




A Visualization Tool for Private Investors: Stock Portfolio Planning and Risk Management

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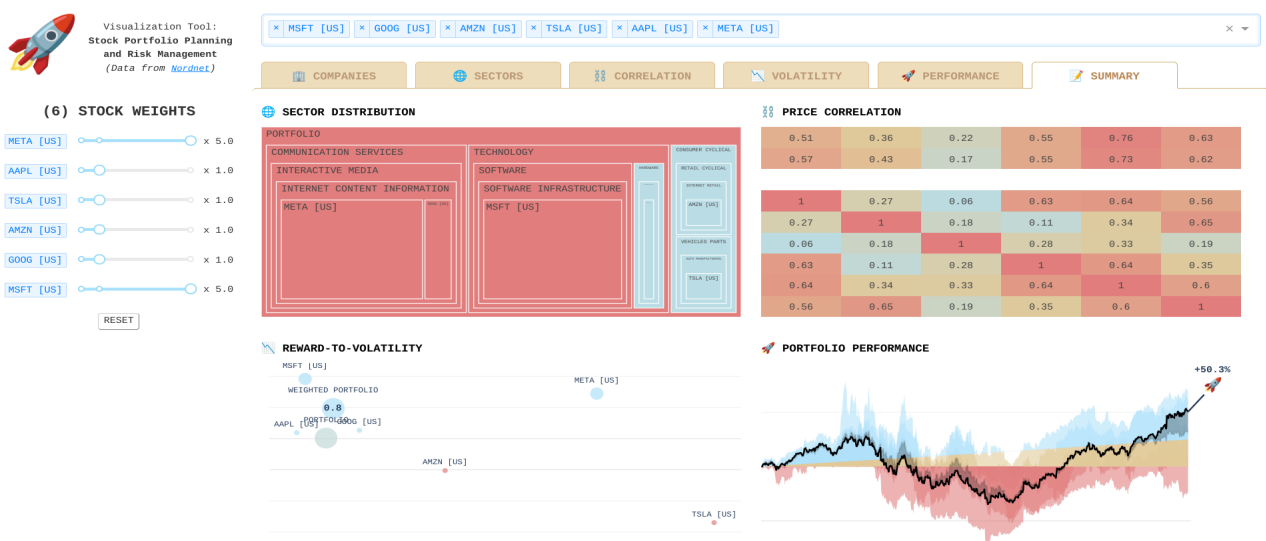


Figure 1: Summary View of our visualization prototype gives an overview of the main metrics of the chosen stocks.

Abstract

We propose a visualization prototype for stock portfolio planning and risk management. Unlike existing tools, we enable amateur investors to make informed investment choices by simplifying analytical concepts through visualizations. In practice, the tool allows for dynamic building, giving weight to, and visually inspecting a stock portfolio from the perspective of various risk-related metrics. Currently, the prototype presented includes perspectives on key financial characteristics.

1. Introduction

Today’s Investment platforms allow private individuals to easily become shareholders in global companies. These platforms often provide basic financial data for fundamental analysis but lack guidance on portfolio risk management. Instead, they offer complex products like derivatives and leveraged trading, requiring a deep understanding of market dynamics. The platforms’ business models promote frequent trading, driven by fees and spreads, while offering free signups to attract customers. They encourage trading through marketing simplified technical indicators as buy/sell signals. However, there is little evidence that applying simple formulas on publicly available historical information will consistently generate abnormal

returns [FQJ14], as any identified market inefficiency will swiftly be negated by participants acting upon it [Fam70]. As a result, amateur investors are highly exposed to the substantial risk of incurring significant financial losses by engaging in speculative trading rather than diversified investments. Nguyen [NGN19] highlights that “the increasing complexity of the investment environment has accelerated the need for better quality financial advice services.”. Our solution offers simplified, educative, easily accessible stock portfolio planning and risk visualization by providing an appealing and intuitive user interface to dynamically pick and give weight to stocks with reactive visualizations of the chosen stocks’ and weights’ impact on select risk-related metrics.

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Related Work: Existing financial tools and resources are plentiful. Many are broadly available, and even more are offered through local bank platforms. An example is TradingView [Tra24], notable for its advanced features and scripting language but primarily catering to trading rather than long-term investment. Yahoo Finance [Yah24] offers a portfolio tracker, yet its visualizations are limited, focusing more on individual stocks rather than combined analysis. FinViz [Fin24] places itself somewhere in between the two. Spreadsheets, while flexible, have a steep learning curve and are prone to user error. Finally, services such as Bloomberg Terminal [Blo24] offer extensive capabilities but are expensive and designed for professional investors. Only a few scientific works focus on stock portfolio analysis [RSE09, RY17], the most notable one being *sPortfolio* [YBL*19], which focuses on visualizing diversification, however, rather providing a sophisticated solution for quantitative investment. As alternative *RankFIRST* [GLY*22] offers sophisticated insights into portfolios via candle stick visualizations focusing on factor investing, whereby treemaps have been proven to be a valuable technique for investors and analysts to better understand and manage their portfolios [JT92].

All of the listed visualizations address the needs of experts and experienced users and are hardly accessible to laypersons. Our solution aims to fill this gap.

2. Visualization Prototype

We developed multifaceted, intuitive, interactive visualizations to enable dynamic visual analysis of stock portfolios and to support risk management. We focused on simple portfolio-level risk-related metrics commonly used, namely *sector distribution*, *price correlation*, and *reward-to-volatility* [SAB98].

Data: The chosen API was made available by Nordnet [Nor24], a Scandinavian trading platform offering data on currently publicly traded companies from primarily North European and North American markets. Several API endpoints were utilized to search stocks by symbol or company name to retrieve historical prices, fundamental company data, and key financial figures.

Visual Design: We utilized a consistent color scale from light blue through medium brown to saturated red to emphasize the transition from viable or desirable towards the opposite by leveraging the common association of red with financial loss while still accounting for necessary contrasts concerning accessibility. Our prototype features a left column with a placeholder logo and a list of user-selected stocks, each with a slider for stock weight adjustment. The stock weight represents the share of a certain stock in the portfolio and is commonly used to diversify and re-balance a portfolio [Bac23]. The main area hosts a stock selection search bar followed by six further view tabs:

- **Companies View:** We display individual details for each user-selected stock. The details consist of fundamental data enabling the user to confirm the choice of the selected stock, as well as key financial figures visualized in a grouped bar chart to give an easily digestible overview of the company's financial performance in relation to its market value. The order and colors of the bars signal which trends are generally comparable and desirable.
- **Sectors View:** We visualize the distribution of the selected stocks across sector levels (e.g., if a company is within the medicinal sector), using a customizable treemap [Rus]. The treemap displays the following hierarchy: Portfolio > Sector Level 1 > Level 2 > Level 3 > Stock. User-adjustable thresholds (0-100% range) and application depth (Sector Level 1, 2, or 3) guide the map coloring to effectively communicate the weighting of the individual sectors and how this affects the diversification level of the overall portfolio.
- **Correlation View:** We use a heatmap to display non-parametric price correlations (Kendall's Tau) between the stocks in the portfolio the user selects. Furthermore, it shows how each stock correlates with the rest of the portfolio (with and without applied weights), excluding the stock itself. A user-adjustable time period (1 to 5 years) controls the scope of the analysis, and thresholds (between -1.0 and 1.0) guide the color coding.
- **Volatility View:** We use a scatter plot to illustrate the Sharpe ratio, a common metric for risk-adjusted returns [SAB98]. It plots each stock and the overall portfolio (with and without applied weights) with excess returns on the y-axis against annualized standard deviation of returns on the x-axis. The color of each point illustrates the calculated ratio, guided by user-adjustable thresholds (0.0 - 10.0) and risk-free rate (1-100%).
- **Performance View:** We offer a portfolio-oriented perspective on a commonly used visualization of stock performance, namely the line plot showing a stock's price movement for a selected period of time. However, in this case, the line represents the entire portfolio, while the individual stocks are shown as transparent fillings towards zero of the y-axis. Coloring is guided by a user-adjustable target (5-500%), and if weights are applied, the unweighted portfolio is displayed as a shade of the plotted line representing the weighted portfolio.
- **Summary View:** We provide an overview of all metrics with limited detail (see Figure 1), allowing users to witness the overall effect on all metrics at once when modifying the portfolio by adding or removing stocks, or changing their weights.

3. Conclusion

The presented visualization prototype outlines the possibilities of empowering and enabling private investors to protect their savings. However, only a few users have evaluated the solution by now, and a sophisticated user study has yet to be conducted. Future improvements include optimizing the layout for mobile-sized screens, reducing cognitive load by initially hiding customization options, and adding explanatory videos and textual hints as an inline tutorial. Furthermore, our prototype could benefit from implementing personalization options and investment suggestions, as well as adding visualizations of maximum drawdown as a measure of volatility, distances of Stock2Vec embeddings [WWWV20] or similar sequential embeddings as a measure of diversification, and the impact of systematic portfolio "care", such as periodically rebalancing or setting up trailing stop-losses.

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