Cougars of Wall Street

BYU Silver Fund | Battle of The Quants Competition

Presented By : Cougars of Wall Street

The Team

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Competition Task

Using the financial metrics provided, create a trading strategy that has the greatest portential to generate high risk adjusted returns.

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Executive Summary

Using past market data (1955-2023) we used economic theory and statistical analysis to bin stocks into three bins according to these factors:

- Ratio of Book to Market Value of Equity
- Market Value of Equity
- Return on Invested Capital
- Market Returns

Using our trading strategy from 1955-2023, with an initial investment of $100, returns of over $464 million were collected.

PnI of All Time
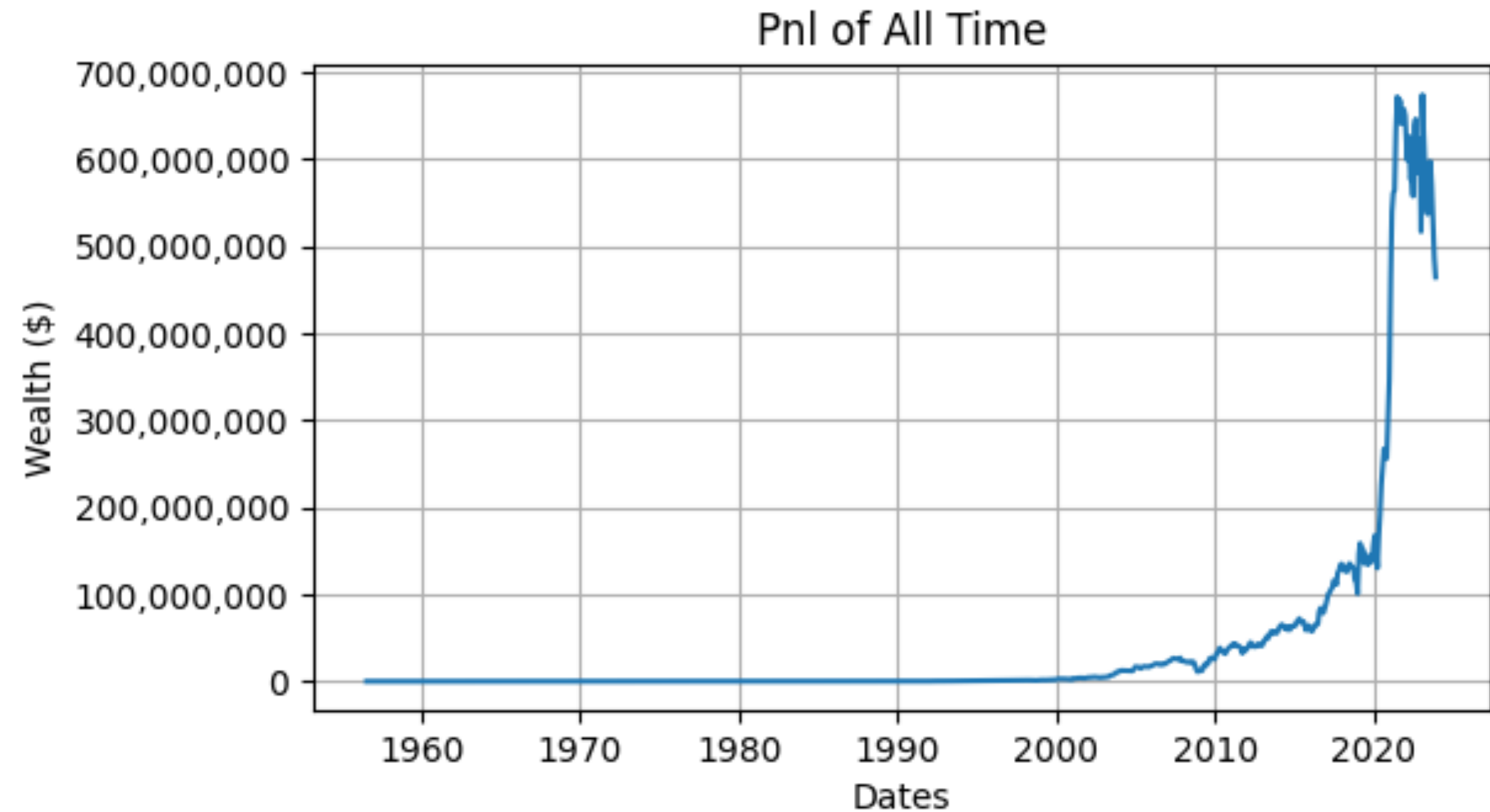
Research Process

We analyzed all 85 financial variables that were provided and filtered out the variables that we believed were not correlated in any way to the health of a company or its returns (70%).

As we started to run test on these variables, we noticed that most of the statisically signifant variables are part of the French-Fama Model. In an inefficient market, this model takes into account certain metrics for each firm to maximize returns.

Running an Ordinary Least Squares (OLS) regression on the factors proposed by Fama and French, we found that BEME, MKT, ROIC, and ME are statistically significant. Therefore, we decided to use these four metrics from the five factor model as the basis for our trading strategy.

Upon further analysis, decreasing the number of bins from five to three increased the calculated return of our trading strategy.

Investment Hypothesis

Fama and French 5 Factor Model: Eugene F. Fama and Kenneth R. French developed a multi-factor asset pricing model that focuses on five factors: **market return, size, book-to-market ratio, profitability, and investment pattern.**

$$R_{it} - R_{ft} = \alpha_{it} + \beta_1(R_{mt} - R_{ft}) + \beta_2 SML_t + \beta_3 VMG_t + \beta_4 RMW_t + \beta_5 CMA_t + \epsilon_t$$

BEME

BEME is the Ratio of book value of equity to market value of equity. This metric measures the **book-to-market ratio** factor in the Fama-French Model

MKT

MKT is the return of the market. This is the **market return** factor in the Fama-French Model.

ROIC

ROIC is return on invested capital. This is the **investment pattern** factor in the Fama-French Model.

ME

ME is the market value of equity. This is the **size** factor in the Fama-French Model.

Algorithm Overview

- Portfolio is updated monthly t = {1,2,... T} with k variables
- Using the data at time t:
  - **Regression**: Regress returns (at time t) on our factor variables (OLS), obtain coefficients $\beta_1, \beta_2, \ldots \beta_k$
  - **Binning**: Use the signs of $\beta_1, \beta_2, \ldots \beta_k$ to form bins (see next slide)
  - **Evaluation**: Calculate Sharpe Ratio and Profit with respect to returns at time t+1 to evaluate the portfolio's success

Binning Strategy

- Iterate through each binning variable
  - Split the available data into 3 bins
  - Drop all data other than the optimal* bin
- When complete, the portfolio contains stocks which are in the optimal bin for each binning variable.

* The sign of each OLS coefficient determines whether to select the "high" or "low" bin.

Sharpe Ratio

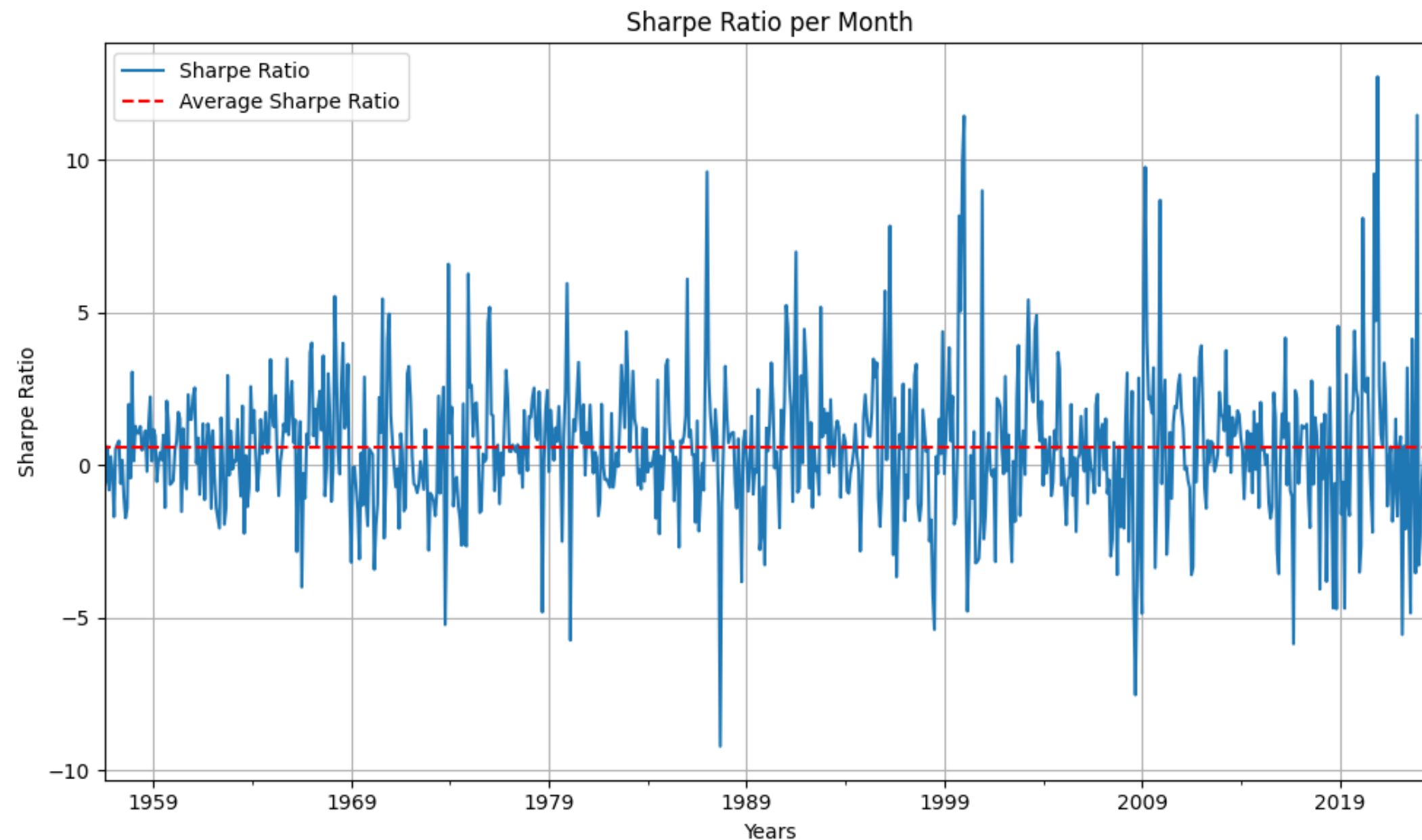Sharpe Ratio is used to measure risk-adjusted returns for a portfolio.

Generally, the greater the Sharpe ratio, the greater the return

We estimated the standard deviation using past returns for the portfolio.

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

- R_p = return of portfolio p

- R_f = risk-free rate

- σ_p = standard deviation of p's returns

Sharpe Ratio - Our Results

Sharpe Ratio per Month

The display on the left shows the Sharpe Ratio of our portfolio over the time period of the entire data set.

The Sharpe Ratio actually has a mean of 0.57 accross all years.

PnL Curve 2010 - 2023

A PnL (Profit and Loss) Curve helps see the trading performance of particular trades. We ran two different PnL curves to truly test our trading strategy.

- To test our strategy against more recent data, we generated a PnL curve from 2010 to 2023. After 2008, the market recovered from the recession and started trading normally until 2020.

As shown on the PnL curve, with an initial investment of $100, returns of over $1,700 were collected.


Pnl of 2010-Present
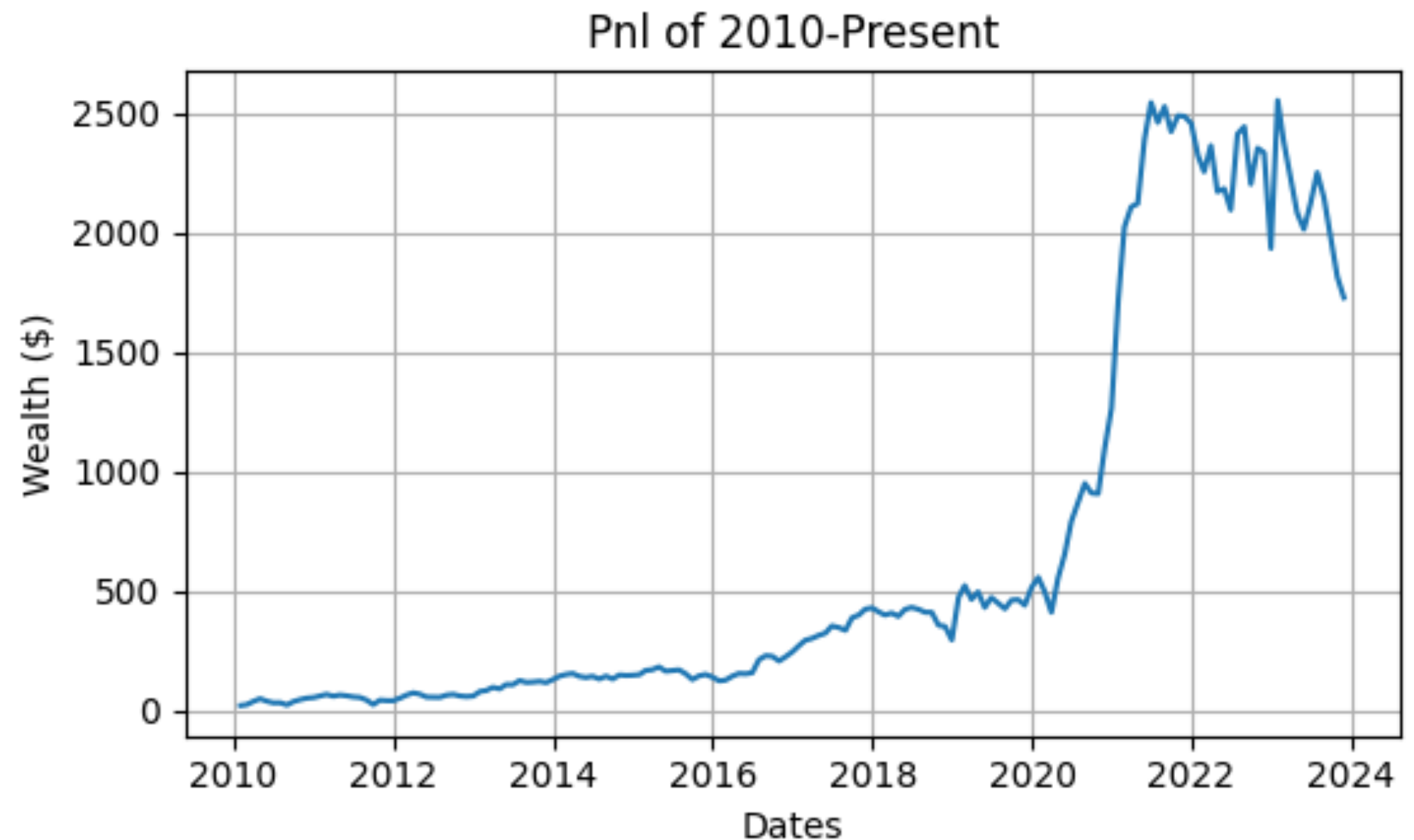
PnL Curve All Time

We didn't want our trading strategy to only generate returns in the last decade, but to be robust enough to show returns through any period of time.

With that being said, we generated a PnL curve from the beginning of our data to the most recent year (1955-2023).

As shown on the PnL curve, with an initial investment of $100, returns of over $464 million were collected.

Pnl of All Time
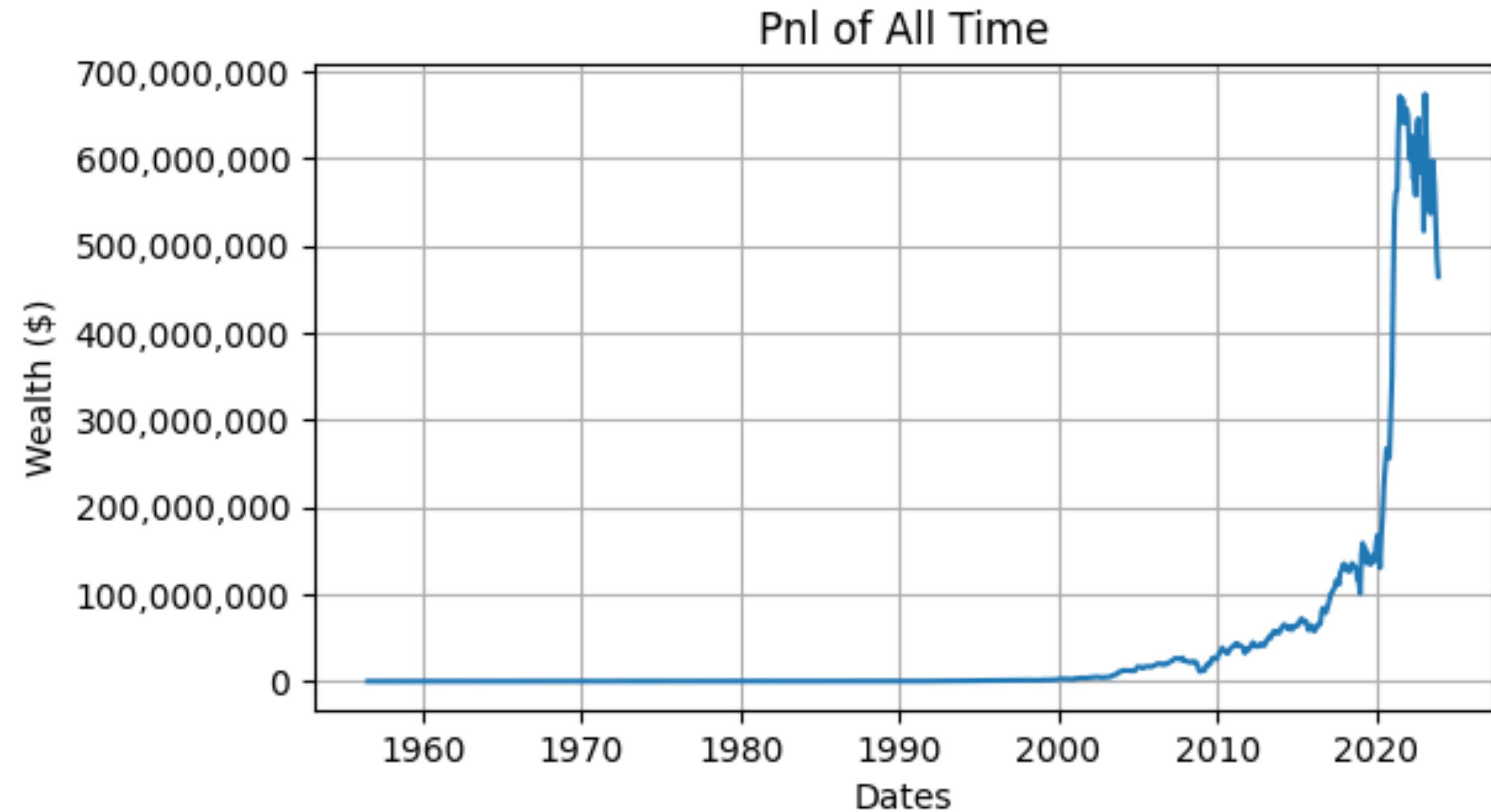
Limitations

Inflation

The PnL of the entire protfolio may not account for inflation. Overestimating our predicted returns.

Bullish Position

Our strategy takes a long position on all the stocks in our bin. This is a bullish position and it could be expanded to include short positions.

Risk Free Rate

The risk free rate was never explicitly given and difficult to compute for a data set of 68 years. Thus, we assumed a risk free rate of 0.

Commission Fees

Executing any buy or sell trade often requires a commission fee that can vary. Trading multiple stocks at the beginning and end of every month can cause an excess of these additional fees.

Recommendation

Use the Cougars of Wall Street binning strategy to invest in a bin of stocks that are binned in thirds according to these factors:

- Ratio of Book to Market Value of Equity (BEME)
- Market Value of Equity (ME)
- Return on Invested Capital (ROIC)
- Market Returns (MKT)