

Portfolio Utility: A Comparative Analysis

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Today's Agenda

1. Let's Talk Finance
2. Our Project
3. Dashboard Tour!
4. The Real World
5. How We Did It
6. Win



Nicholas J Scheri Earning Copious Amounts of
Money After Doing This Project:
Colorized 2024 From a "Recent Date" at 2AM

1. Let's Talk Finance



Who Here is an Active Investor?

What's your current strategy?



A Trip Down Memory Lane

FIN 323 Style



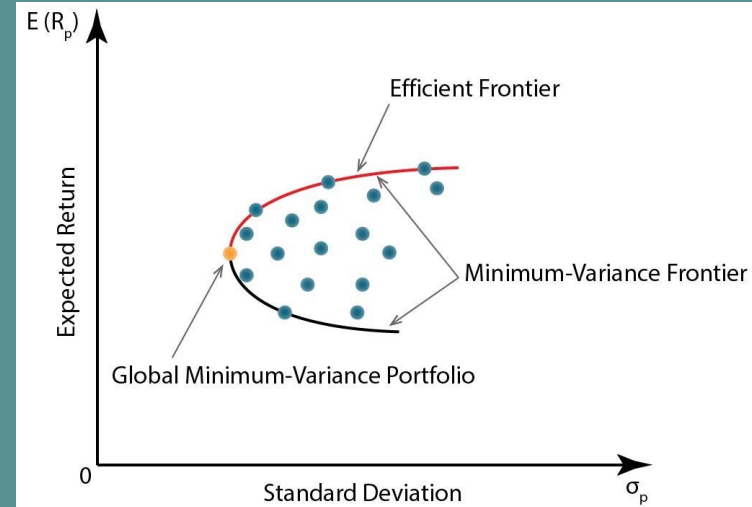
Modern Portfolio Theory and The Efficient Frontier

Modern Portfolio Theory (MPT):

- Highlights the implementation of diversification into a portfolio to reduce risk
- A mix of assets that are not perfectly correlated with each other. (Think variance covariance matrix)

Efficient Frontier:

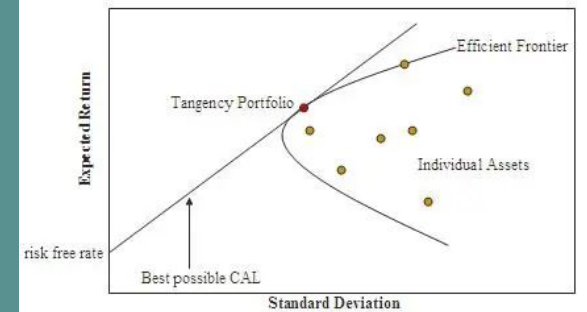
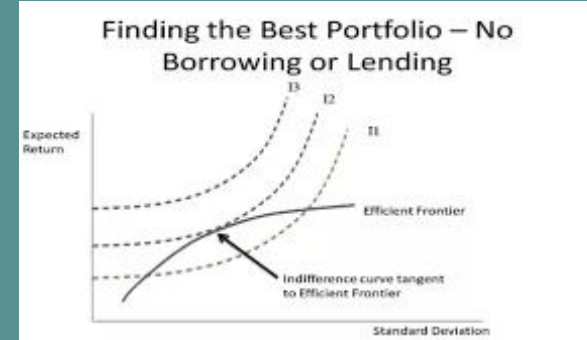
- A line showing optimal portfolios that offer the highest expected return for a given level of risk.
- Portfolios lying on the efficient frontier are considered “efficient” sets



Capital Allocation

Capital Allocation:

- The process of distributing financial resources among different asset classes to optimize risk and return.
- Typically this refers to how much of a portfolio is dedicated to risk free assets, and risk assets
- Tangency Portfolio
- Leveraged Portfolios



2. Our Project



The Starting Point

We originally based our project on the [“portfolio-frontier-streamlit-dashboard”](#) project

Where our project differentiates:

- Focuses on the utility of different portfolios and compares them
- Assesses the change in portfolio utility discrepancies at a given rate of risk aversion
- Arbitrary, discrete risk aversion parameter
- No leveraged portfolios

Using the Efficient Frontier to Show the Power of Diversification

Let's Create a Population: The S&P 500

Holding my aversiveness to risk constant, if I could invest exclusively into tech firms (sample), or into the S&P 500 as a whole, which strategy would provide me with higher utility?

Generally speaking, it's the S&P 500! The greater diversification can provide:

- More efficient assets
- Lower covariance
- Optimized return for risk

This is What Our Project Shows!

How much utility do you sacrifice by restricting your portfolio to a given theme of securities?

How does the level of risk aversion affect the level of utility sacrifice?

Let's find out!

A decorative bar chart at the bottom of the slide, consisting of numerous vertical bars of varying heights, all in shades of teal, creating a rhythmic pattern.

3. Our Dashboard

Choose your adventure

Select your theme :)

ESG Investing

ESG investing has been growing in recent years. It incorporates Environmental, Social, and Governance factors of the firms.

You selected: ESG Investing

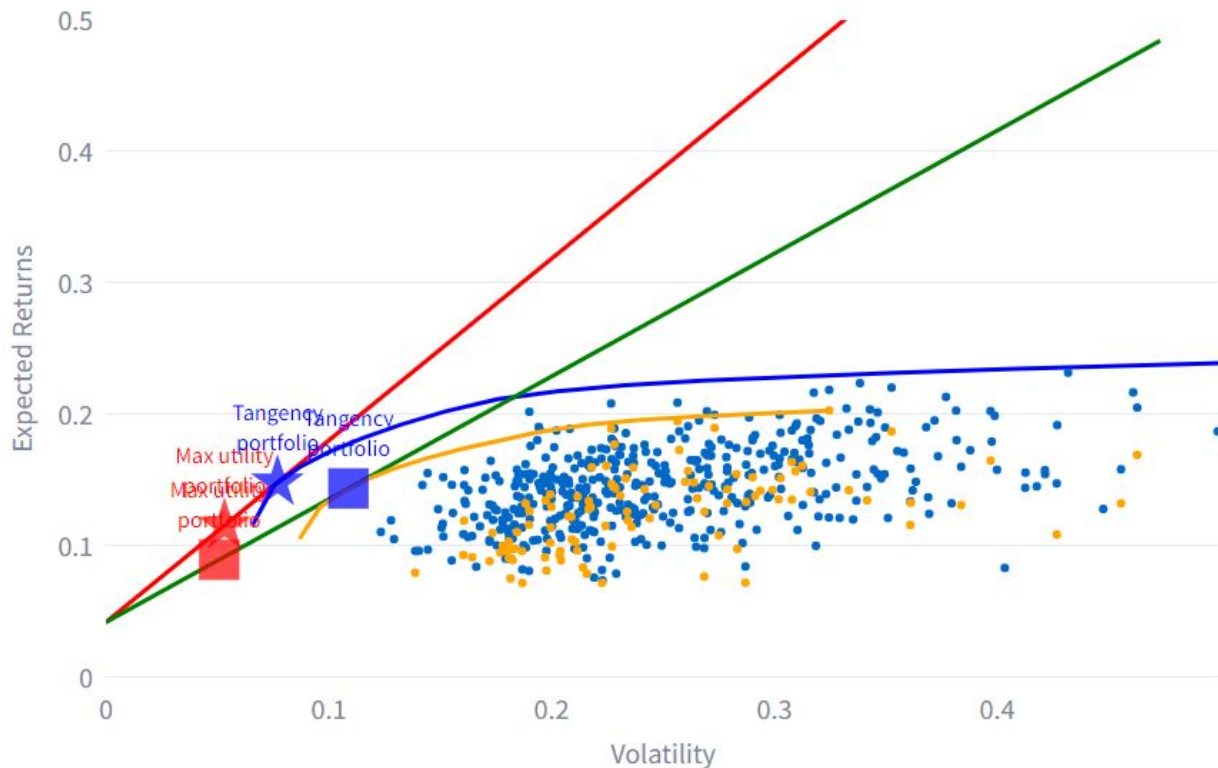
RISK

How risky do you want to be?

- ☐ Mild Risk
- ☐ Moderate
- ☒ Elevated Risk
- ☐ Severe Risk
- ☐ Extreme Risk

You selected: Elevated Risk

Deploy



Your Results

[Click to see your results!](#)

Using the utility function $U = \text{Expected Return} - 0.5A\sigma^2$, the utility of the portfolios are:

Close

Max Utility of SP500: 0.1128

Max Utility of Subset: 0.087

Loss of Utility: 0.0258

Where A is the risk aversion parameter and σ is the standard deviation of the portfolio.

4. The Real World




We Only Use the S&P 500

Now imagine all of the securities traded in the world act as our population

Let's apply what we've learned from our dashboard

- Diversifiable risk can come from similarities in securities/the businesses they represent
- Sampling the **entire population** into a portfolio eliminates the co-relationship of movements across similar assets
 - Reduced correlation
 - Portfolio is now adaptable and dynamic by default

Thus, we see that generally speaker, diversification provides higher utility to an investor compared to thematic investing

A decorative bar chart at the bottom of the slide, consisting of numerous vertical bars of varying heights in shades of teal and blue.

5. How We Did It



Flow of the Files 1

We started out by cloning the efficient frontier repo, and then added/changed files to work for us:

1. **getting_ESG_scores** - Generates a csv of firms and ESG scores for the desired population called "esg_scores".
2. **Get_Data-Copy** - Gets the data
 - a. Download the required data for the S&P 500 including variables required for thematic subsetting (industry, beta, adj price, etc.) (2019-2023)
 - b. Do some manual data manipulation to make working this data easier
 - c. Appends ESG scores to the primary dataframe
 - d. Gets the risk free rate needed for the analysis
 - e. Calculates expected return for each firm (annualized)
 - f. Generates a variance covariance matrix
 - g. Generates a subset of the primary dataframe with one observation per firm
 - h. Outputs the needed data to "covariance_matrix_returns", "data_scores", "expected_returns", "sp500_data_with_scores", and "sp500_tickers"

Flow of the Files 2

`app.py` - the python file that runs the streamlit dashboard

1. **Define Page Configuration:** title, icon, initial sidebar state, and layout.
2. **Sidebar Input Selection:** Allow users to select their thematic investing theme and desired risk level through a sidebar interface. Linked to functions
3. **Functions:** Define helper functions for theme selection and efficient frontier calculations.
4. **Plotting:** Plot the efficient frontier, tangency portfolio, selected assets, and optimal portfolios for both the S&P 500 and the subset of theme-based assets.
 - a. Based on theme selection and risk aversion selection in 2
5. **Results Display:** Display the results of the utility comparison between the S&P 500 and the subset of theme-based assets.
6. **Notes:** Provide additional notes and explanations about the dashboard, including its interactive features and limitations.

A Deeper Dive Into Step Three: Functions

The original efficient frontier project defined two functions which we used, and we defined two of our own:

1. `theme_selector()`: This function is used to handle user input in the sidebar for selecting different themes or sectors. Assigns to a variable used later
2. `get_theme_assets(option, selected_sectors)` This function retrieves a list of assets based on the selected theme and sectors chosen by the user.
3. `get_ef_points(ef, ef_param, ef_param_range)`: This function calculates the points on the efficient frontier based on the given parameters.
4. `get_plotting_structures(asset_list=None)`: This function constructs the plotting structures needed for generating visualizations on the dashboard.
 - a. expected returns
 - b. covariance matrices
 - c. risk-free rates
 - d. calculates efficient frontier points and tangency portfolio information.

Win.



References

[ESG scores function/file](#)

[Efficient Frontier Dashboard](#)

[Link for Financial Theory Infor](#)