

Stock Selection for Portfolio Optimization

How do we '*properly select*' our portfolio?



The consensus reached from the majority of past studies is that **active management DOES NOT** provide superior performance compared to passive investing (Fama & French, 2010).

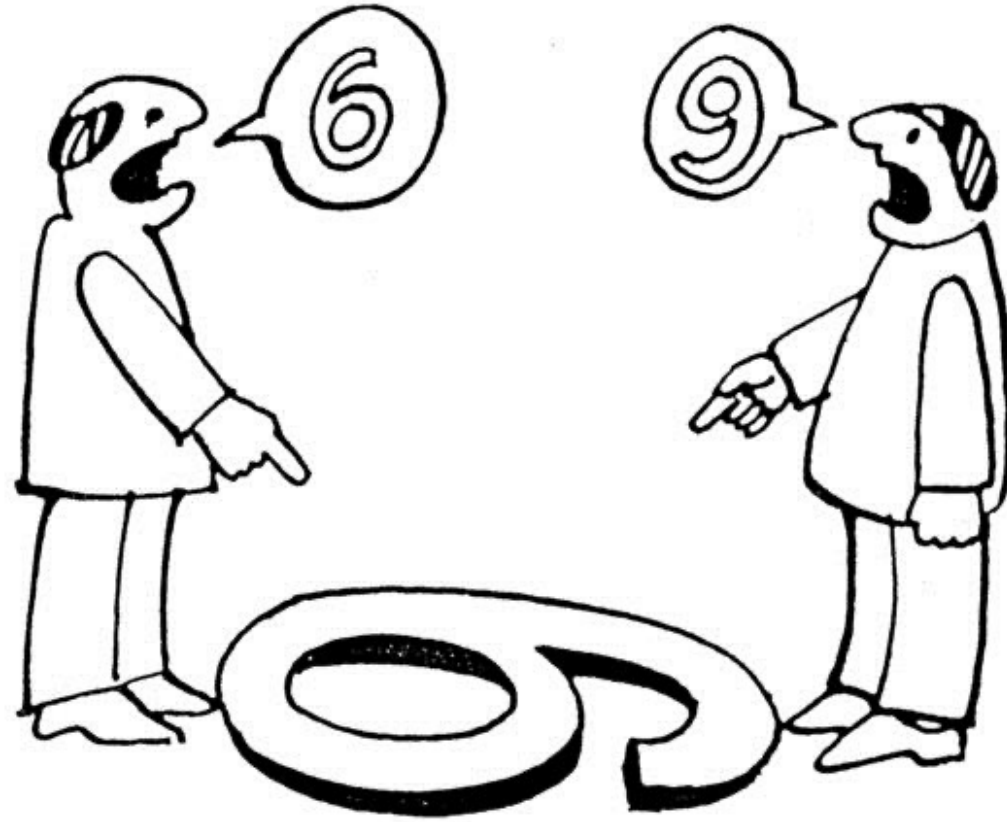
There is a large body of evidence that supports the case for passive management. Studies have shown that the vast majority of **active managers underperform the market** (study by Standard & Poor's, from January 1, 2003, to December 31 2013).

Technical Analysis



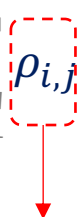
Fundamental Analysis





$$\text{Sharpe Ratio} = \frac{\text{Return}}{\text{Risk}} = \frac{R_p - R_f}{\sigma_p}$$

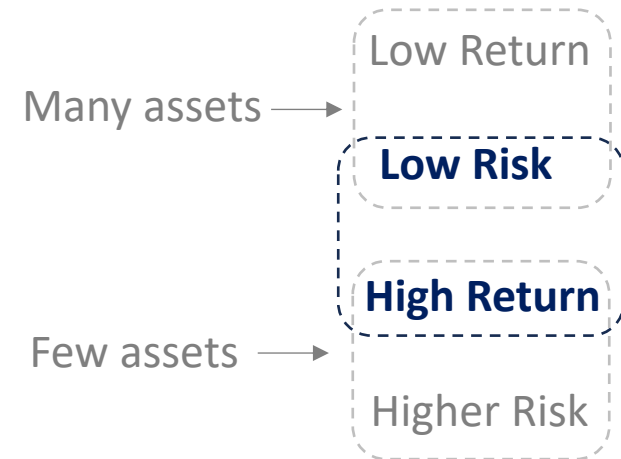
Volatility from correlation

$$\sigma_p = \sum_{i=1}^n \sum_{j=1}^n \rho_{i,j} w_i w_j \sigma_i \sigma_j$$


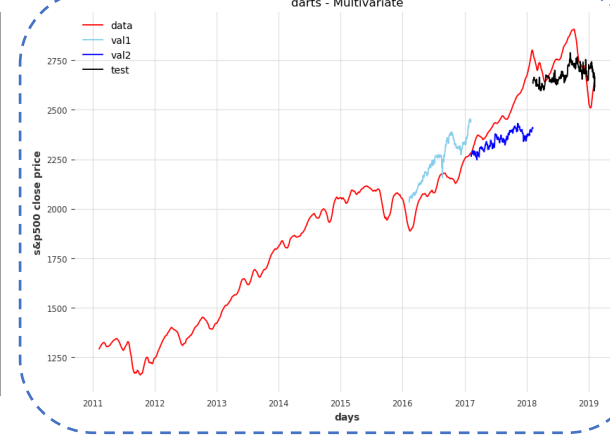
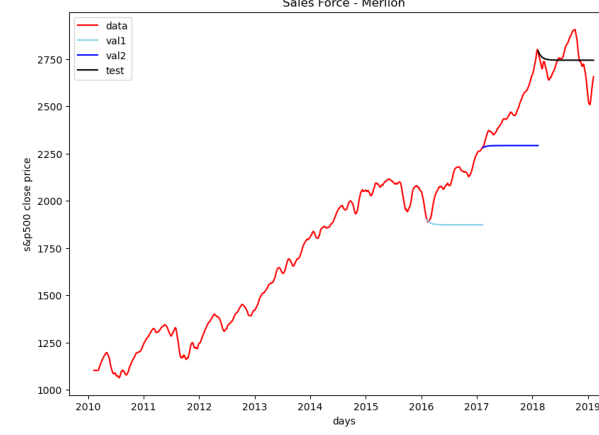
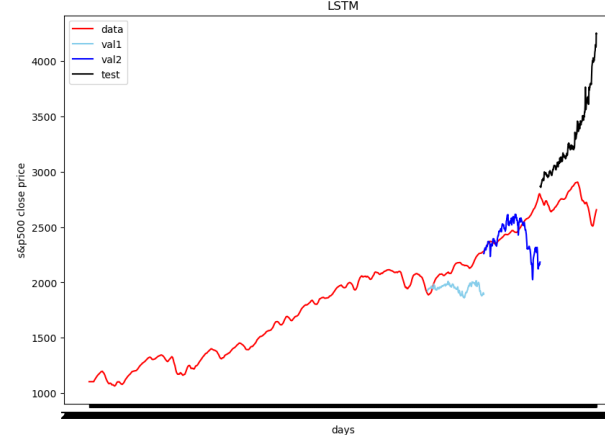
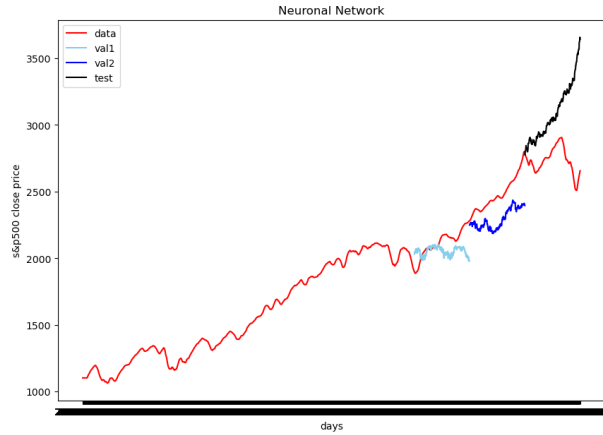
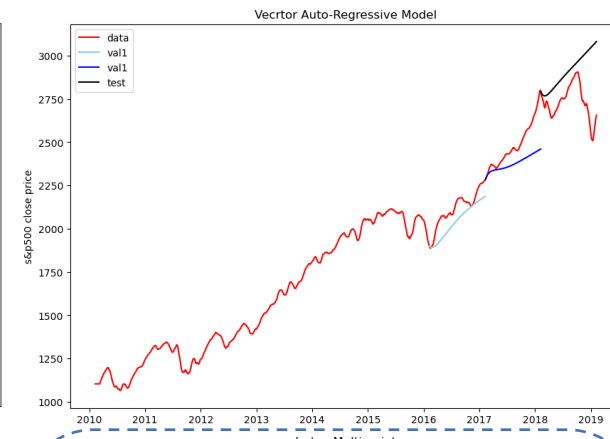
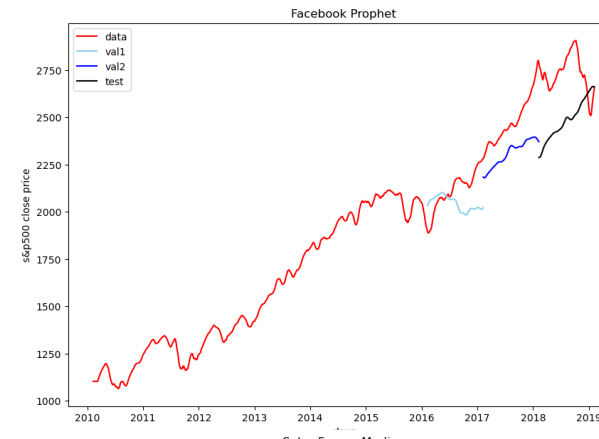
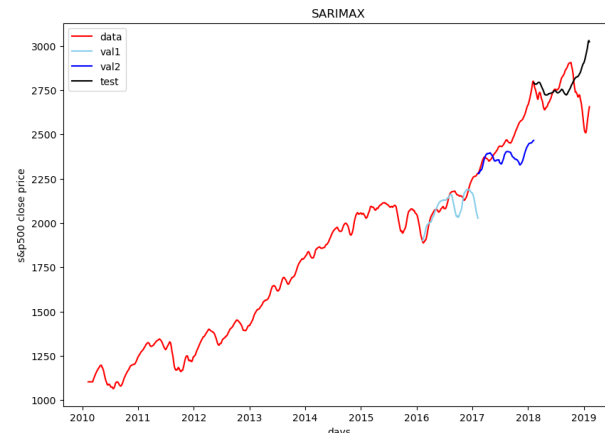
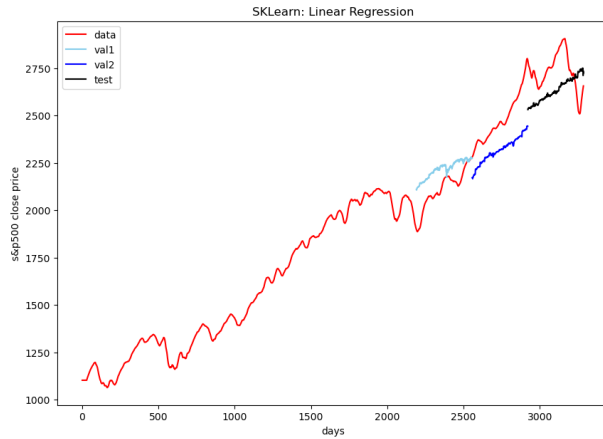
*If correlation is negative, then
that term becomes a subtraction*

From Financial Mathematics

We are not only interested in the
stock return but also interested in
correlations between stocks



S&P500 stock's Return predictive model



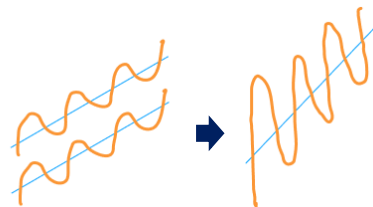
Mean Absolute Error (MAE)

Prediction	SKL - LR	SARIMAX	Prophet	VAM	NN	LSTM	Merlion	Darts Mult
1	103	2,079	119	75	97	174	1,105	132
2	262	2,223	171	103	188	314	1,261	133
3	481	24,223	138	178	358	1,178	1,329	93
Total	846	28,525	428	356	643	1,666	3,695	358

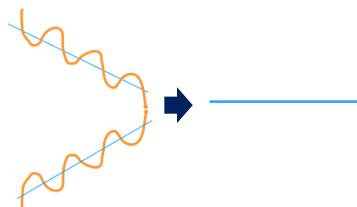
Better prediction of turning points

Optimization: Sequential Least Squares Programming (SLSQP)

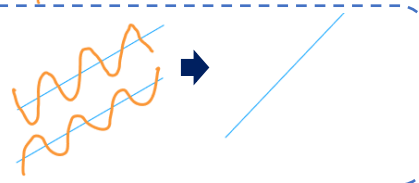
Maximizing Returns



Minimizing Volatility



Maximizing $\frac{\text{Return}}{\text{Volatility}}$

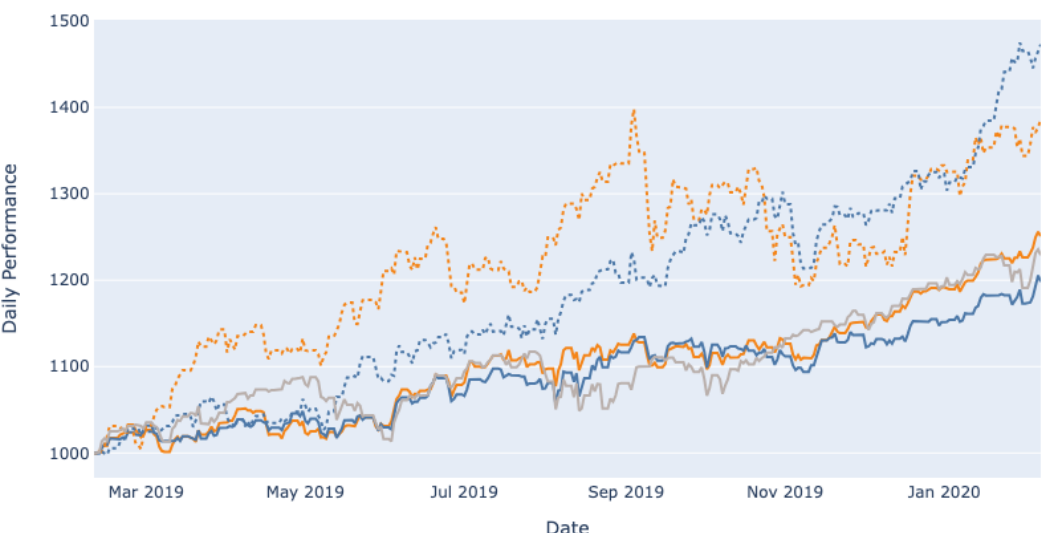


We are
Maximizing
the **Sharpe**
Ratio

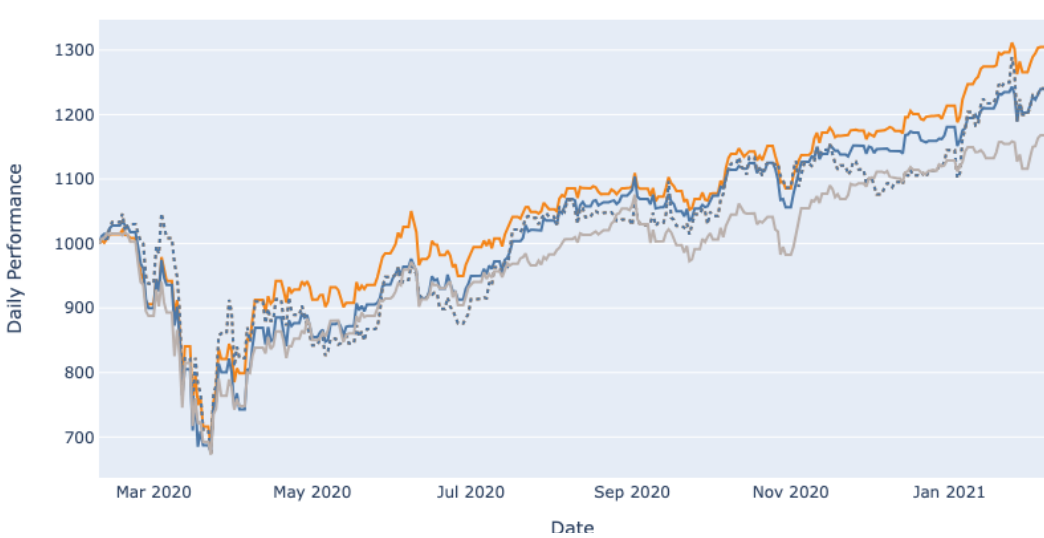
- 1) Selecting the 500 optimal weights for the 500 stocks portfolio.
- 2) Selected the 30 stocks with the highest weight and normalized them

30 stocks based on
financial theory

Portfolio Daily Performance (2019)



Portfolio Daily Performance (2020)



Parameter	Portfolio_Forecast
Annual Return	17.09%
Daily Volatility	1.06%

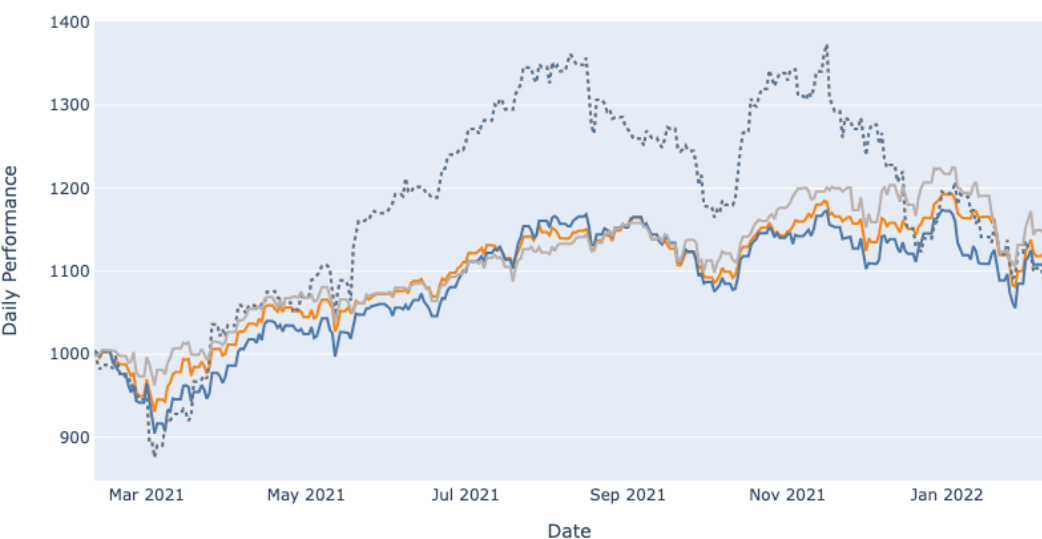
Parameter	Portfolio_Historical
Annual Return	14.35%
Daily Volatility	1.21%

Parameter	Max_Stock Forecast
Annual Return	15.95%
Daily Volatility	1.54%

Parameter	Max_stock Historical
Annual Return	16.07%
Daily Volatility	1.87%

Parameter	S&P500
Annual Return	11.28%
Daily Volatility	1.10%

Portfolio Daily Performance (2021)



Portfolio Daily Performance (2022)



The background of the image is a composite of financial-themed elements. On the left, there is a dark area with a red line graph showing fluctuations and several teal-colored vertical bars of varying heights, resembling a bar chart. In the center, there are stacks of gold coins. On the right, a large blue diagonal shape covers the background, featuring a faint white line graph. The word "THANKS!" is written in white, bold, sans-serif capital letters across the middle of the blue shape.

THANKS!