Climate Risk Metrics & Portfolio Construction

Amundi Quantitative Research*

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¹The opinions expressed in this presentation are those of the authors and are not meant to represent the opinions or official positions of Amundi Asset Management.
Amundi Research Project

1. Portfolio Construction with Climate Risk Measures, January 2022
2. Net Zero Carbon Metrics, February 2022
3. The Shift from Carbon Emissions to Net Zero Carbon Metrics on Portfolio Construction, March 2022
4. Multi-Period Portfolio Optimization & Application to Portfolio Decarbonization, March 2022
5. The Green Risk Premium & The Performance(s) of ESG Investing, March 2022
6. The Impact of Net Zero on Capital Allocation and Equity Portfolio Management, Forthcoming
7. The Impact of Net Zero on Bond Portfolio Management, Forthcoming

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The puzzle

- Portfolio decarbonization
- Portfolio alignment

**Academic findings**

- Portfolio decarbonization is easy
- Portfolio alignment is easy
- The cost of portfolio alignment may be low

**Asset owners & managers**

- Portfolio decarbonization is easy
- Portfolio alignment is difficult
- The cost of portfolio alignment may be high

Asset allocation $\Rightarrow$ Portfolio weights $x_i$

Two visions of asset management

\[\begin{align*}
\text{Asset allocation} & \Rightarrow \text{Portfolio weights } x_i \\
\text{Asset allocation} & \Rightarrow \begin{cases} 
\text{Capital allocation} \\
\text{Economy financing}
\end{cases}
\end{align*}\]
Carbon emissions

The GHG Protocol corporate standard classifies a company’s greenhouse gas emissions in three scopes (*):

- **Scope 1**: Direct GHG emissions (◦)
- **Scope 2**: Consumption of purchased energy (○○)
- **Scope 3**: Other indirect GHG emissions (●●)

  - **Scope 3 upstream**: emissions associated to the supply side
    - First tier direct (●)
    - Tier 2 and 3 suppliers (●●)
  
  - **Scope 3 downstream**: emissions associated with the product sold by the entity
    - Use of the product (●●●)
    - Waste disposal & recycling (●●●●)

(*) Measurement robustness: from ○○○○ (very high) to ●●●● (very low)
Some preliminary concepts
Portfolio Decarbonization & Alignment
Net Zero Carbon Metrics

Carbon emissions

**Figure:** Total absolute scopes per GICS sector in GtCO$_2$e

**Table:** Scope 1 + 2 vs. scope 3

<table>
<thead>
<tr>
<th>Sector</th>
<th>$SC_3$</th>
<th>$SC_{1+2}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication Services</td>
<td>1.1</td>
<td></td>
</tr>
<tr>
<td>Consumer Discretionary</td>
<td>3.0</td>
<td></td>
</tr>
<tr>
<td>Consumer Staples</td>
<td>3.7</td>
<td></td>
</tr>
<tr>
<td>Energy</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td>Financials</td>
<td>1.8</td>
<td></td>
</tr>
<tr>
<td>Health Care</td>
<td>3.3</td>
<td></td>
</tr>
<tr>
<td>Industrials</td>
<td>0.9</td>
<td></td>
</tr>
<tr>
<td>Information Technology</td>
<td>1.9</td>
<td></td>
</tr>
<tr>
<td>Materials</td>
<td>0.3</td>
<td></td>
</tr>
<tr>
<td>Real Estate</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Utilities</td>
<td>0.1</td>
<td></td>
</tr>
</tbody>
</table>
Carbon intensity vs emissions

Emissions (log scale, tCO$_2$e)

Intensity(*) (log scale, tCO$_2$e/$ mn)

(*) Carbon intensity = carbon emissions / output (e.g., revenues)
## Table: Examples of carbon emissions and intensity

<table>
<thead>
<tr>
<th>Company</th>
<th>Emission (in tCO₂e)</th>
<th>Revenue (in $ mn)</th>
<th>Intensity (in tCO₂e/$ mn)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Scope 1</td>
<td>Scope 2</td>
<td>Scope 3</td>
</tr>
<tr>
<td>Alphabet</td>
<td>74462</td>
<td>5116949</td>
<td>7166240</td>
</tr>
<tr>
<td>Amazon</td>
<td>5760000</td>
<td>5500000</td>
<td>20054722</td>
</tr>
<tr>
<td>Apple</td>
<td>50463</td>
<td>862127</td>
<td>27618943</td>
</tr>
<tr>
<td>BP</td>
<td>49199999</td>
<td>5200000</td>
<td>103840194</td>
</tr>
<tr>
<td>Danone</td>
<td>722122</td>
<td>944877</td>
<td>28969780</td>
</tr>
<tr>
<td>Enel</td>
<td>69981,891</td>
<td>5365386</td>
<td>8726973</td>
</tr>
<tr>
<td>Juventus</td>
<td>6665</td>
<td>15739</td>
<td>35842</td>
</tr>
<tr>
<td>LVMH</td>
<td>67613</td>
<td>262609</td>
<td>11853749</td>
</tr>
<tr>
<td>Microsoft</td>
<td>113414</td>
<td>3556553</td>
<td>5977488</td>
</tr>
<tr>
<td>Nestle</td>
<td>3291303</td>
<td>3206495</td>
<td>61262078</td>
</tr>
<tr>
<td>Netflix</td>
<td>38481</td>
<td>145443</td>
<td>1900283</td>
</tr>
<tr>
<td>Total</td>
<td>40909135</td>
<td>3596127</td>
<td>49831487</td>
</tr>
<tr>
<td>Volkswagen</td>
<td>4494066</td>
<td>5973894</td>
<td>65335372</td>
</tr>
</tbody>
</table>
## Carbon intensity

**Table:** The case of Danone (total emissions breakdown)

<table>
<thead>
<tr>
<th>Scope</th>
<th>2019</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Scope 1</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Purchase of goods and services: Agriculture - milk</td>
<td>35.50%</td>
<td>36.90%</td>
</tr>
<tr>
<td>Purchase of goods and services: Agriculture - dairy ingredients</td>
<td>15.40%</td>
<td>15.10%</td>
</tr>
<tr>
<td>Purchase of goods and services: Agriculture - other raw materials</td>
<td>9.00%</td>
<td>8.40%</td>
</tr>
<tr>
<td>Purchase of goods and services: Packaging</td>
<td>10.30%</td>
<td>9.60%</td>
</tr>
<tr>
<td>Purchase of goods and services: Purchase of finished products</td>
<td>5.60%</td>
<td>6.20%</td>
</tr>
<tr>
<td><strong>Scope 3</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upstream transportation and distribution of goods</td>
<td>1.40%</td>
<td>1.20%</td>
</tr>
<tr>
<td>Downstream transportation and distribution of goods</td>
<td>8.10%</td>
<td>6.20%</td>
</tr>
<tr>
<td>Use of sold products</td>
<td>7.10%</td>
<td>7.20%</td>
</tr>
<tr>
<td><strong>End-of-life treatment of sold products</strong></td>
<td>0.90%</td>
<td>3.00%</td>
</tr>
<tr>
<td>Fuel and energy related activities</td>
<td>1.20%</td>
<td>1.10%</td>
</tr>
<tr>
<td>Waste generated in operations</td>
<td>0.60%</td>
<td>0.60%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Agricultural emissions breakdown</th>
<th>2019</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk</td>
<td>59.20%</td>
<td>61.10%</td>
</tr>
<tr>
<td>Dairy ingredients</td>
<td>25.70%</td>
<td>25.00%</td>
</tr>
<tr>
<td>Other raw materials</td>
<td>15.10%</td>
<td>13.90%</td>
</tr>
</tbody>
</table>

Source: Danone, Exhaustive 2020 Environmental Data.
Portfolio decarbonization

- The optimization problem is:

\[ x^*(\mathcal{R}) = \arg \min \frac{1}{2} (x - b)^T \Sigma (x - b) \]

s.t. \[ \begin{align*} 1^n x &= 1 \\
 x &\geq 0^n \\
 \sum_{i=1}^n x_i \cdot CI_i &\leq (1 - \mathcal{R}) \cdot CI(b) \end{align*} \]

where \( x \) is the portfolio and \( b \) is the benchmark portfolio

- \( \mathcal{R} \) is the reduction rate of the carbon intensity

- The underlying idea is to obtain a decarbonized portfolio \( x^* \) such that the tracking error with respect to the benchmark \( b \) is the lowest

- The benchmark \( b \) can be a current portfolio (active management) or an index portfolio (passive management)
Figure: Impact of the carbon scope on the tracking error volatility (S&P 500 index, October 2021)
Portfolio alignment

Paris-aligned benchmarks

- A year-on-year self-decarbonization of 7% on average per annum, based on **scope 1, 2 and 3 emissions** ⇒ postponed in 2023? 2024? 2025?
- A minimum carbon intensity reduction $\mathcal{R}^-$ compared to the investable universe
- A minimum exposure to sectors highly exposed to climate change:
  1. Narrow measure of HCIS (non official, e.g. $\approx 19\%$ of the S&P 500)
  2. Broad measure of HCIS (official, e.g. $\approx 55\%$ of the S&P 500)
- Issuer exclusions (controversial weapons and societal norms violators)
- **Minimum green share revenue**

<table>
<thead>
<tr>
<th>CTB</th>
<th>$\mathcal{R}^- = 30%$</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAB</td>
<td>$\mathcal{R}^- = 50%$</td>
</tr>
</tbody>
</table>
Decarbonization pathway

Figure: Decarbonization pathway of PAB labels (base year = 2020)

Table: Reduction $\mathcal{R}(2020, t)$

<table>
<thead>
<tr>
<th>Year</th>
<th>CTB</th>
<th>PAB</th>
</tr>
</thead>
<tbody>
<tr>
<td>2021</td>
<td>30.0%</td>
<td>50.0%</td>
</tr>
<tr>
<td>2022</td>
<td>34.9%</td>
<td>53.5%</td>
</tr>
<tr>
<td>2023</td>
<td>39.5%</td>
<td>56.8%</td>
</tr>
<tr>
<td>2024</td>
<td>43.7%</td>
<td>59.8%</td>
</tr>
<tr>
<td>2025</td>
<td>47.6%</td>
<td>62.6%</td>
</tr>
<tr>
<td>2026</td>
<td>51.3%</td>
<td>65.2%</td>
</tr>
<tr>
<td>2027</td>
<td>54.7%</td>
<td>67.7%</td>
</tr>
<tr>
<td>2028</td>
<td>57.9%</td>
<td>69.9%</td>
</tr>
<tr>
<td>2029</td>
<td>60.8%</td>
<td>72.0%</td>
</tr>
<tr>
<td>2030</td>
<td>63.6%</td>
<td>74.0%</td>
</tr>
<tr>
<td>2035</td>
<td>74.7%</td>
<td>81.9%</td>
</tr>
<tr>
<td>2040</td>
<td>82.4%</td>
<td>87.4%</td>
</tr>
<tr>
<td>2045</td>
<td>87.7%</td>
<td>91.2%</td>
</tr>
<tr>
<td>2050</td>
<td>91.5%</td>
<td>93.9%</td>
</tr>
</tbody>
</table>
Optimization problem

We have:

\[ x^*(t) = \arg \min_{x(t)} \frac{1}{2} \sigma^2(x(t) | b(t)) + \lambda \tau(x(t) | x^*(t-1)) \]

s.t. \[
\begin{align*}
1^\top_n x(t) &= 1 \\
 x(t) &\geq 0_n \\
CI(x(t)) &\leq (1 - R(t_0, t)) \cdot CI(b(t_0)) \\
HCIS(x(t)) &\geq \varphi \cdot HCIS(b(t))
\end{align*}
\]

where \( \lambda \geq 0, \sigma(x(t) | b(t)) \) is the tracking error risk and \( \tau(x(t) | x^*(t-1)) \) is the one-way turnover of the portfolio between \( t-1 \) and \( t \)

\( \Rightarrow \) Dynamic rebalancing (e.g., every quarter)
The scope 3 issue (which scope 3?)

**Figure:** Tracking error of CTB and PAB labels when implementing the broad HCIS constraint (S&P 500 index, October 2021)
Impact of the scope 3

Figure: Breakdown of the scope 1 + 2 + 3 carbon intensity (Eurostoxx 50 index)
Impact of the reduction rate $R$ on sector allocation

Figure: HCIS constraints do not help to keep strategic sectors in the allocation (Eurostoxx 50 index)
Impact of the reduction rate $\mathcal{R}$ on green share revenues

**Figure:** Average green share (Eurostoxx 50 index)
Impact of the reduction rate $R$ on diversification

**Figure:** Herfindahl index (Eurostoxx 50 index)

- Blue: Company
- Orange: GICS Sector
- Green: GICS Industry
- Purple: GICS Subindustry

**Graph:**
- Y-axis: Effective number of bets
- X-axis: Carbon Intensities reduction rate
- Percentage reduction rates from 0% to 90%
Some preliminary concepts

Portfolio Decarbonization & Alignment

Net Zero Carbon Metrics

Portfolio decarbonization
Portfolio alignment

Comparison of CTB, PAB and IEA NZE scenarios

Figure: Utilities (Eurostoxx 50 index)

Figure: Construction Materials (Eurostoxx 50 index)

CTB and PAB approaches decarbonize faster the strategic sectors than expected by IEA!
The arithmetic of net zero

“Using global mean surface air temperature, as in AR5, gives an estimate of the remaining carbon budget of 580 GtCO$_2$e for a 50% probability of limiting warming to 1.5°C, and 420 GtCO$_2$e for a 66% probability (medium confidence)” (IPCC, 2018).

Pr\{T \leq 1.5°C \mid CB(2019, 2050) \leq 580 \text{ GtCO}_2\text{e}\} \geq 50%\\
Pr\{T \leq 1.5°C \mid CB(2019, 2050) \leq 420 \text{ GtCO}_2\text{e}\} \geq 66%\\
Pr\{T \leq 1.5°C \mid CB(2019, 2050) \leq 300 \text{ GtCO}_2\text{e}\} \geq 83%\\

Remark

- Current carbon emissions \(\approx 36 \text{ GtCO}_2\text{e} \text{ per annum}\)
- \(580/36 = 16 \text{ years (2035)}\)
The arithmetic of net zero

**Figure**: CO₂ emissions in the IEA NZE scenario

\[ \text{Carbon budget} \]

\[ \mathcal{CB}_i(t_0, t) = \int_{t_0}^{t} \mathcal{CE}_i(s) \, ds \]

**NZE scenario**

\[ \left\{ \begin{array}{l}
\mathcal{CB}(2019, 2050) \leq 580 \text{ GtCO}_2\text{e} \\
\mathcal{CE}(2050) \approx 0 \text{ GtCO}_2\text{e}
\end{array} \right. \]
The arithmetic of net zero

Table: IEA NZE global scenario (in GtCO$_2$e)

<table>
<thead>
<tr>
<th>Year</th>
<th>2019</th>
<th>2025</th>
<th>2030</th>
<th>2035</th>
<th>2040</th>
<th>2045</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross emissions</td>
<td>35.90</td>
<td>30.30</td>
<td>21.50</td>
<td>13.70</td>
<td>7.77</td>
<td>4.30</td>
<td>1.94</td>
</tr>
<tr>
<td>CCS</td>
<td>0.00</td>
<td>−0.06</td>
<td>−0.32</td>
<td>−0.96</td>
<td>−1.46</td>
<td>−1.80</td>
<td>−1.94</td>
</tr>
<tr>
<td>Net emissions</td>
<td>35.90</td>
<td>30.24</td>
<td>21.18</td>
<td>12.74</td>
<td>6.31</td>
<td>2.50</td>
<td>0.00</td>
</tr>
<tr>
<td>Reduction (in %)</td>
<td>0.00</td>
<td>15.60</td>
<td>40.11</td>
<td>61.84</td>
<td>78.36</td>
<td>88.02</td>
<td>94.60</td>
</tr>
</tbody>
</table>

By assuming linear interpolation, we find the following values for $CB_i(2019, 2050)$ in in GtCO$_2$e:

- **Global scenario**
  - Gross: 512.35
  - CCS: −27.85
  - Net: 484.5

- **Sectoral scenario**
  - Electricity: 138.225
  - Industry: 158.99
  - Transport: 133.57
  - Buildings: 42.685
  - Other: 11.185

Table: IEA NZE sectoral scenario (in GtCO$_2$e)

<table>
<thead>
<tr>
<th>Year</th>
<th>2019</th>
<th>2025</th>
<th>2030</th>
<th>2035</th>
<th>2040</th>
<th>2045</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity</td>
<td>13.80</td>
<td>10.80</td>
<td>5.82</td>
<td>2.12</td>
<td>−0.08</td>
<td>−0.31</td>
<td>−0.37</td>
</tr>
<tr>
<td>Industry</td>
<td>8.90</td>
<td>8.14</td>
<td>6.89</td>
<td>5.25</td>
<td>3.48</td>
<td>1.80</td>
<td>0.52</td>
</tr>
<tr>
<td>Transport</td>
<td>8.29</td>
<td>7.23</td>
<td>5.72</td>
<td>4.11</td>
<td>2.69</td>
<td>1.50</td>
<td>0.69</td>
</tr>
<tr>
<td>Buildings</td>
<td>3.01</td>
<td>2.43</td>
<td>1.81</td>
<td>1.21</td>
<td>0.69</td>
<td>0.32</td>
<td>0.12</td>
</tr>
<tr>
<td>Other</td>
<td>1.91</td>
<td>1.66</td>
<td>0.91</td>
<td>0.09</td>
<td>−0.46</td>
<td>−0.82</td>
<td>−0.96</td>
</tr>
</tbody>
</table>
Net zero emission tools

- Absolute carbon emissions
- Carbon target
- Carbon trend
- Carbon budget

Net zero emission metrics

Static NZE metrics
- Gap
- Slope
- Budget
- Duration

Dynamic NZE metrics
- Time contribution
- Velocity
- Zero-velocity & burn-out scenarios
The PAC framework

Three questions:

- Is the trend of the issuer in line with the net zero emissions scenario? ⇒ Participation
- Is the commitment of the issuer to fight climate change ambitious? ⇒ Ambition
- Is the target setting of this issuer relevant and robust? ⇒ Credibility

The three pillars depends on the carbon trajectories $CE_i(t)$, $CE_i^{Trend}(t)$, $CE_i^{Target}(t)$ and $CE_i^{nze}(t)$ where:

1. $CE_i(t)$ is the time series of historical carbon emissions
2. $CE_i^{Trend}(t)$ and $CE_i^{Target}(t)$ are the estimated carbon emissions deduced from the trend model and the target
3. $CE_i^{nze}(t)$ is the market-based NZE scenario

$t_{Base}$ is the base date, $t_{Last}$ is the last reporting date and $t_{nze}$ is the target date of the NZE scenario
The PAC framework

Figure: Illustration of the participation, ambition and credibility pillars
## Table: The three pillars of an effective NZE strategy

<table>
<thead>
<tr>
<th>Pillar</th>
<th>Metric</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participation</td>
<td>Gap</td>
<td>$\text{Gap}<em>i^{\text{Trend}}(t</em>{\text{L},\text{ast}}) \leq 0$</td>
</tr>
<tr>
<td></td>
<td>Reduction</td>
<td>$\mathcal{R}<em>i(t</em>{\text{base}}, t_{\text{L},\text{ast}}) &lt; 0$</td>
</tr>
<tr>
<td></td>
<td>Time contribution</td>
<td>$\mathcal{T}C_i(t_{\text{L},\text{ast}} + 1</td>
</tr>
<tr>
<td></td>
<td>Trend</td>
<td>$\beta_{i,1} &lt; 0$ and $R^2_i &gt; 50%$</td>
</tr>
<tr>
<td></td>
<td>Velocity</td>
<td>$\mathcal{V}<em>i^{(1)}(t</em>{\text{L},\text{ast}}) \leq 0$</td>
</tr>
<tr>
<td>Ambition</td>
<td>Budget</td>
<td>$\mathcal{C}B_i^{\text{Target}}(t_{\text{L},\text{ast}}, t_{\text{nz}}) \leq \mathcal{C}B_i^{\text{Trend}}(t_{\text{L},\text{ast}}, t_{\text{nz}})$</td>
</tr>
<tr>
<td></td>
<td>Duration</td>
<td>$\tau_i^{\text{Target}} \leq t_{\text{nz}}$</td>
</tr>
<tr>
<td></td>
<td>Gap</td>
<td>$\text{Gap}<em>i^{\text{Target}}(t</em>{\text{nz}}) \leq 0$</td>
</tr>
<tr>
<td></td>
<td>Budget</td>
<td>$\mathcal{C}B_i^{\text{Target}}(t_{\text{L},\text{ast}}, t_{\text{nz}}) &gt; \mathcal{C}B_i^{\text{Trend}}(t_{\text{L},\text{ast}}, t_{\text{nz}})$</td>
</tr>
<tr>
<td></td>
<td>Burn-out Scenario</td>
<td>$\mathcal{B}O_i(t_{\text{L},\text{ast}} + 1, \mathcal{C}E_i^{\text{nz}}(t_{\text{nz}})) \geq \phi_{\mathcal{BO}} \cdot \mathcal{C}E_i(t_{\text{L},\text{ast}})$</td>
</tr>
<tr>
<td></td>
<td>Duration</td>
<td>$\tau_i^{\text{Trend}} \leq t_{\text{nz}}$</td>
</tr>
<tr>
<td>Credibility</td>
<td>Gap</td>
<td>$\text{Gap}<em>i^{\text{Trend}}(t</em>{\text{nz}}) \leq 0$</td>
</tr>
<tr>
<td></td>
<td>Gap</td>
<td>$\text{Gap}<em>i^{\text{Trend}}(t</em>{\text{nz}}) \leq \text{Gap}<em>i^{\text{Target}}(t</em>{\text{nz}})$</td>
</tr>
<tr>
<td></td>
<td>Slope</td>
<td>$\overline{\text{Slope}}<em>i(t</em>{\text{nz}}) \geq \text{Slope}<em>i^{\text{Target}}(t</em>{\text{nz}})$</td>
</tr>
<tr>
<td></td>
<td>Trend</td>
<td>$R^2_i &gt; 50%$</td>
</tr>
<tr>
<td></td>
<td>Zero-velocity</td>
<td>$\mathcal{Z}V_i^{(1)}(t_{\text{L},\text{ast}} + 1) \geq \phi_{\mathcal{ZV}} \cdot \mathcal{C}E_i(t_{\text{L},\text{ast}})$</td>
</tr>
</tbody>
</table>
The PAC scoring system

Figure: Examples

(a) Model student?

(b) Black sheep?

(c) Shy child?

(d) Greenwashing?

Figure: Rank correlation matrix

\[
\begin{array}{ccc}
\cal{P}\cal{S}_i & \cal{A}\cal{S}_i & \cal{C}_i \\
100\% & -94\% & 92\% \\
100\% & -89\% & 100\% \\
\end{array}
\]
Empirical results

Figure: Carbon emissions, trends and targets and NZE scenario (Company A)

Empirical results

**Figure:** Carbon emissions, trends and targets and NZE scenario (Company C)

Some preliminary concepts
Portfolio Decarbonization & Alignment
Net Zero Carbon Metrics

Empirical results

Figure: Carbon emissions, trends and targets and NZE scenario (global analysis)

Empirical results

**Figure:** Probability to reach 1.5°C

Source: Le Guenedal et al. (2022).
Comparison of NZE portfolios

We consider 4 climate risk metrics:

1. the Scope 1 + 2 + 3 carbon intensity
2. the Scope 1 + 2 + 3 carbon emissions
3. the projected Scope 1 + 2 + 3 carbon intensity (linear trend model)
4. the projected Scope 1 + 2 + 3 carbon emissions (linear trend model)
Comparison of NZE portfolios

**Figure:** Active share between the NZE portfolios (MSCI EMU)
Comparison of NZE portfolios

Figure: Active share between the NZE portfolios (MSCI USA)
Scope 3 ⇒ portfolio decarbonization is more difficult
Negative correlation between green revenues and carbon emissions/intensity
HCIS constraint ⇒ sector distortion (Financials/Luxury solution)
Solution with carbon emissions ≠ solution with carbon intensity
Solution with carbon trends ≠ solution with historical figures

**Negative externalities**: food & beverages, utilities, construction materials

Portfolio decarbonization ≠ portfolio alignment
Asset allocation issue: Diversification ↘

**Gap between finance and economy decarbonization** ↗
What could be a NZE portfolio alignment policy?

Two building blocks of NZE portfolios

Decarbonized portfolio
- Decarbonization pathway
- Top-down approach
- Portfolio optimization
- Carbon metrics

Green solution portfolio
- Financing the transition
- Bottom-up approach
- Security selection
- $\neq$ Carbon metrics

$\alpha\%$  $\quad + \quad $  $(1 - \alpha)\%$
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