Team 113: Portfolio Management Tool

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Overview

There are many tools in the world for portfolio management, but they have at least one of the following two problems:
1. They are not free
2. They are not simple to use or understand

Our project hopes to improve upon both of these aspects. The application we have built is a long-only stock portfolio management tool for analyzing historical performance of a user-defined portfolio of stocks that is geared towards the individual investor. The tool will plot return history, performance metrics, and other important information of a portfolio entered by the user.

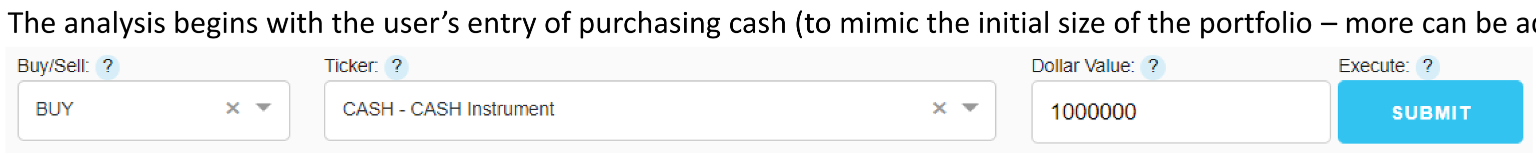
A free and beginner-friendly stock portfolio management tool will empower individual investors to feel more confident and make more informed financial decisions. This will be of direct use to the DIY, individual, and non-institutional investor who doesn't have access or necessarily the training to use more sophisticated applications.

The idea is to focus on answering the questions asked by the majority of individual investors performing this type of analysis, instead of pursuing a more complete response to all the answers an investor might ask.

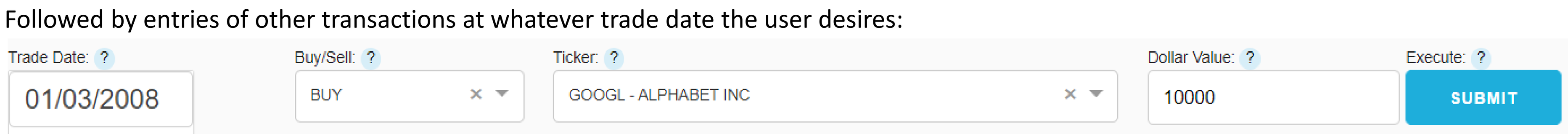
Our Approach

Create a straightforward tool that is interactive, simple, and quickly shows information to answer the most common – and important – questions for the typical investor. This tool includes charts for historical stock prices, portfolio values and returns, and individual stock returns. There are also tables for portfolio and holdings metrics calculated from historical data. In order to improve user-friendliness, tooltips are provided in the application in a manner that is approachable to beginners, but unobtrusive to experts. The combination of easy-to-interpret interface and quick-to-use charts and tables delivers a product that meets the need we identified.

The analysis begins with the user's entry of purchasing cash (to mimic the initial size of the portfolio – more can be added later):



Followed by entries of other transactions at whatever trade date the user desires:

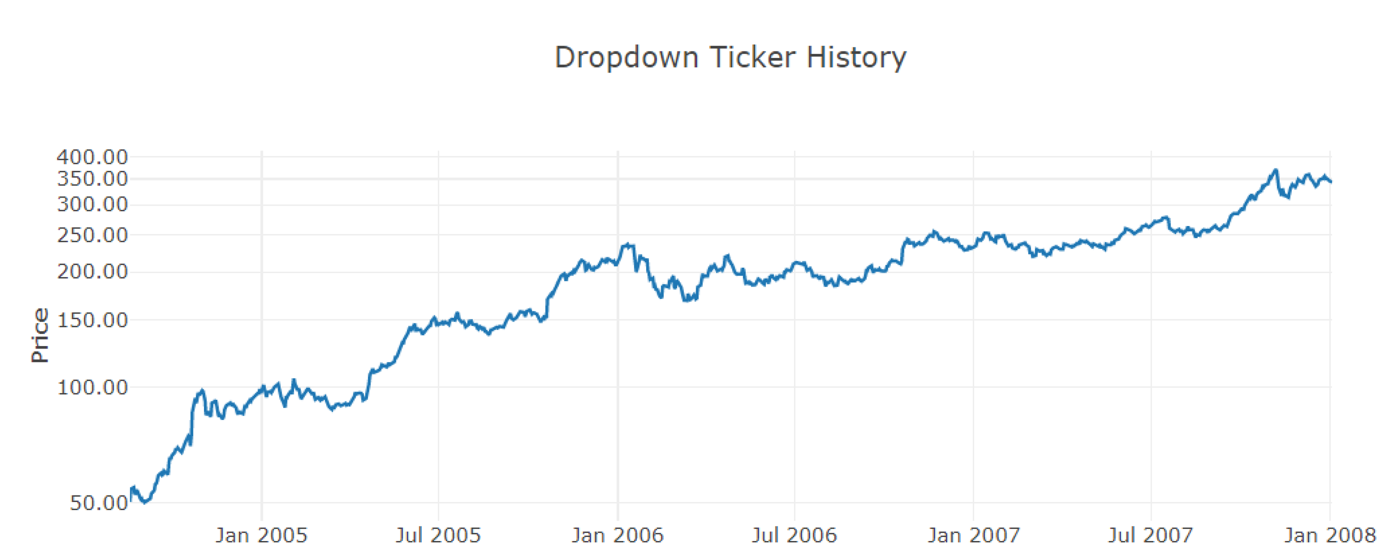


From. here, after each submission of a new transaction, the tool updates all charts and tables to show relevant information about the portfolio as it is being created.

To assist with position selection, we provide a return history chart and quick metrics table that generate upon selecting a ticker in the above field. These update before the decision is made to add the stock to the portfolio. Their purpose is to give a summary of the position's performance and statistics to make the buy decision more informed:

Ticker Screener: ?

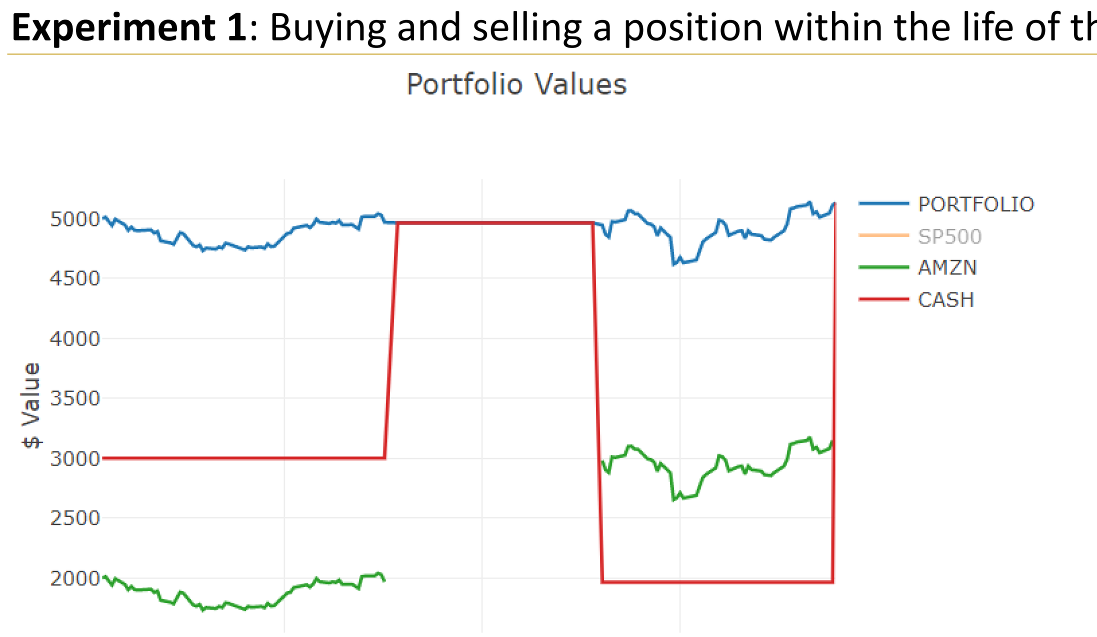
Metric	Value
Ticker	GOOGL
Date	2008-01-03
Alpha	0.4447
Beta	0.971
Sharpe	1.6991
Sortino	2.4011
Volatility	0.2424



Experiments

Once at least one position has been added (in addition to starting cash), several charts and tables are updated to provide various information to the user. In order to test the functionality of the site, we show below a pair of experiments that highlight the usefulness of each chart (all charts and tables on the page are shown via these experiments).

Experiment 1: Buying and selling a position within the life of the portfolio (multiple times):



In this experiment, the user started with $5,000 in cash, immediately bought $2,000 of Amazon stock (AMZN) and held it for 2 months. One can see the portfolio value follows the AMZN value, since it is the only holding during this time period.

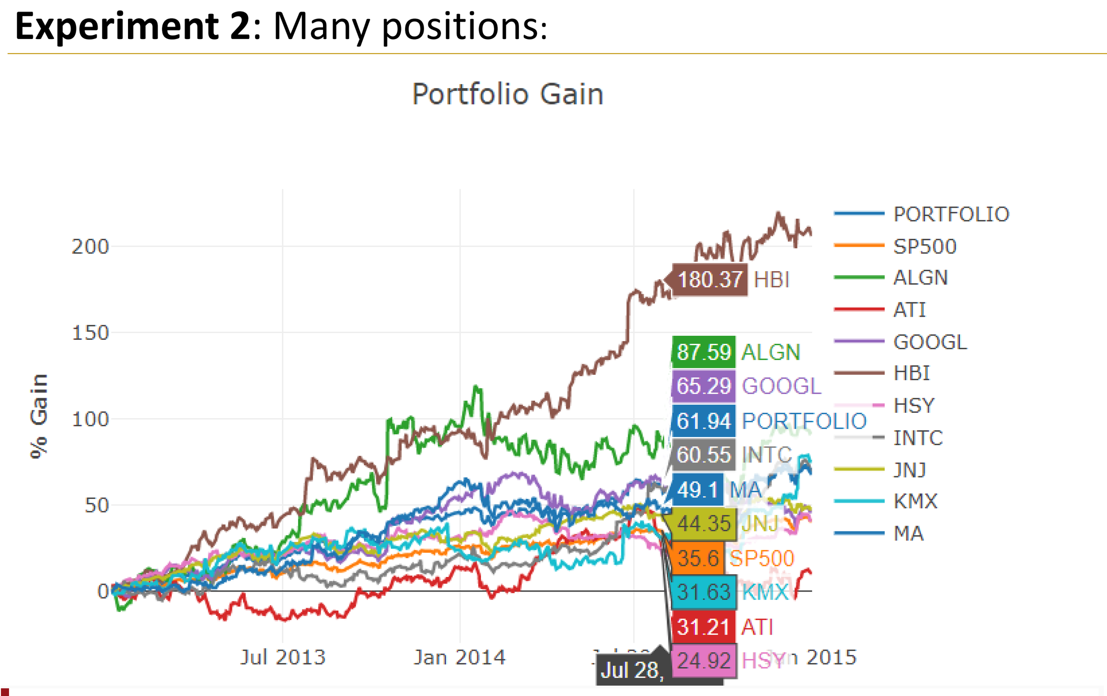
Around April, the user sold all AMZN stock, cash rebounds up to near $5,000 (just under due to a small loss on the AMZN holding), and the portfolio value then matches cash since it has no non-cash holdings. Finally, the user buys AMZN again in June, this time $3,000, and holds it through August.

Portfolio Metrics: ?

Date	Value	Tot ret (%)	Sp500 tot (%)	Alpha (%)	Beta	Sharpe	Sortino	Volatility (%)
2010-08-18	$5,132.12	2.64	8.44	2.64	0	0.38	0.42	13.5

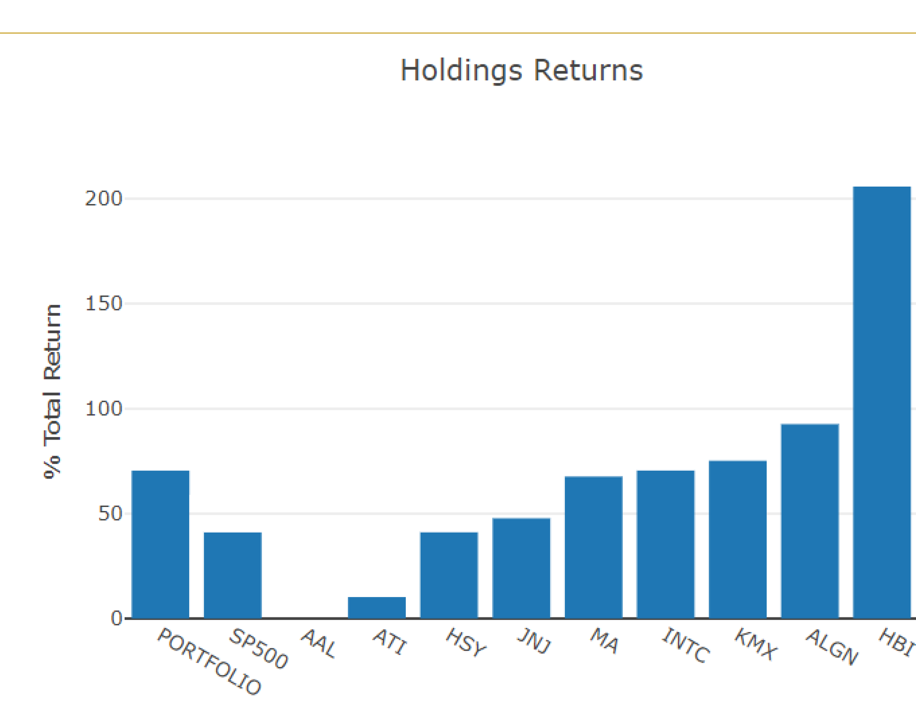
The portfolio-level metrics table tracks the performance of the portfolio through the buys and sales of AZMN across the life of the experiment.

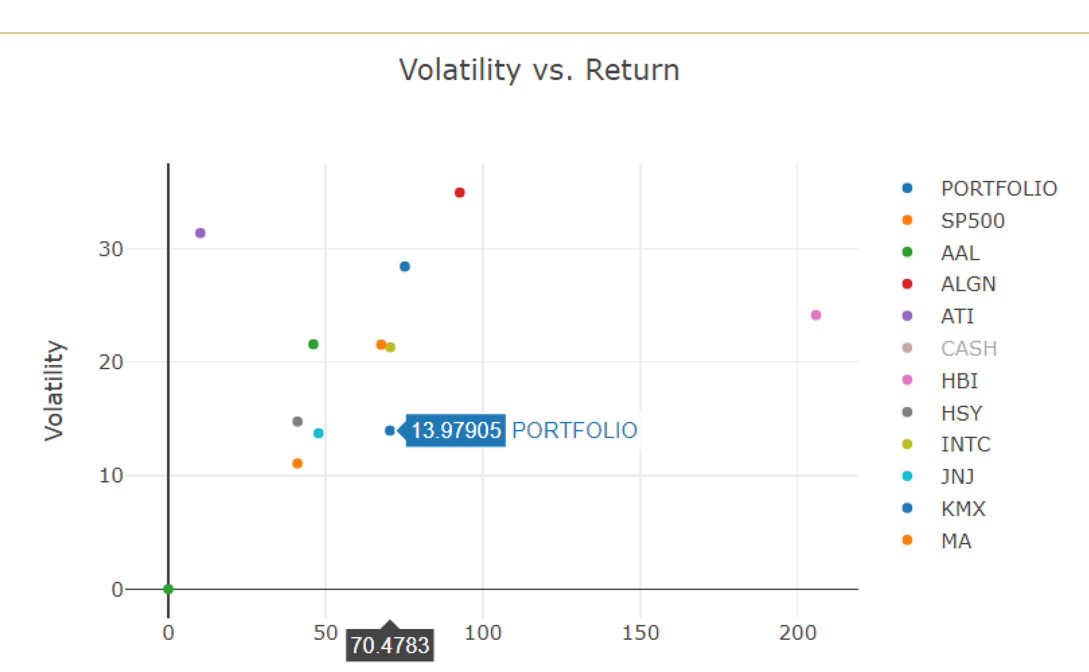
Experiment 2: Many positions:



Holdings Metrics: ?

Ticker	Date	Value	Portfolio (%)	Tot ret (%)	Sp500 tot (%)	Alpha (%)	Beta	Sharpe	Sortino	Volatility (%)
CASH	2015-01-02	$0.00	0	0	0	0	0	0	0	0
ALGN	2015-01-02	$3,853.27	11.3	92.66	41.94	31.83	1.49	1.11	2.03	34.94
ATI	2015-01-02	$2,203.78	6.46	10.19	40.27	-63.49	1.81	0.31	0.47	31.37
GOOGL	2015-01-02	$2,922.49	8.57	46.12	41.03	3.51	1.05	0.99	1.73	21.56
HBI	2015-01-02	$6,116.12	17.94	205.81	41.76	164.8	1.01	2.44	4.38	24.14
HSY	2015-01-02	$2,821.66	8.28	41.08	41.58	16.3	0.61	1.24	1.95	14.77
INTC	2015-01-02	$3,410.88	10	70.54	40.46	28.84	1.02	1.36	2.01	21.3
JNJ	2015-01-02	$5,910.09	17.33	47.75	40.64	19.77	0.69	1.49	2.11	13.75
KMX	2015-01-02	$3,503.95	10.28	75.2	40.57	22.89	1.28	1.13	1.65	28.42
MA	2015-01-02	$3,353.42	9.84	67.67	40.8	18.07	1.22	1.31	1.96	21.54





This experiment was to demonstrate a couple of different features, and portray the remaining charts on the page.

First is to show the utility of the on-chart tool tips where they might be otherwise-overwhelming (see the Portfolio Gain chart top left). Each line is clearly labeled with the value shown upon hovering over a specific spot. All the charts have a zoom in feature if the user wants to investigate (or save as a picture) a specific portion of the chart.

The Holding Returns bar chart (top middle) shows the absolute return of the individual stocks in an easy-to-consume format for quick comparisons.

The Volatility vs. return scatterplot (top right) gives the user a rough indication of the risk/return trade-off of the constituent members of the portfolio. This chart breaks down the pieces of the Sharpe ratio and plots them. This feature is particularly useful for larger portfolios when comparing positions.

For more granular analysis, the Holdings Metrics table (left) shows more detailed measures including current position value, % of portfolio return, Alpha, Beta, Sharpe and Sortino ratios, and volatility. All metrics are as of the current date selected by the user.

Data

CRSP | Center for Research in Security Prices

Our data comes from the CRSP/Compustat database[1]

How did we get it?
- Downloaded full dataset from CRSP directly (free via Georgia Tech)

What is it?
- Contains security-level data for more than 32,000 securities.
- Daily price and return data for each security from 2007 through 2018
- Original size is 43GB, reduced to 1gb after our manipulations

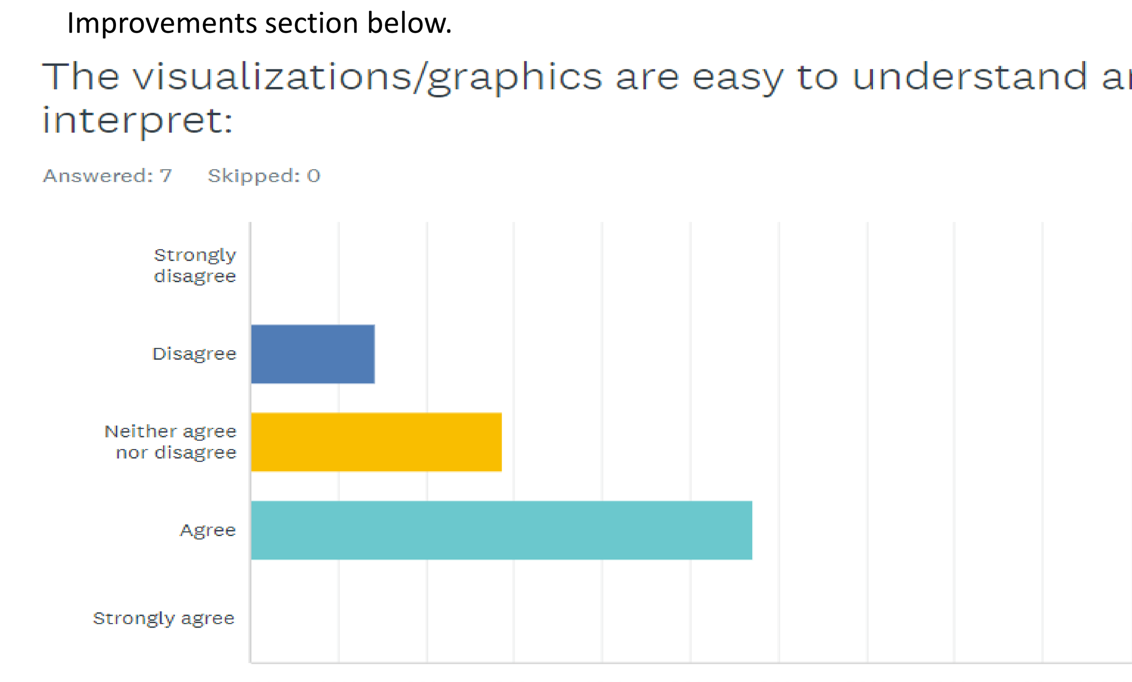
What did we do to it?
- Trimmed the data down to the 707 current and previous constituents of the S&P500
- Focused on daily return data and its manipulation
- Computed metrics at both the holdings (individual) and portfolio (aggregate) levels
- Hosted in a database on Amazon RDS, using an AWS cluster to run our code

How did we display it?
- Using the Dash library (python based), made by Plotly, to display the data and calculations.
- Deployed our webpage via AWS Elasticbeanstalk
- The resulting charts are all interactive: they allow for zooming in, cropping the view space, downloading as a .png, and including hovering tool tips.

Results & Further Improvements

We Performed a user survey, results summarized below. Along with assessing our experiments, and comparing our tool to the existing methods, in particular Portfolio Visualizer.

User Survey
- Taken by other Georgia Tech students, the majority of them believed our visuals were easy to understand. Their comments and feedback was used to develop the Further Improvements section below.



Comparison to Portfolio Visualizer[2] ("PV", existing method), our tool:
- Provides more results:
  - PV shows only portfolio return, an ownership pie chart, and annual returns
- Operates using fewer interactions:
  - PV requires at least 10 clicks to get data, while ours requires at least only 4.
- Is more flexible:
  - PV will only allow 1 period in its portfolio – one start and end date for everything
  - Our tool is dynamic across each position – every position can be different.
- Is not as fast:
  - PV is faster – this is addressed below in Further Improvements

Further Improvements

Speed
- Increasing the memory of the host cluster will make a remarkable impact on the response time of the webpage.

Better descriptions
- Adding additional pages that provide look-throughs to the raw data (like a monthly-return summary table.
- Add a help page to explain in more depth the purpose of the metrics and graphs.

Better Functionality
- Provide upload/download options to push up pre-made transaction histories and pull down results.

Better charts
- Poll a larger audience (of investors) to determine what other information investors are looking for, and adding accessible charts to the page to address those.

References:
1. CRSP.com
2. https://www.portfoliovisualizer.com/backtest-portfolio