



**Universität
Zürich^{UZH}**

**Applied Financial Analytics for Strategic
Decision and Value Creation**

UBS Portfolio Carbon Footprint

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1. Introduction

In the recent past, the growing concern for environmental sustainability and emphasis on responsible investment have significantly altered the course of financial strategies globally. Governments, institutions, and private investors have recognized the increasing urgency around the climate crisis and the need for better alignment of investment decisions with international commitments, such as the Paris Agreement. The Task Force on Climate-related Financial Disclosures underlines how the integration of climate metrics into business and financial strategies is critical for the transition to a low-carbon economy (TCFD, 2023). At the same time, initiatives like the Principles for Responsible Investment emphasize the key role of investors in encouraging companies to improve their environmental performance (PRI, 2019).

Fig. 1: ESG issues that investors can consider when investing responsibly



(Based on PRI, 2019)

This increasing attention to environmental, social, and governance (ESG) criteria is changing the landscape of investment. Investors are no longer satisfied with the pursuit of profit alone but see opportunities in sustainable strategies and therefore consider the environmental and social impact of their decisions. Companies that adopt low-carbon policies tend to be more resilient and better positioned to meet future challenges, offering opportunities for long-term growth.

In this context, our project aims to analyse the carbon footprint of an investment portfolio developed by UBS, focusing on the greenhouse gas emissions related to the constituent securities of the portfolio. Using a methodology that integrates Scope 1, Scope 2 and Scope 3 emissions data, the analysis offers a practical tool that allows investors to assess the direct and indirect contribution of the companies in the portfolio, providing a wide view of the environmental impact of these investment decisions. A distinctive aspect of this project is the comparison of the UBS portfolio's carbon footprint with that of some of the major global equity indices, including the S&P 500, Nikkei, DAX, MSCI World and MSCI Emerging Market. This approach not only positions the portfolio against sector benchmarks, but also identifies areas for improvement and opportunities for reallocation to lower-carbon assets.

Consequently, the objectives of the analysis are twofold: one is to provide a precise and clear picture of what environmental impact the UBS portfolio has, and second, to underpin strategic investment decisions in the transition to a low-carbon economy. Measuring and benchmarking emissions is a powerful tool for the alignment of the portfolio with sustainability objectives while reducing long-term climate risks.

This project is not limited to measuring emissions but also to provide practical support for the decision-making process of investors, as it helps them to spot where efforts should be made within their portfolios. It enables the user to run various alternative investment scenarios to evaluate what impact changes in different securities or sectors have on the overall carbon footprint and ESG goals. This tool also offers the opportunity to clearly and transparently communicate the effectiveness of sustainability strategies to stakeholders, building confidence in the decisions made.

2. Metrics and KPIs

2.1 Carbon Emission metrics

The inclusion of **Scope 1, Scope 2, and Scope 3** emissions, along with the total overall emissions in the dashboard, is aimed at providing a comprehensive assessment of the environmental impact of investments. Scope 1 emissions reflect the immediate impact of a company's operations, such as the combustion of fossil fuels in plants and company vehicles, offering critical insights into a company's direct contribution to climate change. In contrast, Scope 2 covers indirect emissions from the production of purchased energy, such as electricity or heat, highlighting companies' energy efficiency and procurement practices. Scope 3 includes all other indirect emissions along the entire value chain, from suppliers to transportation and the usage and recycling of products by consumers. Since Scope 3 often represents the largest portion of the carbon footprint, it is indispensable for a complete analysis. Aggregating these three categories provides a holistic view of a company's environmental impact, enabling consistent comparisons across different organizations.

The metric **Carbon Emissions Stock (M ton CO₂)** represents the total annual carbon emissions directly and indirectly attributed to a specific stock or company in the portfolio, expressed in millions of metric tons. In the dashboard, this metric is particularly useful for identifying the most significant contributors to the portfolio's carbon footprint, enabling investors to focus on companies that may need targeted sustainability efforts or even divestment due to high emissions.

The **Carbon Intensity Stock (KgCO₂e/\$)** measures how much carbon dioxide equivalent is emitted per dollar of market capitalization. It quantifies the environmental efficiency of a company in generating economic output. This metric allows for meaningful comparisons between companies, industries, or regions, highlighting those that are more carbon-efficient versus those that are lagging in sustainability performance. It helps pinpoint investments that align with environmental goals, making it valuable for ESG-driven decisions.

Total Carbon Emissions (th ton CO₂e) aggregates the carbon emissions for an individual asset, expressed in thousands of metric tons of CO₂ equivalent. This figure serves as a baseline for understanding the overall carbon footprint of the portfolio. It is essential for tracking how this footprint changes over time as companies adopt cleaner practices or as the portfolio is adjusted. It provides a comprehensive snapshot of the portfolio's environmental impact.

The **Carbon Footprint (Kg CO₂e/\$)** quantifies the amount of CO₂ equivalent emitted per dollar of the portfolio's total market value. By offering a ratio that accounts for both emissions and economic value, it enables investors to assess how carbon-heavy their investments are relative to their financial worth. This metric is particularly useful for benchmarking the portfolio against other indices, benchmarks, or other possible funds.

Finally, the **Total Carbon Emissions, Class Formula** represents an adjusted or aggregated measure of emissions based on portfolio weighting or classifications such as sector or region. It provides insights into which classes of investments (be it sectors like finance or energy, or geographical regions) contribute most to the portfolio's total emissions. This data is fundamental for targeted analysis and rebalancing strategies, allowing investors to align their portfolios with environmental priorities by reducing exposure to high emission categories.

2.2 Others relevant metrics

The **CPRS Main Sector** refers to the sector classification of each stock, using the Climate Policy Relevant Sectors (CPRS) taxonomy. This categorization identifies industries that are particularly significant in terms of climate policy and environmental impact, such as finance, energy, or transportation. Including this metric in the dashboard helps users analyze the portfolio's exposure to high-impact sectors and understand where emissions reductions can have the greatest impact.

The **Country** field specifies the geographic location of the company's headquarters. This information is essential for regional analysis, as emissions regulations, climate policies, and market conditions vary by country. The country metric allows users to assess geographic diversification and the implications of regional ESG policies on the portfolio.

Shares denotes the number of shares held in each stock by the portfolio. This is a fundamental investment as by tracking shares, users can evaluate their position size in relation to other holdings. The **Share in Stock** metric calculates the proportion of the company's total shares that the portfolio owns. This provides a sense of the portfolio's influence or stake in the company. **Market Cap** represents the total market value of a company, calculated as the stock price multiplied by the total number of outstanding shares. Market cap gives users an idea of the size of the companies in the portfolio and provides context for their emissions. Larger companies might have higher absolute emissions but could also have more resources to implement sustainable practices.

Holdings reflects the monetary value of the portfolio's investment in a specific stock, derived from the number of shares multiplied by the stock price. This metric is important for understanding the portfolio's financial exposure to individual companies. The **Weight of Stock in Portfolio** shows the proportion of the portfolio's total value that is invested in a specific stock. It is expressed as a percentage and helps to identify the most significant contributors to the portfolio's financial and emissions performance. Lastly, the **Total Portfolio Value** represents the aggregated monetary value of all investments in the portfolio. It serves as the denominator for calculating portfolio-level metrics such as carbon intensity and emissions per dollar. Monitoring this value over time allows users to assess growth, track capital allocation changes, and contextualize other metrics in the dashboard.

2.3 Data Timeframe

The analysis encompasses the period from 2019 to 2023, offering a comprehensive overview of corporate emissions and sustainability trends. This timeframe captures the transformative period during which companies established comprehensive greenhouse gas emissions inventories and formalised their ESG reporting practices. This period also coincides with a series of crucial regulatory developments, including the enactment of the Corporate Sustainability Reporting Directive (CSRD) in 2023, which significantly enhanced transparency requirements (European Commission, 2024).

The selected timeframe reflects the evolution of corporate climate commitments, with a notable increase in the number of science-based targets and net-zero goals. By 2023, the reporting of scope 3 emissions had become increasingly mandatory, with a report from the CDP indicating that these indirect emissions frequently exceed direct operational emissions by up to 11 times (CDP, 2021).

3. Charts and tabs description (e.g. in a navigator menu page)

The dashboard offers multiple perspectives to explore and analyse emissions, financial metrics, and geographic distribution.

The **Treemap** offers a clear view of the net carbon emissions (combining Scope 1, 2, and 3) associated with the portfolio, sorted by sector. Each sector is represented by a block, with individual companies nested within. The size of each block corresponds to the level of emissions, allowing users to immediately identify the most carbon-intensive sectors or companies. Color coding makes it easier to distinguish between sectors, enabling quick comparisons. This visualization highlights sectors like "fossil fuels" or "transportation" as major contributors, guiding users to prioritize areas for action or further analysis.

At the top of the dashboard, the **Cards** provide a summary of the portfolio's key metrics. These include the total market capitalization of all stocks, the cumulative value of portfolio holdings, the net emissions across all three scopes, and the carbon intensity (or carbon footprint), measured as KgCO₂e per dollar.

The **Emissions Graph** combines stacked columns and a line chart to track the evolution of emissions and carbon intensity over time, spanning the years 2018 to 2023. The stacked columns break down total emissions into Scope 1, Scope 2, and Scope 3 components, while the line chart represents carbon intensity. This dual perspective demonstrates how emissions have increased alongside the portfolio's growth but at a disproportionately lower rate, particularly between 2018 and 2020, reflecting improved carbon efficiency. The graph emphasizes the significant progress made in reducing carbon intensity, even as the portfolio expanded.

The **table of stocks** provides detailed information at the stock level, including the name of each company, its sector, and its carbon intensity. This interactive table allows users to sort and filter data, enabling easy comparison of carbon efficiency across different companies. By examining individual stocks, users can pinpoint high-carbon-intensity holdings that may warrant closer evaluation or divestment.

The **geographic map** adds another dimension to the analysis, visualizing the global distribution of the portfolio's holdings and the associated emissions. Countries are shaded based on the total emissions of portfolio holdings located within their borders. Hovering over a country provides additional details, such as the total emissions and investment value, allowing users to identify regional hotspots of carbon intensity and tailor strategies for specific areas.

The **scatter chart** focuses on the relationship between market capitalization and carbon intensity, with bubble size reflecting the weight of each stock in the portfolio. This chart is particularly useful for identifying stocks that are both carbon-inefficient and heavily weighted, helping users prioritize these for potential action. The visualization highlights stocks with high market capitalization and low carbon intensity as desirable, while those with high carbon intensity and significant weight become immediate candidates for further scrutiny.

Finally, the **slicers for year and sector** provide an interactive filtering capability that enhances the usability of the dashboard. The year slicer allows users to explore trends for specific years or compare data across multiple years, while the sector slicer enables sector-specific analyses. These tools make it easy to tailor the data views to align with specific questions or objectives, such as evaluating the performance of a particular sector or tracking emissions over time.

4. Summary of key findings, highlights

The dashboard analysis highlights several important insights into the portfolio's carbon footprint, financial performance, and progress toward sustainability goals. One of the most notable findings is the significant reduction in carbon intensity (KgCO₂e/\$) observed over the analysis period from 2018 to 2023. Despite an increase in total emissions, driven by the portfolio's growth, the carbon intensity dropped markedly between 2018 and 2020. This trend demonstrates that while the portfolio expanded in market capitalization, the

associated emissions rose at a disproportionately lower rate, reflecting improved carbon efficiency and alignment with environmental objectives.

A closer look at sectoral emissions reveals that industries such as fossil fuels and transportation contribute disproportionately to the portfolio's overall carbon footprint. These sectors dominate the Scope 1, 2, and 3 emissions, particularly through significant value-chain (Scope 3) contributions. On the other hand, sectors like finance and technology have a minimal impact on emissions, presenting potential areas for increased investment to support sustainability goals.

The geographic distribution of emissions presents another layer of insight. The emissions are concentrated in specific regions, notably North America and Asia, which house a significant number of high-emission companies. This geographic concentration underscores the importance of regional strategies, whether through engaging with companies in these areas to adopt cleaner practices or reallocating investments toward regions with greener portfolios. The map also highlights regions with lower overall emissions, offering opportunities to increase exposure to environmentally friendly investments.

At the individual stock level, the dashboard uncovers several holdings with both high carbon intensity and significant weight within the portfolio. These stocks represent strategic opportunities for reducing the portfolio's overall footprint. By prioritizing actions such as divestment, reallocation, or engaging with these companies, investors can achieve meaningful reductions in emissions. Conversely, the data also reveals companies with strong market capitalization and low carbon intensity, indicating promising opportunities for growth while maintaining environmental responsibility.

The emissions graph suggests notable improvements in carbon efficiency, particularly between 2018 and 2020, however, recent trends indicate a slower pace of improvement. This signals a need for renewed focus on decarbonization strategies to keep pace with long-term sustainability goals. Given the dominance of Scope 3 emissions across the portfolio, particular emphasis should be placed on addressing value-chain emissions. These are often the most challenging to manage but also represent the largest potential for impactful change.

The analysis also points to the portfolio's heavy reliance on high-emission sectors, such as energy-intensive industries and utilities, which poses a challenge for aligning with environmental, social, and governance (ESG) goals. However, this reliance also presents an opportunity for meaningful impact through strategic shifts in investment. The dashboard underscores the importance of sectoral and regional diversification, which offers a pathway to balance financial returns with environmental impact.

5. Example of a Use Case: Aligning UBS's Portfolio with a Hypothetical EU Directive on Carbon Intensity

In response to a fictitious EU directive stating that portfolios of public European companies must not exceed a carbon intensity of 0.03 kg CO₂/\$ of market capitalization, UBS seeks a data-driven solution to ensure compliance while aligning with its broader sustainability objectives.

The Power BI dashboard serves as UBS's primary tool to address the requirements of the fictitious EU directive. By leveraging this tool, UBS can measure its portfolio's carbon intensity across Scope 1, Scope 2, and Scope 3 emissions, ensuring compliance while aligning with others sustainability goals. The dashboard enables investors and analysts to compare portfolio performance against the directive threshold and industry benchmarks, identify high-carbon-intensity holdings, propose rebalancing strategies, and visualize trends. It also allows for the simulation of potential investment decisions to understand their impact on the overall carbon intensity of the portfolio.

The workflow begins with an initial overview of the portfolio. The dashboard provides a high-level summary of total emissions, breaking them down by Scopes 1, 2, and 3. This overview includes visualizations such as a line chart or gauge to compare the "Portfolio Carbon Intensity" metric with the EU directive threshold of 0.03 kg CO₂/\$ of market capitalization. To further enhance analysis, a heatmap identifies sectors and companies contributing most to the portfolio's carbon intensity, offering immediate insight into critical areas for intervention.

Analysts can then drill down into specific data using filters to focus exclusively on European equities, ensuring alignment with the directive's jurisdictional scope. By sorting data by carbon intensity, they can select companies exceeding acceptable levels. A sectoral breakdown provides additional insights into industries like energy, materials, and utilities that contribute disproportionately to the portfolio's carbon footprint. For example, sector analysis might show that the energy sector accounts for a significant share of the portfolio's emissions despite a smaller contribution to its market capitalization. This disproportionate impact suggests a priority area for rebalancing. The dashboard also identifies outliers and optimization opportunities by employing scatter plots of carbon intensity versus market capitalization. This analysis highlights stocks with high emissions relative to their financial performance. Simulations allow analysts to explore how replacing high-emission stocks with low-carbon alternatives can reduce the portfolio's overall carbon intensity, making it a powerful tool for strategic rebalancing. In addition, benchmarking analysis positions the UBS portfolio against global peers, showing moderate performance compared to indices like the MSCI World and MSCI Emerging Markets.

To monitor progress, time-series graphs illustrate reductions in carbon intensity over the past five years, from 2019 to 2023. These visualizations help UBS track its alignment with sustainability goals. Supposing dynamic

KPIs that can display the portfolio's current status in real-time, indicating whether it is compliant with the EU directive, managers can ensure transparency and accountability as UBS manages its investments. Also, the dashboard facilitates reporting and decision-making by enabling stakeholders to generate comprehensive reports for internal review or regulatory submissions. "What-if" scenarios allow decision-makers to simulate the impacts of divestment from specific sectors or reinvestment in low-carbon initiatives, empowering UBS to forecast outcomes using predictive analytics.

The benefits of this data-driven approach are substantial. The dashboard enables UBS to enhance compliance through real-time monitoring and alerts, ensuring alignment with the EU directive. It provides insights that allow UBS to make informed investment decisions, balancing financial returns and environmental impact. By demonstrating a commitment to reducing carbon intensity, UBS positions itself as a leader in sustainable investing, strengthening its reputation and competitive edge in the market.

6. Assumptions, Limitations and Disclaimer

6.1 Choice of the metric 'CO₂ Equivalent Emissions'

For the analysis of the portfolio's carbon footprint, we chose to use the 'CO₂ Equivalent Emissions' metric available in the Refinitiv Eikon screener. This metric represents total greenhouse gas (GHG) emissions expressed in terms of tonnes of CO₂ equivalent (tCO₂e). This approach aligns with international standards such as the Greenhouse Gas Protocol (GHG Protocol), which sets globally recognized guidelines for emission measurements. The aggregate value includes emissions of several GHGs, such as:

- Carbon dioxide (CO₂),
- Methane (CH₄),
- Nitrous oxide (N₂O),
- Fluorinated gases (e.g. HFC, PFC, SF₆).

To obtain this standardised and comparable measure, the different greenhouse gases are converted to CO₂ equivalents using their Global Warming Potential (GWP, 2024).

Within the Refinitiv Eikon screener, there are different possibilities regarding Scopes 1, 2, and 3. Among these options, in addition to CO₂ Equivalent Emissions, more specific metrics are available, such as CO₂ emissions alone or emissions of individual gases such as CH₄, N₂O or fluorinated gases. Every alternative has an advantage in specific sectorial contexts, while the analysis of the overall impact is limited. For example, CO₂ emissions take into account only carbon dioxide, excluding those gases with high warming potential, like methane or nitrous oxide. On the other hand, measurement of every single gas, like CH₄ or N₂O, is useful in the framework of a sector like agriculture or industry where methane or fluorinated gases are more significant, but still, this doesn't give the total view of the emissions.

The decision to use the aggregated metric “CO₂ Equivalent Emissions” was driven by several factors. Firstly, this metric is an aggregate measure that standardizes the impact of total emissions; therefore, comparability across companies, sectors, and benchmarks is easier. The CO₂ equivalent is globally recognized and, making it a good tool to track and communicate progress toward climate-related goals such as those of the Paris Agreement. The Aggregation would prevent sector-specific distortions when considering a diversified portfolio of companies coming from different sectors and even geographical areas, such as the one of UBS. Also, at a portfolio level, the choice simplifies the analysis by considering overall effect and not single components of the emissions.

In this context, it is assumed that the data provided by Refinitiv Eikon for “CO₂ Equivalent Emissions” are computed according to standardised and updated methodologies. The chosen metric is also considered to be appropriate for portfolio-level analysis, given the focus of understanding the overall environmental impact rather than details for each greenhouse gas. However, it is important to emphasise that the quality of the data depends on the reporting provided by the companies. Especially, the accuracy of Scope 3 estimates can vary significantly between companies, introducing a potential source of inaccuracy in our results.

6.2 Choice of Reference Indices

The choice of reference indices to analyze is guided by the objective of the study, which is to offer a comprehensive, diversified, and meaningful representation of carbon emissions in the world's major financial markets. The considered indices include: S&P500, Nikkei 225, DAX, MSCI World, and MSCI Emerging Markets. This choice reflects a strategic combination of geographical, sectoral, and economic development perspectives that guarantee balanced and representative coverage.

S&P

500

The S&P 500 index has been included as representative of the US market, one of the largest and most influential globally. Comprising the 500 largest capitalization companies in the US, it represents a broad range of economic sectors and is a key benchmark for assessing the performance of companies in one of the most industrialized and rapidly developing regions in terms of ESG initiatives.

Nikkei 225

The Nikkei 225 represents the Japanese market, which is one of the main economic players in Asia, among the first in the ranking of technology, manufacturing, and environmental innovation. Inclusion of this index will give an insight into the sustainability strategies of a highly industrialized, culturally unique market.

DAX 40

For this project, continental Europe is represented by the DAX index, composed of the 40 largest listed companies in Germany. Being one of the world leaders in environmental policies and technological innovation, the inclusion of Germany allows for an assessment of the emissions by European companies, which operate under one of the most binding regulatory environments in terms of sustainability.

MSCI World

The MSCI World was selected to provide a broad perspective on companies in the developed markets. This index offers diversified and comprehensive benchmarking to analyse the issues of companies operating in developed economies and highly competitive sectors, comprising securities from over 23 countries.

MSCI Emerging Markets

Complementing this perspective of developed markets, the paper has also added the MSCI Emerging Markets Index, which represents major companies from developing economies. This index provide an analysis of the contribution of emerging economies to the global carbon footprint, in a context of rapid economic growth and energy transition.

The choice of these five indices ensures an analysis that:

1. **Reflects Geographic Diversity:** Covering North America, Europe, Asia, and Emerging Markets, the selected indices offer a global and inclusive view.
2. **Considers Economic Relevance:** Consider the use of indices that best represent the leading companies in their markets and are representative of global economic activity.
3. **Encourages Comparison between Sectors:** Since the indices are an indicative representation of a broad variance of sector representation, the nature for specific trends can be developed and issues compared across applicable industries.
4. **Supports Benchmarking:** The combination of developed and emerging indices provides a balanced benchmark for analysing the contribution of each market and sector to global sustainability goals.

6.3 Update and Completeness of Data

For the analysis presented in the dashboard, there is a general assumption that all information provided through Refinitiv Eikon was timely, comprehensive, and accurate at the date of extraction. Due to its quality and reliability, Refinitiv Eikon is an internationally recognised online platform for financial and ESG data, thus an authoritative source for benchmarking and evaluating corporate sustainability performance. However, any discrepancies, gaps or delays in collecting and updating the original data could affect the accuracy of the analyses and results displayed in the dashboard.

6.4 Disclaimer

The analysis presented and the data displayed in the dashboard are based on the information available at the time of extraction from the Refinitiv Eikon databases. Although every effort has been made to ensure the accuracy and consistency of the data, there are some potential limitations of which users should be aware:

1. **Quality and Completeness of Original Data:** ESG data provided by companies and aggregated by Refinitiv Eikon may have discrepancies due to inconsistent reporting methodologies, gaps in company reports, or errors in information collection.

2. **Delays in Updating Data:** As company releases are often published later than the relevant fiscal year, some information may not reflect the current state of company releases.
3. **Timeframe:** The data included covers the period 2019-2023. However, updates after the extraction date may not be incorporated into the dashboard. Furthermore, for an analysis based on historical trends, it is suggested to also take into account data prior to the period analysed in the Dashboard.
4. **Interpolation Missing Data:** Companies without sufficient information on Scope 1, Scope 2, or Scope 3 emissions were estimated using a formula that measures a linear average through missing data points.
5. **Limitation for valuation:** The dashboard is an add-on module designed to analyze the carbon footprint of UBS's investment portfolio, focusing on sustainability metrics such as carbon intensity and emissions contributions. It is not intended to include financial performance or valuation metrics, as these are managed through UBS's primary financial platforms. Its purpose is to support sustainability objectives, not to serve as a standalone financial analysis tool.
6. **Representativeness:** The chosen indices (S&P 500, Nikkei, DAX, MSCI World, MSCI Emerging Markets) provide a broad but not exhaustive view of global companies. The analysis may not be representative of all sectors or geographic regions.

Users are encouraged to consider these caveats when interpreting the results and using the dashboard for decision-making purposes.

7. Description of data sources used and timestamp

7.1 Introduction to Refinitiv Eikon

Refinitiv Eikon is one of the leading global platforms in providing financial, market, and ESG data. Known for its reliability and wide coverage, Eikon gives comprehensive and organized access to corporate information, including official data, independent analysis, and industry insights. The platform is particularly valued for the quality and consistency of its ESG data, crucial for monitoring companies' environmental impacts and evaluating their performance related to sustainability.

7.2 Collection and Standardisation of ESG Data

ESG data collected by Refinitiv Eikon comes from a combination of primary and secondary sources:

- **Corporate Sustainability Reports:** Official documents published by companies, including detailed information on Scope 1, Scope 2 and Scope 3 emissions, as well as governance indicators and social impacts.
- **Annual Reports:** Annual reports and corporate statements often include sections regarding environmental management and sustainability.

- **Regulated Information:** In some jurisdictions, companies are obliged to disclose ESG data as part of their financial reporting.
- **Independent Sources:** Refinitiv Eikon adds its independent judgments and industry comparisons to official information to provide superior consistency and reliability for the data.

Refinitiv follows a rigorous standardization process in order to make the data from different sources comparable and usable for cross-sectional analysis. This is particularly important in the case of Scope 3 emissions, where there is often large variation between companies in the calculation method.

7.3 Data extraction

Data for reference indices were extracted using the advanced screening function of Refinitiv Eikon, a flexible and powerful tool with several filters that can select and filter financial and ESG data based on user-defined criteria, hence ensuring that the output is targeted and precise. The data output was then downloaded to an Excel file to be further post-processed and for the creation of the dashboard in Power BI. Each downloaded file was then run through manual quality checks to validate:

- **Data Consistency:** Ensure that there are no duplicated or inconsistent values (e.g., negative values).
- **Uniform Formatting:** Standardize units and names used to prevent inconsistencies in further calculations.
- **Temporal Completeness:** Verify that data for all reference years (2019-2023) are included.
- **Compatibility:** Ensure that exported files align with the standard formats used for subsequent processing and analysis.

The dataset for the UBS portfolio was provided by a professor from another course, who extracted the information from Refinitiv Eikon.

7.4 Timestamp of extraction

Excel files with ESG and financial metrics regarding references index were extracted on 9 November 2024, specifically:

- DAX 40: 09.11.2024, 18:08 CET
- MSCI EM: 09.11.2024, 18:12 CET
- MSCI World: 09.11.2024 18:09 CET
- Nikkei 225: 09.11.2024, 18:05 CET
- S&P 500: 09.11.2024, 18:04 CET
- UBS Portfolio: 22.02.2024, 14:41 CET

8. Filters or adjustments made to the data

The adjustments we made to the data were essential for ensuring consistency, alignment, and relevance across the datasets used in the analysis. To begin, missing values were addressed using interpolation techniques. For companies with insufficient information on Scope 1, Scope 2, or Scope 3 emissions, missing data points were estimated using a linear interpolation formula, which calculates an average based on the available data before and after the gaps. This approach ensured continuity and consistency across the dataset while minimizing the impact of missing information on the overall analysis."

Additionally, derived metrics were calculated to provide deeper insights. This included carbon intensity, expressed as CO₂e emissions per unit of market capitalization, and carbon footprint, calculated based on CO₂e emissions per dollar of portfolio holdings. These derived metrics required aggregation of emissions across scopes to create meaningful summary statistics.

To enhance the analysis and provide actionable insights, several derived metrics were calculated:

- **Carbon Intensity:** Defined as Total CO₂e Emissions \ Market Capitalization. This metric normalizes emissions relative to the size of the company.
- **Carbon Footprint:** Calculated as Total CO₂e Emissions \ Portfolio Holding Value. This reflects the environmental impact per dollar invested.
- **Aggregate Emissions:** Total emissions across Scope 1, Scope 2, and Scope 3 were computed for each instrument and benchmark to provide a complete view of emissions impact.

To refine the analysis, the classification of stocks into sectors was standardized using CPRS classifications, enabling coherent sectoral benchmarking and comparisons.

Lastly, the datasets underwent transformations to ensure compatibility with Power BI visualization requirements. This included pivoting or transposing data where necessary, for example, the data was restructured to enhance usability and analysis by transposing figures based on years from a horizontal to a vertical format. Moreover, the format of numeric fields, such as emissions and weights, was standardized for clarity and uniformity in presentation. These adjustments collectively ensured that the datasets were not only consistent and aligned but also optimized for meaningful analysis and reporting.

To prepare the datasets for visualization in Power BI, several transformations were performed:

- Data were transposed or pivoted where necessary to align with the requirements of visualizations, such as aggregations by year or sector.
- Numeric fields were formatted uniformly to ensure consistent representation across dashboards (e.g., tons of CO₂, kilograms per dollar of investment).

- Units were standardized (e.g., converting emissions data to a consistent unit like tons or kilograms of CO₂e).

9. Default filtering settings

Default filtering settings are critical for presenting meaningful and actionable data while ensuring consistency with the intended scope of the analysis. Based on the dataset, the following filtering defaults are inferred:

1. Temporal Scope:

- Data is filtered to include only records within the time frame of **2019 to 2023**. This ensures that all metrics align with the period of analysis.

2. Sectoral Focus:

- Stocks are categorized by the "CPRS Main Sector" field, enabling filtering by sectors of interest. For example, the finance sector ("7-finance") can be selected to focus on specific industry contributions to emissions and portfolio performance.

3. Geographical Relevance:

- The "Country" field provides geographical information. Filters may default to including all countries or specific regions based on user preferences or portfolio mandates.

4. Carbon Emissions Metrics:

- By default, instruments are included if they have non-zero values for total carbon emissions (Scope 1, Scope 2, and Scope 3).

5. Portfolio Holdings:

- Filters default to excluding instruments with negligible holdings or weights. For example, instruments with a "Weight of stock in ptf" below a certain threshold (e.g., 0.01%) might be excluded to focus on impactful assets.

6. Market Capitalization:

- Default filters may prioritize stocks with significant market capitalizations. A minimum threshold (e.g., \$1 billion) could be applied to ensure data reflects substantial contributors.

7. Derived Metrics:

- Metrics such as "Carbon Intensity Stock (KgCO₂e/\$)" and "Carbon Footprint (Kg CO₂e/\$)" could have thresholds applied to highlight assets with above-average environmental impacts relative to financial performance.

These settings ensure a balanced approach, focusing on relevance and usability while allowing flexibility for users to refine filters based on specific needs.

10. Contact person

For any questions, technical support, or maintenance needs related to the Power BI dashboard, please contact:

Name: Alfred Kaiser

Academics: Banking and Finance

Organization: University of Zurich

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Phone: +41 79 170 05 86

Availability: Monday to Friday, 9:00 AM to 5:00 PM CET

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