

Strategy Research Tools

This project is a web based application that allows users to research historical correlations between US based single name equities, evaluate multiple pairs trading strategies, and analyze individual stocks contribution towards the variance of the main US stock indices (S&P 500, Nasdaq 100, and Russell 2000)

How to Use

Page 1 - Equity Pairs Trading

The first page of the application is the Equity Pairs Trading dashboard. On this dashboard users can quickly identify the most correlated equities over a user-specified time period as well investigate two separate trading strategies.

The user initially selects a time period of interest as well as the number of top pairs they want to investigate and be displayed in the table. They can then sort the results alphabetically, by price correlation, the P-Value of the cointegration, and the correlation of volatility.

Select Dates to Calc Correlations:

01/01/2024 → 08/25/2024

Allows to user to define the time period of interest, this time period will be used to filter the table below

Number of Rows to Display:

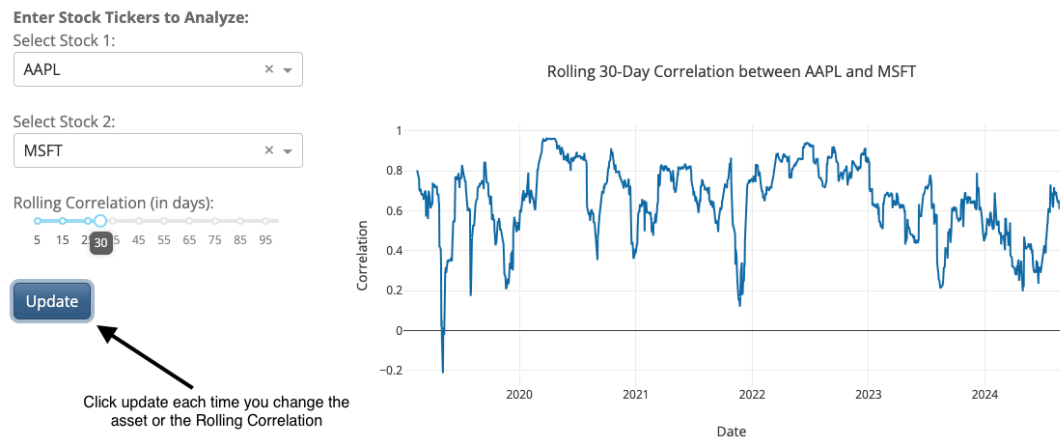
10

The user can select the number of rows to display in the table below when investigating top correlations

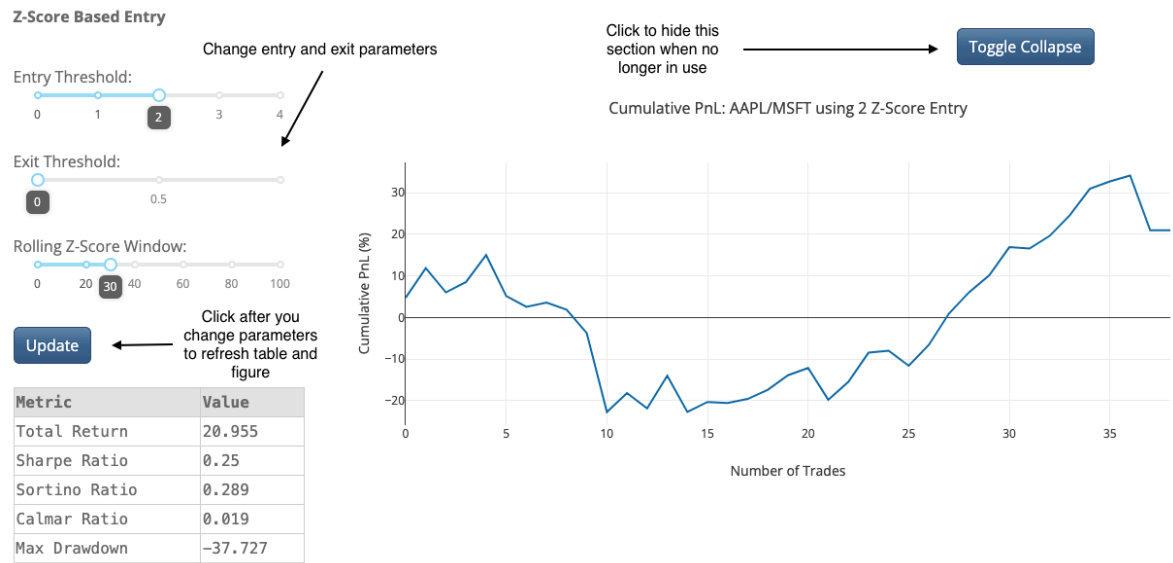
Click the arrows in any column to sort table by the selected column

↕Stock 1	↕Stock 2	↕Correlation	↕Cointegration P-Value	↕Vol Correlation
NVDA	USD	0.955	0.751	0.915
NDX	^SPX	0.95	0	0.946
AMAT	LRCX	0.948	0.977	0.926
CVX	HES	0.947	0.267	0.905
KLAC	LRCX	0.939	1	0.979
TMHC	TPH	0.933	0.638	0.892
AMAT	KLAC	0.933	0.992	0.911
AVTE	OVID	0.926	0.596	0.957
FFBC	UBSI	0.916	0.854	0.91
LEN	PHM	0.915	0.336	0.669

In the section below the user can view the rolling historical correlation between any two assets. They can adjust the rolling correlation window via the slider; click update each time either the assets or rolling window are changed.

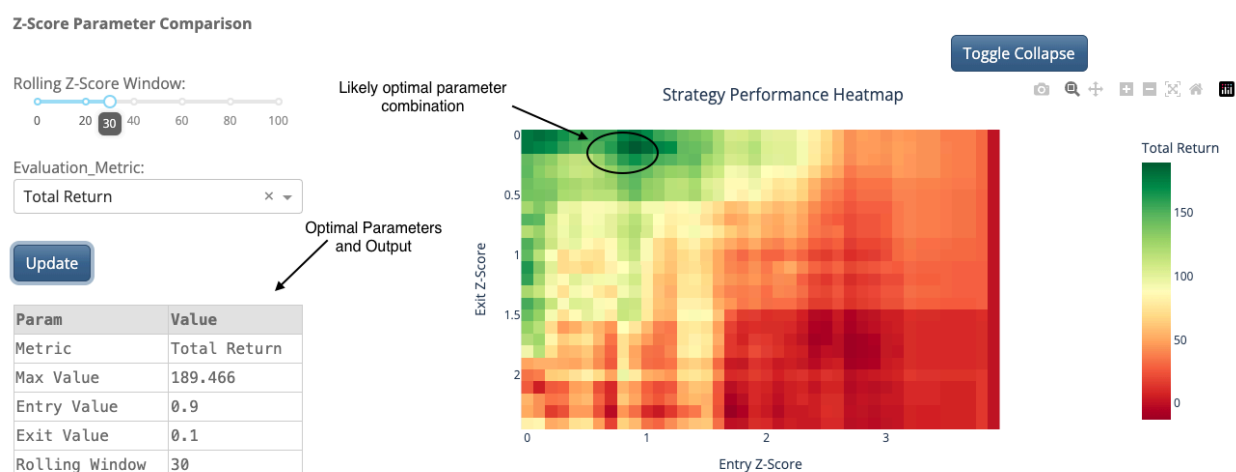


Below this section the user can begin to investigate one of two defined trading strategies. The first strategy using a Z-Score entry and exit technique between the two assets selected in the section above. The user can change the entry/exit conditions via the sliders. They can also hide the section via the “Toggle Collapse” button when no longer in use.



If the user wants to investigate the parameter sensitivity of the strategy they can use the “Z-Score Parameter Comparison” section. In this section they select a rolling window for the Z-Score (default to 30) and an evaluation metric (Return, Sharpe, Sortino, Drawdown, etc.). They can then view how the strategy performs under all reasonable combinations of parameters

Note: This section takes ~30 seconds to complete via the web server but ~5 seconds when running locally.



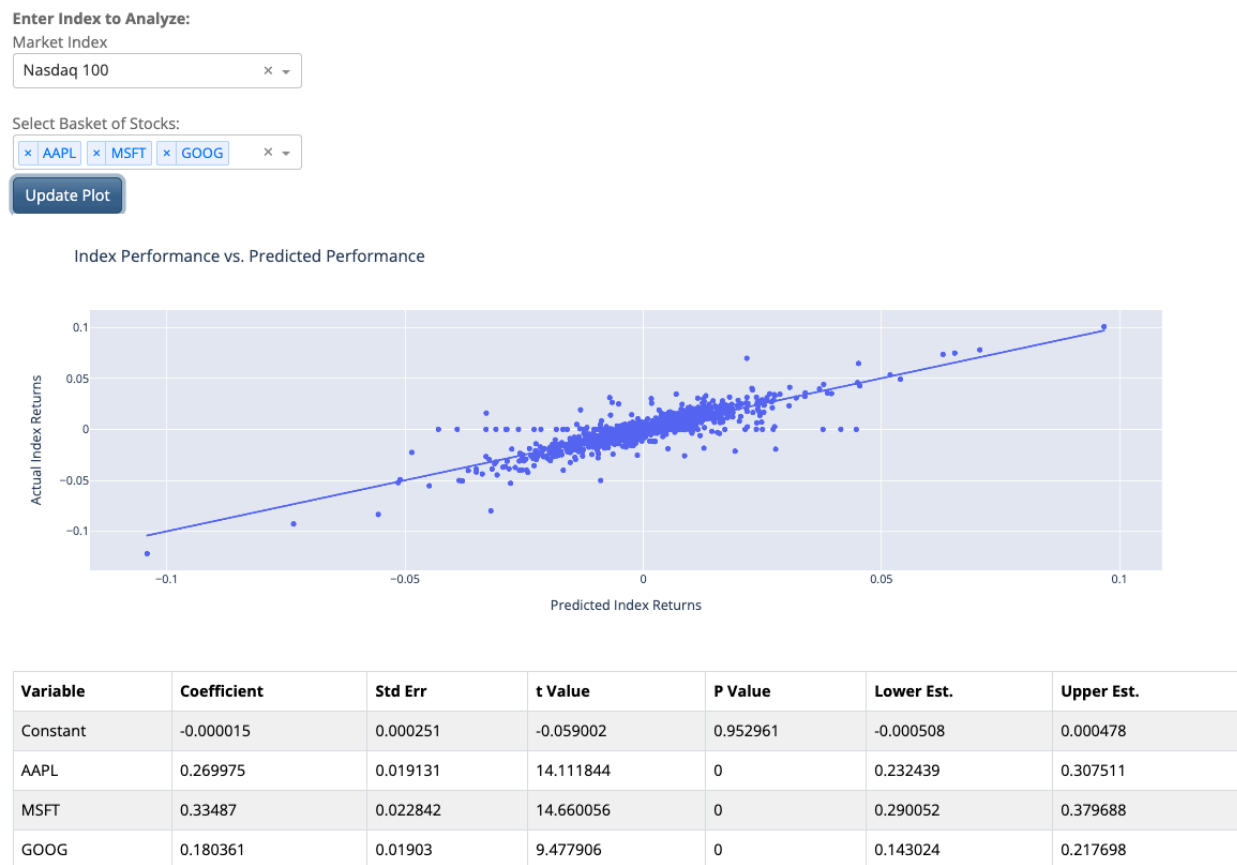
The next two sections are visually similar and require the same user interaction; however, they employ an RSI based entry system on the pair. Those sections can also collapse when not in use via the “Toggle Collapse” buttons.

Page 2 - Index Regression

To navigate to the index regression section of the application, simply click on the “Index Regression” tab in the navigation bar at the top.

First the user is able to regress any of the three indices against a basket of securities chosen. Use the dropdown to select an index and then enter the stock tickers of your choice. Hit enter after each stock ticker you type in. Then click ‘Update Plot’.

The output should look similar to the one below depending on the tickers selected.



The user can also select any of the three indices and the app will display the 10 securities that most account for the variance of the index returns. This was done via PCA. The table displays the ticker, company name, sector and industry in order of their contribution to the index returns.

Index Explanation

Market Index

Russell 2000

Security	Importance	Company	Sector	Industry
RRR	1	Red Rock Resorts, Inc.	Consumer Cyclical	Resorts & Casinos
ARWR	2	Arrowhead Pharmaceuticals, Inc.	Healthcare	Biotechnology
OVLY	3	Oak Valley Bancorp	Financial Services	Banks—Regional
MELI	4	MercadoLibre, Inc.	Consumer Cyclical	Internet Retail
UPWK	5	Upwork Inc.	Communication Services	Internet Content & Information
EXPI	6	eXp World Holdings, Inc.	Real Estate	Real Estate Services
AMC	7	AMC Entertainment Holdings, Inc.	Communication Services	Entertainment
DDD	8	3D Systems Corporation	Technology	Computer Hardware
CLSK	9	CleanSpark, Inc.	Financial Services	Capital Markets
FN	10	Fabrinet	Technology	Electronic Components

Database Construction

For this project I elected to use SQLite to create and access a local database. There are two tables in the database, Stocks and DailyPrices. Stocks contains the tickers and metadata (industry, sector, company name, etc.) for each holding in the three indices. DailyPrices contains the OHLC and volume data for each ticker on a daily frequency. The two tables are linked via the stock_id and date_id fields.

If I were to continue to expand on this project I would migrate this database to MySQL to handle the queries faster and expand the database beyond the 5 years of data that it currently contains.

I would also create a separate script to run each night and update only new data to each of the tables via crontab or python scheduler.

Project Continuation

Given that the database contains metadata for each stock, This project could also be expanded to analyze sector performance and correlation. A potential alpha signal could be generated from comparing individual stock returns to the returns of its sector and seeing if there is lagged correlation between the two time series.

This app could also be expanded to serve fixed income, commodity, or energy markets where there are a sufficient number of unique assets. For example, one could run a similar correlation

analysis on different points of the yield curve as well as nearly adjacent points if they wanted to structure a Micro RV trade.

Installation

Prerequisites

- Python (version 3.10.0 or higher)
- pip (Python package installer)

Steps

Save all files into working directory:

Create a virtual environment:

bash

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```
python -m venv venv  
source venv/bin/activate # On Windows, use `venv\Scripts\activate`
```

1.

Install the required packages:

bash

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```
pip install -r requirements.txt
```

Usage

- Instructions on how to deploy both locally and on web server

Local Deployment

1. Install necessary packages using requirements.txt file
2. Ensure that all files in zip file are located in same directory
3. Run application from terminal using `python app.py`

Web Server

1. Access the application at <https://mmn21.pythonanywhere.com/>

Contact

For any questions regarding the application contact Michael Nimerfroh at mmnimerfroh@gmail.com.