



Data Integrity and Climate Transition

By **Andreas G. F. Hoepner**

- Full Professor of Operational Risk, Banking & Finance, University College Dublin
- Head of Data Science Hub, European Commission Platform on Sustainable Finance [which, inter alia, launched and continues to develop the EU Taxonomy for Sustainable Finance (EU TSF)]



ROY SORTING: CLIMATE AND STATUS QUO STRATEGIES [AFA 2025 PAPER]

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Contribution: Roy Competitive Sorting

Classic Labor Model of Roy (1951)

- Optimal Competitive Sorting
- Best Hunters end up Hunting and Best Fishers end up Fishing

When a transition moment arrives

Roy sorting:

- Some firms optimally reach for market share in status quo technologies
- Others optimally sort to transition technologies

Here: Transition moment = climate

- Same principle might hold for AI transition, etc.



ChatGPT

Note the visualization of the businessperson.

Active Managerial Edits

Company ESG scores

Contribute

Methodology

Data process

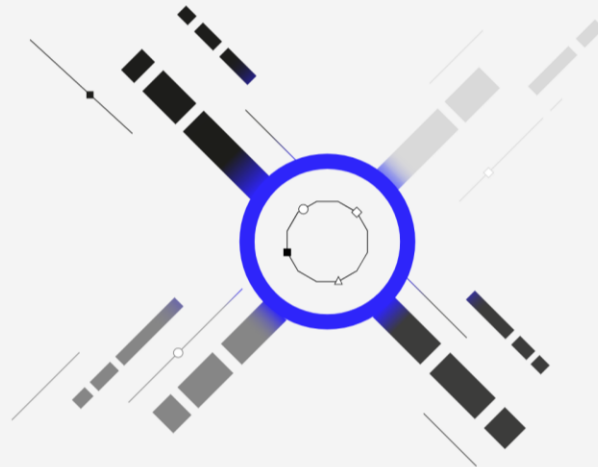
Global coverage

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Showcase your firm's ESG data



Our ESG Contributor Tool helps you verify and provide timely updates on your ESG initiatives to investors and other stakeholders. The tool helps you showcase a deep range of environmental, social and governance data from your firm. We pride ourselves in our auditable ESG data, investors can trust the data we provide due to the 'click to source' capabilities within Eikon. The tool allows you to:

- Ensure the financial community has access to the timeliest ESG data on your company
- Contribute your company ESG data for the latest fiscal year
- Review and edit the historical ESG data that is already available for your company
- Communicate more effectively with your stakeholders.

Contribute

CFA Results for Transition Strategy by Env Policy (Hunting)

	Low EnvPS	High EnvPS
<i>Confirmatory Factor is:</i>	<i>Growth</i>	<i>Growth</i>
<i>Dependent Variable: 2-Week Returns</i>		
Transition Strategy (Latent)	-0.0017** (0.0007)	0.0015** (0.0006)
* Energy	0.0072** (0.0031)	0.0024 (0.0027)
* Industrials & Basic Materials	0.0016 (0.0011)	-0.0003 (0.0010)
* Mining & Metals	0.0101*** (0.0023)	0.0060* (0.0043)
Δ ESG Fundamentals	-0.0001 (0.0001)	0.0000 (0.0001)
Fama-French 5 & Sector FE	Yes	Yes
Observations	29,702	19,636

➤ Roy Hunting:
No evidence that energy firms can competitively sort in high environmental regulation countries

CFA Results for Status Quo Strategy by Env Policy (Fishing)

	Low EnvPS	High EnvPS
<i>Confirmatory Factor is:</i>	<i>Growth</i>	<i>Growth</i>
<i>Dependent Variable: 2-Week Returns</i>		
Status Quo Strategy (Latent)	-0.0029*** (0.0010)	0.0012 (0.0010)
* Energy	0.0038*** (0.0014)	-0.0005 (0.0017)
* Industrials & Basic Materials	0.0028** (0.0012)	0.0004 (0.0011)
* Mining & Metals	0.0109*** (0.0025)	0.0026 (0.0027)
Δ ESG Fundamentals	-0.0001 (0.0001)	0.0000 (0.0000)
Fama-French 5 & Sector FE	Yes	Yes
Observations	29,702	19,636

- Roy Fishing:
No evidence that firms can competitively sort to status quo fishing in high regulation countries
- Punchline is that regulation may make Roy sorting unobservable or not possible (i.e., not a value-relevant option)

CFA Results for Grey Zone Strategy (Low Environmental Policy Countries)

Panel A – Scoring Parameters that Construct the Latent Grey Zone Strategy

	(1)	(2)	
No Resource Edit	10.4556**	17.5332***	
No Emissions Edit	11.1972**	18.7634***	➤ Significant and positive loadings
No Workforce Edit	9.0499**	15.1689***	
<i>Confirmatory Factor is:</i>	<i>Grey Revenue & Grey M&A</i>	<i>Grey Revenue</i>	

Panel B - Dependent Variable: 2-Week Returns

Grey Zone Strategy (Latent)	-0.0000 (0.0005)	0.0112*** (0.0027)
* Energy	-0.0065** (0.0030)	-0.0247*** (0.0071)
* Industrials & Basic Materials	-0.0023** (0.0011)	-0.0122*** (0.0042)
* Mining & Metals	-0.0121*** (0.0025)	-0.0311*** (0.0069)
Δ ESG Fundamentals	-0.0001 (0.0001)	-0.0001 (0.0001)
5 Fama-French Factors & Sector FE	Yes	Yes
Observations	29,702	29,702

➤ Grey Zone: When evidence arrives placing a firm in the grey zone for its growth strategies, firms in the 3 industrial base sectors devalue



UCD Michael Smurfit
Graduate Business School

How effective is GHG Assurance?

Sergio Garcia Vega^a, Andreas G. F. Hoepner^{ab}, Joeri Rogelj^c & Frank Schiemann^d

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^c Director of Research, Grantham Institute for Climate Change, Imperial College London, UK

^d Faculty of Social Sciences, Economics and Business, University of Bamberg, Germany

[Views expressed are not necessarily shared by DG FISMA. Authors alphabetically listed.]

Summary

- When reporting their Global Scope 1 and Scope 2 greenhouse gas emissions (GHG) to the Carbon Disclosure Project (CDP), companies are encouraged to also *voluntarily* report their total GHG emissions broken down into (i) Activities, (ii) Business Units, (iii) Facilities, (iv) GHG types and (v) Regions.
- If companies had a suitable software or just an accurate Excel sheet for their voluntary GHG breakdown reporting, the equation 1 should hold:
$$\text{Reported Global Emissions} = \text{Sum of Breakdown [Basic Bookkeeping Test]}$$
- We investigate if the Basic Bookkeeping Test holds for oil & gas firms in the CDP database between 2010 and 2019 for
 - The Bookkeeping Test Fail % vary from 15.4% per Region Breakdown to 37.4% per Facility Breakdown
 - In 2012, only 25.9% of firms failed on at least one attempted breakdown. In 2015, 51.9% did.
- Using these Basic Bookkeeping errors, we test the effectiveness of GHG Assurance
 - We find GHG Assurance weakly significant at the 10% level
 - 1 standard deviation better assurance reduces the error chance by 4.5%
 - Moving from worst to best assurance reduces the error chance by 20.7%
 - Assurance Processes are worse for GHG Activity breakdowns
 - Assurance Processes are better spotting companies over- rather than under-reporting



Transition Pathway Initiative: Oil & Gas (Levels 1-4, Scope 1)

Reported Global Emissions ≠ Sum of Breakdowns

Mistakes on any breakdown between 2010 and 2019

	Organization	Country	Activity	Business	Facility	GHG	Region	Mismatch (Total)	Mismatch (Percentage)	TPI Level
1	Royal Dutch Shell	Netherlands	n/a	8/9	n/a	10/10	9/10	27/29	93.1%	4
2	PTT	Thailand	3/4	4/4	n/a	5/5	0/1	12/14	85.7%	3
3	Woodside Petroleum	Australia	0/1	n/a	2/2	3/3	3/5	8/11	72.7%	3
4	Occidental Petroleum Corporation	USA	n/a	3/3	n/a	3/7	5/9	11/19	57.9%	4
5	Cenovus Energy Inc.	Canada	3/7	1/7	1/2	7/8	n/a	12/24	50%	3
6	Neste Oil Oyj	Finland	4/7	3/8	7/8	2/7	2/8	18/38	47.4%	3
7	Devon Energy Corporation	USA	5/6	1/8	0/1	8/8	0/8	14/31	45.2%	3
8	Chevron Corporation	USA	1/3	4/8	n/a	2/8	2/8	9/27	33.3%	3
9	Oil & Natural Gas	India	n/a	0/2	n/a	2/2	0/2	2/6	33.3%	1
10	Marathon Oil Corporation	USA	n/a	0/2	n/a	2/3	0/1	2/6	33.3%	2
11	Ecopetrol Sa	Colombia	0/4	2/6	2/5	2/5	n/a	6/20	30%	3
12	Petrobras	Brazil	n/a	3/10	n/a	4/10	1/10	8/30	26.7%	4
13	Inpex Corporation	Japan	n/a	1/4	1/3	1/4	2/8	5/19	26.3%	4
14	Novatek	Russia	n/a	2/7	1/1	0/1	0/3	3/12	25%	3
15	eni	Italy	2/9	1/10	4/6	2/10	1/10	10/45	22.2%	4
16	Canadian Natural Resources Limited	Canada	n/a	1/6	n/a	2/3	1/10	4/19	21.1%	3
17	Lukoil OAO	Russia	0/1	n/a	n/a	0/2	1/2	1/5	20%	2



Organization	Country	Activity	Business	Facility	GHG	Region	Mismatch (Total)	Mismatch (Percentage)	TPI Level
18 BP	UK	n/a	2/8	n/a	1/8	1/8	4/24	16.7%	4
19 OMV AG	Austria	1/1	2/10	0/1	0/10	1/10	4/32	12.5%	4
20 Oil Search	Australia	n/a	n/a	0/4	1/5	0/2	1/11	9.1%	2
21 Repsol YPF	Spain	0/7	1/9	1/9	1/10	1/10	4/45	8.9%	4
22 Hess Corporation	USA	n/a	0/7	0/2	0/9	2/10	2/28	7.1%	4
23 Suncor Energy Inc	Canada	0/7	2/8	1/10	0/10	0/10	3/45	6.7%	3
24 EOG Resources Inc	USA	0/6	n/a	n/a	1/2	0/7	1/15	6.7%	2
25 Imperial Oil	Canada	n/a	1/7	n/a	0/8	0/1	1/16	6.3%	3
26 Exxon Mobil Corporation	USA	n/a	0/7	n/a	1/7	0/8	1/22	4.5%	3
27 ConocoPhillips	USA	n/a	1/10	n/a	0/10	0/10	1/30	3.3%	4
28 Equinor	Norway	n/a	0/9	1/2	0/10	0/9	1/30	3.3%	4
29 Formosa Petrochemical	Taiwan	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1
30 PetroChina	China	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1
31 Reliance Industries	India	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1
32 TATNEFT	Russia	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1
33 Concho Resources	USA	n/a	n/a	n/a	n/a	n/a	n/a	n/a	2
34 Cabot Oil & Gas	USA	n/a	n/a	n/a	n/a	n/a	n/a	n/a	2
35 Diamondback Energy	USA	n/a	n/a	n/a	n/a	n/a	n/a	n/a	2
36 HollyFrontier	USA	n/a	n/a	n/a	n/a	n/a	n/a	n/a	2



Organization	Country	Activity	Business	Facility	GHG	Region	Mismatch (Total)	Mismatch (Percentage)	TPI Level
37 Ovintiv	Canada	n/a	n/a	n/a	n/a	n/a	n/a	n/a	2
38 Phillips 66	USA	n/a	n/a	n/a	n/a	n/a	n/a	n/a	2
39 Pioneer Natural Resource	USA	n/a	n/a	n/a	n/a	n/a	n/a	n/a	2
40 Saudi Aramco	Saudi Arabia	n/a	n/a	n/a	n/a	n/a	n/a	n/a	2
41 Marathon Petroleum	USA	n/a	n/a	n/a	n/a	n/a	n/a	n/a	2
42 Valero Energy	USA	n/a	n/a	n/a	n/a	n/a	n/a	n/a	2
43 China Petroleum & Chemical	China	n/a	n/a	n/a	n/a	n/a	n/a	n/a	3
44 Eneos (Oil & Gas)	Japan	n/a	n/a	n/a	n/a	n/a	n/a	n/a	3
45 Gazprom	Russia	n/a	n/a	n/a	n/a	n/a	n/a	n/a	3
46 Rosneft Oil	Russia	n/a	n/a	n/a	n/a	n/a	n/a	n/a	3
47 SK Innovation	South Korea	n/a	n/a	n/a	n/a	n/a	n/a	n/a	3
48 Santos	Australia	n/a	n/a	n/a	n/a	n/a	n/a	n/a	3
49 Sasol (Oil & Gas)	South Africa	n/a	n/a	n/a	n/a	n/a	n/a	n/a	4
50 Galp Energia SA	Portugal	0/2	0/6	n/a	0/8	0/8	0/24	0%	4
51 Total	France	n/a	0/8	n/a	0/8	0/8	0/24	0%	4
52 Apache Corporation	USA	0/3	n/a	n/a	0/6	0/6	0/15	0%	3
53 Noble Energy Inc	USA	0/6	n/a	n/a	n/a	0/6	0/12	0%	2
54 CNOOC	China	n/a	n/a	0/1	0/1	0/2	0/4	0%	2





Emissions estimations should embed precautionary principle

Andreas G. F. Hoepner & Joeri Rogelj
[Nature Climate Change, 2021]

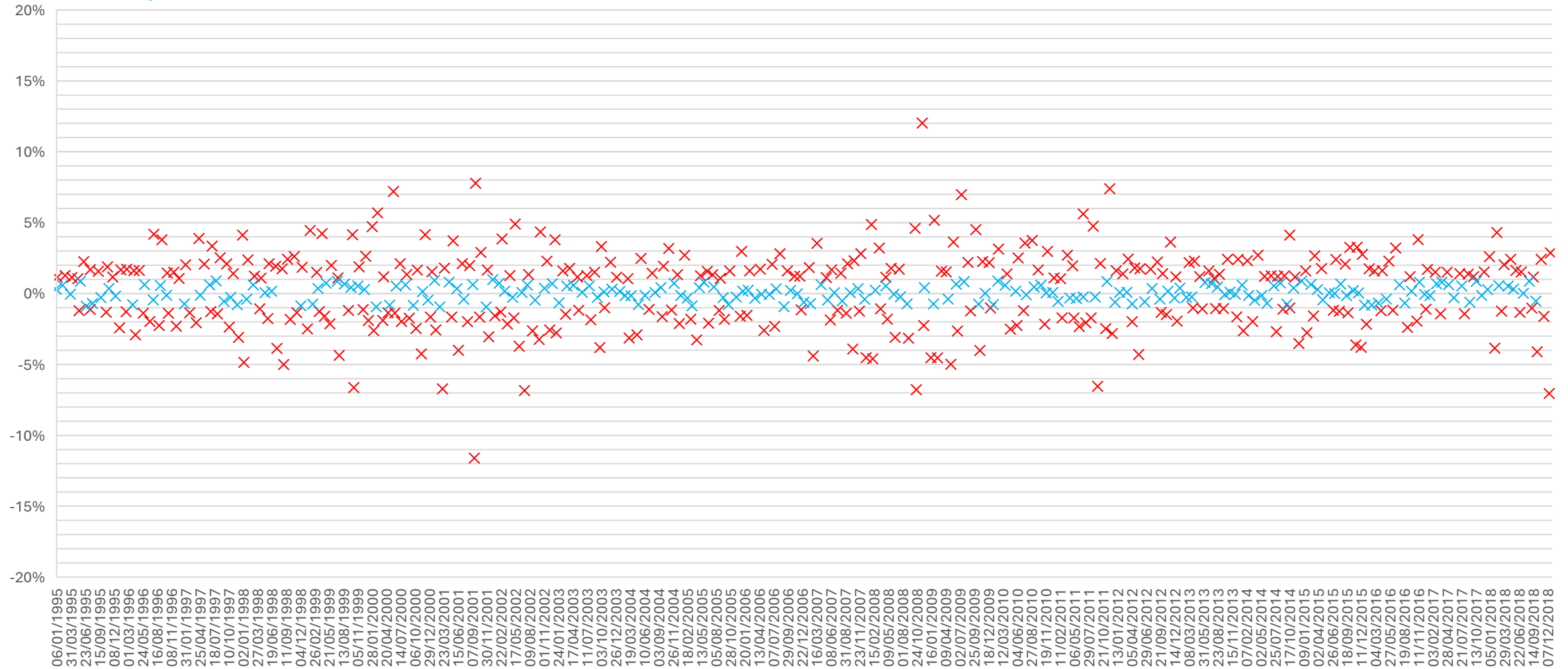


Markowitz' (1959: 193-194) view on risk

- "Variance [V] is superior [to semi-variance [S]] with respect to cost, convenience and familiarity. [i] For example, roughly two to four times as much computing time is required (on a high speed electronic computer) to derive efficient sets based on S than ... on V. ... Unlike semi-variance, variance and standard deviation are known by many people acquainted with modern statistics."
- "Familiarity, finally is a transient thing: use can make S as familiar as V. Analyses based on S tend to produce better portfolios than those based on V. **Variance considers extremely high and extremely low returns equally undesirable.** An analysis based on V seeks to eliminate both extremes. An analysis based on **S[emi-variance]**, on the other hand, **concentrates on reducing losses.**"
- "Efficient portfolios based on variance, however, cannot be characterized as [generally] bad or undesirable. ... The only complaint one can raise about such a portfolio is that it sacrifices too much expected return in eliminating both extremes."
- In other words, Mean/Variance Optimizations tend to have schizophrenic tendencies, since they aim to maximize (extremely) positive outcomes in the numerator while aiming to minimize extremely positive outcomes in the denominator.

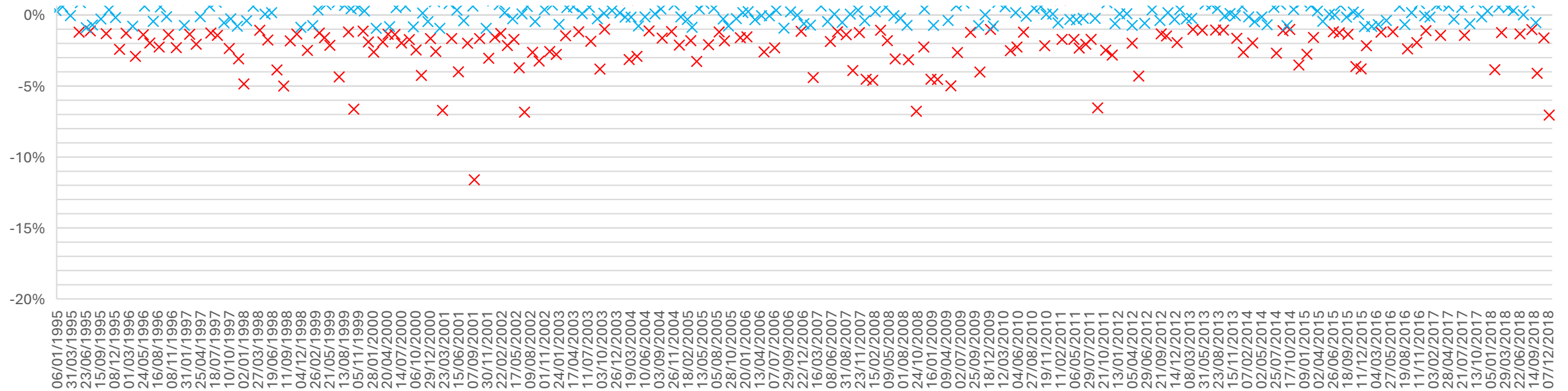
Standard Deviation (red) S&P 500 Weekly Return Distribution 1995-2018 Mean 16bps, St.D. 236bps, Skewness -0.53

Weekly S&P500 Returns 1995-2018 (Mean 16bps)



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Weekly S&P500 Returns 1995-2018 (Mean 16bps)



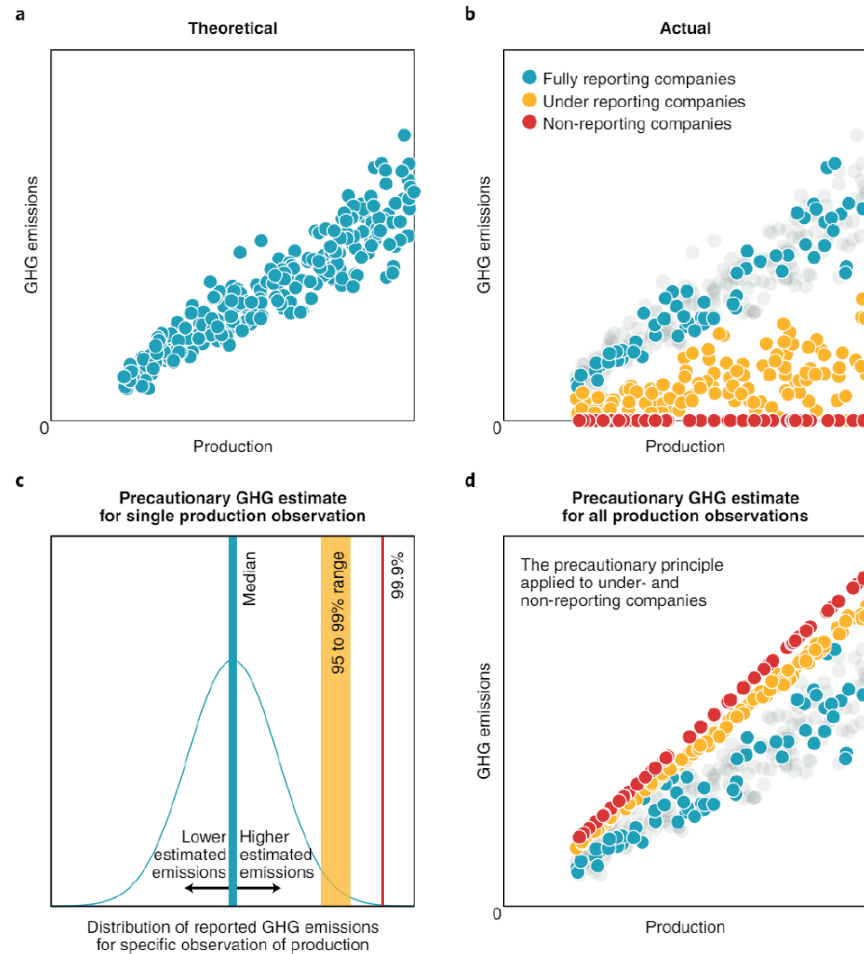


Fig. 1 | Application of the precautionary principle to estimation of under- and non-reporting companies.

a, Theoretical distribution of company GHG emissions as a function of production. **b**, Illustrative actual distribution of company GHG emissions under full (blue), underreporting (yellow) and non-reporting (red) scenarios. **c**, Proposed application of the precautionary principle to estimate the GHG emissions for an under- or non-reporting company with a specific production level. **d**, Outcome of the application of the precautionary principle to estimating under- and non-reporting emissions, providing incentives for improvement.

Conclusion:

Precautionary Principle Estimation of CO₂e emissions is essential!

Andreas G. F. Hoepner and Joeri Rogelj

Climate action is sprouting worldwide. Companies around the world are announcing greenhouse gas (GHG) emission reduction targets (for example, see ref. ¹), and the EU has now published Paris Aligned Benchmarks that require participating investors to reduce the average GHG emissions of the portfolio of companies in which they invest by 7% per year (weighted by their investment value; for example, see refs. ²⁻⁴). Reliable targets and their achievement rely on robust GHG data. To calculate weighted average GHG emissions, investors need emissions data for any potentially investable company globally. This information is necessary regardless of whether the company (i) has a target, (ii) is reporting company-wide GHG emissions or (iii) is participating partly or in whole in the EU's Emissions Trading Scheme (ETS; where emissions of participating facilities are verified). Hence, many investors are now starting to assess available GHG emissions data to understand their position and plan a strategy ahead. This includes (i) detailed milestone data on pathways that meet the climate goals of the Paris Agreement^{5,6} and estimates of actors' (ii) past and (iii) present GHG emissions^{7,8}. Notably, GHG emissions reported by organizations are always estimates, as no organization has the capacity to install sufficient sensors to literally measure 100% of their GHG emissions⁹. With this demand for data of sufficient quality that is needed for making investment decisions also comes an important responsibility: investors and their delegates (for example, rating agencies) who collect and estimate GHG emissions data, or scientists supporting them, should take into account the incentives that come with the estimates they provide. Specifically, methods for providing climate and other environmental information for target setting should be impregnated with the precautionary principle.

Problem for investors
Wherein lies the problem for investors?
Underreporting or non-reporting of GHG

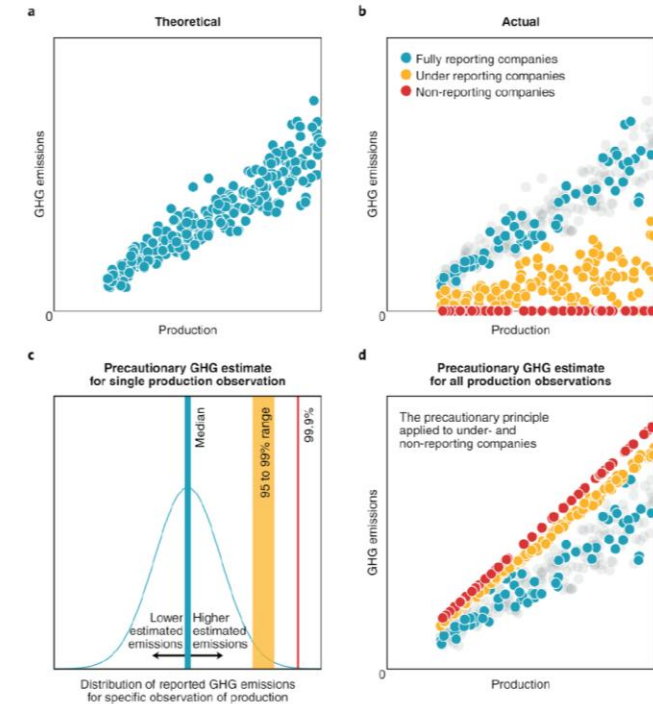


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emissions is a prevalent and systematic global problem. While the EU ETS has introduced a system of regulated GHG emissions verification for about half of

Europe's emissions, and China's ETS launched earlier this year aims to have similar features, investors need GHG emissions data for companies globally.



Thank You for Your Attention!

By Andreas G. F. Hoepner

- Full Professor of Operational Risk, Banking & Finance, University College Dublin
 - Head of Data Science Hub, European Commission Platform on Sustainable Finance [which, inter alia, launched and continues to develop the EU Taxonomy for Sustainable Finance (EU TSF)]
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