EM green assets (%) - by country invested in 14

Figure 4. Market value of global EM equity funds' positions in green companies in EM 15

Figure 5. MSCI EM country weights vs. Green investment country weights 19

Figure A.1. AUM of sustainable funds, breakdown EM and non-EM (tln, USD) 29

Figure A.2. Origin of funds' investments in EM assets 30

Figure A.3. Distribution of funds according to the share of companies involved in carbon solutions in portfolio 32

Figure A.4. Flows to "green" funds (USD bln) 33

TABLES

Table 1. Fund characteristics 17

Table 2. Country characteristics 21

Table A.1. Distribution of the revenues from carbon solutions of firms in funds' portfolios (%) 31

Table A.2. Average Characteristics of funds across definitions 33

Table B.1. Pairwise correlation matrix of country specific control variables 35

Table B.2. Variables sources and definitions 34

Table B.3. Robustness checks on funds' characteristics deviation from category average and without global dummies 35

Table B.4. Poisson regressions on country characteristics, with fund dummies 36

Table B.5. Two-part model regressions on country characteristics 37

1 Introduction

Emerging Markets (EMs) will need significant green finance in the coming years to facilitate a smooth transition towards becoming low-emission economies, yet they are still far from this target. A recent paper 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[1]).

EMs currently rely mainly on domestic public sector financing to fund green investment (Naran et al., 2022[2]; IEA, 2021[1]). However, as the fiscal space is shrinking 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[3]). In this context, private financing will have to cover a large share of future needs (Songwe, Stern and Bhattacharya, 2022[4]; IMF, 2023[5]).

For markets with few domestic investors, cross-border private capital flows will be particularly important for EMs (Rottgers, Mantovani and Laengle, 2024[6]), including foreign direct investment (FDI), bank lending, as well as portfolio equity and debt flows by global investors. Greenfield investment in renewable energy has indeed been increasing since 2012, while greenfield investment in fossil fuels shows signs of slowdown (Knutsson and Ibarlucea Flores, 2022[7])1. However, even if FDI is refocused on low-carbon assets, other sources of financing, and notably portfolio investment flows, will still be needed to meet EMs' increasing financing needs (Couto, 2023[8]). The present paper complements existing contributions in this field by focusing on and providing precise estimates of the current investment landscape of green financing to EMs by mutual funds.[2]

A major development in capital markets and cross-border portfolio flows in recent years is indeed the rise of non-bank financial intermediaries. Investment funds accounted for the largest part of this rise (FSB, 2020[9]). Non-bank financial intermediaries, and especially investment funds, are particularly large players in EMs, where they now represent 40% of financial intermediation and 50% of external financing (FSB, 2022[10]). 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 paper.

It is worth noting at the onset the limits regarding the role of investment funds in green 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. 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" (Jachnik, Mirabile and Dobrinevski, 2019[11]). The availability and the terms and conditions of finance for investments in new tangible fixed assets influence the relative attractiveness of low and high carbon intensive activities. 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[12]), 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[13]).

On the basis of a comprehensive portfolio-level dataset of 37 000 investment funds, this paper proposes to explore two main questions: First, how to best measure investments into actual green assets in EMs instead of relying on much broader definitions of sustainable or ESG investing? Second, which are the drivers of allocation of green investments towards EMs on both the investor and recipient side: namely which funds are most or least likely to invest in green assets (compared to "brown" assets) and which features make certain EMs receive more green capital than others?

Our first contribution regards how to measure "green" investments from a data perspective. A now large literature on sustainable finance has demonstrated the poor performance of ESG, sustainability, or even climate indicators in quantifying firms' environmental outcomes (OECD, 2022[14]; Fichtner, Jaspert and Petry, 2023[15]; Boffo, Marshall and Patalano, 2021[16]; Berg, Kölbel and Rigobon, 2022[17]; Curtis, Fisch and Robertson, 2021[13]; Noels and Jachnik, 2022[18]). Using security level data, we provide a novel definition of green investments which allows us to go beyond broad-based definition of ESG/sustainable investment by looking specifically at companies involved in carbon solutions (renewable energy, transport, and infrastructure). Armed with this definition, we are able to quantify how much green investment is flowing towards EMs and show that only a very small proportion goes to EM and with the distribution being highly skewed towards The People's Republic of China (hereafter 'China'). This adds an important contribution to the above-mentioned existing evidence on the current magnitude of investments of different sources to EMs for climate transition which have so far not focused on portfolio investment and mutual funds.

Turning to what are driving such mutual funds' investments in EMs green companies, fund-level and fund-country level regressions highlight several important fund and country characteristics as drivers of green investments. A fund's exposure to EMs, as well as a fund's mandate as "sustainable" are positively associated with green investments, while older funds and funds serving institutional investors are investing less in green companies. We confirm a strong role of EM benchmark in driving green investments in different EMs and there is significantly greater allocation in EMs with higher portfolio flows openness and economic freedom.

These findings contribute to the broader literature on investment funds' asset allocation, providing specific evidence for EMs and for green investments. The literature has so far focused on "home bias" characteristics (Chan, Covrig and Ng, 2005[19]) or "home currency bias" (Burger, Warnock and Warnock, 2018[20]; Maggiori, Neiman and Schreger, 2020[21]); the implications of benchmark effects on country allocations ((Raddatz, Schmukler and Williams, 2017[22]; Antonelli et al., 2022[23]); the impact of exchange-traded funds (ETFs) on international capital flows (Converse, Levy-Yeyati and Williams, 2023[24]); the sensitivity to push and pull factors of funds' flows (Brandao-Marques et al., 2022[25]; Bush, Cañón and Gray, 2022[26]); the exposure to a country sovereign risk (Converse and Mallucci, 2023[27]); or the impact of transparency on portfolios' allocations (Gelos and Wei, 2005[28]). In relation to EMs and the origin of their higher cost of capital, existing evidence showed that strong institutions and governance, rule of law and property rights are important determinants of investment allocation (La Porta et al., 2000[29]; Papaioannou, 2009[30]) and so is perceived or actual policy uncertainty (Kalemli-Özcan and Varela, 2021[31]), and openness of capital account (Aggarwal, Klapper and Wysocki, 2005[32]; Chan, Covrig and Ng, 2005[19]). We show that green investments by mutual funds respond to a significant extent to traditional drivers of portfolio allocation, and that "risk-return" considerations continue to play a major role.

On green investment specifically, 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[33]) and an increased perception of risk by global investors. We find that several climate-related drivers such as exports in renewables or its share in energy generation are also crucial positive drivers of green investments.

In view of the above, the paper is structured as follows: Section 2 describes our investment fund dataset, cleaning process, and discusses our definition of green companies. Section 3 provides an overview of the current investment landscape in green companies in EMs by mutual funds. Section 4 provides an econometric analysis of the drivers of such green portfolio allocation from both the investor and the recipient country perspective. Section 5 concludes and discuss the implications of our findings for policy in order for private capital to finance the climate transition in emerging markets.

2 Data description

Investment fund holdings and security-level analysis

The paper uses Morningstar dataset on investment funds characteristics and holdings, the most comprehensive dataset of open-end funds and exchange traded funds (ETFs) at this granularity. In our analysis, we focus on funds with AUM above USD 100 mln (around 37000 funds), capturing the lion's share of the AUM covered by Morningstar (USD 47 tln out of the USD 52 tln). The aim of this paper is to take stock of the state of green investment at the date of conducting the analysis (March 2023).

To reconstruct the country-level cross-border positions, each fund's equity and fixed income country allocation is accessed, and each fund's monthly AUM calculated for each country. Depending on the domicile of the fund, the holdings will be classified as domestic or cross-border.[3]

In addition, Morningstar provides detailed data on funds' individual holdings, which can then be classified according to definitions of "green" investments at the security level. We restrict the analysis 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 (as confirmed by research on portfolio concentration of funds (Sapp and Yan, 2008[34]; Kacperczyk, Sialm and Zheng, 2005[35])).

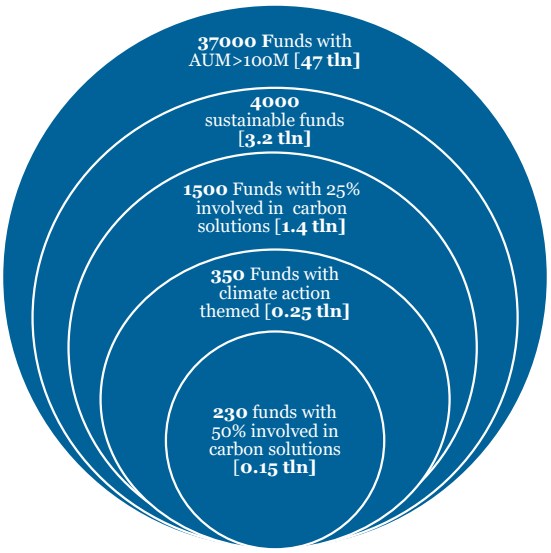
As a result, we can thus reconstruct the fund holdings of green assets in different destination countries.

Defining "green" assets: getting closer to climate impact

The use of data on sustainable/ESG investment has some limits and an important contribution of this paper is to provide estimates of investments into "actual" green assets. Asset managers may claim to adopt sustainable or ESG conscious strategies, for instance, through a fund's name or prospectus[4]. But these names, or ESG or even climate ratings do not appear to contribute to more environmental sustainability as proxied by carbon footprint, emissions, environmental R&D or the use of renewable energy (Noels and Jachnik, 2022[18]; Boffo, Marshall and Patalano, 2021[16]; OECD, 2022[14]). 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 capitalization.

The choice of indicator to define "green investments" or "green funds" will significantly impact the size of the AUM under study and is thus a crucial importance. Figure 1 shows the number of mutual funds and their respective AUM for different kinds of "green fund" definitions compared to our initial sample of 37 000 funds with USD 47 tln of AUM.

Figure 1. Number of funds and AUM (USD) for different "green funds" definitions



Note: See Annex for definitions of the different fund universes.
Source: Morningstar, author's calculations (2023).

Going beyond commonly-used definitions related to "ESG-labelled", this paper suggests a sectoral approach to defining green investments as the best approach to get closer to actual climate impact and transition, in line with by OECD (2020[36]). In addition, we decide to choose an "inclusion" rather than exclusion approach as exclusion that would avoid negative climate impact (do no harm) metrics would not capture positive impact towards the transition. OECD (2020[36]) 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. We identify a closely related metric in Morningstar and define "green" assets are thus defined using the metric "% of the revenue from involvement in carbon solutions". More specifically, 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*".

Morningstar aggregates such metric at the fund level, provided the % of eligible and covered assets in each fund's portfolio that are investments equity or bonds) in companies involved in carbon solutions. The "any revenue" cut-off is meaningful and does not simply capture greenwashing as demonstrated by the distribution across all funds (See Annex, Table A1).

Using security level data, we are thus able to classify individual funds' portfolio holdings as green or not green and reconstruct each fund's geographic "green" allocation.

3 Estimating the geographic allocation of green investments using security level data

For our total sample of 37 000 large funds, there are USD 3.8 tln invested in "green" assets globally, i.e., 7.9% of total global AUM according to the above definition. If the current global allocation to EMs (11%) were allocated in this proportion to "green" assets, EMs would thus be expected to receive USD 416 bln in green investments.

Measuring exactly which share of these green invested assets globally are in companies located in EMs requires analysis of individual securities in each of our 37 000 funds' portfolios. We provide in this section a more realistic data effort focusing on reconstructing the geographic allocation of green investments by two samples of funds that are of particular interest: 1) specialized green funds, which we define as funds that have more than 25% [5] of assets in companies involved in carbon solutions (1600 funds) and 2) global EM equity funds, which are global funds with specific investment mandate in EMs (712 funds).

Green investments by specialized green funds

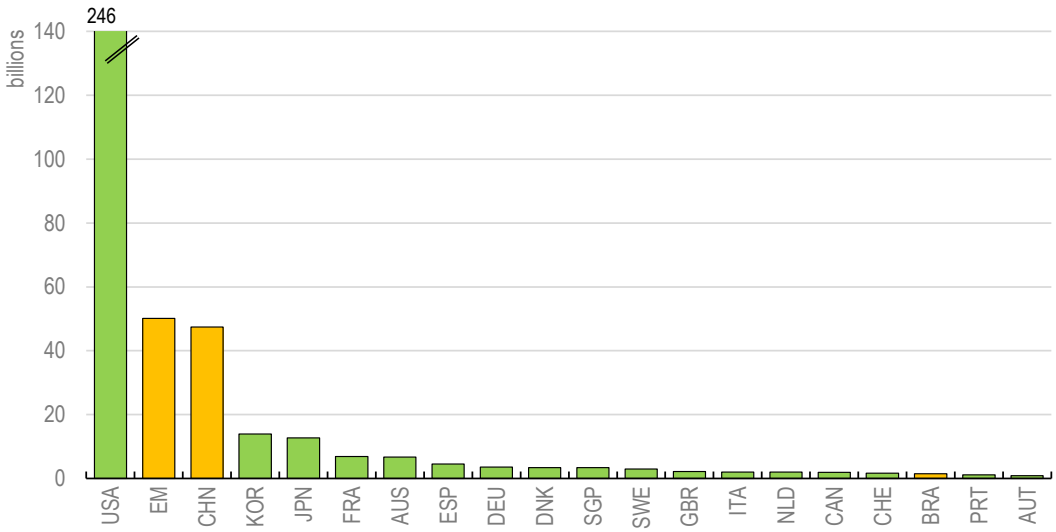
We first analyse 78 000 individual securities held by our specialized green funds sample, 14 000 of which we classify as green. Out of these 14 000, 3600 are investments in EM companies.

Figure 2 a) shows 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, similar to the weight of the US in most global indices (e.g. MSCI World).

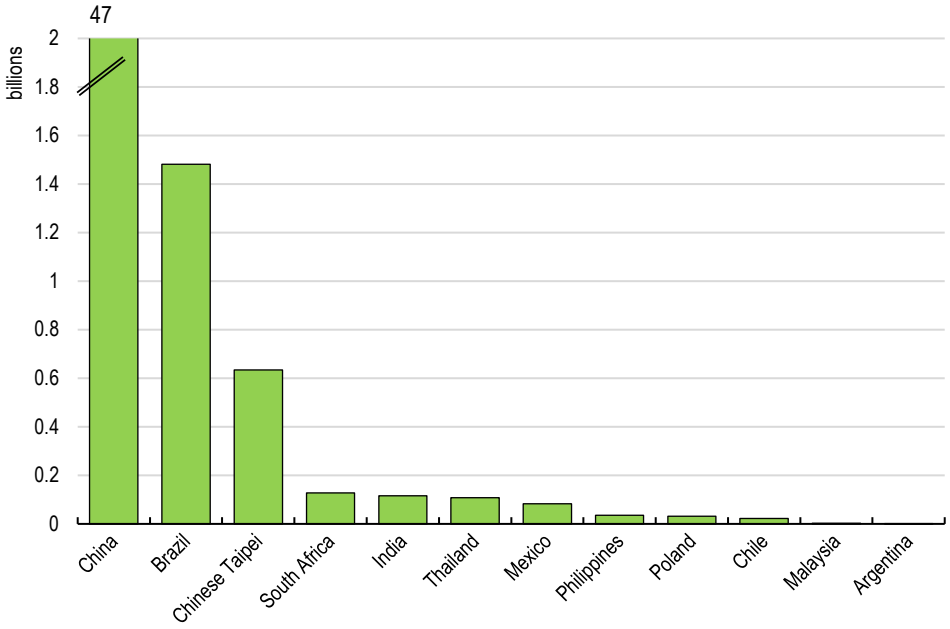
China is by far the next largest investment destination and represents the biggest share of green investments in EMs. Brazil comes a distant second, but still much larger than next EMs on the list – Chinese Taipei, South Africa, Mexico, India, Thailand and Poland (Figure 2 b)). Overall, EMs represent only 13.6% of total green investment by green funds in the sample, and less than 1% excluding China.

Figure 2. Market value of green funds' positions in green companies (bln USD)

a) Worldwide



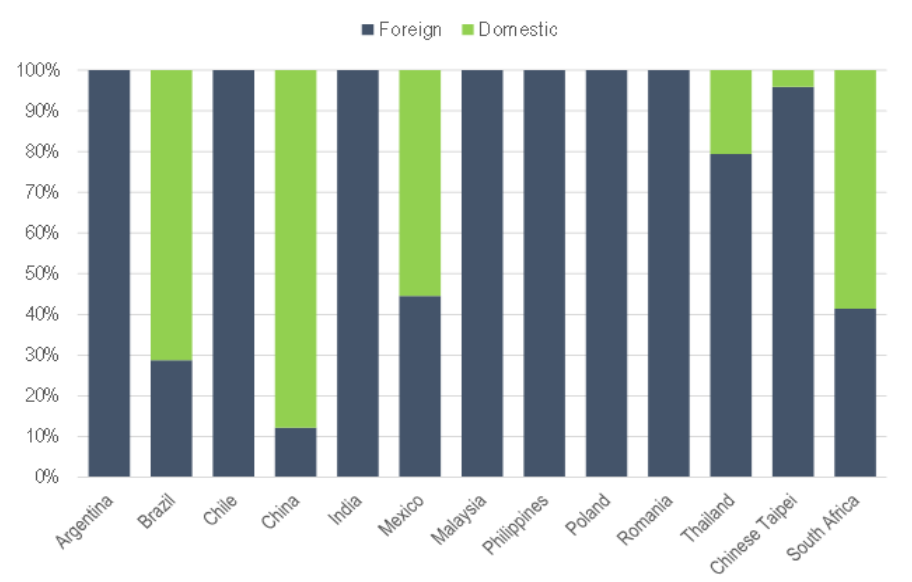
b) Emerging markets



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

About half of these funds are based in the US, and 13% in China, with many having domestic allocation mandates. In other countries like Argentina, Chile, India, Malaysia, Philippines, Poland, and Romania, foreign green funds make up the entirety of green investments, while in China, Brazil, Mexico, South Africa, and to some extent Thailand, domestic green funds are the primary source of green investments (Figure 3).

Figure 3. Foreign vs. domestic origin of green funds investing in EM green assets (%) - by country invested in



Source: Morningstar, OECD calculations.

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[37]). 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.

In the empirical analysis that follows (Section 4.2), we test the hypothesis that countries that are important manufacturers and exporters of renewable energy manufacturing products (e.g. solar panels, wind turbines) receive more green investments.

Green investments by global EM equity funds

We now turn to analyse of green allocation of “global EM 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).

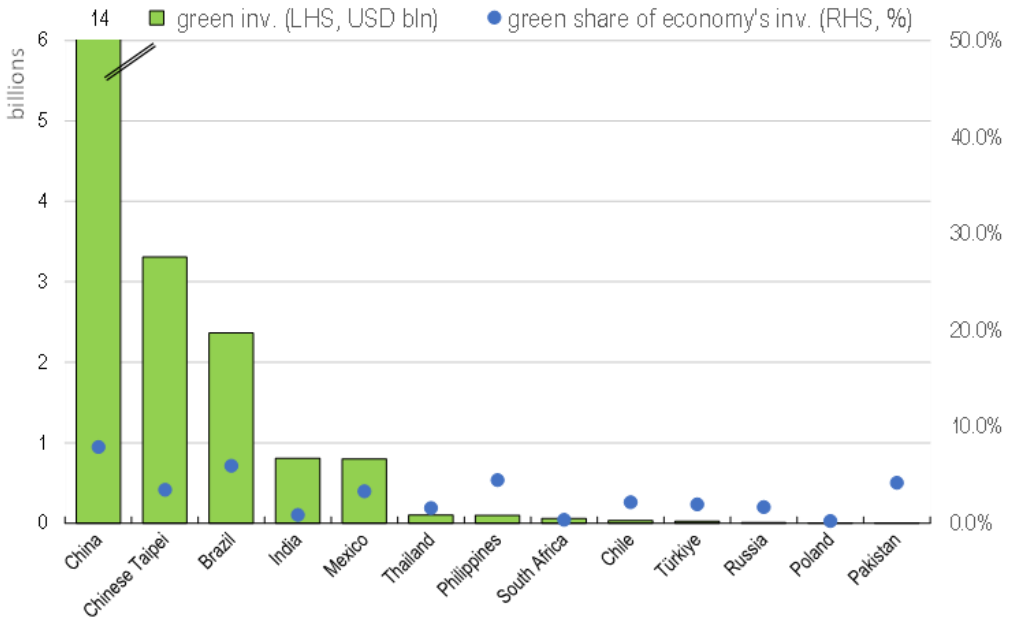
The average global EM equity fund invests 9.6% of its portfolio into companies involved in carbon solutions. While this is only slightly lower than the average allocation in our global fund universe (10%), it is much lower than the cut-off proposed in this study for definition as a “green fund” (25%, see previous section), most likely in line with funds’ mandate.

Figure 4 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 4. 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.

4 Drivers of green portfolio allocation: analysing the cross-section of holdings

This section aims at testing empirically some of the possible drivers of green investments as defined above and explore the cross-fund and cross-country heterogeneity highlighted above.

Investor side: Fund characteristics

We start by focusing on fund-specific factors, to address the question "Which funds are most or least likely to invest in green assets?". To answer this, we start by analysing the cross-section of our universe of 37000 large funds (all funds) and run the following models:

$$Green\_share_i = \beta_x X_i \ + u_z + \text{error} \qquad (1)$$

$$Fossilfuels\_share_i = \beta_x X_i \ + u_z + \text{error} \qquad (2)$$

Where $Green\_share_i$ is the share of green assets as defined above in the portfolio of fund i. X_i is a vector of fund specific characteristics such as age, retail vs. institutional, fund size, passive vs. active, domicile, or type of investment mandate and u_z is a set of dummies fund's category (Africa equity, Commodities, Property, Japan Fixed income etc). In an alternative set of regressions, we compare how these fund-specific factors also impact the share of assets in the fund portfolio involved in fossil fuels, indicated by the variable $Fossilfuels\_share_i$. We run OLS regressions with robust standard errors. Variables' definitions are provided in Table B2 and results are provided in Table 1 below.

Table 1. Fund characteristics

Dep Var:	Share of green assets in portfolio					Share of fossil fuel related assets in portfolio				
VARIABLES	1	2	3	4	5	6	7	8	9	10
Fund size (log)	-0.042	-0.027	-0.038	-0.037	0.012	-0.219***	-0.224***	-0.224***	-0.227***	-0.214***
	0.04	0.04	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.05
Age (log)	-0.807***	-0.701***	-0.758***	-0.776***	-0.573***	0.358***	0.325***	0.307***	0.308***	0.438***
	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.06
Passive/Index funds	0.292*	0.324**	0.330**	0.317*	0.289*	1.013***	1.003***	0.974***	0.973***	1.010***
	0.16	0.16	0.16	0.16	0.17	0.17	0.17	0.17	0.17	0.16
Institutional investors	-0.630***	-0.528***	-0.574***	-0.581***	-0.692***	0.297*	0.266*	0.239	0.220	0.433***
	0.12	0.12	0.12	0.12	0.13	0.16	0.16	0.16	0.16	0.15
EM domicile		1.991***					-0.613**			
		0.28					0.24			
EM mandate			2.100***					-2.177***		
			0.32					0.30		
Domestic EM mandate				1.961***					-3.095***	
				0.31					0.27	
Sustainable fund					3.998***					-3.651***
					0.20					0.16
Constant	4.449***	1.971**	2.098**	2.421***	2.832***	14.789***	15.552***	17.228***	17.990***	14.281***
	0.82	0.90	0.90	0.89	0.86	1.08	1.12	1.13	1.14	1.12
Global category dummies	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Observations	26,121	26,121	26,121	26,121	23,213	26,107	26,107	26,107	26,107	23,212
Adjusted R-squared	0.233	0.236	0.236	0.235	0.248	0.394	0.395	0.396	0.398	0.447

Note: the regressions are ran using OLS on funds holdings as of 2023Q1. The dependent variable is the share of green or fossil fuel related assets in the portfolio. All regressions include global category dummies. Robust SE. * p<0.10, ** p<0.05, *** p<0.01.

Regarding funds' basic characteristics, the size of the fund is not a significant driver of the green investment share, while the age is negatively correlated with allocation of investments in green assets. In other words, newer investment funds are investing more in green assets, picking up new trends compared to older funds. Passive funds tracking specific indices (5166 of our 37000 funds) is weakly associated with a higher share of green assets and funds targeted at institutional investors (5582 funds) are associated with a significantly lower share of green investments.

We then test variables related to funds' EM exposure, the fact that fund is either domiciled in an EM, or has an EM mandate (for example across a region or multiple countries or single country), or a domestic EM mandate (on a specific country). These three aspects are positively correlated with investment in green assets, highlighting that funds domiciled and investing in a single country are typically more likely to invest in green assets.

Finally, we test whether having a "sustainable" scope in the funds' mandate affects investment in green assets and confirm this is a significant driver of investment in green assets, with positive correlation.[6] Hence, despite potential greenwashing, we find unsurprisingly that sustainable labelled funds are still more likely than other funds to have a higher share of their investments in green companies.

A striking mirroring picture is obtained when analysing investment in fossil fuels. In this case, the size of the fund is a significant driver of investment in fossil fuels' assets, with a negative correlation, so the bigger the fund, the smaller would be the share invested in fossil fuels. Older funds are investing more in fossil fuels assets than younger funds. Funds targeted by institutional investors are more likely to have higher share of fossil fuels investments. EM exposure is negatively associated with of fossil fuels allocation, with a bigger negative coefficient in the case of a mandate on a specific domestic EM country, than on an EM

regional mandate, or a domicile in an EM. The fact that the fund is defined as "sustainable" negatively affects investment in brown assets. An exception is passive funds which are also significantly associated with a higher share of fossil fuel investment, which could be linked to higher overall energy exposure of these funds.

As robustness checks, we check potential collinearity between variables and fund category dummies by checking pairwise correlations and by removing the fund category dummies (Table B3, col 5-8). We also run the same baseline regression without dummy but demeaning the dependent variable by the global category average of green investment share of the portfolio (Table B3, col 1 to 4). Results strongly hold.

Recipient side: country characteristics

In this section, we use the security-level dataset constructed in Section 3 and create a fund-country dataset in order to incorporate the destination of fund investments in the dataset and be able as a result to test recipient country characteristics. The objective of this section is to understand the cross-country heterogeneity identified in Section 3. "Why do some countries receive more green investments than others?"

The country specific allocation of fund is determined by their mandate – global, regional, or country specific. Unlike the previous section, we restrict our sample to global EM equity funds (the 700 funds analysed in Section 3.2) as these funds can in theory invest in any EM. We drop country specific and regional funds as their domestic (but also regional) mandates constrain their geographic investment allocation and reallocation possibilities.

We start by estimating the following model:

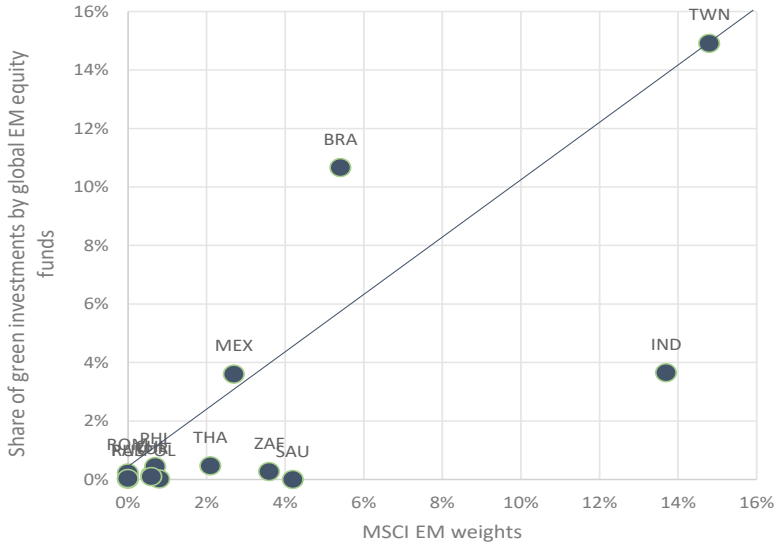
$$Green\_share_{ij} = \beta_x X_j \quad [+u_i] \; + error \qquad (3)$$

Where $Green\_share_{ij}$ is the share of green assets invested in country j in the portfolio of fund i; X_j is a vector of country specific characteristics and in some regressions u_i is a set of fund dummies.

Regarding our country specific controls, we note that global funds typically allocate investments following benchmarks as demonstrated by Raddatz et al (2017[22]), this regardless of whether mutual funds are passive or active, and this is especially the case for EM investments (Arslanalp et al., 2020[38]). We thus expect that a prime determinant of country allocation also in green would be to follow EM benchmarks and use the country share in MSCI EM index.

We visually plot the different country weights of the MSCI EM equity index (as of Mar 23) against the country weights of green investments into EMs by our global EM equity fund sample (Figure 5). Overall, the correlation is very high (91%), perhaps unsurprisingly as they reflect large investment opportunities. Nonetheless, there exists some divergence from the 45° line: China, Brazil and to a lower extent Mexico appear "overweight", while India, Saudi Arabia and South Africa are "underweight".

Figure 5. MSCI EM country weights vs. Green investment country weights



Note: Sample of 700 global EM equity funds. China is removed from the chart to enhance the focus but appears "overweight" with Y=65% and X=31%. Corr: 0.91.

In addition, we then test a number of variables including i) concentration of ownership in listed companies (Medina, de la Cruz and Tang, 2022[39]) and portfolio account restrictions, ii) investment climate and iii) climate related variables (climate policy, share of renewable energy production, exports in green products, ESG country ratings). As many of these country level variables are correlated, we use parsimonious models. Table B1. in the Annex plots the pairwise correlation matrix in key variables. Table B2 provides the definition and data sources for each variable used.

As a large number of funds do not invest in green assets in all EMs but only key ones such as China and Brazil (as demonstrated in Figure 4), the fund-country dataset has a large number of zeros (more than 80% of observations), which renders linear regressions problematic. As such, we use Poisson regressions as proposed in the seminal paper by Santos Silva and Tenreyro (2006[40]) and further tested and explained in Santos Silva and Tenreyro (2011[41]; 2022[42]). Continuous control variables are logged when the Poisson regressions deem values to be too high. Errors are clustered at the fund level.

Results are displayed in Table 2. The country allocation in the benchmark MSCI EM equity index appears the single most important positive covariate of green investments in EMs in all models, confirming more formally the intuition in Fig 6 and underscoring the importance for green companies to make their ways into benchmarks. We also find that the more concentrated the ownership of firms (proxied by the share of listed companies where the top 3 shareholders own more than 50% of the shares), the less countries receive green investments.

Next, we find that traditional drivers of portfolio allocation are also important drivers of green investments such as the lack of portfolio inflows restrictions and the level of openness and economic freedom (capturing the rule of law, government size, regulatory efficiency, market openness).

Nonetheless, two highly significant green-specific drivers of green investments are the country's size of renewable exports and the share of renewable energy generation of the country. The climate vulnerability/exposure to climate and the ESG global score, which captures the level of a country's ESG

rating system, are significant drivers, but signs shift depending on the inclusion of other covariates, possibly due to collinearity (see col. 8 and 9; 10 and 11, respectively).

In contrast, climate policy drives green country share portfolio allocations negatively (col. 14) although the statistical significance drops at times depending on the models.

As first robustness check in the Annex, Table B4. shows results with fund dummies, which do not change key results.7 As second robustness check, we use another type of model that has been put forward to deal with regressions with many zeros and with continuous dependent variables: two part models, that estimate first a binary choice model for the probability of observing a positive-versus-zero outcome and then a linear regression conditional on a positive outcome (Belotti et al., 2015[43]; Eisenberg et al., 2015[44]). The model then allows to calculate marginal effects and standard errors combining binary and linear models for each control variable -these are displayed in Table B5. and strongly confirm our baseline results.

Table 2. Country characteristics

Dep Var:	Green country share													
VARIABLES	1	2	3	4	5	6	7	8	9	10	11	12	13	14
MSCI EM country share	12.666***			8.345***	17.360***	12.512***	9.471***	9.113***	14.704***	10.455***	13.267***	9.458***	11.862***	13.780***
	0.26			0.30	0.41	0.38	0.41	0.34	0.72	0.35	0.57	0.39	0.39	0.60
Concentration of firm ownership			-2.831***											
			0.15											
Green exports		0.621***	0.523***	0.199***		0.545***	0.180***	0.172***	0.553***	0.090***	0.551***	0.174***	0.459***	0.463***
		0.02	0.02	0.01		0.04	0.01	0.01	0.04	0.01	0.04	0.02	0.03	0.03
Portfolio inflow restrictions					-2.302***	-6.381***			-7.422***		-6.659***		-5.010***	-5.691***
					0.14	0.43			0.56		0.50		0.43	0.29
Economic freedom index							1.215***							
							0.37							
Climate vulnerability								-3.150***	6.331***					
								0.56	1.37					
Beyond ratings ESG global score										0.874***	-1.087**			
										0.17	0.43			
Renewable share (% energy generation)												1.453***	0.331***	
												0.12	0.11	
Climate policy														-0.041***
														0.01
Constant	-7.573***	-19.239***	-15.593***	-11.191***	-6.775***	-14.791***	-15.932***	-9.515***	-17.200***	-12.814***	-10.381***	-15.803***	-14.919***	-13.348***
	0.07	0.44	0.44	0.23	0.10	0.51	1.57	0.28	0.85	0.68	1.56	0.70	0.56	0.43
Fund dummies	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Fund-country observations	9,068	8,463	7,863	8,463	8,468	7,863	8,463	7,863	7,863	7,257	7,257	7,863	7,863	7,257
R-squared	0.399	0.388	0.424	0.399	0.443	0.450	0.402	0.440	0.450	0.436	0.447	0.449	0.450	0.447

Note: Dependent variable is the fund level country share of green assets in the portfolio. Poisson regressions. Clustered SE at the fund level. * p<0.10, ** p<0.05, *** p<0.01.

5 Conclusions

The study provides an investigation with micro-level data on portfolios' allocations towards green assets in EMs, and their drivers both from a supply and demand perspective.

The determinants of the allocation of investments towards green assets are in line with the literature in this field, however we are able to identify some additional drivers that are specific to portfolios' allocations towards the green sector.

The crucial role of benchmarks in driving investment in general, and also green investments, point to the importance of index inclusion of green companies. However structural issues in global capital markets act as barriers for EMs, including the concentration of firm ownership and its impact on free-float levels and biases towards large companies for inclusion in an index.

The absence of portfolio inflows restrictions and the level of openness and economic freedom are drivers considered common drivers of investment in general and are found to also impact green investment, but we also found the renewable energy generation of the country and the country's share in green exports are important drivers of investment funds' asset allocation towards green.

Working on benchmark inclusion and maintaining openness and good investment climate, while developing green sectors domestically to ensure a pool of green competitive and investable companies are all avenues that may be on policymakers' agendas.

Further work needs to be conducted on the impact of climate policies in driving or deflecting investment allocation, as the data analysed in this paper is not best suited to do so. While the analysis is conducted on the stock of investments at a given time in March 2023, time series analysis of funds' portfolios could investigate how global investors respond to changes in environmental policies, e.g. whether they rebalance their portfolios towards some sectors or some countries as a result of the environmental policy changes, whether there are some cross-sector and cross-country spillovers.

Finally, as touched upon marginally in this paper, further work may study the actual exposures and drivers of investment in fossil fuels over time as countries aim to transition away from such energy sources. This transition may entail risks and volatility which necessitate in dept ex ante analysis of exposures. Research questions that could be then addressed are: what divestment could this entail in the near future? How has the share of brown within a fund portfolio evolve over time (e.g. since the Paris agreement, the COP 28 agreement on fossil fuel, and other events)? We leave these questions for another investigation.

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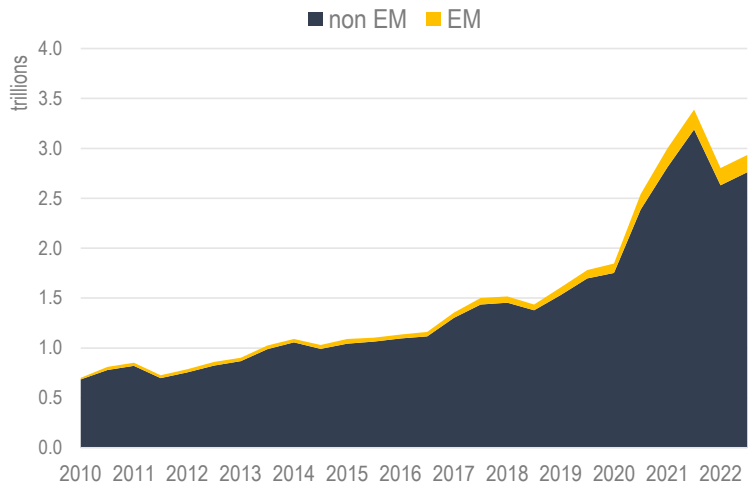
Annex A. Concepts and definitions

Sustainable investment

Capital markets have shown strong and growing appetite for sustainable investing. To demonstrate this appetite, we use the Morningstar definition of sustainable funds, a narrower definition than other sources such as the GSIA. Sustainable funds are defined by Morningstar 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."

Asset Under Management (AUM) by "sustainable" funds tripled over the decade 2010-20, with an exponential boom in the period 2019-2022. The peak of almost USD 3.2 tln at the end of 2021 (Figure A1).

Figure A.1. AUM of sustainable funds, breakdown EM and non-EM (tln, USD)



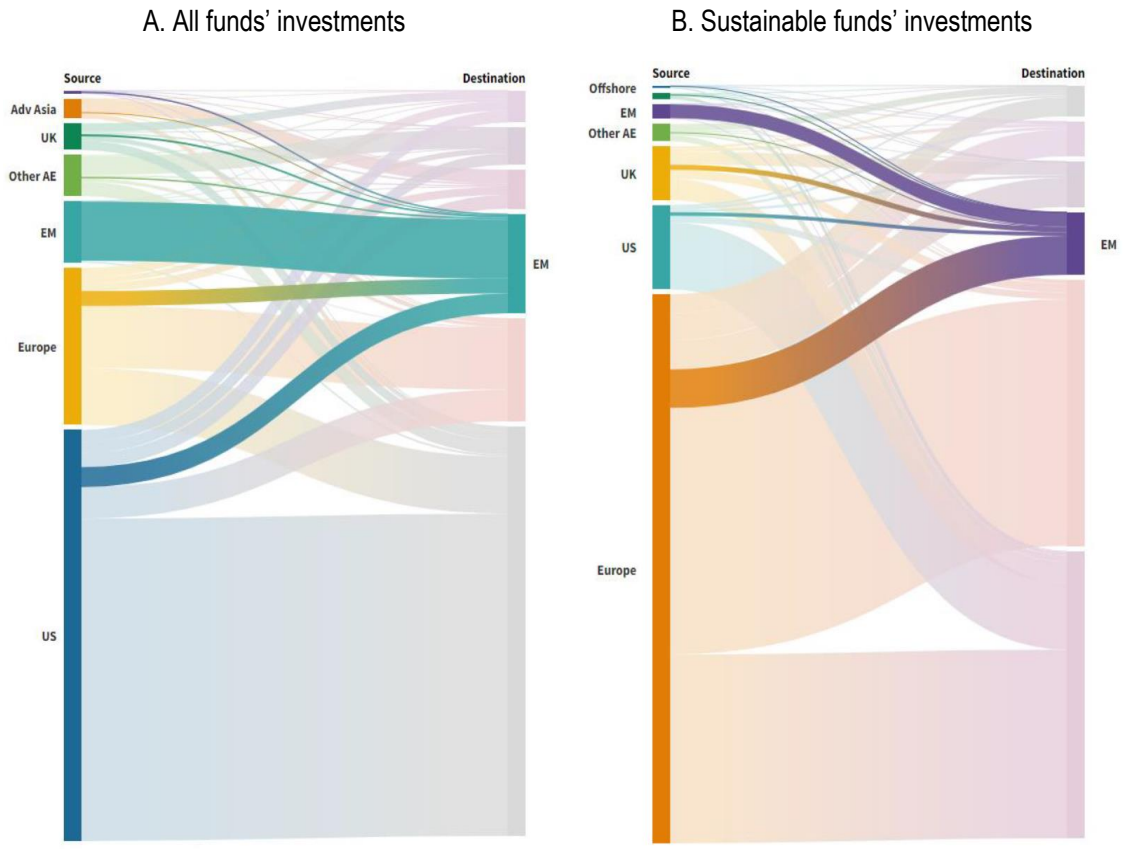
Note: Sustainable classification based on name and prospectus.
Source: Morningstar, authors' calculations (2023).

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, a much lower figure than the 36% provided by some estimates using broader definitions (GSIA, 2021[45]). This points to necessary scrutiny in definitions, names and labels, amid possibilities of "greenwashing" as further discussed in Section 2.

There is major room for more geographic diversification of investment towards EMs (Figure A1). 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 A2, Panel A). 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 A2, Panel B).

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 A.2. Origin of funds' investments in EM assets



Source: Morningstar, authors' 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).

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, a gap that has also been noted in other studies (IMF, 2022[46]). 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).

ESG integration

The term 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.

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”.

Green assets and green funds

Our key variable to classify investments as green or not in the paper is the “% of the revenue from involvement in carbon solutions”. We show here that 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 (%)

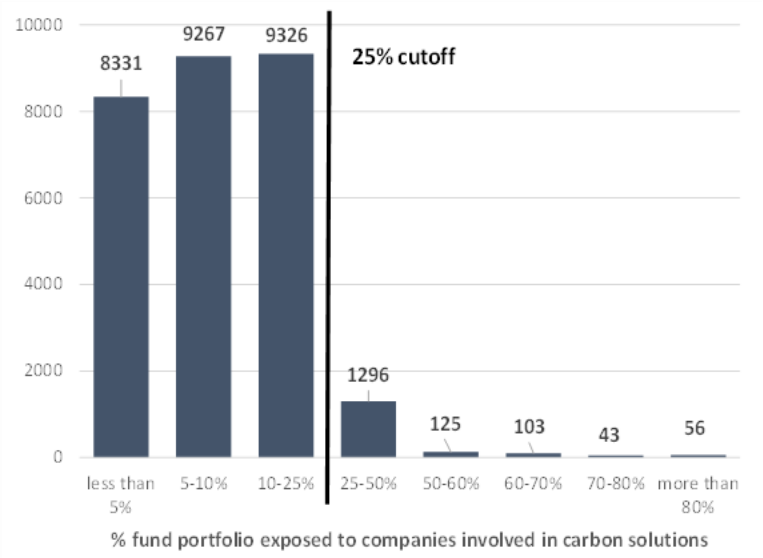
	Carbon Solutions Percentage of Covered Portfolio with Less than 5 % Involved	Carbon Solutions Percentage of Covered Portfolio with 5 to 10 % Involved	Carbon Solutions Percentage of Covered Portfolio with 10 to 25 % Involved	Carbon Solutions Percentage of Covered Portfolio with 25 to 50 % Involved	Carbon 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 37 000 largest funds.

Morningstar 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”. Each individual position’s market value is then converted into USD.

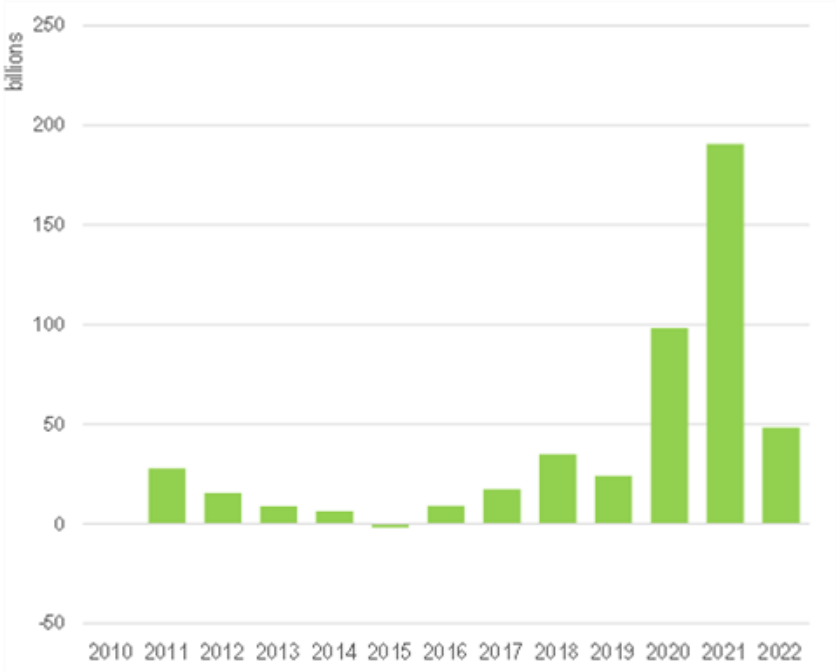
For the purpose of Section 3, we define a fund as “green” using a threshold on the share of the portfolio that represents companies involved in carbon solutions. A 25% threshold is adopted. Figure A3 displays the distribution of funds according to the share of companies involved in carbon solutions in the fund’s portfolio.

Figure A.3. Distribution of funds according to the share of companies involved in carbon solutions in portfolio



Flows to green funds have increased remarkably over 2020-21, peaking at around USD 200 bln in 2021 (Figure A4).

Figure A.4. 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, authors' calculations (2023).

Analysing the portfolios of funds under different definitions

Analysing the portfolios of funds under these different definitions (Table A2):

- 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 paper (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).

Annex B. Sample, variables and additional regression tables

Emerging Markets: sample

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

Data sources, Additional Statistics and Regression tables

Table B.1. Pairwise correlation matrix of country specific control variables

	MSCI EM Share	Portfolio flow restrictions	Climate vulnerability	Climate policy index	Renewable share (% energy generation)	Green exports (log)	Beyond ratings ESG global score	Economic freedom index
MSCI EM Share	1							
Portfolio flow restrictions	0.5562*	1						
Climate vulnerability	0.1405*	0.3891*	1					
Climate policy index	0.5109*	0.1597*	0.4257*	1				
Renewable share (% energy generation)	0.0112	-0.4078*	-0.0417*	0.0633*	1			
Green exports (log)	0.6317*	0.8917*	0.0207	0.1281*	0.2987*	1		
Beyond ratings ESG global score	-0.0750*	-0.2915*	-0.9501*	-0.4460*	0.1232*	0.1566*	1	
Economic freedom index	-0.2250*	-0.6525*	-0.5029*	0.1592*	0.006	-0.1263*	0.5371*	1
Concentration of firm ownership	-0.5204*	-0.3619*	-0.2978*	-0.1998*	0.4066*	-0.2293*	0.2932*	0.5122*

Note: * means correlation is significant at the 1% level.

Table B.2. Variables sources and definitions

Variables	Description	Data source
Sustainable Fund	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.	Morningstar
Institutional investors	An indication that the share class is primarily aimed at institutional investors. For the US market this will include "I" (Institutional) share classes or classes with a minimum initial purchase of more than $100,000 and for non-US markets where the share class is primarily aimed at institutional investors as defined by the provider of the fund.	Morningstar
MSCI EM share	Country allocation in the MSCI EM index as of March 2023	MSCI

Variables	Description	Data source
Portfolio flow restrictions	Higher value means more restrictive. Sum of score on inflows controls in equity, bonds, and collective investment securities. Latest data available (2019).	Fernandez et al (2015[47])
Climate vulnerability	Index measuring a country's exposure, sensitivity and capacity to adapt to the negative effects of climate change, by considering six life-supporting sectors – food, water, health, ecosystem service, human habitat, and infrastructure. Latest available data (2021)	Notre Dame Global Adaptation Initiative
Climate Policy	Performance rating by climate and energy policy experts in the area of climate policy. Latest available data	Climate Change Performance Index (CCPI)
Renewable share	Renewable energy share of electricity capacity and generation (%). Latest data available (2021)	IRENA
Green exports	Sum of exports in 2021 and 2022 of solar panels and wind turbines (HS 854140, 850231)	UN COMTRADE
Beyond ratings ESG global score		Refinitiv
Economic freedom index	Overall economic freedom based on 12 quantitative and qualitative factors, grouped into four broad categories: Rule of Law (property rights, government integrity, judicial effectiveness), Government Size (government spending, tax burden, fiscal health), Regulatory Efficiency (business freedom, labor freedom, monetary freedom) Open Markets (trade freedom, investment freedom, financial freedom)	Heritage Foundation
Concentration of firm ownership	Share of listed companies in a given country where the top 3 shareholders own more than 50% of the shares. Value in 2022.	(Medina, de la Cruz and Tang, 2022[39])

Table B.3. Robustness checks on funds' characteristics deviation from category average and without global dummies

Dep Var:	Share of green assets in portfolio (deviation from cat. Average)					Share of green assets in portfolio				
VARIABLES	1	2	3	4	5	6	7	8	9	10
Fund size (log)	-0.015	-0.002	-0.007	-0.007	0.037	-0.203***	-0.200***	-0.202***	-0.192***	-0.156***
	0.04	0.04	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.05
Age (log)	-0.680***	-0.629***	-0.656***	-0.656***	-0.501***	-0.943***	-0.932***	-0.941***	-0.911***	-0.888***
	0.07	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.07	0.08
Passive/Index funds	0.410**	0.462***	0.430***	0.436***	0.279*	1.681***	1.693***	1.683***	1.717***	1.209***
	0.16	0.16	0.16	0.16	0.16	0.19	0.19	0.19	0.19	0.19
Institutional investors	-0.455***	-0.377***	-0.422***	-0.405***	-0.552***	-1.036***	-1.019***	-1.034***	-0.968***	-1.427***
	0.12	0.12	0.12	0.12	0.13	0.14	0.14	0.14	0.14	0.14
EM domicile		0.532***					0.116			
		0.18					0.20			
EM mandate			0.378**					0.028		
			0.16					0.17		
Domestic EM mandate				0.412**					0.562***	
				0.20					0.22	
Sustainable fund					3.803***					3.754***
					0.20					0.22
Constant	1.720**	1.232	1.419*	1.433*	-0.148	15.827***	15.720***	15.805***	15.435***	14.796***
	0.79	0.79	0.79	0.79	0.82	0.91	0.92	0.91	0.91	0.95
Category dummies	N	N	N	N	N	N	N	N	N	N
Observations	26,121	26,121	26,121	26,121	23,213	26,121	26,121	26,121	26,121	23,213

Note: the regressions are ran using OLS on funds holdings as of 2023Q1. Robust SE. * p<0.10, ** p<0.05, *** p<0.01.

Table B.4. Poisson regressions on country characteristics, with fund dummies

Dep Var:	Green country share													
VARIABLES	1	2	3	4	5	6	7	8	9	10	11	12	13	14
MSCI EM country share	12.625***			8.312***	17.309***	12.468***	9.428***	9.075***	14.659***	10.414***	13.223***	9.424***	11.824***	13.726
	0.26			0.30	0.41	0.38	0.41	0.34	0.72	0.35	0.56	0.39	0.39	0.00
Green exports		0.618	0.521	0.198***		0.543***	0.180***	0.171***	0.552***	0.090***	0.550***	0.174***	0.458***	0.462
		0.00	0.00	0.01		0.04	0.01	0.01	0.04	0.01	0.04	0.02	0.03	0.00
Concentration of firm ownership			-2.826											
			0.00											
Portfolio inflow restrictions					-2.298***	-6.365***			-7.406***		-6.642***		-5.003***	-5.682
					0.14	0.43			0.56		0.50		0.43	0.00
Economic freedom index							1.203***							
							0.37							
Climate vulnerability								-3.137***	6.331***					
								0.56	1.37					
Beyond ratings ESG global score										0.871***	-1.086**			
										0.17	0.43			
Renewable share (% energy generation)												1.449***	0.329***	
												0.12	0.11	
Climate policy														-0.041
														0.00
Constant	-9.431***	-21.048	-17.246	-13.040***	-8.473***	-16.469***	-17.735***	-11.208***	-18.876***	-14.492***	-12.063***	-17.476***	-16.594***	-15.039
	0.06	0.00	0.00	0.23	0.09	0.51	1.56	0.28	0.85	0.68	1.56	0.71	0.57	0.00
Fund dummies	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Fund-country observations	7,965	7,434	6,825	7,434	7,350	6,825	7,434	6,825	6,825	6,300	6,300	6,825	6,825	6,300
R-squared	0.571	0.560	0.657	0.575	0.683	0.705	0.580	0.680	0.706	0.678	0.703	0.703	0.705	0.704

Note: Dependent variable is the fund level country share of green assets in the portfolio. Poisson regressions with fund dummies. Clustered SE at the fund level. * p<0.10, ** p<0.05, *** p<0.01.

Table B.5. Two-part model regressions on country characteristics

Dep Var:	Green country share													
VARIABLES	1	2	3	4	5	6	7	8	9	10	11	12	13	14
MSCI EM country share	0.028***			0.027***	0.028***	0.023***	0.025***	0.018***	0.022***	0.021***	0.023***	0.019***	0.022***	0.028***
	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Green exports		0.001***	0.001***	0.000		0.001***	0.000***	0.000***	0.001***	0.000***	0.001***	0.000***	0.001***	0.000***
		0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Concentration of firm ownership			-0.008***											
			0.00											
Portfolio inflow restrictions					-0.003***	-0.007***			-0.007***		-0.007***		-0.007***	-0.005***
					0.00	0.00			0.00		0.00		0.00	0.00
Economic freedom index							-0.001							
							0.00							
Climate vulnerability								-0.011***	-0.004*					
								0.00	0.00					
Beyond ratings ESG global score										0.004***	0.002***			
										0.00	0.00			
Renewable share (% energy generation)												0.002***	0.000	
												0.00	0.00	
Climate policy														-0.000***
														0.00
Fund dummies	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Fund-country observations	9,068	8,463	7,863	8,463	8,468	7,863	8,463	7,863	7,863	7,257	7,257	7,863	7,863	7,257

Note: Dependent variable is the fund level country share of green assets in the portfolio. Marginal effects are displayed, averaged over the sample, for the combined first part logit and second part OLS of the two-part model with SE clustered at the fund level. * p<0.10, ** p<0.05, *** p<0.01.

Notes

[1] 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.

[2] As this paper is about capital market investments, we study countries falling into the "emerging markets" category rather than developing economies that have limited access to capital markets.

3 As discussed at length in Maggiori et al (2020[21]), Morningstar cannot provide information of the nationality of investors in the fund but they show that in most cases it is reasonable to assume that the domicile of the fund is also the jurisdiction of residency of its investors.

4 The most widespread strategy is "ESG integration" by asset managers (see definition in Annex A). 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. Strategies that often accept a tangible trade-off between wealth creation and better ESG results, such as impact investing, are much less.

[5] A threshold that strikes a reasonable balance between climate impact and the inclusion of a meaningful number of funds (see Annex A, Figure A3).

[6] We also test other types of sustainable or green fund classifications, including climate action fund and sustainability ratings and result go in the same direction. Definitions are provided in Annex A and B.

[7] The large number of dummies may at times lead to issues in the estimation of coefficients and standard errors in the Poisson regressions.