

BEYOND TRADITIONAL INDEXING

24 September 2026
15:30 – 17:30 hrs
Amsterdam

ROBECO
The Investment Engineers

 CFA Society
Netherlands

BEYOND TRADITIONAL INDEXING

15:30	Welcome and introduction by Anne-Marie Munnik (CFA Society Netherlands)
15:40	Joop Huij (RSM, Robeco): The Investment Implications of Sustainable Investing
16:05	Gerben de Zwart (APG AM): From Investment Beliefs to Custom Indices
16.30	Coffee break
16.40	Remco Zwinkels (VU): Measuring Corporate Transition Risk for Index Design
17:05	Panel discussion
17.30	Networking drinks

Robeco/CFA Seminar on Indices

The Investment Implications of Sustainable Investing

Joop Huij¹, Dries Laurs², and Jan Anton van Zanten³

September 2026

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³ Erasmus University Rotterdam

For professional investors

Recent Developments & Context

Consolidation of ESG data providers (1/2)

2018	ISS ESG 	acquires	oekom
2019	S&P Global Ratings	acquires	ROBECOSAM  We are Sustainability Investing.
2019	MOODY'S RATINGS	acquires	vigeo eiris 
2019	MSCI 	acquires	CARBON DELTA
2020	MORNINGSTAR	acquires	 SUSTAINALYTICS
2021	 DEUTSCHE BÖRSE GROUP	acquires	ISS ESG 

Proxy advisor buys ESG rating agency



Rating agency buys ESG rating agency



Credit rating agency buys ESG rating agency



Index provider buys ESG analytics fintech



Fund rating agency buys ESG rating agency



Marketplace buys proxy advisor / ESG ratings



Consolidation of ESG data providers (2/2)

2021	MOODY'S RATINGS	acquires	RMS
2022	S&P Global Ratings	acquires	TCS The Climate Service
2022	ICE	acquires	URGENTEM
2022	S&P Global Ratings	acquires	°C CICERO Shades of Green
2023	MSCI 	acquires	 Trove Research
2026	MSCI 	acquires	 First Street

Credit rating agency buys climate risk modeler



Rating agency buys climate risk analytics



Exchange operator buys emissions data provider



Rating agency buys green bond analytics



Index provider buys carbon credit data firm



Index provider buys physical climate risk modeler



Investors are rethinking Paris-aligned benchmarks

General versus Paris Aligned

Choosing the right benchmark is another challenge. Many investors already work with general ESG benchmarks (i.e. MSCI, S&P Dow Jones Indices, FTSE Russell and Bloomberg). Before choosing a benchmark, and more importantly, before choosing between a general ESG benchmark that takes into account more environmental, social and governance aspects than a Paris Aligned benchmark, an investor has to check the restrictions of the benchmark and potential tilts related to certain sectors and certain climate risks. A Paris Aligned benchmark **may currently be too concentrated, leading to insufficient diversification.**

1. **PABs can create significant active risk which comes with a systematic style bias:** By using PABs as a proxy for the passive implementation option, investors are making an active investment decision.
2. **Lower quality Scope 3 emissions will dominate the construction of a PAB:** The phase in of Scope 3 emissions to the PAB regulations^{1,2}, may pose challenges to portfolio construction.
3. **PABs may inadvertently hinder the transition to a low-carbon economy:** PABs exclude some of the firms that are likely to be most critical for decarbonising the energy sector, especially in emerging markets.

Why Paris-aligned benchmarks go ‘way too far’

“We believe that 95 per cent or all of your reduction, if you can, should come from within sector, not across sector, allocations. The PABs push you out of particular sectors and we don’t think that does you any good in terms of enabling the economy to transition.”

Sources: Ortec Finance (top), Ben Corris (middle), Robert Scott (middle), Lachlan Maddock (bottom), Mike Aked (bottom).

Relation Between Paper of Van Dijk et al and Huij et al.

Key findings

- > Van Dijk et al investigate diversification (in the light of sustainable investing) and find that
- > It takes considerably more than **30-40 stocks** to fully diversify idiosyncratic risk
- > It takes around **750 stocks** for **portfolio volatility to converge to market volatility**
- > Huij et al. find that implementing **common approaches to sustainable investing does not affect diversification and factor premiums** and exposures in a negative way per se.



FOMO in equity markets?
Concentration risk in (sustainable) investing

Andreas Bruggen, Jeroen Koelzer, and Mathijs van Dijk*

Abstract
This paper revisits the trend towards concentration risk in (sustainable) investing. Based on a large global sample of equity returns, we study the idiosyncratic risk of FOMO (Fear Of Missing Out) in wealth creation and stock performance. We find that FOMO is based on ESG screens, which leads to a concentration risk in (sustainable) investing.

Journal of International Money and Finance

journal homepage: www.elsevier.com/locate/jimf

The investment implications of sustainable investing*

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Keywords: concentration risk; sustainable investing; ESG; FOMO

HIGHLIGHTS

- We examine the investment implications of three common approaches to sustainable investing.
- Our analysis considers diversification based on ESG scores, ESG ratings, and carbon emissions data.
- Diversification, factor premiums, and factor exposures remain largely unaffected from moderate exclusions in the long run.
- Sustainable exclusions using ESG scores and carbon emissions can be effective in avoiding investments in stocks on exclusion lists and in avoiding applying exclusions using ESG ratings is not.

ARTICLE INFO

ABSTRACT

We examine the investment implications of three common approaches to sustainable investing. Specifically, we analyze whether implementing sustainability restrictions using ESG ratings, ESG scores, and carbon emissions data affects diversification, factor premiums, and factor exposures in investment portfolios. Our findings indicate that sustainable investing offers similar diversification benefits as unrestricted investment portfolios, and does not affect factor premiums and exposures in the long run. While applying sustainability exclusions using ESG scores and carbon emissions data can be effective in avoiding investments in stocks on exclusion lists and in avoiding applying exclusions using ESG ratings is not. Our findings have practical relevance in the context of the debate on the investment implications of sustainable investing.

1. Introduction

One of the most notable developments in the financial industry in the past decade is the rise of sustainable investing. The assets associated with the United Nations Principles for Responsible Investment have increased almost 15-fold: from about \$2.5 trillion in 2008 to more than \$12.4 trillion in 2024. Although many actively managed mutual funds have struggled to retain capital in the past decade, funds with an explicit environmental, social, and governance (ESG) mandate have done well on aggregate in all capital markets (see Hartmann and Sussman, 2019; Huij et al., 2022; Cecchetti et al., 2024). Despite the popularity of sustainable investing, some investors, policy makers, and academics, there is ambiguity about the definition of sustainable investing and the consequences of investing sustainably.

* The views in this paper are the authors' views and do not necessarily represent their affiliated institutions. We thank Kees Koelzer, Xing Guo, Anneli Scholten, and two anonymous referees for valuable suggestions on this work. All errors remain our own.

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E-mail address: joop.huij@vrijeuniversiteit.nl (J.A. van Zanten).

<https://doi.org/10.1016/j.jimf.2025.103772>

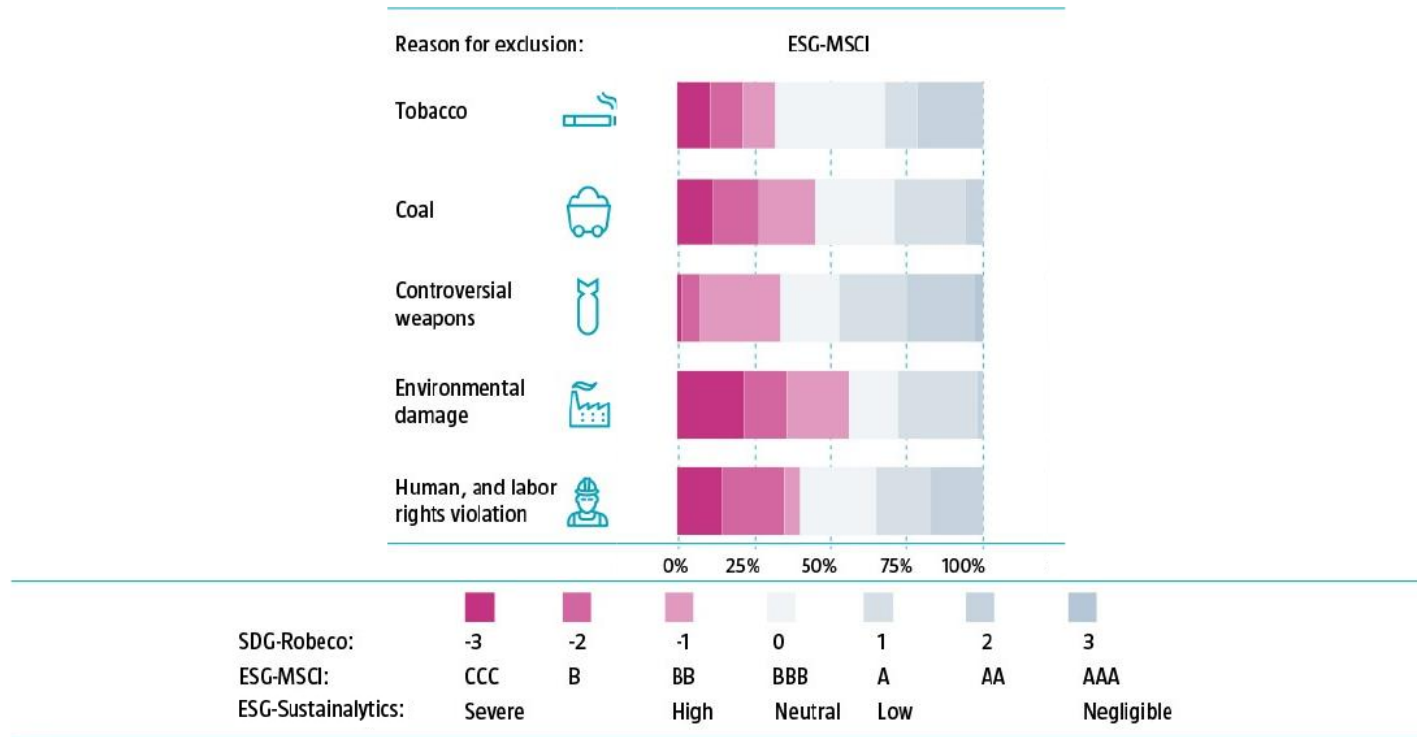
How to Measure Sustainability? ESG versus SDG

How sustainable do you perceive these companies to be?



This case is used as an example; it is not intended to be and does not constitute an investment recommendation.
The analysis was conducted using data as of: September 2023.

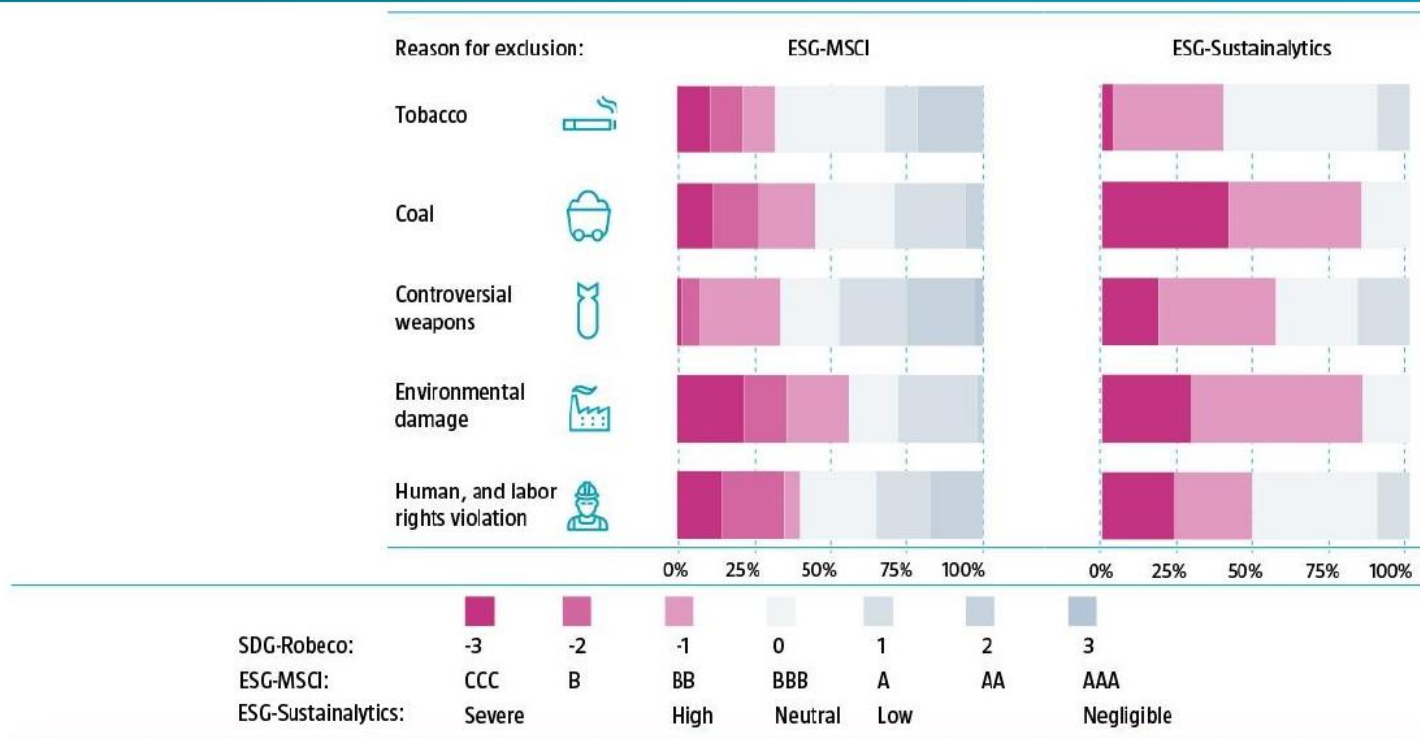
Do ESG ratings align with the values of large investors?



Source: Huij, J., Lansdorp, S., and Van Zanten, J., February 2022, "Do ESG ratings align with the values of large investors?", Robeco article.

The figure shows that more than half of the tobacco producers that are excluded from the portfolios of large asset owners receive an average ESG rating or are even considered ESG leaders by MSCI. By the same token, more than 50% of these companies are assessed as having neutral or even low ESG risk according to Sustainalytics. By contrast, all of these firms receive the lowest Robeco SDG score of -3 in line with the harmful products they produce. For stocks that are avoided for other reasons that are deemed important by large asset owners, we similarly find that the SDG scores are seemingly more aligned with the negative impact they inflict on society.

Do ESG ratings align with the values of large investors?

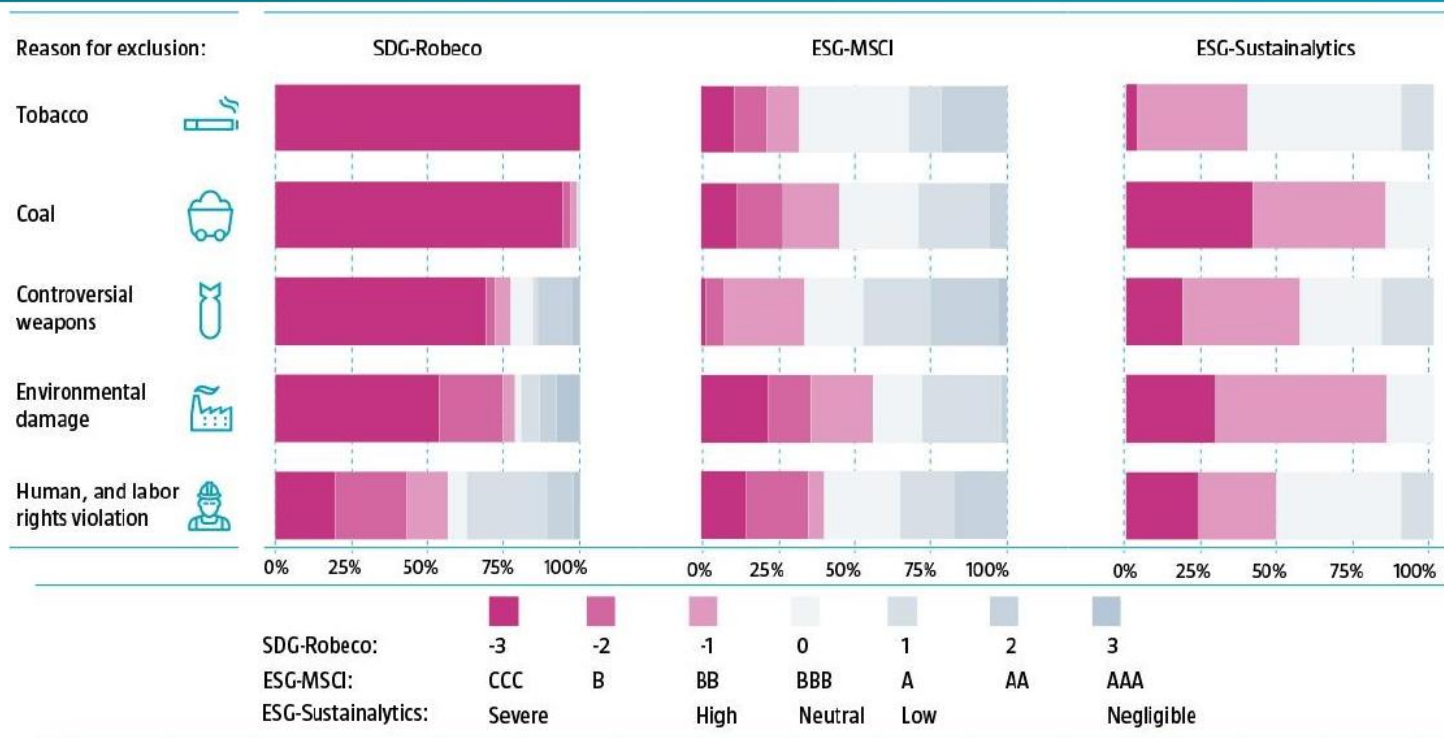


Source: Huij, J., Lansdorp, S., and Van Zanten, J., February 2022, “[Do ESG ratings align with the values of large investors?](#)”, Robeco article.

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Do ESG ratings align with the values of large investors?

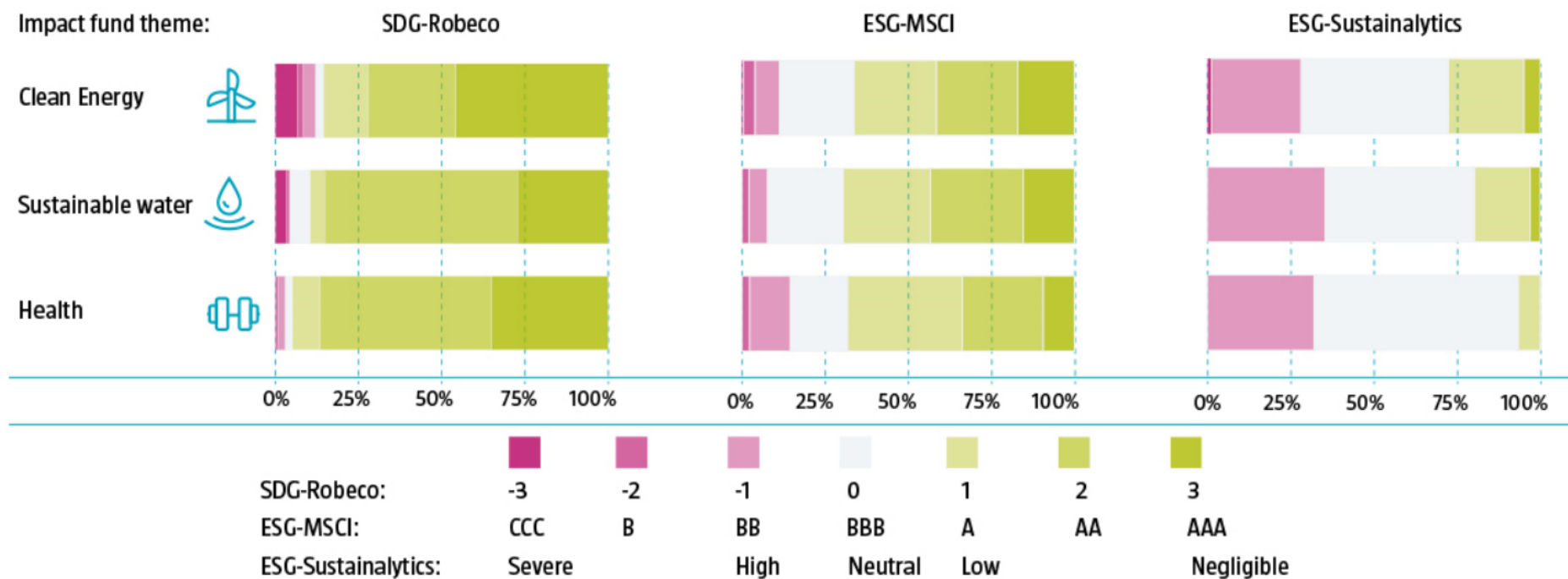
Not really, they align much stronger with the SDG Scores



Source: Huij, J., Lansdorp, S., and Van Zanten, J., February 2022, "Do ESG ratings align with the values of large investors?", Robeco article.

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Do ESG ratings align with holdings of popular thematic impact funds?



Source: Huij, J., Lansdorp, S., and Van Zanten, J., March 2022, "Do ESG ratings align with popular thematic impact funds?", Robeco article.

The figure shows that about 25% of the investee companies in our sample of popular third-party thematic impact funds with a focus on clean energy are considered to have high ESG risk, according to Sustainalytics, while an additional 50% of the holdings receive only a neutral ESG risk rating. While the picture improves when using MSCI ESG ratings, most stocks still only have an average ESG score (BB, BBB or A) or are considered to be ESG laggards (CCC and B). By contrast, the majority of the underlying investments (more than 80%) exhibit a positive Robeco SDG score, in line with their positive impact on clean energy. A similar trend is also visible across the other themes when we look at our sample of popular third-party thematic impact funds with a focus on sustainable water and health.

Research papers on ESG to SDG

Do ESG ratings align with the values of large investors?¹

Indices insights Do ESG ratings align with the values of large investors?

- There is a weak relationship between firms being on exclusion lists and their ESG ratings
- There is a much stronger alignment with SDG scores
- SDGs scores are better suited than ESG ratings for investors seeking to avoid negative impact

This is the first article of a new series, Indices insights, in which we focus on some of the flaws of ESG ratings. Compared to the UN SDGs, the use of ESG ratings have some shortcomings. Indeed, it's possible for firms that typically appear on asset owners' exclusion lists to have decent ESG ratings.

Many investors either incorporate sustainability considerations in their portfolios or plan to do so in the future. One of the key motivating factors for this adoption is that it enables investors to align with positive impact, i.e., by allocating capital to companies that are sustainable and which benefit society, while avoiding investments in those that inflict significant harm on it. To achieve this, investors often rely on readily available ESG ratings.

It is, however, important to assess whether these ESG scores appropriately measure societal impact. In our analysis, we scrutinized the ESG ratings of companies that are explicitly earmarked by large institutional asset owners as being bad for society. Surprisingly, we found a weak relationship between the firms that are on exclusion lists and their respective ESG ratings. By contrast, there was a much stronger alignment when we used a measure based on the United Nations Sustainable Development Goals (SDGs).

Article
for professional investors
February 2022

Jan Anton van Zanten, PhD
Sustainable Index Solutions Team



Do ESG ratings align with popular thematic impact funds²

Indices insights Do ESG ratings align with popular thematic impact funds?

- Holdings in thematic impact funds don't necessarily have good ESG ratings
- But they exhibit a stronger link with SDG scores
- Thus for investors seeking alignment with positive impact, SDGs scores trump ESG ratings

In the second article of the Indices insights series, we shed more light on the shortcomings of ESG ratings. We find that investee companies in popular thematic impact funds often have low to mediocre ESG ratings. By contrast, we observe that the same firms perform better when assessed in terms of Robeco SDG scores.

In practice, sustainable investing is often associated with mitigating exposure to ESG risk. However, we see that our clients are increasingly shifting their focus towards impact investing. This approach enables them to avoid controversial firms that have a negative impact on the environment and society, while allocating capital to those that offer positive solutions to promoting sustainable economic growth, advancing social inclusion and safeguarding the environment. As ESG ratings are still the dominant metric used in sustainable investing, we assessed if they provide investors suitable guidance to align with positive impact, or whether there is a better alternative.

In the first "Indices insights" article,¹ we scrutinized the sustainability ratings of companies that are explicitly earmarked by large institutional asset owners as being harmful for society. In our analysis, we found a weak relationship between the firms that are on exclusion lists and

Article
for professional investors
March 2022

Jan Anton van Zanten, PhD
Sustainable Index Solutions Team



ESG to SDG, 2022³

ESG to SDG: Do Sustainable Investing Ratings Align with the Sustainability Preferences of Investors, Regulators, and Scientists?

42 Pages • Posted: 12 Aug 2022 • Last revised: 8 Nov 2022

Jan Anton van Zanten

Erasmus University Rotterdam (EUR) - Rotterdam School of Management (RSM), Robeco Asset Management

Jaap Huij

Erasmus University - Rotterdam School of Management, Robeco, Erasmus University Rotterdam (EUR) - Erasmus Research Institute of Management (ERIM)

Date Written: November 6, 2022

Abstract

Sustainable investors aim to invest in companies that contribute to sustainable development. However, there is disagreement on how best to measure corporate sustainability performance. We assess the construct validity of two types of sustainability ratings: (i) a novel score that measures companies' impacts on the Sustainable Development Goals (SDGs); and (ii) established ESG ratings that assess if companies face environmental, social, and governance risks. We develop three tests that gauge if these sustainability ratings can identify companies that investors, regulators, and scientists view as being (un)sustainable. Our findings show that, unlike ESG ratings, the SDG score (i) captures investors' revealed sustainability preferences; (ii) aligns with the EU taxonomy regulations; and (iii) supports climate change mitigation. We conclude that, as a sustainability rating, the SDG score has high, and ESG ratings low, construct validity. While concepts like ESG, sustainability, and impact can be used complementarily, we caution against using them interchangeably.

Keywords: Sustainable investing, ESG, impact investing, Sustainable Development Goals (SDGs), sustainable finance, EU Taxonomy

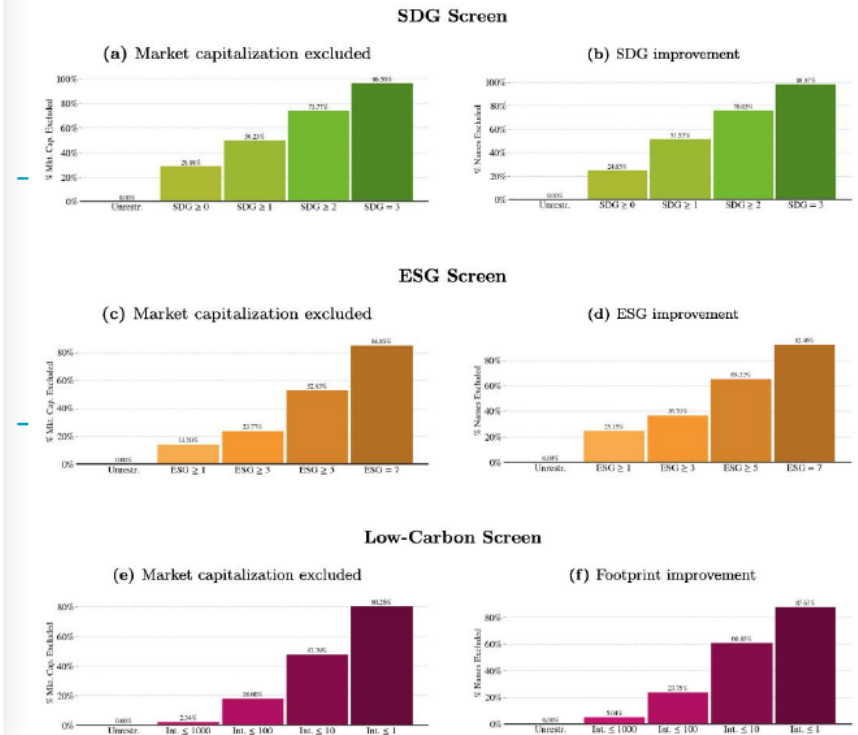
¹ Indices insights: Do ESG ratings align with the values of large investors?

The Investment Implications of Sustainable Investing

Data and Sample Construction

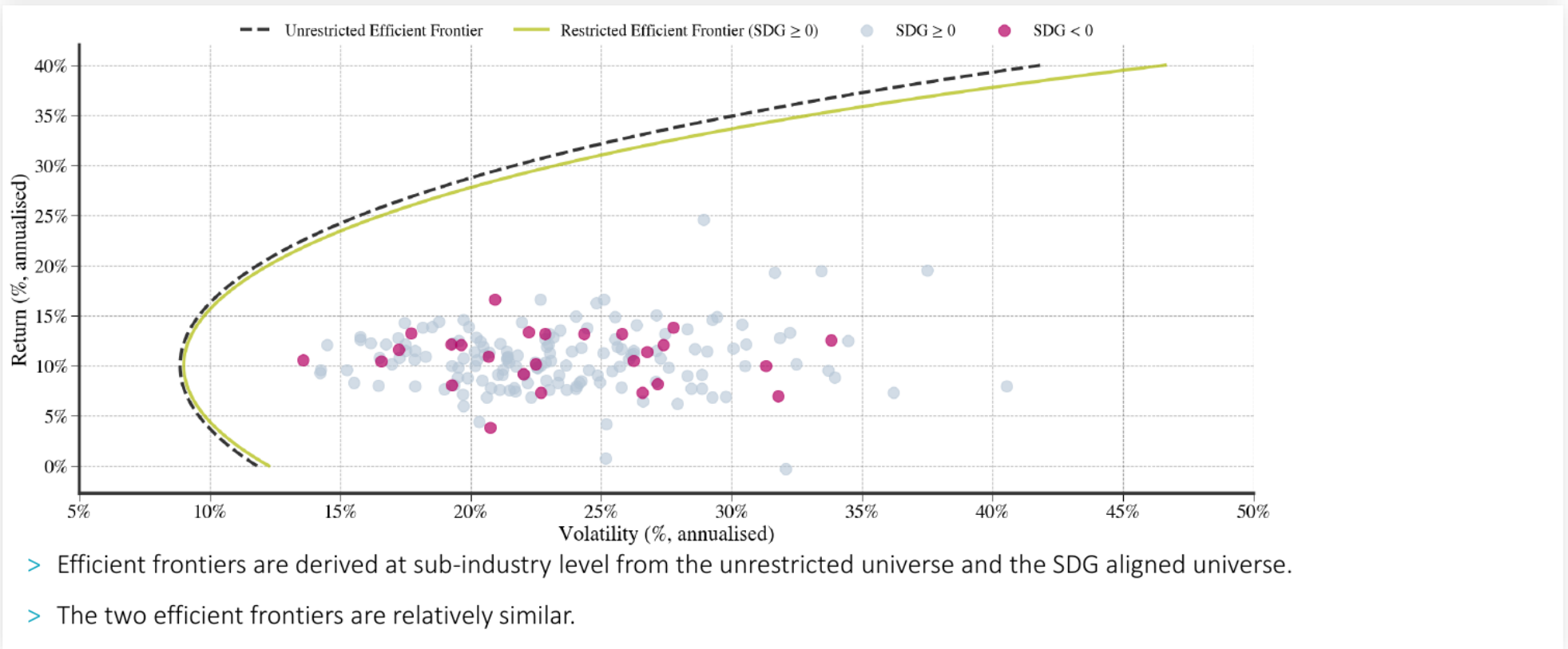
Key points

- > Sample of stocks in MSCI World Developed Index from January 1985 to the end of May 2024.
- > SDG data are from Robeco (see Van Zanton, 2025), ESG data are from MSCI, and emissions data are from Trucost.
- > Main analyses focus on restricted stock universes with
 - > SDG => 0 (29% excluded)
 - > ESG >= 3 (24% excluded)
 - > Emissions <= 100 tonnes CO2 per million EVIC (18% excluded)
- > We also used data from:
 - > Exclusion lists from large asset owners
 - > Hong and Kacperczyk (2009) to indicate Sin Stocks



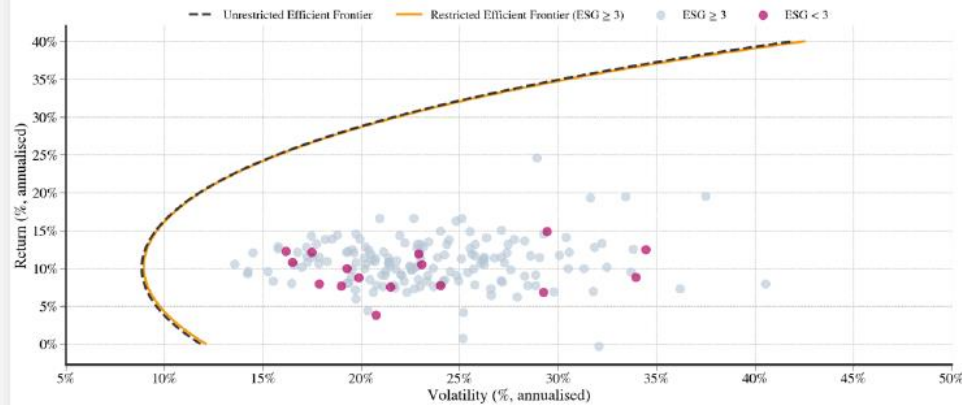
Implications for Diversification

Exclusions using SDG scores

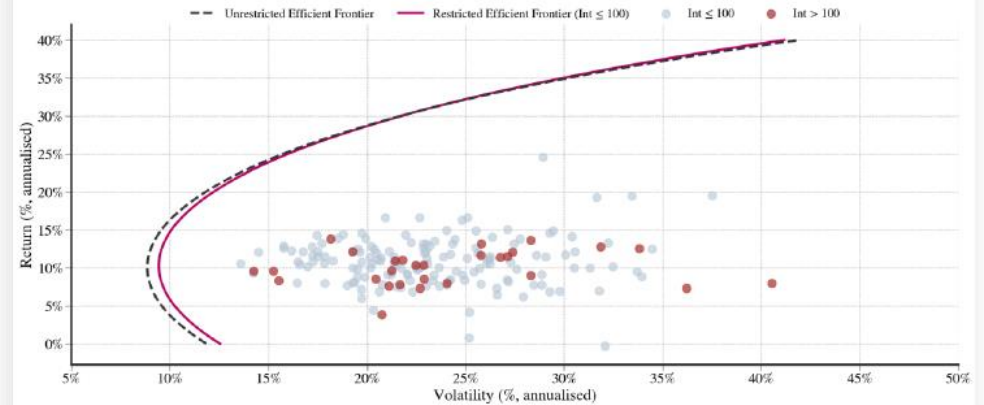


Implications for Diversification

Exclusions using ESG ratings data and the efficient frontier



Exclusions using carbon emissions data and the efficient frontier



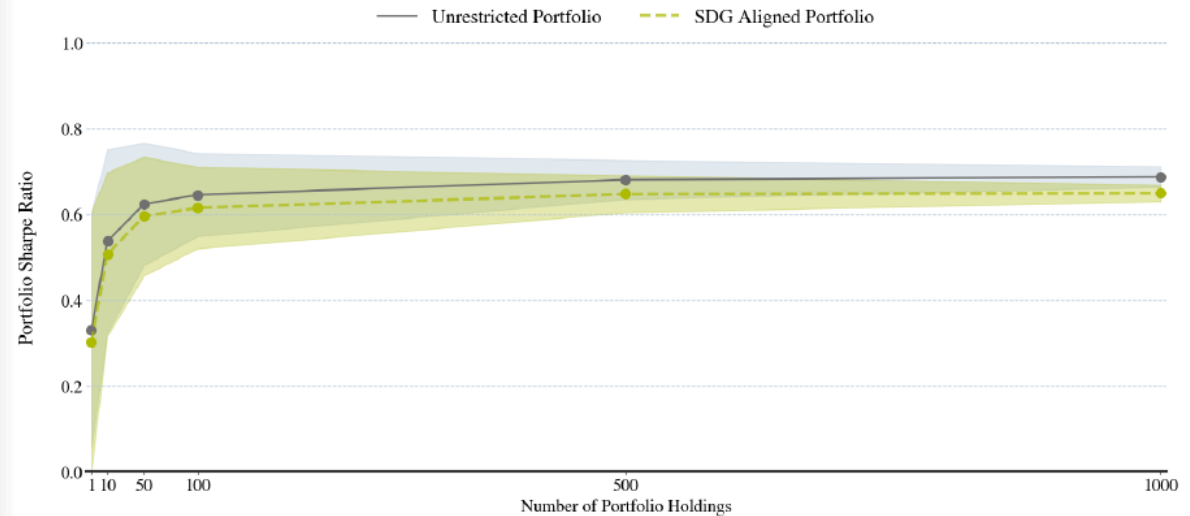
- > The efficient frontiers closely resemble each other, with a possible slight variation observed in the restricted universe that excludes stocks with high carbon emissions.

Implications for Diversification (2)

Key points

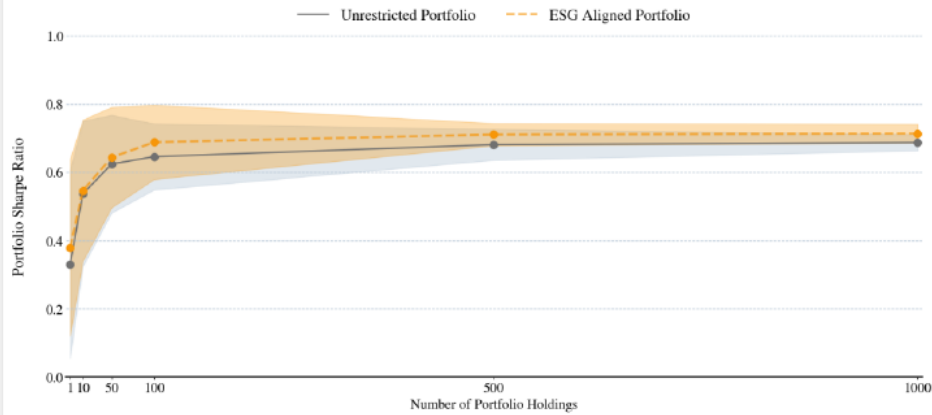
- > We randomly construct portfolios from restricted and unrestricted universes of different portfolio sizes using a bootstrap method.
- > For these bootstrapped portfolios, we consider whether the average Sharpe ratio differs.
- > We perform this sampling 10,000 times for each portfolio size N , with N in 1, 10, 50, 100, and 1000.
- > The 95%-confidence intervals are virtually identical.

SDG Screen

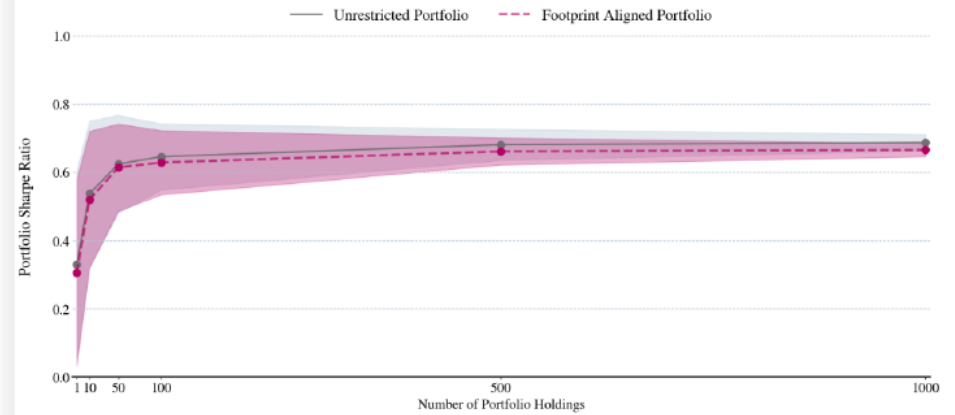


Implications for Diversification (2)

ESG Ratings screen



Carbon emissions screen

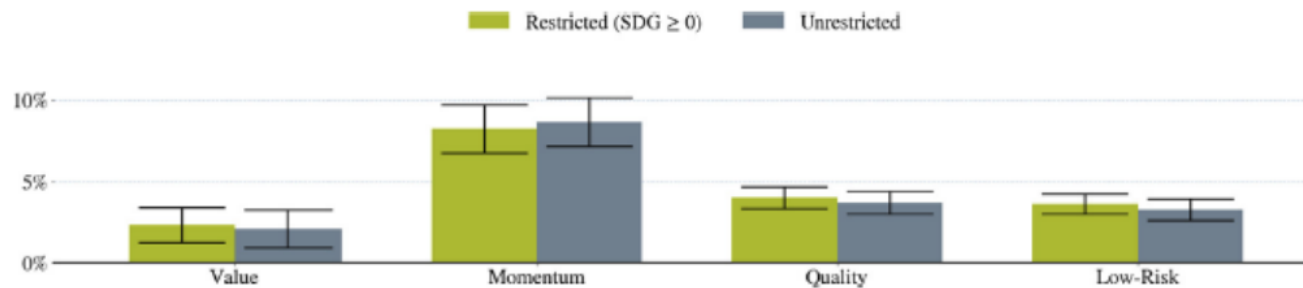


> The results are consistent for restricted universes using **ESG ratings** and carbon **emissions data**.

Implications for Factor Premiums

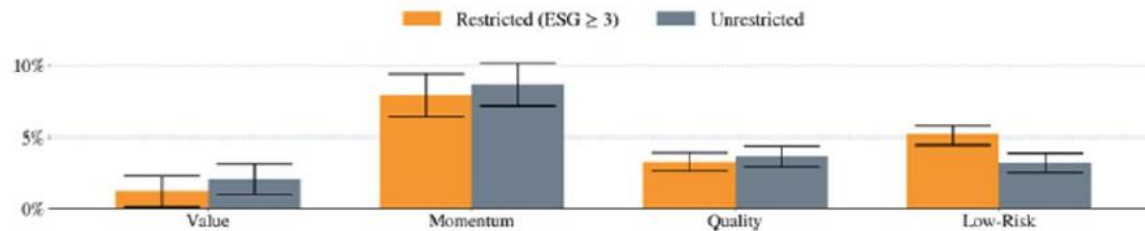
- > We devise simple investment strategies that are designed to capture the Value, Momentum, Quality, and Low-Risk premiums.
- > The premium is then determined by the CAPM-alpha of each strategy.
- > We compare the premiums for the unrestricted and restricted universes.
- > We do not observe differences in premiums for the unrestricted universe and the restricted universe with SDG aligned stocks.

SDG Screen

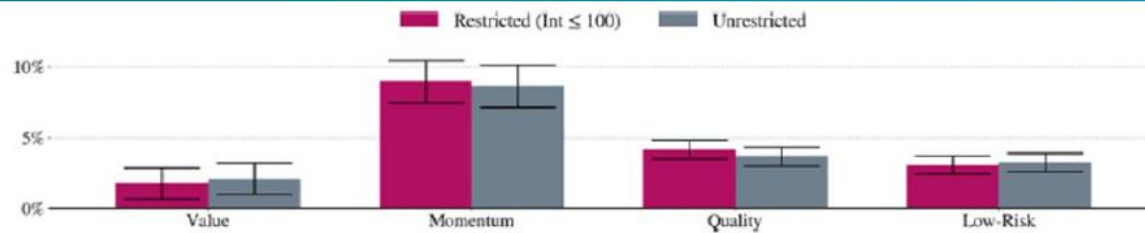


Implications for Diversification (2)

ESG Ratings Screen



Low-Carbon Screen



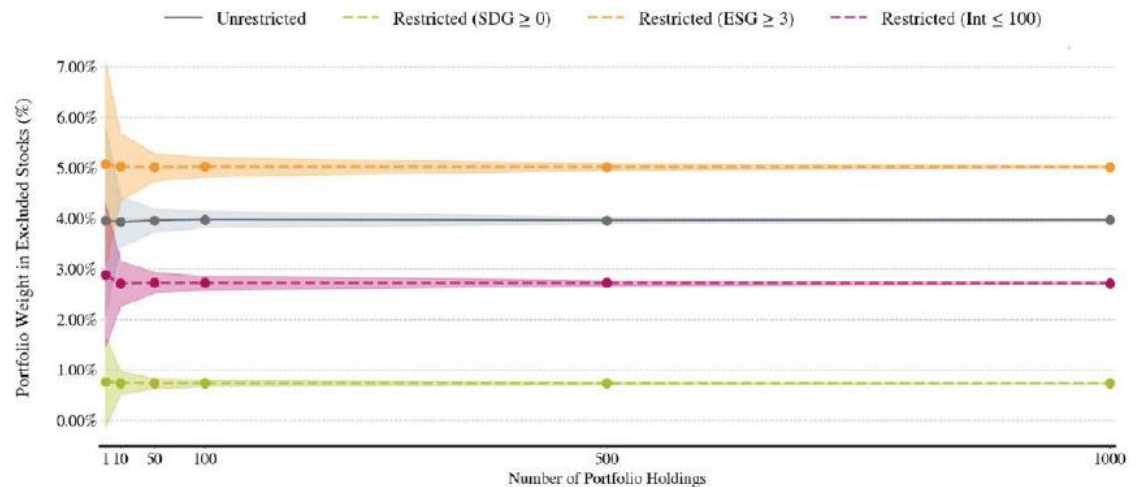
- > The results are consistent for restricted universes using [ESG ratings](#) and [carbon emissions data](#).

Implications for Investing in Stocks on Exclusion Lists

Key points

- > We generate 10,000 bootstrapped portfolios that we randomly sample from unrestricted and restricted universes using SDG scores, ESG ratings, and carbon emissions data.
- > About 4 percent of the MSCI World Developed index is on average invested in firms that are on exclusion lists.
- > For the restricted universe using SDG data this number is less than one percent.
- > For the restricted universe using ESG data this number is 5 percent!

Sustainability exclusions and investing in stocks on exclusion lists

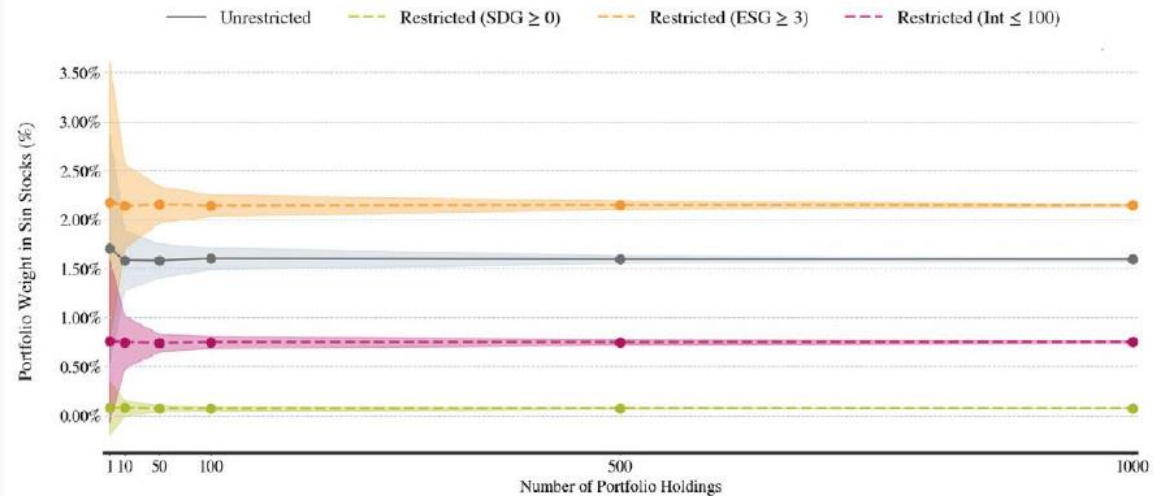


Implications for Investing in Sin Stocks

Key points

- > It appears that restricted universes based on SDG and carbon emissions data have smaller weights invested in Sin Stocks.
- > The restricted universe using ESG data has a larger weight invested in Sin Stocks!

Sustainability exclusions and investing in stocks in sin stocks



Conclusions

Key takeaways

- > We examine the investment **implications of three common approaches** to sustainable investing.
- > Specifically, we analyze whether implementing sustainability **restrictions using SDG scores, ESG ratings, and carbon emissions data** affects diversification, factor premiums, and factor exposures of investment portfolios.
- > Our findings indicate that **sustainable investing offers similar diversification as unrestricted investment portfolios, and does not affect factor premiums and exposures in the long run *per se*.**
- > While **applying sustainability exclusions using SDG scores and carbon emissions data can be effective in avoiding investments** in stocks on exclusion lists and sin stocks, **applying exclusions using ESG data is not!**



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The investment implications of sustainable investing[☆]

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HIGHLIGHTS

- We examine the investment implications of three common approaches to sustainable investing.
- Our analysis considers exclusions based on SDG scores, ESG ratings, and carbon emissions data.
- Diversification, factor premiums, and factor exposures remain largely unaffected from moderate exclusions in the long run.
- Sustainable exclusions using SDG scores and carbon emissions can be effective in avoiding investments in stocks on exclusion lists and sin stocks, while applying exclusions using ESG ratings is not.

ARTICLE INFO

JEL classification:

G11

G12

H23

Q54

Keywords:

Sustainable development goals

Sustainable investing

Factor investing

ABSTRACT

We examine the investment implications of three common approaches to sustainable investing. Specifically, we analyze whether implementing sustainability restrictions using SDG scores, ESG ratings, and carbon emissions data affects diversification, factor premiums, and factor exposures of investment portfolios. Our findings indicate that sustainable investing offers similar diversification as unrestricted investment portfolios, and does not affect factor premiums and exposures in the long run *per se*. While applying sustainability exclusions using SDG scores and carbon emissions data can be effective in avoiding investments in stocks on exclusion lists and sin stocks, applying exclusions using ESG data is not. Our findings have practical relevance in the context of the current debate on the investment implications of sustainable investing.

From Investment Beliefs to Custom Indices

How sustainability data, index design and governance shape risk and return

Gerben de Zwart – Head of Investment Solutions

CFA Society Netherlands | Beyond Traditional Indexing
September 24, 2026



Start



Index investing makes benchmark design a strategic decision

Index design integrates return, risk, responsible investing and costs

Why index customization is rising

- Index investing becomes the default investment approach
- Responsible-investment requirements remain fully applicable
- Key investment choices shift into benchmark design

The customized index becomes the portfolio's strategic blueprint



The Investment Diamond

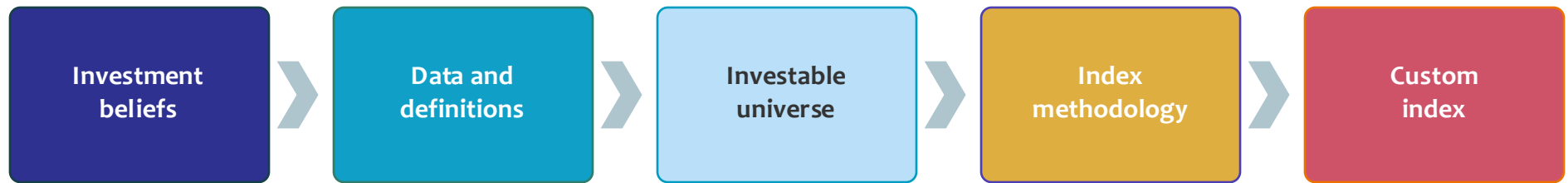


Customization determines how these four objectives are balanced in practice

The customized benchmark is where investment beliefs become investable portfolio choices

From investment beliefs to a customized index

Every translation step introduces choices, constraints and measurable exposures



Index construction turns beliefs and data choices into financial exposures

Defining a sustainable and investable universe

Responsible-investment objectives must be translated into transparent company-level rules

Four focus themes Responsible Investing



Climate



Nature & Biodiversity



Respect for Human Rights

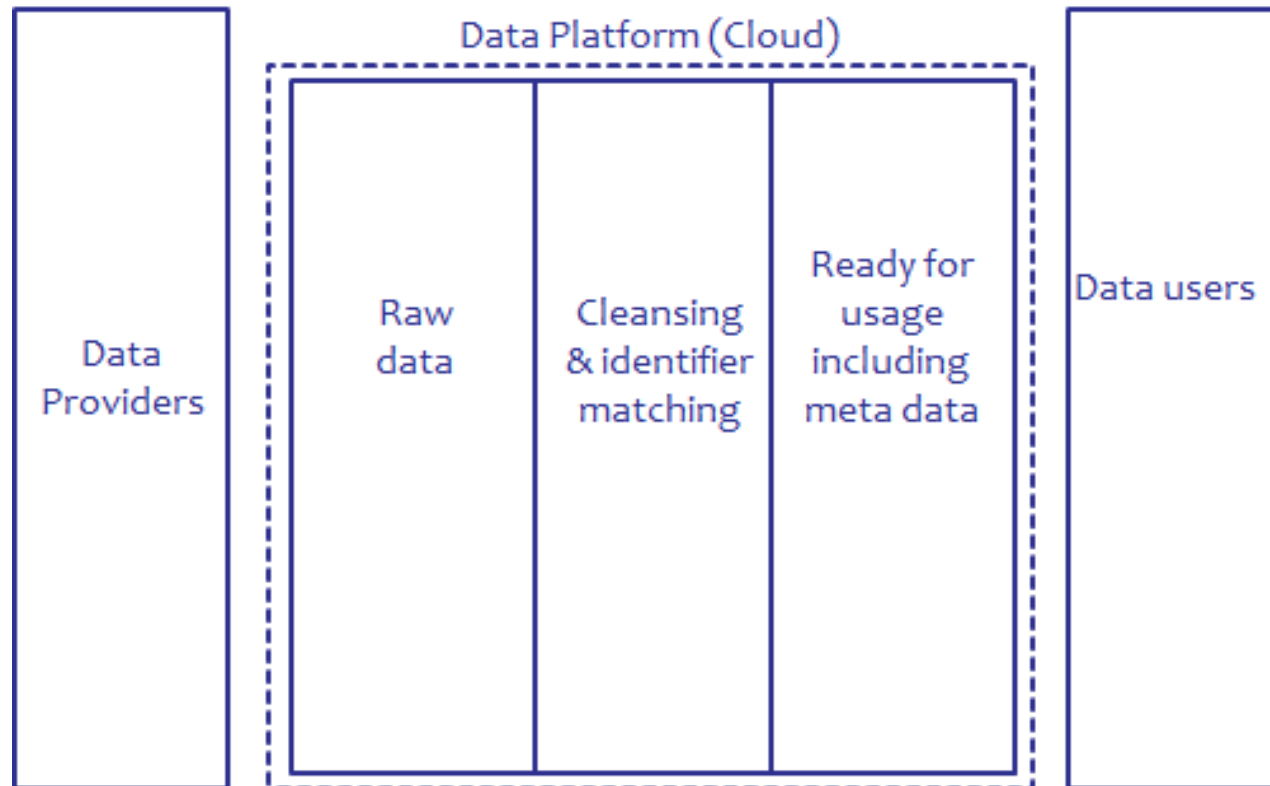


Governance & Business Integrity

More sustainable portfolio | Focused engagement | Explainable decisions | Fewer holdings

The data platform is index infrastructure

Turning fragmented source data into controlled and reusable index inputs



Governance: Who conducts the index orchestra?

No single party controls the entire chain, so roles, decisions and escalation must be explicit.

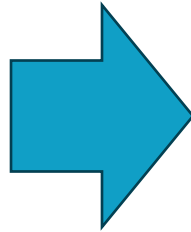


From user to provider of governed index inputs

Once proprietary data determines index constituents, data quality becomes an investment and governance responsibility

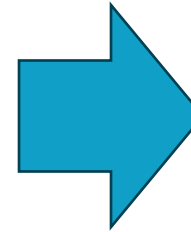
1. Validate data

- ESG data differs across providers
- Multiple sources enable triangulation
- Material discrepancies require expert review
- Corrections and decisions are documented



2. Govern the universe

- Apply transparent eligibility rules
- Document overrides and corrections
- Establish formal sign-off



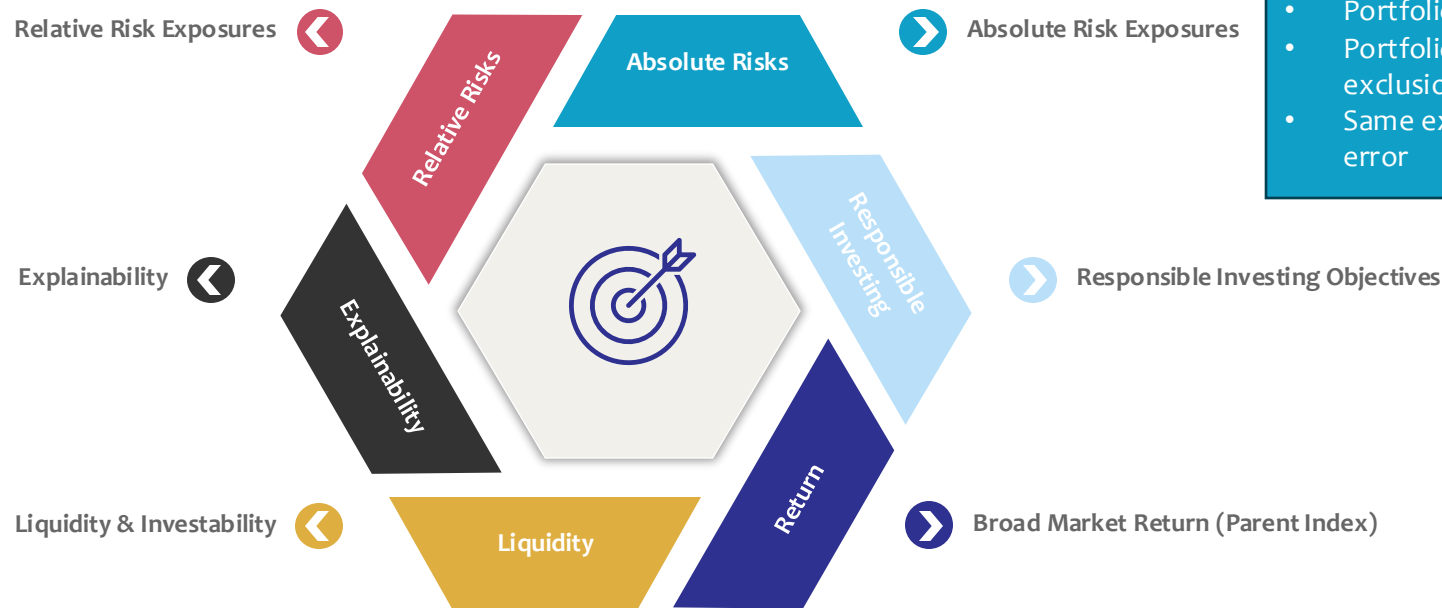
3. Deliver and assure

- Provide controlled inputs to the benchmark administrator
- Meet predefined formats and cut-off dates
- Resolve exceptions through clear escalation
- Reconcile and validate the pro-forma index

Providing the universe creates accountability for data quality, index integrity and portfolio outcomes.

Index construction makes the trade-offs explicit

The methodology determines how competing objectives appear in portfolio weights



Not all exclusions are created equal

- Portfolio A: many small exclusions
- Portfolio B: one large, difficult-to-replicate exclusion
- Same excluded weight, different tracking error

What must be achieved? | Which risks are acceptable? | Which constraints protect implementability?

Three developments increasing the need for stronger benchmark governance

Political shifts, private-market complexity and total-portfolio thinking are changing investors requirements from benchmarks

ESG data under political pressure

- Providers are changing methodologies and withdrawing data
- Reporting requirements are being reduced or reconsidered
- Structural shift or temporary political cycle?

→ More source, methodology and continuity risk

Private Markets

- Growing demand for robust benchmarks
- Data remain scarce, delayed and difficult to compare
- Greater differentiation in methodology and coverage

→ less standardization and greater reliance on judgement

Total Portfolio Management

- Growing adoption of Total Portfolio Management
- Demand for benchmarks spanning public and private assets
- Need to balance comparability, investability and governance

→ greater need for cross-asset consistency

As benchmarks broaden, governance must move from periodic approval to continuous oversight

Concluding remarks

Sustainable investment leadership is becoming a (data) integration challenge

- | | | |
|-----------|---|--|
| 01 | Data platforms are index infrastructure | Trusted and traceable data enable repeatable index decisions. |
| 02 | Index methodology creates portfolio exposures | Definitions, exclusions and weighting rules affect concentration, risk and return. |
| 03 | Customized indices require adaptive governance | Responsibilities and trade-offs must remain visible through the full benchmark lifecycle |

The question is not whether sustainability data affects risk and return, but whether those effects are understood, intentional and governed

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Measuring Corporate Transition Risk for Index Design

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Climate risk and index design

A lower carbon footprint does not necessarily imply lower transition risk

The indexing challenge

Emissions-based exclusions and tilts can overlook differences in companies' ability to adapt to the transition.

This paper's contribution

Carbon beta measures stock-return sensitivity to a carbon risk factor, capturing market expectations beyond current emissions.

The evidence

High-carbon-beta stocks underperform when climate concerns rise. Companies with similar emissions can have very different carbon betas.

The implication for indexing

Carbon beta adds an input for index construction and monitoring, alongside carbon-footprint targets.

Index design starts with distinguishing the emissions objective from the risk objective.

Roadmap

1. Measuring corporate transition risk
2. The current standard
3. Carbon Beta
4. Practical advantages
5. Economic advantages
6. Conclusion

Measuring corporate transition risk

Measurement

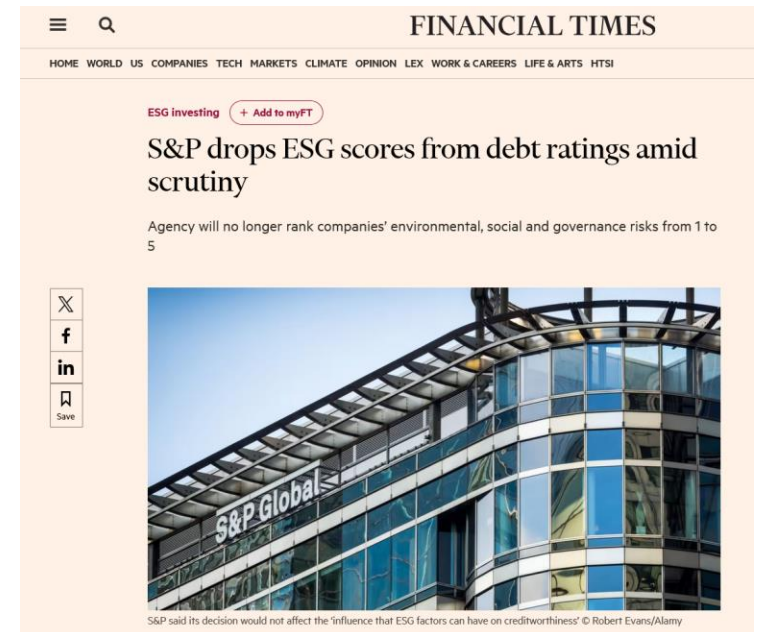
- Managing portfolio transition risk starts with measurement
- The measure needs to comply with a number of **characteristics**:
 - Available per asset
 - Accurate
 - Forward looking
- However, there are many **uncertainties**:
 - What is the transmission channel from emission to climate change?
 - What are the economic costs of climate change?
 - What is the response of policy makers?



The current standard

Current

- 38% of investors use emissions
 - Emissions vs Intensities
 - Scope 1/2/3
- Emissions do **not** give a complete picture
 - Current levels
 - Self reported
 - Only losers, not winners
- Alternative is **ESG** data
 - Focus on E
 - Often mainly based on emissions
 - Unclear how the measure is built up
 - Large discrepancies between suppliers



Carbon Beta

Carbon beta

➤ Our measure for transition risk: **Carbon beta**

1. Create a hypothetical carbon risk factor: Pollutive Minus Clean (PMC)

- Long in pollutive stocks, short in clean stocks
- Pollutive/clean based on emissions
- Correct for other company characteristics

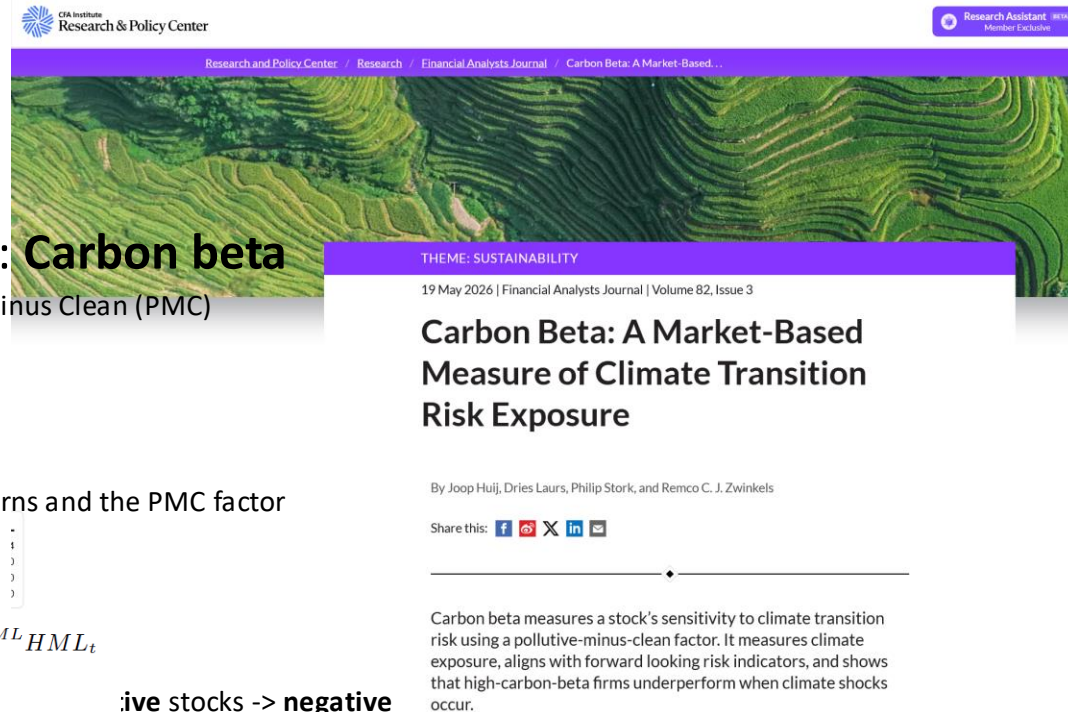
2. Measure the correlation (=BETA) between stock returns and the PMC factor

$$R_{i,t}^e = \alpha_i + \beta_i^{RMRF} RMRF_t + \beta_i^{SMB} SMB_t + \beta_i^{HML} HML_t + \beta_i^{UMD} UMD_t + \beta_i^{PMC} PMC_t + \epsilon_{i,t},$$

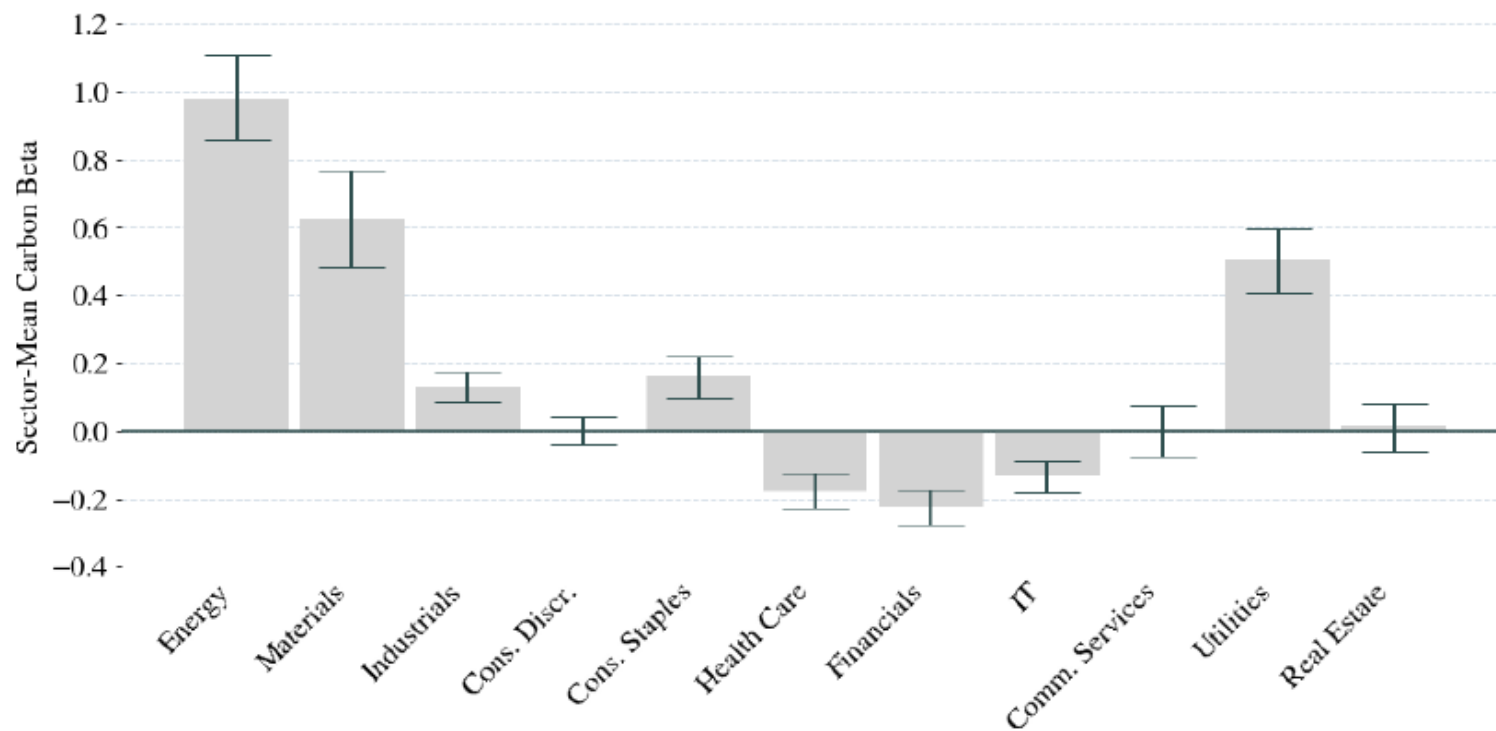
- impact of unexpected climate transition shocks
- Stock with **low** carbon beta move in tandem with **clean** stocks -> **positive** impact of unexpected climate transition shocks
- **pollutive** stocks -> **negative** impact of unexpected climate transition shocks

➤ We apply an existing and validated concept to transition risk

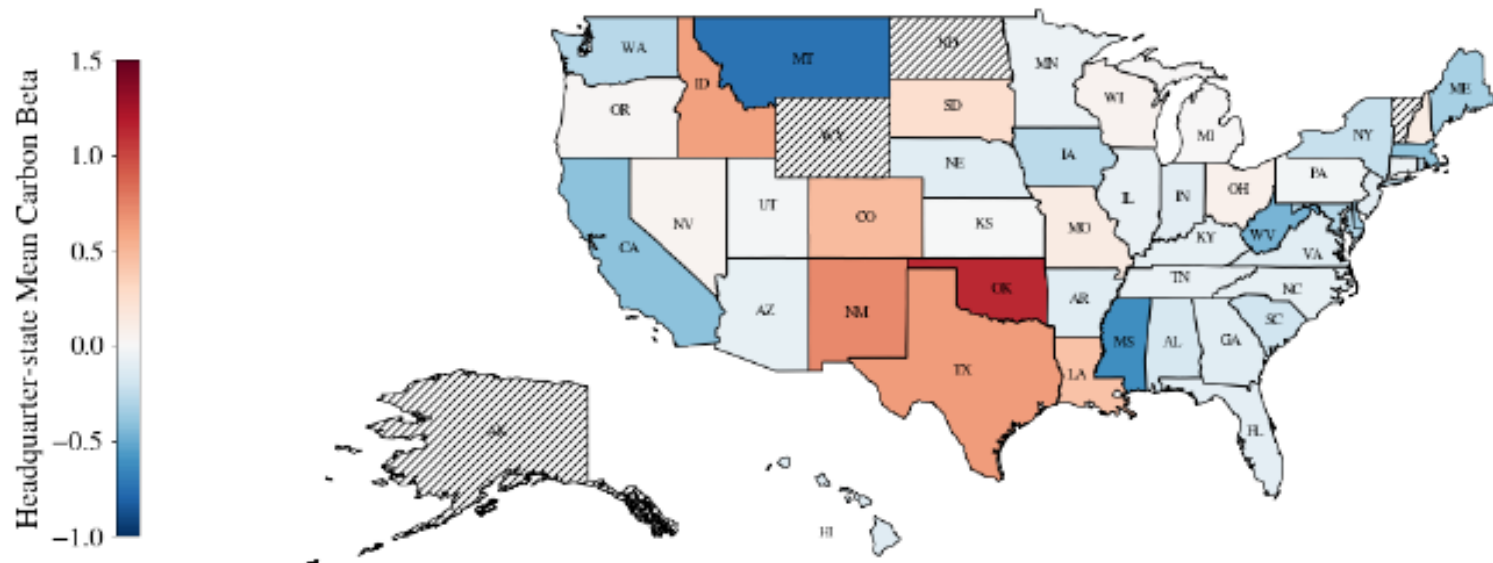
- Beta and asset pricing literature



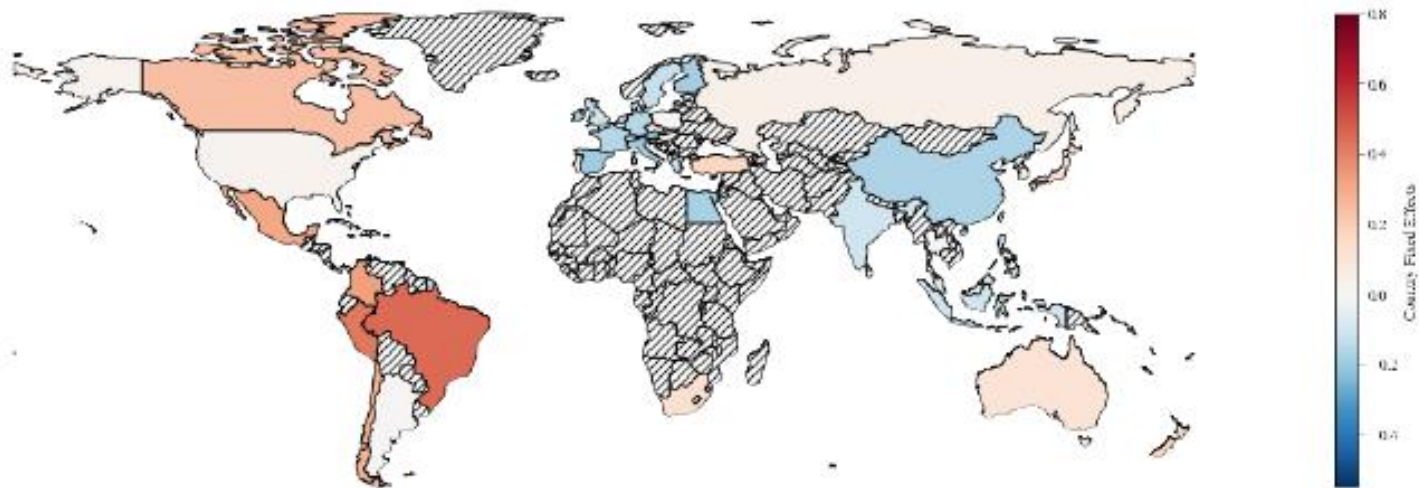
Carbon beta



Carbon beta



Carbon beta



Carbon beta

Table 3: Carbon Beta and Firm Characteristics

This table reports the regression coefficients obtained from regressing monthly, firm-level estimates of Carbon Beta on firm characteristics. The regression equation is given by [Equation \(3\)](#). Firm-specific characteristics are derived from Compustat data. Corporate greenhouse gas emissions are obtained from Trucost. Standard errors are clustered at the firm level. * and ** denote statistical significance at the 5% and 1% level.

Dependent variable:	Carbon Beta [†]			
	(1)	(2)	(3)	(4)
ln(Market Cap.)	-0.023** (0.005)	-0.197** (0.012)	-0.052** (0.004)	-0.127** (0.011)
Book/Market	0.124** (0.014)	0.100** (0.033)	0.078** (0.013)	0.051 (0.027)
Return on Equity	-0.013 (0.009)	-0.024 (0.013)	-0.012 (0.007)	-0.012 (0.011)
Debt/Assets	0.368** (0.044)	0.310** (0.067)	0.164** (0.035)	0.166** (0.053)
Investment/Assets	2.944** (0.237)	3.138** (0.493)	1.136** (0.169)	1.100** (0.289)
Property, Plant, & Equipment/Assets	0.740** (0.032)	0.524** (0.058)	0.183** (0.025)	0.151** (0.040)
Research & Development/Assets	-0.886** (0.076)	-1.244** (0.144)	-0.526** (0.077)	-1.171** (0.147)
ln(Emissions) [†]	- (-)	0.510** (0.025)	- (-)	0.266** (0.025)
Year - Month FE	Yes	Yes	Yes	Yes
Industry FE	No	No	Yes	Yes
N. Obs.	595,293	200,917	595,202	200,917
R ² -Adj.	0.243	0.472	0.421	0.608

Practical advantages

Application

What makes carbon beta useful in practice?

- **Availability**
 - Also for companies without emission data
 - Also for other financial products
- **Simple** to calculate and apply
- **Cheap**
 - We make the PMC factor available to anyone



Economic advantages

Carbon beta measure transition risk

Table 8: Carbon Beta, Climate Policy Uncertainty, and Stock Returns

This table reports the full set of coefficients obtained from estimating Equation (6). The sample period is from January 2007 to December 2020. ΔCPU is the monthly percentage change in the Climate Policy Uncertainty index, as defined in Section 1.1. All regressions include sector and year-month fixed effects. Standard errors are clustered at the firm level. * and ** denote statistical significance at the 5% and 1% level.

Dependent variable:	Monthly excess return ($\times 100$)			
	(1)	(2)	(3)	(4)
Carbon Beta [†] $\times$ $\Delta CPU^{\dagger}$	-0.143** (0.019)	-0.066** (0.025)	- -	- -
Carbon Beta [†]	0.043 (0.028)	0.058 (0.046)	- -	- -
Emissions Intensity [†] $\times$ $\Delta CPU^{\dagger}$	- -	- -	-0.026 (0.018)	- -
Emissions Intensity [†]	- -	- -	-0.053 (0.031)	- -
$\ln(\text{Emissions})^{\dagger} \times \Delta CPU^{\dagger}$	- -	- -	- -	-0.064* (0.028)
$\ln(\text{Emissions})^{\dagger}$	- -	- -	- -	0.177* (0.080)

Economic

Transition winners and losers



Emission percentile
80 80

Carbon beta percentile
95 5



Carbon beta is forward looking

Table 6: Carbon Beta and Green Innovation

This table reports the coefficients obtained from estimating regression Equation (4). Green Share (%) is the measure of green patent innovation from Cohen, Gurun, and Nguyen (2020). We collect data on U.S. patents issuance from the U.S. Patent and Trademark Office's Bulk Data Storage System. In the first column, we regress carbon betas on green shares across all firms in our sample while in subsequent columns we only consider firms categorized in the Energy sector (2-digit GICS equal to 10). The data are from December 2010 to December 2020. Standard errors are clustered at the firm level. * and ** denote statistical significance at the 5% and 1% level.

Dependent variable:	Carbon Beta [†]	Carbon Beta [†]	Emissions Intensity [†]	ln(Emissions) [†]
Green Share (%)	-0.071 (0.041)	-0.344* (0.148)	-0.161 (0.274)	0.297 (0.264)
ln(Market Cap.)	-0.044** (0.006)	0.006 (0.028)	0.086** (0.039)	0.413** (0.028)
Book/Market	0.109** (0.027)	0.065 (0.082)	0.158 (0.122)	0.200** (0.076)
Return on Equity	-0.003 (0.010)	0.009 (0.050)	-0.032 (0.050)	0.002 (0.037)
Debt/Assets	0.187** (0.054)	0.708* (0.302)	0.600 (0.475)	0.688* (0.276)
Investment/Assets	0.078 (0.330)	1.263 (0.849)	-1.639 (0.869)	-1.161* (0.497)
PP&E/Assets	0.380** (0.045)	0.636** (0.141)	0.509** (0.147)	0.246** (0.092)
R&D/Assets	-0.686** (0.104)	-1.712 (1.043)	-4.136 (6.582)	-6.527 (6.580)
Year-Month	Yes	Yes	Yes	Yes
Industry FE	Yes	No	No	No
Sectors	All	Energy	Energy	Energy
N. Obs.	223,659	12,660	6,859	6,859
R ² -Adj.	0.432	0.342	0.136	0.726

Conclusion

Conclusion

An alternative measure for climate transition risk

- Measurement is **key**
- Current measures have fundamental **issues**
- Carbon beta is a viable **alternative**

Thank you!

BEYOND TRADITIONAL INDEXING

Upcoming Society Events

- 1 Oct: AI in Risk Management
- 6 Oct: European VC & Growth Equity
- 12 Oct: Strategic Asset Allocation with double materiality
- 4 Nov: Vastgoed seminar 2026
- **17 nov: The Total Portfolio Approach: From Principles to Practice**
- 26 Nov: ALM 2026: ALM en beleggingskeuzes in een tijd van geopolitieke schokken en AI versnelling

The Total Portfolio Approach: From Principles to Practice

PGGM Headquarters, Zeist
Tuesday, 17 November 2026
15:00 coffee, 15:30 – 17:30 + drinks



**Geraldine
Leegwater**
CEO PGGM IM



Roger Urwin
Co-Founder Think
Ahead Institute



David O'Sullivan
CIO & Exec Director
Mercer Global
Investment Europe



Arjen Plasma
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63

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