



Building portfolios with decreasing carbon intensities*

(*Disclaimer: we present the views of the authors and not necessarily the views of the BIS)

Benoît Mojon, based on papers joint with Gong Cheng, Eric Jondeau (U. Lausanne) and Luiz Pereira

Sustainable Finance Research Forum, 27 September 2022



Purpose

- Assess what it takes to decarbonise portfolios
 - i.e. reduce carbon by -10% per annum for several years
 - Using simulations on historical data
- Proof of concept for 2 asset classes (based on 2 published BIS WP papers)
 - Corporates stocks (and bonds)
 - Sovereign bonds
- Show what data on carbon emissions are available to indicate the carbon intensity of national loan portfolios

Outline

- Decarbonising portfolios of corporate stocks
- Decarbonising portfolios of sovereign bonds

Decarbonising portfolios of corporate stocks

Based on

BIS Working Papers No 985 Building benchmarks portfolios with decreasing carbon footprints by Eric Jondeau, Benoît Mojon, and Luiz Awazu Pereira da Silva



Paper download

Decarbonising portfolios of corporate stocks

- We use Trucost data on carbon emissions
- These cover over 95% of the corporates in the All Country World Index of MSCI

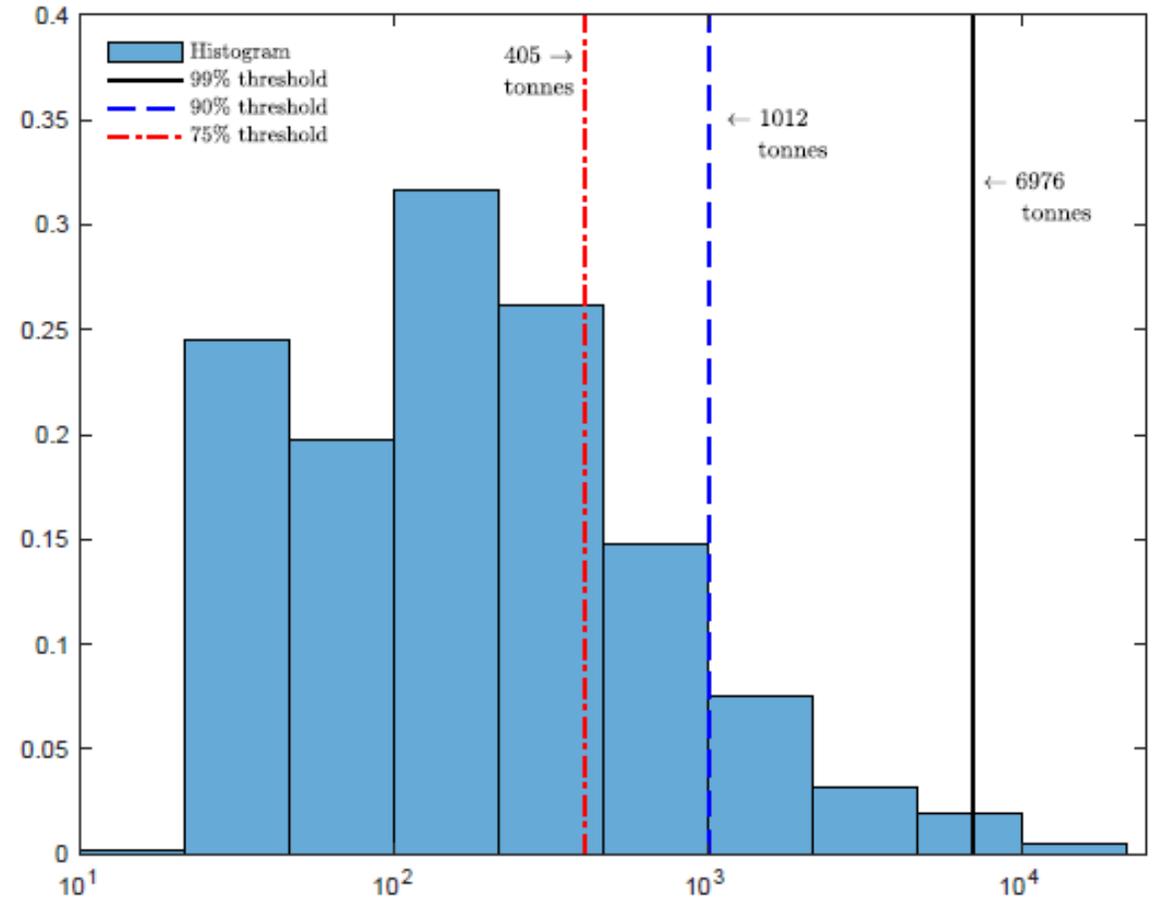
Year	Nb firms in Trucost	Nb firms in MSCI index	Proportion (nb of firms)	Proportion (market cap)
2005	3756	2630	76.9	87.0
2006	4039	2754	81.2	88.4
2007	4175	2884	85.7	91.6
2008	4155	2439	91.6	94.4
2009	4442	2423	93.9	95.6
2010	4613	2462	94.8	95.8
2011	4713	2435	95.3	95.9
2012	4750	2431	95.1	95.9
2013	5628	2434	96.0	96.5
2014	6024	2470	96.4	96.6
2015	6114	2491	96.6	96.3
2016	13502	2486	97.4	98.2
2017	14400	2499	97.8	98.2
2018	15088	2758	98.2	98.0
2019	15663	3051	98.0	98.1

Business-as-usual (BAU) Benchmarks

- MSCI standard indices represent the portfolio of a passive investor
 - All country World Index (ACWI)
 - Emerging Countries
 - Europe
 - North America
 - Pacific
- Most (over 96% since 2015) firms of the MSCI indices are covered in the Trucost database; what we call our BAU is based on the firms covered in both

The distribution of corporates scope 1-3 Carbon intensity (2020) is highly skewed

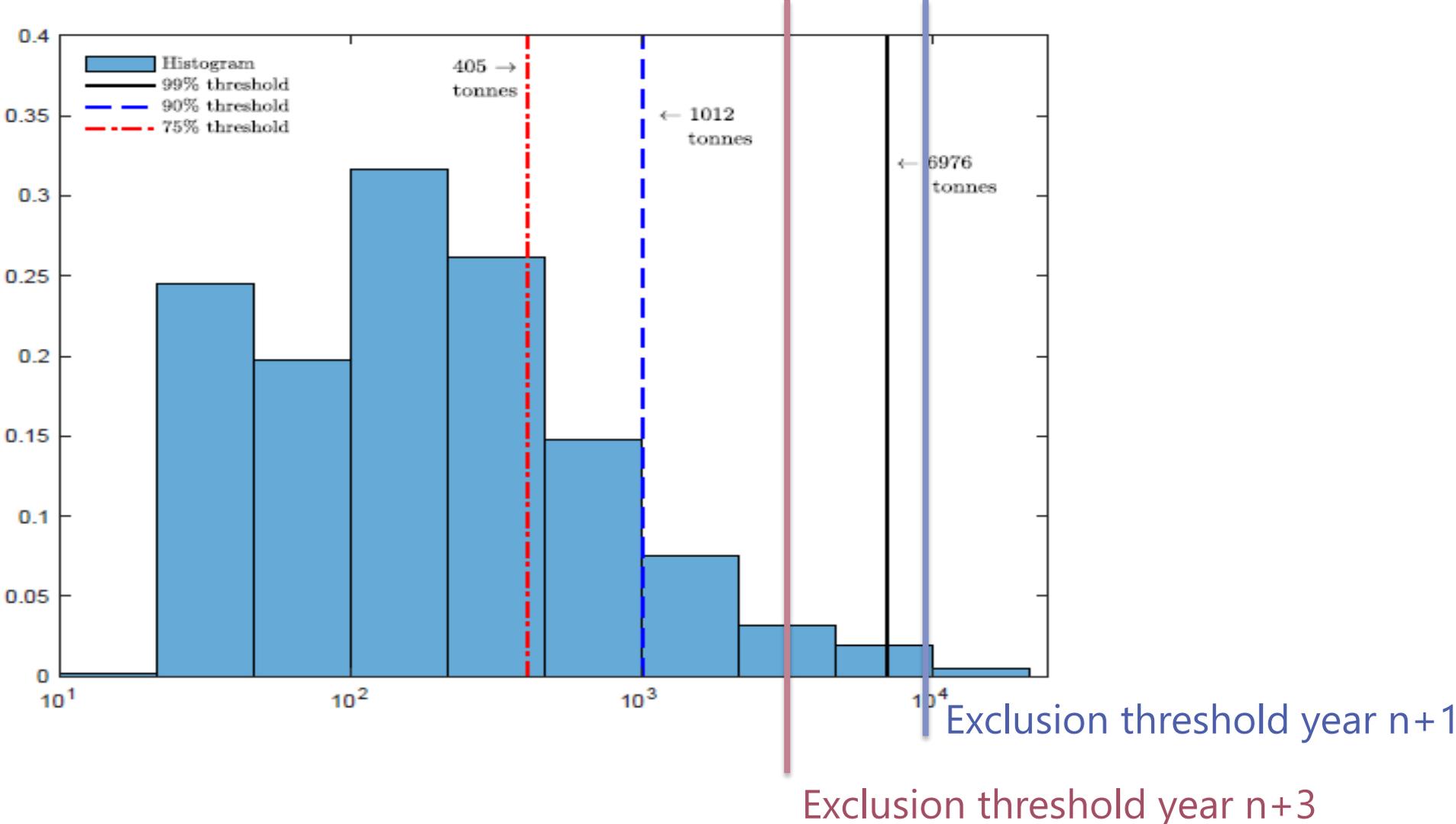
- A few firms account for the bulk of carbon emissions in the portfolio



What do we do to decarbonise a portfolio of global stocks

- Step 1: Rank firms by their Scope 1-3 Carbon intensity
- Step 2: Define a **threshold** of carbon intensity at the firm level to match the carbon reduction objective
- Step 3: All firms with carbon intensity above this threshold are excluded from the portfolio
- Step 4: Proceeds of the exclusion are reinvested in the same "region" and same "sector"
- Step 5: We implement this strategy in a dynamic fashion to target a decarbonized Paris-consistent portfolio, i.e. -10% carbon intensity per annum

Net Zero Emission Target: illustrating the exclusion



Net Zero Emission Target: how we implement it

- Year 1: Reduce the carbon emission of the portfolio to 90% with respect to year 0 (2010)
- Year n+1: Reduce carbon emission of the portfolio to 0.9^n % with respect to year 0
 - By 2013, you aim at having 0.9^3 % = 0.73 % with respect to 2010 (27% reduction /2010)
 - ...
 - by 2020, you aim at having 0.9^{10} % = 0.35 % with respect to 2010
(or a 65% cummulated reduction)
- Each year you need to exclude more firms
 - Unless firms improve (reduce) their carbon emissions
 - This set incentives for large emitters to improve (reduce) their carbon emissions

Worldwide Paris-Consistent, Net Zero Trajectory Portfolio, cumulative reductions (2010–2020)

- Decarbonising is easy
- -67% carbon in after 10 years
 - Progressive
 - Only 7.8 % of firms excluded
 - Only 4.61% of the market cap
 - Same sector/country as BAU
 - Same returns
 - Same Sharpe ratio

	Reduction target			BAU bench.	MSCI Index
	5%	10%	15%		
Starting emissions (GtCO _{2e})	46.8	46.8	46.8	46.8	–
Final emissions (GtCO _{2e})	20.6	13.9	9.3	20.8	–
Cumulative reduction (%)	-53.92	-67.1	-76.6	-55.6	–
Annual reduction (%)	-6.80	-9.60	-12.36	-7.11	–
Annual return (in %)	10.6	10.7	10.5	10.7	10.5
Annual volatility (in %)	14.0	14.0	14.0	14.0	13.7
Sharpe ratio	0.76	0.76	0.75	0.76	0.77
Annual tracking error (%)	0.14	0.91	1.98	–	–
Number of firms excluded	25.4	198.0	440.2	–	–
Prop. of firms excluded (%)	1.12	7.83	17.86	–	–
Prop. of market value excluded (%)	0.52	4.61	12.30	–	–

Discussion

- Carbon intensity in BAU benchmark declined by 40% in last 10 years. It is unclear what will happen in the next 10 years
- We assume investors are price takers. If decarbonization is implemented on a massive scale, it will have an impact on stock (and bond) prices of both excluded and best-in-class firms
- Divestment via firm exclusion may be less effective to finance transition than engaging with the management of corporates (what large investors can do)

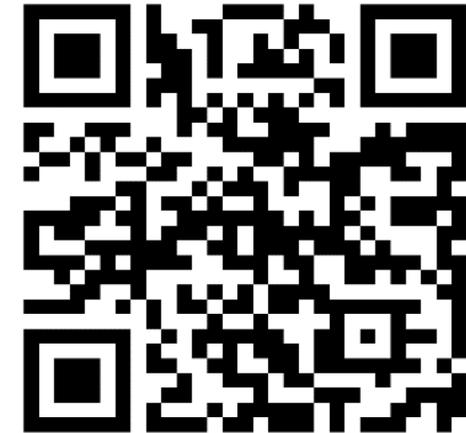
Outline

- Decarbonizing portfolios of corporate stocks
- Decarbonizing portfolios of sovereign bonds

Decarbonising portfolios of sovereign securities

Based on

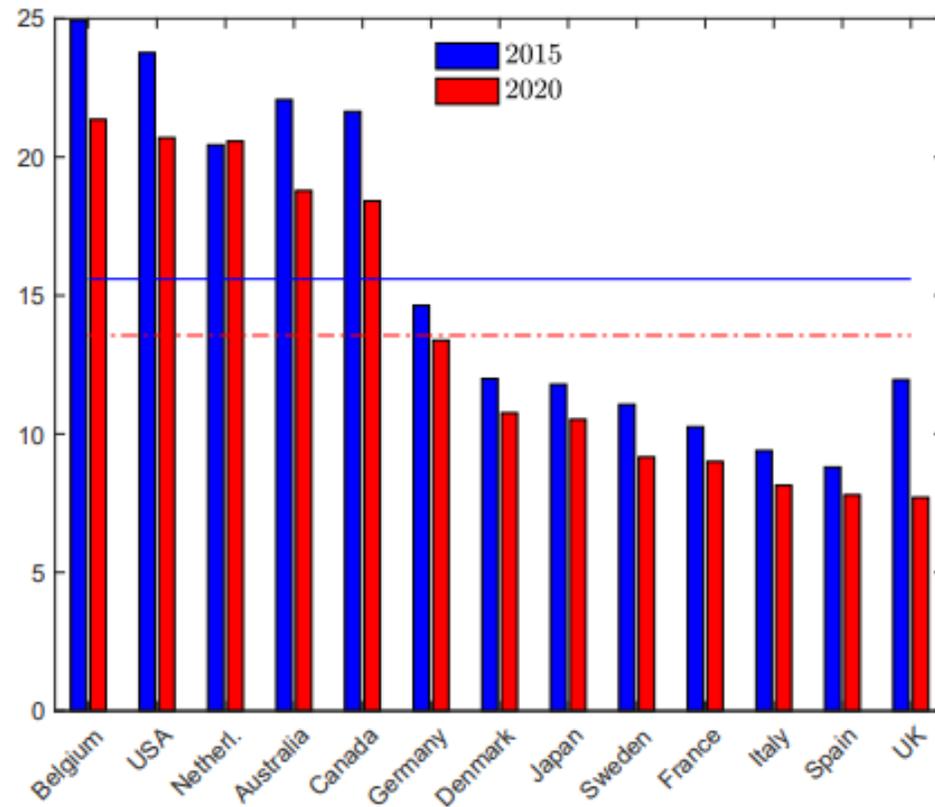
BIS Working Papers No 1038 Building portfolios of sovereign securities with decreasing carbon footprints by Gong Cheng, Eric Jondeau and Benoît Mojon



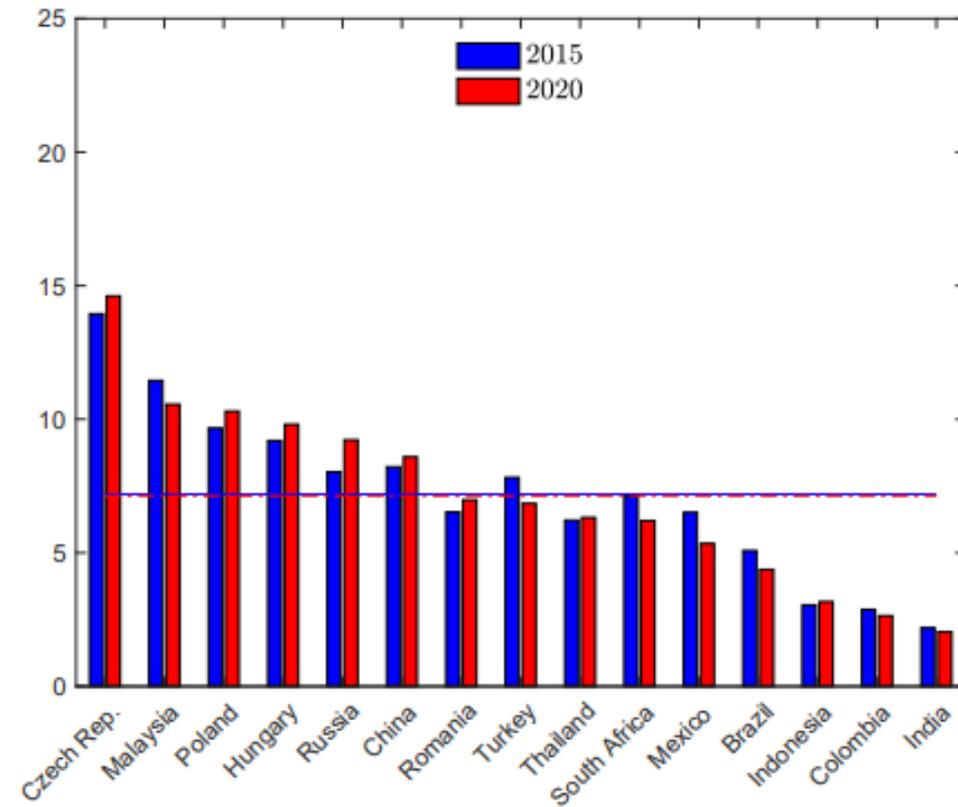
Paper download

Distribution of consumption-based carbon intensity

Advanced Economies



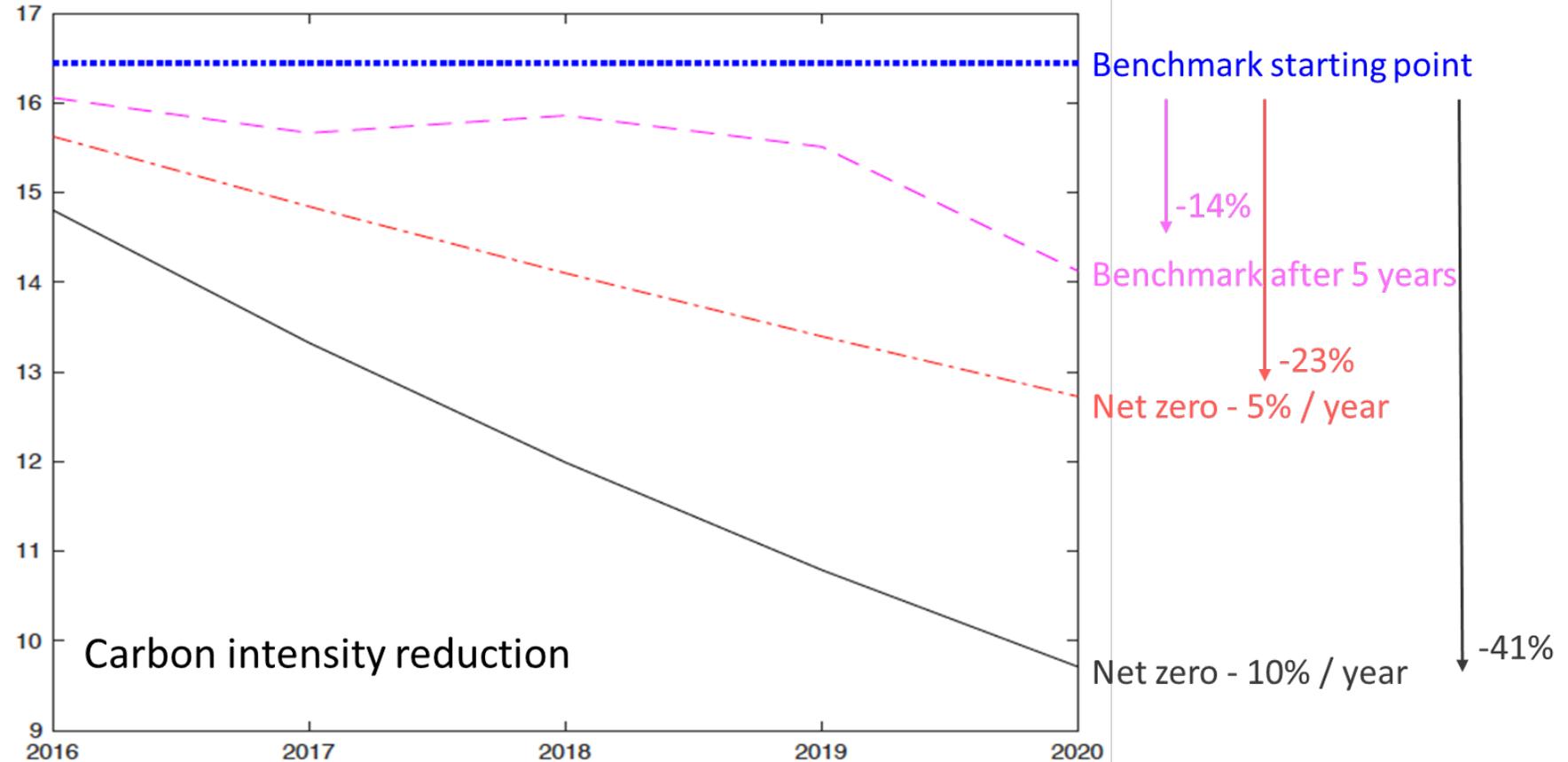
Emerging Markets Economies



The Net Zero (NZ) portfolio achieves sizeable carbon intensity reduction...

- Investors could build a NZ portfolio with a targeted per annum carbon intensity reduction
- A 41% of cumulative reduction achieved with 10% reduction per year over five years
- The business-as-usual (BAU) benchmark achieves much less reduction with a bumpy path

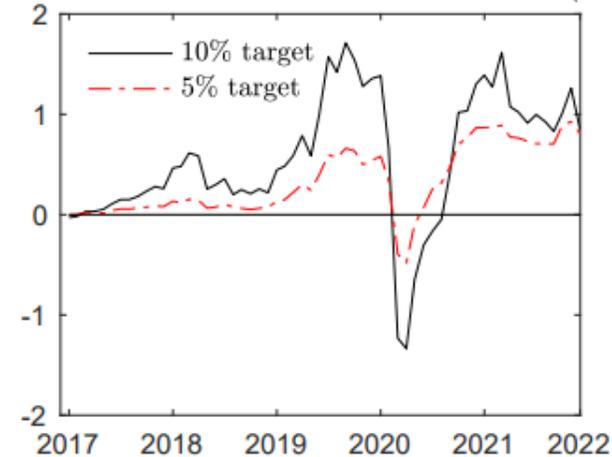
Net zero portfolios vs benchmarks



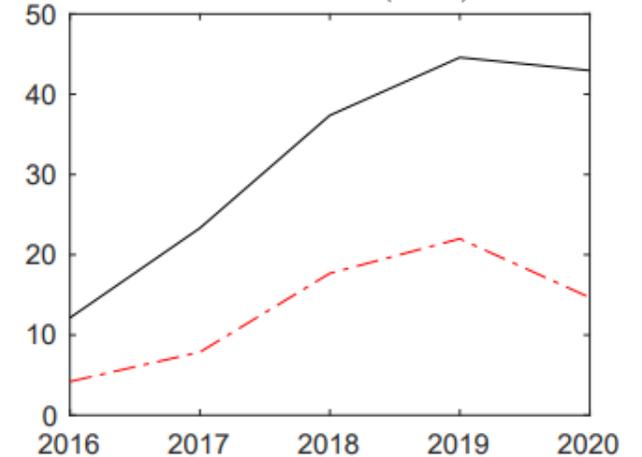
... without sacrificing financial returns

- The annualised returns of **the NZ portfolio (3.3%)** is slightly higher than the BAU benchmark (3.2% on average)
- But **return volatilities are higher** as measured by annual tracking error (up to 1%)
- **Annual turnover** is kept below 10% on average

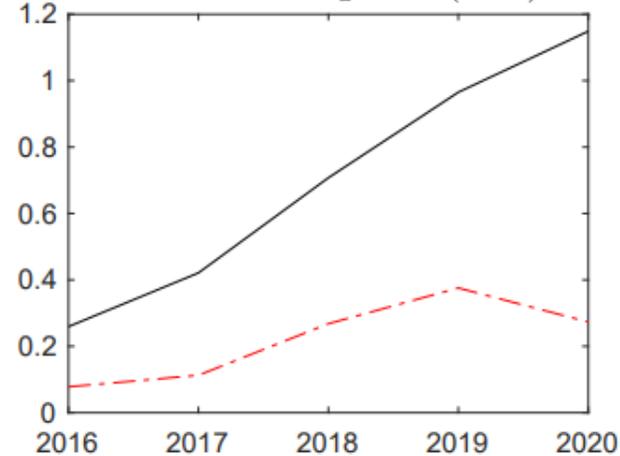
Cumulative return relative to the BAU (in %)



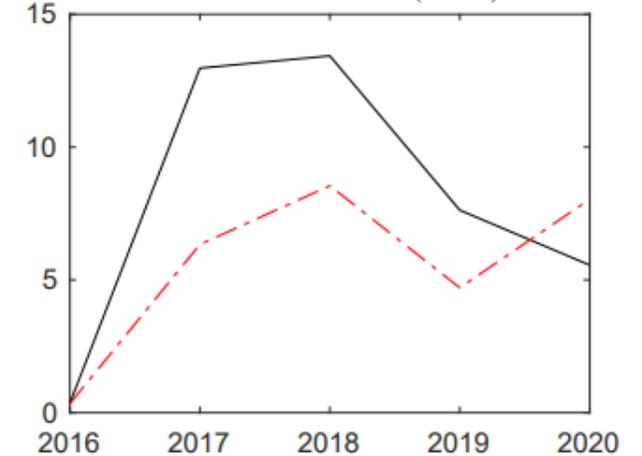
Active share (in %)



Annual tracking error (in %)



Annual turnover (in %)



Decarbonisation achieved through radical country weight rebalancing

	BAU	NZ portfolio	
	portfolio	10% reduction	5% reduction
Panel A: Advanced economies	90.61	90.61	90.61
Australia	1.49	0.00	0.27
Belgium	1.71	0.00	0.23
Canada	1.29	0.00	0.24
Denmark	0.39	1.44	1.06
France	6.94	10.81	8.28
Germany	4.72	1.82	4.25
Italy	6.32	11.62	8.02
Japan	18.13	19.83	18.95
Netherlands	1.45	0.01	0.38
Spain	3.93	9.73	5.74
Sweden	0.27	3.67	1.51
United Kingdom	6.42	10.86	7.87
United States of America	37.55	20.83	33.81

	BAU	NZ portfolio	
	portfolio	10% reduction	5% reduction
Panel B: Emerging economies	9.39	9.39	9.39
Argentina	0.02	0.00	0.02
Brazil	0.87	0.29	0.74
Chile	0.09	0.00	0.02
China	3.31	0.27	1.56
Colombia	0.23	1.29	0.91
Czech Republic	0.14	0.00	0.00
Dominican Republic	0.01	0.35	0.71
Hungary	0.16	0.00	0.00
India	1.48	3.36	2.33
Indonesia	0.49	0.72	0.96
Malaysia	0.23	0.00	0.00
Mexico	0.56	0.02	0.22
Peru	0.10	0.85	0.70
Philippines	0.01	2.21	0.97
Poland	0.39	0.00	0.02
Romania	0.11	0.00	0.02
Russian Federation	0.28	0.00	0.01
South Africa	0.39	0.00	0.09
Thailand	0.33	0.01	0.08
Turkey	0.19	0.00	0.03
Uruguay	0.01	0.00	0.00

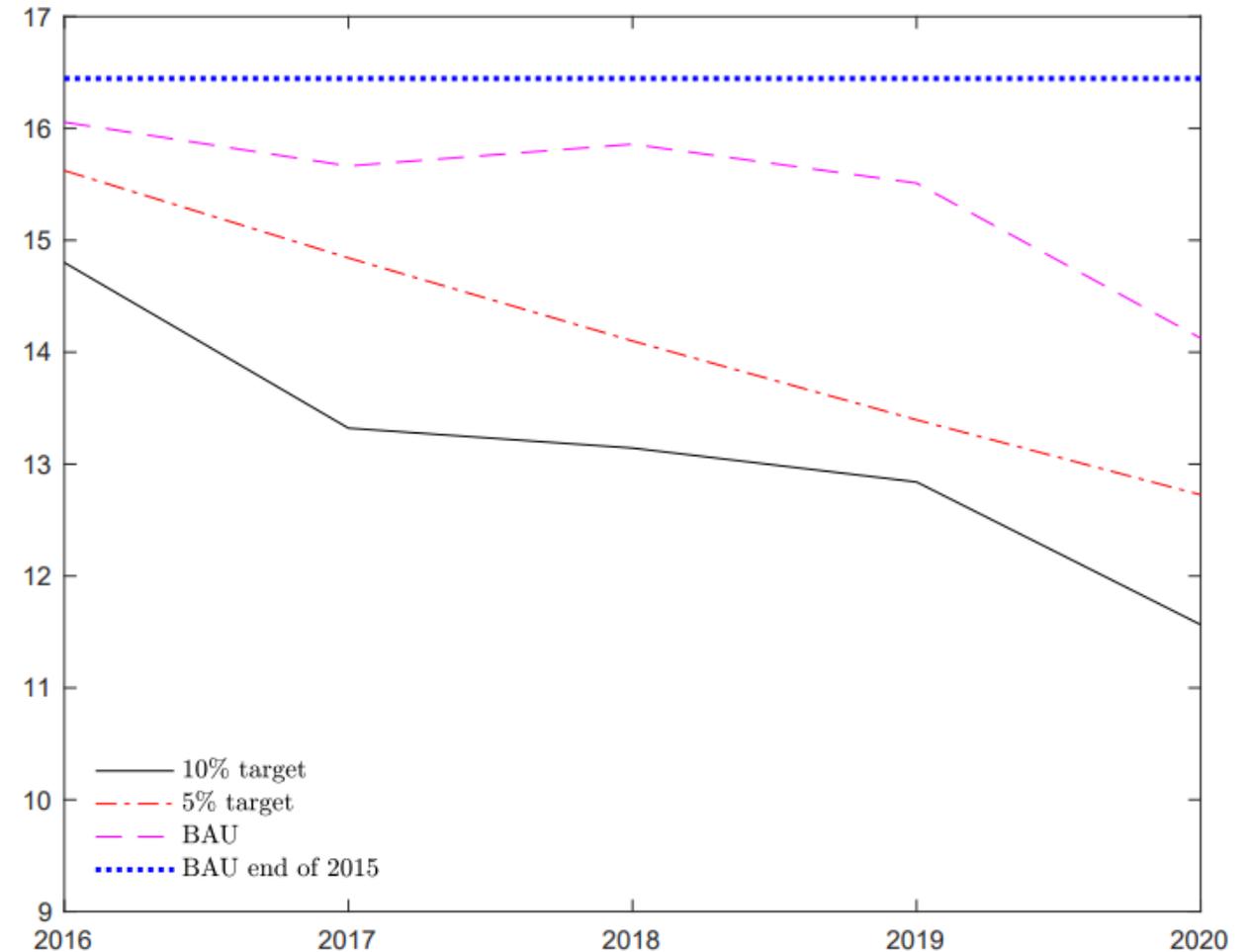
The unconstrained rebalancing entails several issues:

- **Some countries are excluded** from the portfolio after rebalancing while **the demand for other countries' sovereign securities doubles**
- Rebalancing may entail **macro-financial risks**
 - The supply of sovereign securities may be unable to increase fast without triggering fiscal sustainability issues
 - For the countries from which investors disinvest, sovereign funding costs and rollover risks may rise
 - Rebalancing between currencies could lead to exchange rate fluctuations
- We thus set **boundaries for the portfolio rebalancing**, the constrained approach:
 - To keep the creditworthiness of the portfolio unchanged
 - To limit country weight changes between 0.5 and 1.5 times country weights in the BAU benchmark

The constrained approach

- The constrained approach achieves a lower carbon intensity reduction by 30% after five years
- The NZ trajectory is less smooth and cannot fall below 10 tons of CO2 per capita by 2020
- Still better than the BAU benchmark (14%)

Net zero portfolios vs benchmarks



Decarbonisation achieved through radical country weight rebalancing

	BAU portfolio	NZ portfolio	
		10% reduction	5% reduction
Panel A: Advanced economies	90.61	90.61	90.61
Australia	1.49	0.75	0.77
Belgium	1.71	0.86	0.86
Canada	1.29	0.65	0.67
Denmark	0.39	0.59	0.58
France	6.94	10.17	9.03
Germany	4.72	5.10	4.11
Italy	6.32	9.38	8.51
Japan	18.13	24.66	19.94
Netherlands	1.45	0.72	0.79
Spain	3.93	5.89	5.55
Sweden	0.27	0.41	0.41
United Kingdom	6.42	9.29	8.56
United States of America	37.55	22.15	30.83

	BAU portfolio	NZ portfolio	
		10% reduction	5% reduction
Panel B: Emerging economies	9.39	9.39	9.39
Argentina	0.02	0.02	0.02
Brazil	0.87	1.31	1.19
Chile	0.09	0.13	0.12
China	3.31	1.77	2.20
Colombia	0.23	0.35	0.34
Czech Republic	0.14	0.07	0.07
Dominican Republic	0.01	0.01	0.01
Hungary	0.16	0.08	0.08
India	1.48	2.22	2.16
Indonesia	0.49	0.73	0.73
Malaysia	0.23	0.12	0.12
Mexico	0.56	0.82	0.72
Peru	0.10	0.15	0.15
Philippines	0.01	0.01	0.01
Poland	0.39	0.20	0.20
Romania	0.11	0.13	0.08
Russian Federation	0.28	0.14	0.14
South Africa	0.39	0.48	0.47
Thailand	0.33	0.49	0.43
Turkey	0.19	0.16	0.13
Uruguay	0.01	0.01	0.01

Discussion

- It is feasible to build a sovereign portfolio with decreasing carbon footprint, eg a carbon reduction by 10% each year over 5 years
 - Rebalancing of country weights depends on the selected criterion of carbon intensity
 - A consumption-based measure - scaled per capita - encourages advanced economies to further strengthen their decarbonisation effort
 - Financial performance of the portfolio is similar to the benchmark, with however heightened volatilities
- However, macroeconomic constraints and implications need to be factored in
 - Constraints on sovereign security supply affect portfolio rebalancing
 - Rebalancing could also affect countries' debt issuance, financing costs and ultimately debt sustainability
 - Large swings in sovereign securities denominated in different currencies could entail exchange rate movements, although fixed income investors are mostly hedged



Conclusion

- Passive investors can decarbonise portfolios
 - i.e. reduce carbon by -10% per annum for several years
 - Either on stocks, on corporate bonds or on sovereigns
 - Limited (negligible impact on performance and the adjustment costs)
- Decarbonizing a portfolio by exclusion is not necessarily implying large incentives of issuers to decarbonize their activities