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Statistics 436

Project Milestone 3, Group 10: ESG Insights

December 16th, 2024

**Introduction**

ESG investing is a sector of financial investment that emphasizes the importance of investing in companies that are not only financially successful, but also have strong equitability and sustainability practices. ESG stands for Environmental, Social and Governance, and there is a numerical score and letter grade assigned to a company for each of these categories. We hope to be informative to those who already cherish the practice, as well as convincing to others that financial investment is most successful when both the investor and those impacted by the company win.

We sourced our data from Kaggle, specifically the data sets: Corporate Environmental Impact which contains sustainability metrics for over 2,500 corporations, as well as Public Company ESG Ratings which contains official ESG scores for 722 publicly traded companies. The former focuses on three monetarily based compositions of economic impact as well as eight more columns of "safeguard subjects," which are ratings related to a certain sector of sustainability. The latter contains sustainability ratings of A, B, BB, and BBB, as well as 0-1000 scores for all sectors of ESG.

Our goal in this project was to design a Shiny app in R with multiple interactable and

customizable visualizations that make understanding and comparing ESG ratings between companies more intuitive for anyone. We designed visualizations that can both directly compare any two chosen companies, as well as delve further into industry metrics, contextualizing and comparing scores more broadly.

**Literature Review**

Our motivation behind this project–to encourage and support sustainable investing–is a somewhat controversial topic in the financial sector; therefore, an important first step in literature review is understanding the real-world efficacy of ESG investing. "*Does ESG Impact Really Enhance Portfolio Profitability?"* analyzes a Mean-Variance-ESG optimization model for portfolio selection. Cesarone, Martino and Carleo report that including ESG analysis during investment selection can improve portfolio performance (in the US market).

Similarly, in "*The use of Visual Presentations for Integrated Reports in the Investment Decision-Making Process"*, Widyatama and Narsa found that integrated financial reporting that uses visualizations to convey non-financial metrics makes the investment decision process easier for non-professional investors, and also that investors are more likely to choose a company which reports on non-financial aspects of their business (such as ESG).

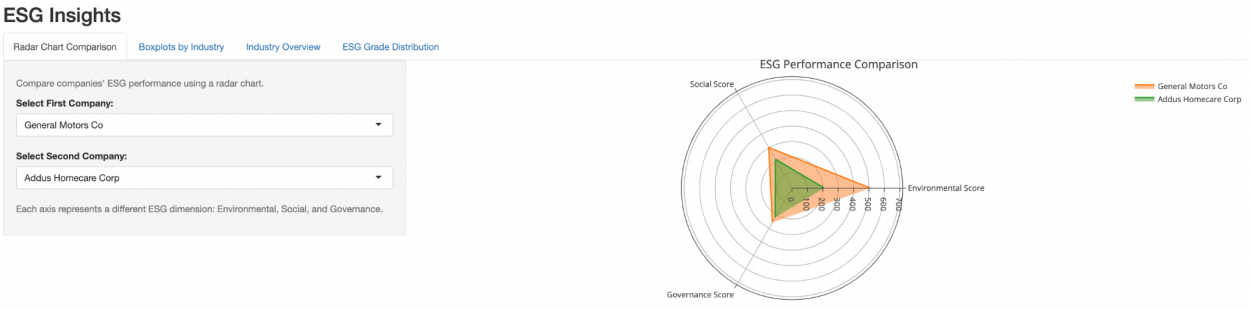
*"A Survey on Visual Analysis Approaches for Financial Data"* details how variations in data sources and structure can influence the following visualizations. According to the authors, the most prevalent financial data visualizations are those belonging to the family of standard charts; however, they argue that these plots (pie, bar, line) are not always appropriate for higher

dimensional data (such as ours), instead offering 3D alternatives. Furthermore, a method to balance visual clutter and information density is multi-view visualizations. In our project, we implemented a multi-view tab ('Industry Overview') along with filtering options on most of our visualizations for user control over data density. Overall, this article guided our visualization design by outlining accepted methods and how investors utilize each kind of visualization.

## Interface Design

We wanted to make our interface consistent and intuitive, so that users would never struggle to produce graphs to answer their comparative questions. Using Shinyapps.io, we published a website with 4 distinct visualization tools, navigable by four uniform and modular tabs. Each tab has the same basic structure, a grey sidebar on the left with customizability options and directions on how to interpret results. The visualization itself occupies the rest of the page, allowing for readability. This design leaves no uncertainty for users and promotes seamless transitions between each plot.

## Radar Chart Comparison

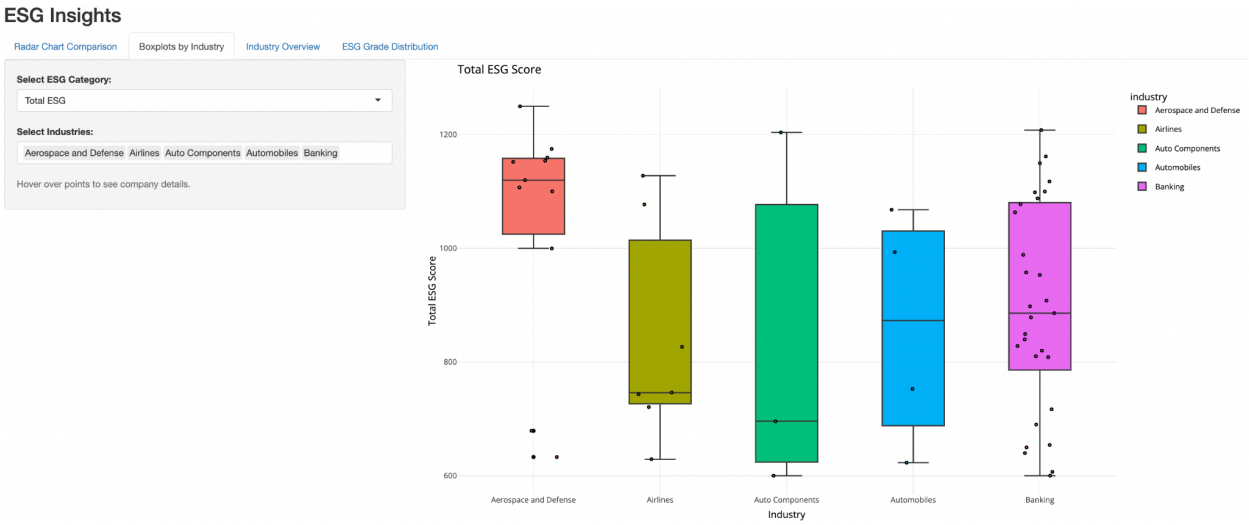



The ESG radar chart is designed to give users a simple way to visually compare the ESG scores of two companies. Using drop-down menus, users can select any two companies from the public

companies' ESG ratings dataset to display on the chart. The selected companies are represented by contrasting triangle overlays, making it easy to compare their ESG performance at a glance. By observing the triangles, users can quickly identify which company performs better in each of the three ESG metrics, as well as see the overall extent of their performance differences based on the size and shape of the triangles. For added clarity, the graph also allows users to zoom in for a closer look.

The simplicity of the graph makes it both easy to use and not overwhelming for new users. While its functionality is somewhat limited due to its simple design, it offers a wide range of practical applications for both new and experienced users. New users exploring ESG can use it to compare companies they are unfamiliar with, while more experienced users may leverage it to evaluate ESG scores against companies they are already invested in. Overall, this visualization is a good starting point for comparing company ESG scores, providing users with a clear and accessible way to analyze and contrast public company ESG performance. It can be used as a starting point for deeper analysis, helping users identify trends, strengths, and areas for improvement within specific companies.

## Boxplots by Industry

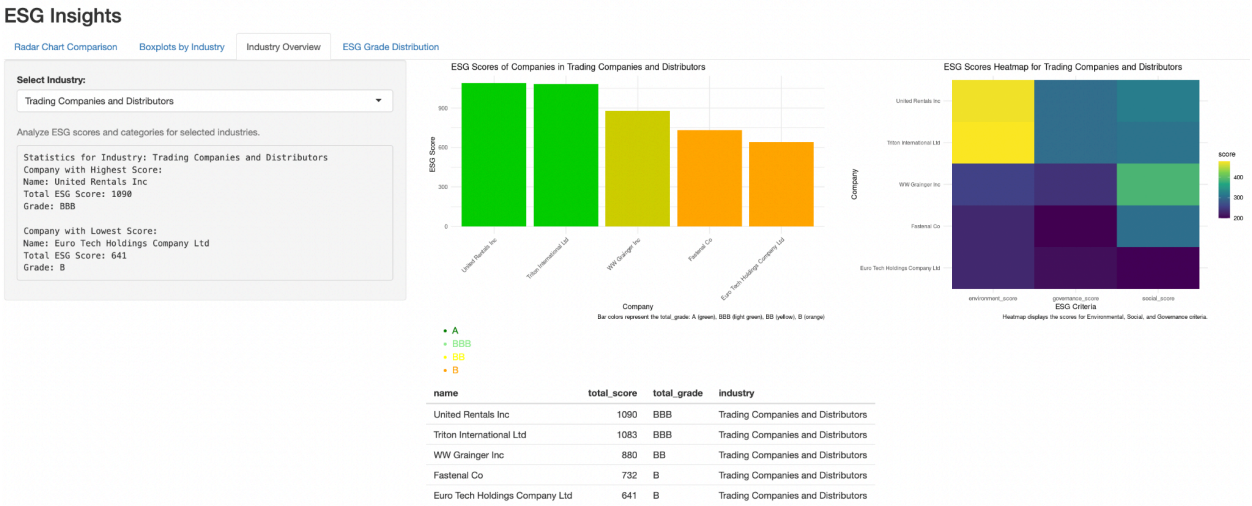



The overlaid radar chart provides the best head to head comparison between two companies, but we wanted to go beyond this and provide more context to the environments that companies are operating in. By categorizing each company by its industry, and comparing multiple industries across the x-axis, a user can better contextualize how a company performs within their industry, and how different industries tend to perform compared to each other.

This visualization is fully customizable, allowing users to select what type of scores they want to see: Environmental, Social, Governance, or the aggregated total ESG scores. Additionally, a user can search for, or select from a dropdown, any number of the 46 different industry sectors to include on the graph. Comparison is made easy because all data is measured by the y-axis, leaving no confusion between which industries/companies outperform each other. Hovering over one of the jittered points will show a user which company is being represented as well as their exact score, allowing investors to illuminate outliers and other interesting data points. Plotly interactions also add an extra layer to the customizability, allowing a user to zoom, pan or select a subsection of the graph to view full screen.

The simplicity but free customizability of the plot means that an expert ESG investor can search for an exact answer to any question, without making the tool too complicated for any regular person to use.

## Industry Overview




The Industry Overview visualization combines bar plots and heatmaps to provide a detailed analysis of ESG scores across companies in a selected industry.

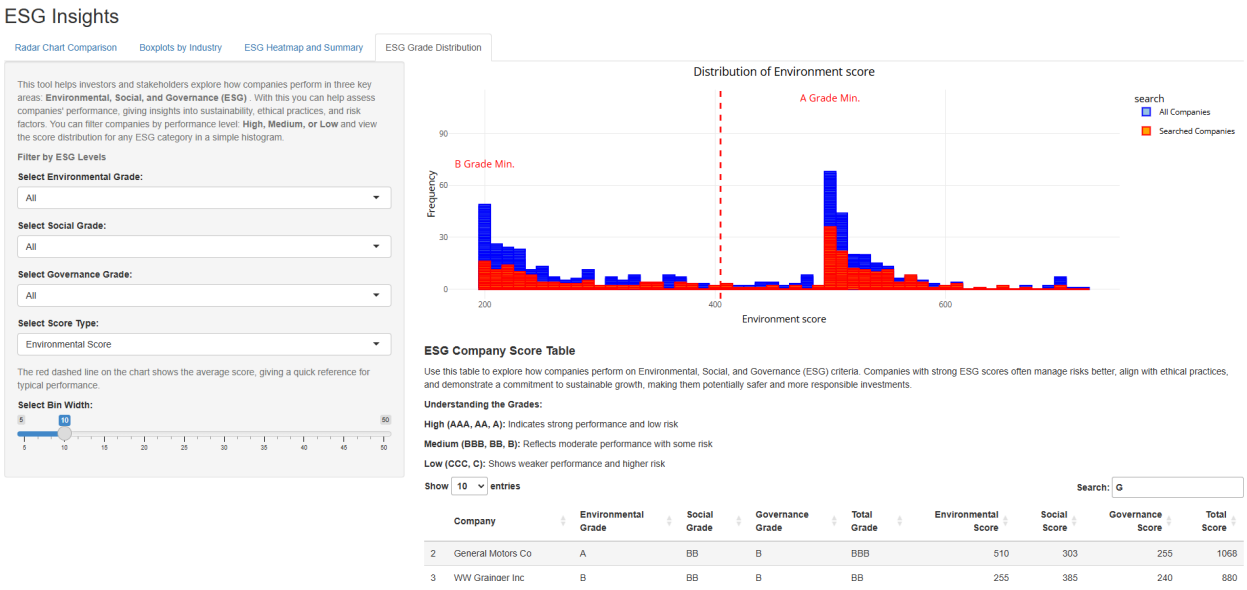
Firstly, the bar plot allows users to compare ESG scores of companies within an industry at a glance. It uses intuitive color-coding based on letter grades (A, BBB, BB, B) to distinguish between performances within industries.

The heatmap offers a deeper dive into ESG components: environmental, social, and governance scores by visualizing the performance of each company across these categories. Companies are ordered by total ESG scores for better readability and pattern recognition. This detailed

breakdown caters to experienced investors seeking more detailed insights into specific ESG factors.

The interactive element is a dropdown menu that enables users to filter visualizations by industry. Additionally, the summary statistics section highlights the highest and lowest ESG scores within the selected industry. Further, a comparison table is included allowing users to compare exact scores and grades across companies.

## ESG Grade Distribution




The ESG grade distribution interface was developed to help potential investors explore ESG performance across sectors, while offering them both high-level insights and a detailed analysis of companies. Users can filter by grades (High, Medium, Low) for each ESG sector, select a specific score type, and adjust the granularity of score distributions using the bin width slider to discover insights about potential investments. The search bar in the data table connects search queries to the histogram, visually highlighting specific companies searched. Key features include

annotations for threshold scores such as the B grade minimum (200) and the A grade minimum (500). The red dashed line also indicates the average score of the data presented, offering benchmarks for quick performance evaluation. These features make the dashboard an intuitive and tailored view for diverse investor needs, whether for broad trends or focused interests.

This dashboard reveals significant clustering near the key grade thresholds, especially for a B grade minimum (200) and an A grade minimum (500), highlighting how companies often target these benchmarks. Grades provide a quick performance overview, while selecting a specific sector score can offer deeper insight into company achievements and gaps. The integration of the filters, search functionality, and adjustable bin widths allows any kind of user to seamlessly analyze patterns, compare companies and assess ESG performance comprehensively. With this design, we bridge the gap between abstract ESG concepts and actionable insights, empowering any user to make informed decisions based on the accessible and visually clear data provided.

**Conclusion**

Our Shiny app provides an intuitive and powerful platform for analyzing ESG ratings, making complex sustainability data accessible and actionable for users of all experience levels. By offering a suite of interactive visualizations (such as radar charts for direct company comparisons, industry-specific boxplots, and grade distributions) our tool simplifies the process of evaluating environmental, social, and governance performance. Users can uncover meaningful insights, identify trends, and make well-informed investment decisions with ease.

The design of our app is rooted in user-centered principles, ensuring both clarity and depth. Each feature, including customizable filters, search functionality, and zooming capabilities, allows users to navigate the data in a way that meets their individual needs. The radar chart enables quick, visual comparisons between two companies, highlighting performance differences across ESG categories. Industry-specific boxplots provide further context by allowing users to examine how companies perform relative to their industry peers and across sectors, while the grade distribution histogram offers insights into score clustering and benchmarks. Together, these tools help users identify strengths, weaknesses, and areas for improvement within companies and industries.

The literature supporting this project emphasizes the growing importance of ESG integration in financial decision-making. Research demonstrates that including ESG metrics can enhance portfolio performance, particularly in the U.S. market, and that visual reporting makes sustainability data more digestible for non-experts. This aligns with our goal to bridge the gap between abstract ESG concepts and practical applications.

Ultimately, our app promotes ESG investing by fostering greater transparency and understanding of sustainability metrics. By aligning financial success with environmental and social responsibility, we empower users to make decisions that benefit both investors and society as a whole. Our project demonstrates that sustainable investing is not only ethical but also practical, offering a pathway toward more informed and responsible investment practices.

## References

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ESG Shiny App

ESG App Code