Climate portfolio alignment and temperature scores

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Introduction

Temperature alignment scores are gaining traction among investors as they are forward-looking, easy to communicate, and summarize, in a simplified way, the degree of alignment of a given company or portfolio toward well-known Paris-compatible climate scenarios. They convey a simple message to investors: an estimation of the likely temperature increase the planet could face if the world's economy were to be represented by their own portfolio. Although an aggregate temperature metric may mask many layers of different analysis, assumptions, climate scenario uncertainties as well as different construction methodologies or objectives, the quality of temperature scores can be improved with greater methodology transparency and greater convergence in conceptual foundations and methodological principles.

In this paper, we will show, first with a toy model and then with actual data, how the aggregation method heavily determines and shapes the exposures of the final portfolio when one uses climate temperature scores as input. The default choice for portfolio optimization under a temperature constraint or for ex-post temperature measurement is given by the simple weighted average of companies' climate temperature scores, the weights being proportional to the amount invested in each company (hereafter WAT – *weighted-average temperature*).

We compare the WAT approach with the carbon-weighted temperature score (hereafter CWT), a different aggregation metric that increases the sensitivity of the portfolio's total temperature to companies with high-climate related risks. By design, our CWT is heavily dependent on the most impactful companies and sectors in the portfolio. It is therefore consistent with the evidence that most of our economies' direct impact on climate comes from a relatively limited number of companies and sectors. It is worth noting that the two aggregation methods we examine here are both in the list of weighting options proposed in CDP Worldwide and WWF International's Temperature Rating document.

WAT vs. CWT

The weighted average temperature is computed simply as:

$$WAT = \sum_j w_i * T_i \quad (1) \quad \begin{cases} w_i\text{: weight of security i in the portfolio} \\ T_i\text{: temperature score of security i} \end{cases}$$

As an alternative approach to computing portfolio temperature, we could consider the marginal contribution of each security's carbon footprint to the portfolio's carbon footprint as the weight used in the portfolio's temperature score. Therefore, we define carbon weighted temperature as:

$$CWT = \sum_j \varepsilon_i * T_i \quad \text{, where } \varepsilon_i = \frac{w_i * \frac{C_i}{EV_i}}{CFP} \quad (2) \quad \begin{cases} w_i\text{: weight of security i in the portfolio} \\ T_i\text{: temperature score of security i} \\ C_i\text{: total GHG emission of security i} \\ EV_i\text{: enterprise value of security i} \\ CFP\text{: carbon footprint of the portfolio} \end{cases}$$

We quickly illustrate the difference between WAC and CWT in Exhibit 1, where we assume that an economy comprises two companies, A and B, and consumers, and where Company A is aligned with the 1.5°C scenario while Company B is significantly above the 2°C target. In the aggregate, this economy is not aligned with the temperature limit in the Paris Agreement. If Company A's market capitalization is significantly larger than Company B's, it is possible to have a WAT for the market portfolio below 2°C, even though we know that this economy is not aligned. On the other hand, the CWT better represents the fact that our hypothetical economy is not aligned with the Paris Agreement.

Exhibit 1: Hypothetical example of an economy with two companies.
(we assume, for the sake of simplicity, that the market capitalization is proportional the enterprise value.)

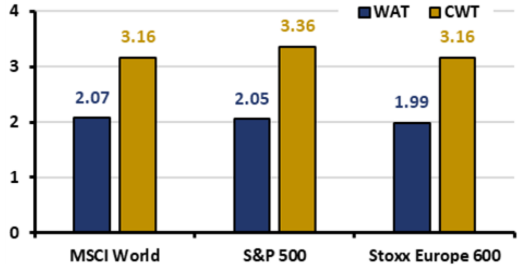
	Market Capitalization	Temperature Score	WAT	Carbon Footprint	ξ	CWT
Company A	85%	1.5°C	1.275°C	15	3.70%	0.06°C
Company B	15%	4°C	0.6°C	390	96.30%	3.85°C
Total Market	100%		1.876°C	405		3.91°C

For illustration purpose only.

WAT vs. CWT in practical cases

We now compute WAT and CWT for major stock market indices: the S&P 500 Index, the MSCI World Index, and the Stoxx Europe 600 Index. Exhibit 2 shows WAT and CWT absolute values for the three indices between the two approaches.

Exhibit 2: Temperature scores for global benchmark, WAT and CWT

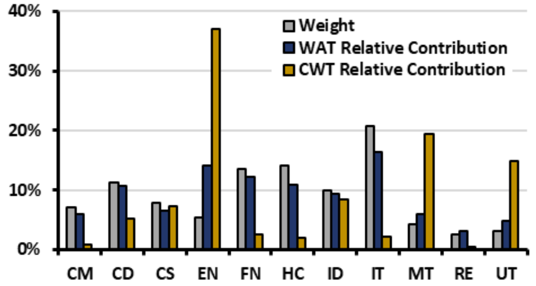


Source: Bloomberg, MSCI, S&P, Stoxx, Trucost, ISS. As of September 30, 2022.

It is striking that under WAT, the three indices would be almost in line with the (upper) limit set in the Paris Agreement (2°C). Under CWT instead, the three indices would settle above 3°C. Notwithstanding the uncertainty around such estimates, as well as the fact that these indices are not a fair representation of the global economy, the CWT numbers are in line with UNEP (2022) for which, under current policies, there is a 66% probability to be at 2.8°C by the end of the century. These numbers are also in line with the likely ranges of SSP-2.6 and SSP-4.5 (IPCC (2022)). On a relative basis, we see that WAT understates the temperature alignment of the three indices by 60% circa (from 53% for the MSCI World Index to 64% for the S&P 500 Index).

To understand where these large differences come from, we compute the relative contribution of each sector in our indices to both WAT and CWT scores. Exhibit 3 shows the relative sector contributions to the MSCI World Index WAT and CWT together with the weights of each sector in the index. We see that WAT relative sector contributions fairly match the index sector weights, which translates to the fact that the total temperature alignment, under WAT, is mainly driven by the sector composition. On the contrary, we see that in the case of CWT, the largest contributors are sectors like Energy, Materials, and Utilities, and their combined contribution is above 70% of the total CWT. Furthermore, their contribution is significantly higher than their financial weight: together they represent less than 15% of the MSCI World Index, yet they contribute for more than 70% of the CWT temperature score.

Exhibit 3: Sector weights in the MSCI World Index and their relative contribution to WAT and CWT temperature scores.



Source: Bloomberg, MSCI, S&P, Stoxx, Trucost, ISS. As of September 30, 2022.
CM: communication services; CD: consumer discretionary; CS: consumer staples; EN: energy; FN: financials; HC: health care; ID: industrials; IT: information technology; MT: materials; RE: real estates; UT: utilities.

Conclusion

In this paper, we show, by using both a simplified example and real data on major stock market indices, that when it comes to temperature scores, the aggregation method choice is particularly important and full of consequences. More precisely, we prove how the popular WAT approach, although simpler, is not satisfying and poses the risk of a severe underestimation of portfolio's temperature. We propose therefore the CWT aggregation method, for which the marginal contribution to the total temperature score is proportional to the marginal contribution to the carbon footprint. As such, high-climate sensitive companies have a large impact on the overall temperature of the portfolio, which is consistent with empirical findings and evidence from climate science.

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