S&P Global
Market Intelligence

Case Study

Environmental Impact: Lowering the Carbon Footprint of a Portfolio

Sigmund Correa, FRM
Quantitative Specialist

sigmund.correa@spglobal.com

Highlights

- Using S&P Global's ClariFI, investors can optimize their portfolios to passively mimic benchmark characteristics, while tilting their portfolio's holdings to reduce their overall carbon footprint ("creating greener portfolios").
- Using carbon scope 1+2 as a secondary constraint in the optimization process, the weighted S&P 500, MSCI EAFE and MSCI World's carbon intensity[1] reduced by 30.4%, 39.3% and 35.2% on average during the period.
- The carbon reduction strategy maintains the underlying benchmark's risk & return characteristics and closely tracks the benchmark with a low tracking error. The lower carbon portfolios also have better climate characteristics than their benchmarks.

Motivations and Consideration of ESG Investing

The 2016 Paris Agreement committed to net-zero emissions globally by the second half of this century to keep the rise in mean temperatures well below 2 degrees Celsius above pre-industrial levels and to limit global warming to 1.5 degrees. To date, progress has been worryingly slow. Research by S&P Global Trucost shows that major global companies are on track for >3°C warming, falling 72% short of the required emissions reductions needed at this stage.[2] The recent explosion of net-zero commitments from companies, financial institutions, and countries provides welcome optimism. By overweighting/underweighting low/high carbon companies, we illustrate how Portfolio Managers can reduce the overall carbon footprint of their portfolio whilst maintaining underlying risk & return characteristics utilizing S&P Global's ClariFI.

[1] We use a Carbon overlay factor by adding scope 1 and scope 2 and standardize the sum by revenue. This results in a Carbon Intensity (CI) measure (CO2e ton per $1M of revenue). Companies with low/high CI emit less/more emissions per $1M of revenue.
[2] "State of Green Business 2021: Climate Risk," GreenBiz Group and S&P Global, 2021, www.spglobal.com/marketintelligence/en/news-insights/research/state-of-green-business-2021

Optimizing Portfolios with Trucost's Carbon Data

The goal is to construct "green portfolios" with a lower carbon footprint whilst maintaining the characteristics of the benchmark. We use a similar framework established by the GHGP[3], which categorizes greenhouse gas emissions into three categories - Scope 1, Scope 2, and Scope 3, but we exclude Scope 3 for this exercise.[4] We consider reducing the direct impact of greenhouse gas emissions that companies emit by overweighting/underweighting our portfolio allocation towards low/high carbon companies.

In Modern Portfolio Theory (MPT)[5], investors often use a vector of asset expected returns (Alpha Model) and a matrix of asset covariances (Risk Model). In practice, one can develop an appropriate alpha model to enhance the return alongside an overall improved environmental impact profile[6]. In this example, we use a **zero-alpha** model to demonstrate how investors can attempt to minimize the risk component while optimizing their portfolios to ensure neutrality with the benchmark. We employ a framework utilizing S&P Global's U.S. and Global Short-Term Risk Model[7] to lower overall portfolio risk, maximize alpha and lower the carbon footprint.

Those constraints include:

- Sector & Country Exposures to the benchmark
- Beta Exposure

We constructed Carbon tilted portfolios based on the S&P 500, MSCI EAFE and MSCI World indices using the following parameters:

Objective: Lower the Carbon Footprint and minimize risk while attempting to closely track the benchmark using ClariFI's Portfolio Optimizer.

Subject to:

1. Sector & Country Exposure Neutrality
2. Beta Neutrality
3. 50% to 200% individual Holding Weights relative to the benchmark
4. A Carbon Scope 1+2 factor as an overlay and attempt to reduce weighted exposure of this factor relative to the benchmark (50 % to 75% of the benchmark)

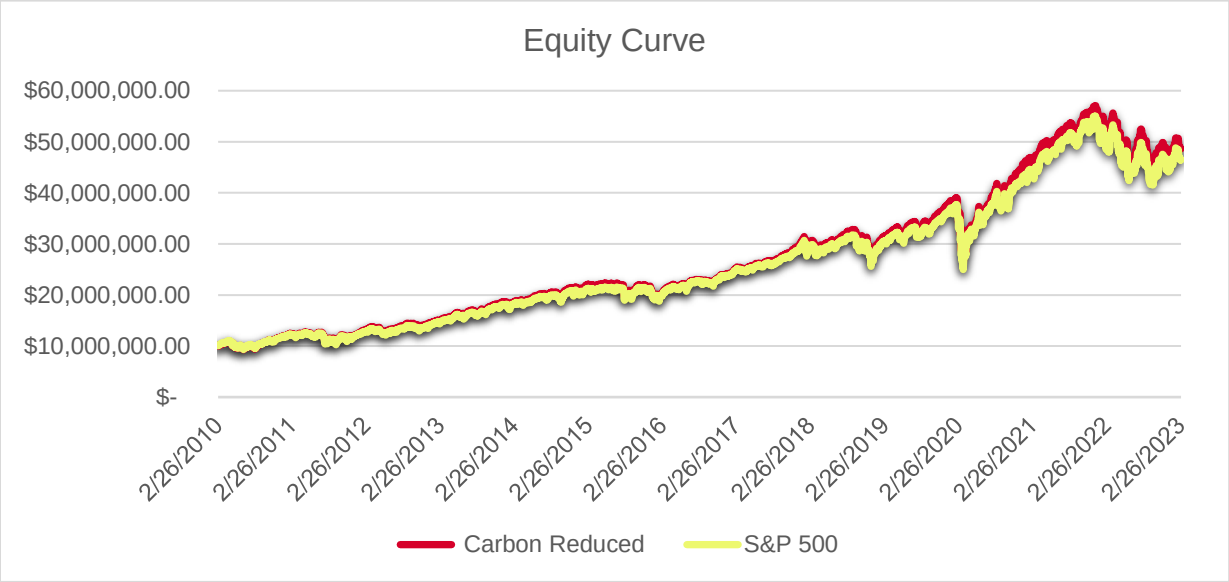
Carbon Tilted Portfolio Results

S&P 500:

- The Carbon tilted S&P 500 portfolio maintained the underlying characteristics of the S&P 500 benchmark with a Sharpe Ratio of 0.725 compared to 0.703 for the benchmark and a realized tracking error of 1.21%.
- The total return of the Carbon tilted S&P 500 portfolio slightly outperformed the benchmark over the same period, with a return of 385.91% vs. 364.32% for the benchmark,[8] and an annualized turnover of the portfolio at 87.56%.[9]
- The Carbon tilted S&P 500 portfolio had a significant reduction in carbon intensity and damage costs[10], 30.4% and 10.6% lower than that of the S&P 500 benchmark.[11]

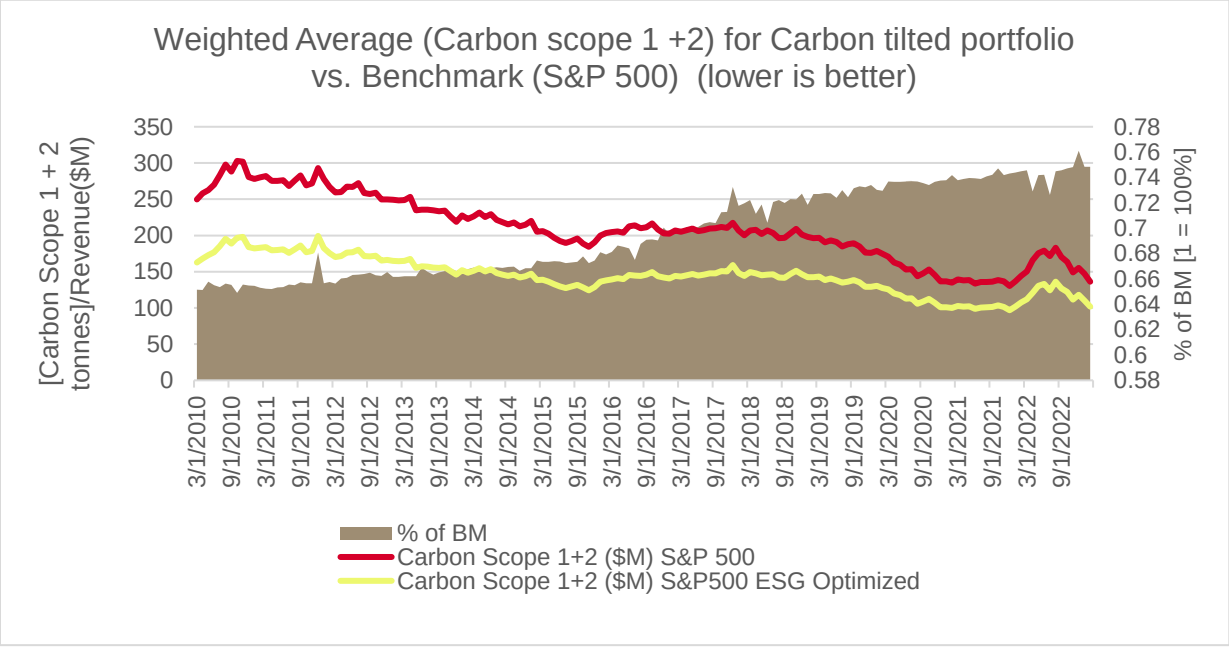
[3] GHGP is a partnership between the World Resources Institute and the World Business Council for Sustainable Development.
[4] Scope 3 can be much harder to measure and captures the emissions from the company's supply chain.
[5] A framework introduced by Harry Markowitz. A mean-variance optimization is characterized by asset and risk parameters
[6] Environmental Impact and Outperformance: A data-driven approach to integrating Carbon Footprinting into the Investment Process, Ruben Falk, Kirk Wang, et.al, May 2020
[7] See Balachander, B., Falk, R., Scherer, B., and Yen, B., 2010 "Introducing S&P Capital IQ's Fundamental U.S. Equity Risk Model", S&P Global Market Intelligence, Quantamental Research
[8] Historical back-test performance figures for these stats exclude brokerage fees and slippage. We ran a comparable backtest with fees of 10bps on each trade and a slippage cost of 5bps on the execution price. This scenario underperformed the benchmark with a total return of 353.54% and a Sharpe Ratio of 0.692.
[9] Turnover is measured as an annualized sum of purchases/sales turnover for each rebalance. We ran a similar scenario with quarterly rebalancing and limited the turnover to 31.07% without compromising return or benchmark characteristics (T.E. = 1.16%, T.R. = 355.37%, SR = 0.699)
[10] Trucost measures damage costs as either direct or indirect. Direct costs are associated with a company's direct operations, while indirect damage costs are related to the company's supply chain. Total damage cost combines both measures and is a useful measure of a company's overall environmental costs.
[11] This statistic was computed by taking a ratio of the weighted average carbon scope (tons) and damage costs ($) per unit of revenue of the tilted portfolio and the benchmark.

Figure 1: Value of $10M invested in the simulated S&P 500 Carbon tilted Portfolio vs. S&P 500 (Jan 2010 – Feb 2023)



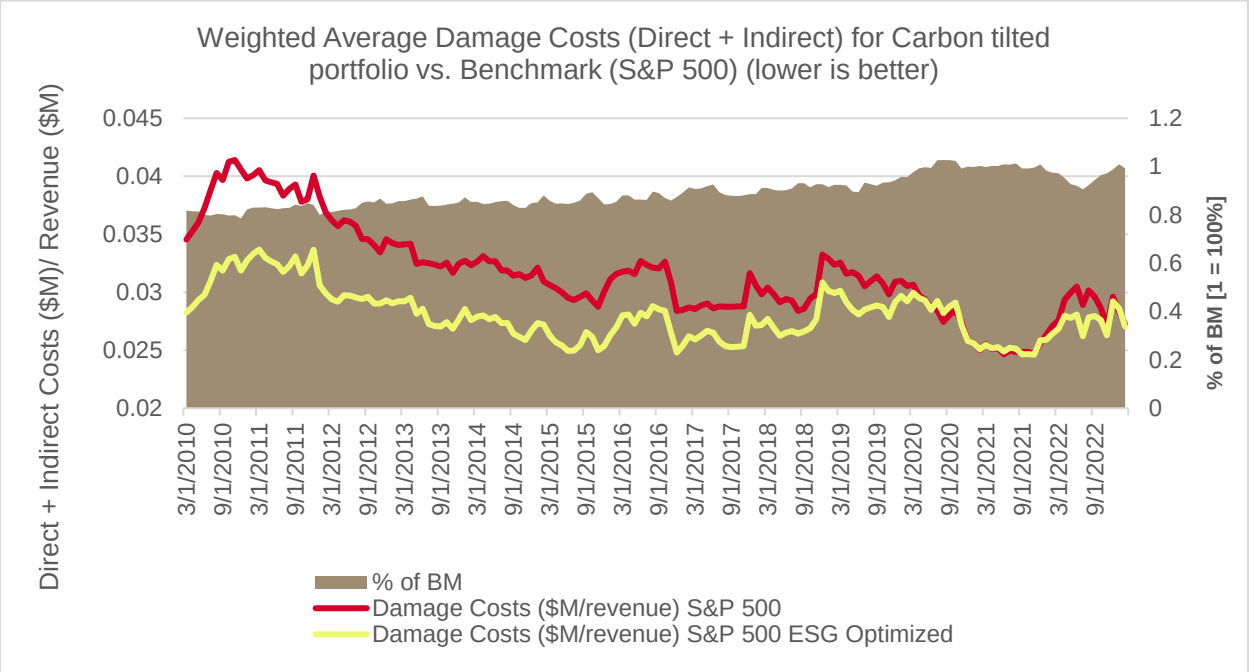
Source: ClariFI, S&P Global Market Intelligence. Indices are unmanaged, statistical composites and their returns do not include the payment of any sales charges or fees an investor would pay to purchase the securities they represent. It is not possible to invest directly in an index. Past performance is not a guarantee of future results.

Figure 2: Weighed Averaged (Carbon Scope 1 +2) for S&P 500 Carbon tilted portfolio vs. S&P 500 benchmark



Source: S&P Global Market Intelligence, Trucost, ClariFI as of 02/28/2023

Figure 3: Weighed Averaged Damage costs (Direct + Indirect) for S&P 500 Carbon tilted portfolio vs. S&P 500 benchmark



Source: S&P Global Market Intelligence, Trucost, ClariFI as of 02/28/2023

MSCI EAFE:

- The Carbon tilted MSCI EAFE portfolio maintained the underlying characteristics of the MSCI EAFE benchmark with a Sharpe Ratio of 0.372 compared to 0.334 for the benchmark and a realized tracking error of 1.32%.
- The total return of the Carbon tilted MSCI EAFE portfolio outperformed the benchmark over the same period, with a return of 68.84% vs. 60.2% for the benchmark, with an annualized turnover of the portfolio at 131.26%.
- The Carbon tilted MSCI EAFE portfolio had a significant reduction in carbon intensity and damage costs, 39.3% and 33.6% lower than its benchmark.

MSCI World:

- The Carbon tilted MSCI World portfolio maintained the underlying characteristics of the MSCI World benchmark with a Sharpe Ratio of 0.645 compared to 0.593 for the benchmark and a realized tracking error of 0.87%.
- The total return of the Carbon tilted MSCI World portfolio outperformed the benchmark over the same period, with a return of 148.95% vs. 131.88% for the benchmark, with an annualized turnover of the portfolio at 125.92%.
- The Carbon tilted MSCI World portfolio had a significant reduction in carbon intensity and damage costs, 35.2% and 29.2% lower than its benchmark.

Summary of Performance & Characteristics (Beta, Country, and Sector neutral)

Jan 2010 – Feb 2013	Benchmark	Sharpe Ratio	Sharpe Ratio (BM)	Total Return	Total Return (BM)	Excess Return	Tracking Error	Carbon Reduction	Direct + Indirect Cost Reduction
S&P 500 Tilted Portfolio	S&P 500	0.725	0.703	385.91%	364.32	21.59%	1.21%	30.4%	10.6%
MSCI EAFE Tilted Portfolio	MSCI EAFE	0.372	0.334	68.84%	60.24	8.6%	1.32%	39.3%	33.6%
MSCI World Tilted Portfolio	MSCI World	0.645	0.593	148.95%	131.88%	17.07%	0.87%	35.2%	29.2%

Source: S&P Global Market Intelligence, Trucost, ClariFI, MSCI, as of 02/28/2023

Conclusions

Utilizing S&P Global's ClariFI we demonstrated a non-exclusionary framework for creating and imposing a carbon reduction strategy on our benchmark replicating process. It is non-exclusionary as it does not exclude companies with lower/higher carbon profiles, but rather increases/reduces exposure in the portfolio to their holdings. One can construct low turnover and low tracking error portfolios with significantly lower carbon intensity and damage costs compared to the benchmark. The framework also enables the creation of higher ESG scoring portfolios with low to no drift from the benchmark's characteristics. This framework can be extended to use other ESG signals as an overlay to an existing factor portfolio or other portfolio construction and optimization strategies.

About Trucost ESG Data

S&P Global's Trucost data set provides robust and standardized environmental data on more than 15,000 listed companies. Trucost's data and analysis provides insights relating to climate change, water use, waste disposal, fossil fuel exposure, land, water & air pollution, and the over-exploitation of natural resources. Trucost also specializes in forward-looking datasets on transition risk, such as future carbon pricing scenarios and physical risk.

About ClariFI®

ClariFI® represents S&P Global Market Intelligence's advanced solution for a quantitative investment management workflow. Accessible as both a locally installed or hosted solution, ClariFI offers a full integration of S&P Global's Xpressfeed data, unlimited computational scalability, and a rich library of computational algorithms, allowing clients to:

- Integrate time-series and point-in-time data from multiple datasets
- Create derived data using a simple drag and drop user interface
- Run quantile analysis on multiple factors using the Factor Backtest module
- Fit and evaluate linear models to your derived data
- Reliably simulate and optimize complex trading strategies
- Perform mean variance optimization with real world constraints

About Capital IQ Risk Models

The risk model used for this analysis is the S&P Global Market Intelligence U.S short-term risk model, Global short-term risk models. All risk models are built using Point-In-Time (PIT) data sources and use style factors to better reflect the key building blocks typically used in alpha generation and portfolio construction. Apart from the U.S and a global risk model, other country/region risk models available include Canada, China A-share, Pan-Asia ex Japan and Pan-Europe.

Where to Discover More

- **Trucost Environmental Data**
- **Xpressfeed**
- **ClariFI**

References

Quantamental Research: The 'Trucost' of Climate Investing: Managing Climate Risk in Equity Portfolios
Balachander, B., Falk, R., Scherer, B., and Yen, B., 2010 "Introducing S&P Capital IQ's Fundamental U.S. Equity Risk Model", S&P Global Market Intelligence, Quantamental Research

Contact Us

Asia-Pacific
+852-2533-3565

Europe, Middle East & Africa
+44-207-176-1234

The Americas
+1 877 863 1306