UNIVERSITY of STIRLING

INVP012 [202425_Spring]

Trade Simulation 3

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Our primary objective is to maximize long-term shareholder value by balancing growth and risk. Group 3 aims to achieve sustainable returns through a disciplined approach that emphasises prudent asset allocation, diversification, and risk management.

We allocate our fund into three separate portfolios:

- **Long-term equity portfolio. We allocate 70% of our fund** to high-quality companies with enduring competitive advantages, based on fundamental analysis.
- **Short-term trading portfolio. 20% of our portfolio** is dedicated to leveraging advanced stock prediction models to identify attractive market opportunities (using Python).
- **Risk-free rate. The remaining 10%** of our capital is held in cash deposit to provide liquidity and minimize volatility during uncertain market conditions.

In the event of a market disruption or a black swan event, we are positioned to deploy cash reserves strategically, capitalizing on undervalued assets with long-term growth potential. Our approach prioritizes value creation, stability, and the safeguarding of shareholder wealth in all market environments.

A. LONG - TERM EQUITY PORTFOLIO

I. Our investment goal

We aim to outperform the S&P500 in the two-month period, by holding diversified mid and large-cap stocks.

II. Our investment strategy

We believe that the market is semi-efficient, therefore the market price of the stock will reflect all public information, especially the announcements about operating results. Investment horizon is 2 months (from February to March), utilizing fundamental analysis methods to pick target companies with massive operational growth potential in 1H2025 and the remainder of 2025. These firms require strong financial stability, defined by a Return on Equity (ROE) above 15%, a Return on Assets (ROA) exceeding 10%, and consistently positive cash flow from operations. Additionally, maintaining a high and stable profit margin is essential for safeguarding against adverse market conditions.

III. Investment constraint

- Maximum weight for each stock is 20%
- Maximum weight for each sector is 40%
- Maximum weight for technology stocks is 5%

IV. Trading Strategy

We use the Dollar-cost averaging strategy to reduce the impact of volatility and the herding effect. We will buy stocks for our portfolio at the beginning of each month. The time may change depending on market conditions, but no more than 20 days from the beginning of each month.

V. Rebalancing

We are committed to proactively managing our portfolio by conducting a thorough review every Friday and implementing necessary rebalancing on the following Monday. If there is material evidence that can negatively affect the company's long-term growth potential, we will reevaluate and either decrease the weight or liquidate that stock. Utilizing the Markowitz method for weekly rebalancing, we commit to achieving optimal performance while permitting an absolute deviation of 5% and a relative deviation of 25% from the original weight. This systematic strategy enables us to remain flexible and responsive to fluctuations in the market, thereby protecting and potentially increasing the value of our investments.

VI. Portfolios constitute (Stock pitch)

We use a Top-down method to choose individual stocks for our portfolio. Based on macroeconomic analysis, we will pitch the stocks that can take advantage of President Trump's second term and the Wildfires in California. These are two central investment themes.

1. President Trumps' second term affect

- **Rising domestic oil production.** During this term one of Trump's goals is to promote energy security by increasing domestic supply through expanded drilling activity. He has honored his commitment by making efforts to overturn Biden's limitations on new offshore oil and gas initiatives. Additionally, Trump has postponed the imposition of 25% tariffs on Mexico and Canada for 30 days, there remains a significant risk that these two countries will face high tariffs on all goods imported into the U.S. (United states) after this period. According to Statista (2024), petroleum and refinery imports from Canada and Mexico accounted for 81.6% of total U.S. petroleum imported in 2023. When the imported oil price is higher, U.S. domestic oil companies are likely to increase production to compensate for the shortfall, creating substantial growth opportunities for the upstream sector such as oil drilling companies. As a result, we have chosen EOG Resources **(NYSE: EOG)** for our portfolio; one of the largest crude oil and natural gas exploration and production companies in the United States.

- However, as the U.S. increase drilling activity the total oil supply will rise. Given that global oil demand remains weak, we do not see any significant risks threatening global supply chains, we expect this increase in production to drive oil prices down this year. As a result, industries that rely heavily on oil, such as airlines, will benefit from lower fuel costs. After screening and analysis, we selected **United Airlines (NASDAQGS: UAL)** for this investment idea.

- **Investment in AI**. With substantial rise of China, President Trump will boost investment in AI development to maintain American dominance in this sector. President Donald Trump announced a $500 billion investment in AI infrastructure through a joint venture called Stargate, involving OpenAI, SoftBank, and Oracle. This large-scale project is designed to develop data centers across the United States. It is anticipated that the United States will allocate extensive resources to secure victory in this race as this sector is poised to influence the future of the global economy and national security. As a result, **NVIDIA Corporation (NASDAQGS: NVDA),** the leading

company in the AI hardware market, will benefit most because of the higher demand for Nvidia's GPUs and AI-related products.

- **Applying AI in law enforcement.** One of Trump's notable actions is advocating for the expanded use of AI in law enforcement. Other key aspects include increasing the use of body-worn cameras and TASER devices to enhance the efficiency of police operations. As a result, **AXON Enterprise (NASDAQGS: AXON)** is a strong investment opportunity for our portfolio because of its significant competitive advantage in the US.

- **High interest rate in the short term.** According to the Federal Open Market Committee (FOMC) in December 2024, FED forecasted they would cut interest rates two times in 2025 to reach the inflation target of 2%. The existing elevated import tax policy has the potential to instigate a trade conflict between the United States and other nations, particularly China. This situation poses a significant risk of increased inflation. The Labour Department report on 12/2/2025 showed an unexpected increase in January 2025 CPI, which increased 0.5% after adjusting for seasonal effects, which is the highest rate since August 2023. Consequently, we anticipate that the Federal Reserve will reduce the rate of decrease to just one instance or potentially maintain the current rate throughout the year to limit borrowing and consumption and meet their inflation objectives. This outlook will benefit insurance companies in the short term because most of their assets are invested in savings accounts. Based on an assessment of asset quality, product segments and growth potential, we pitch a non-life insurance company - **The Progressive Corporation (NYSE: PGR)**.

2. Wildfires in California

According to The California Department of Forestry and Fire Protection (CAL FIRE), the wildfire in California had burned 57.660 acres and destroyed 16.248 structures, accounting for 0.12% of total housing units in the state. We believe that the demand for materials and tools for housing repairs and rebuilding will increase significantly once the wildfire is entirely under control. As a result, we expect this surge in demand will boost sales of home improvement retailers, as seen in previous disasters. Besides that, while wildfire can negatively impact insurance companies due to the high volume of claims, we can see an opportunity for insurers to increase their premium in the medium term.

Based on our analysis and our stock selection criteria, we chose **The Home Depot (NYSE: HD)** and **Lowe's Companies (NYSE: LOW)** for our portfolio, as 10.54% and 6.41% of their stores are in California, respectively.

Figure 1: Correlation matrix

	EOG Resources	*Progressive*	*Lowe's Companies*	*Home Depot*	*United Airlines*	*Nvidia*	*Axon*
EOG Resources	1						
Progressive	0.252	1					
Lowe's Companies	0.191	0.058	1				
Home Depot	0.193	0.091	0.867	1			
United Airlines	0.042	0.060	0.184	0.140	1		
Nvidia	-0.011	-0.114	0.058	0.119	0.130	1	
Axon	0.270	0.145	0.101	0.120	0.180	0.150	1

Source: Group's estimation

The constituents in our portfolio provide strong diversification, as demonstrated in the correlation matrix. Most stock pairs have a correlation lower than 0.27, while Nvidia (Technology) exhibits a negative correlation with EOG resources *(Energy)* and Progressive *(Insurance)*. The only exceptions are Lowe's Companies and Home Depot, which have a high correlation of 0.867 due to both operating in the same business, home improvement retail. We have overweighted this sector based on our expectation that these companies will have good operating results in 1Q, driven by high demand after the wildfire in California.

VII. Portfolio allocation

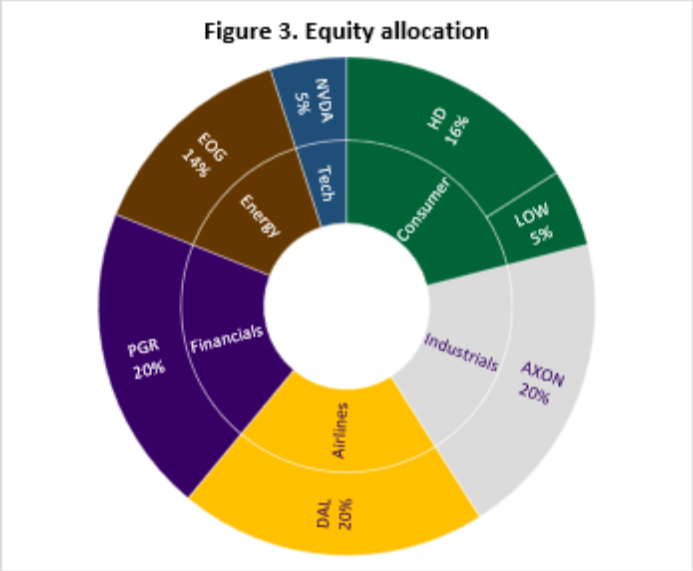
We allocate 10% of the fundamental portfolio to cash deposits at a 2% interest rate and 90% to equities for long-term holding. This allocation will reduce our one-year expected return from 56.95% to 51.46%, however, this will protect us from systematic risk and provide cash reserve to increase stock weightings in the case of significant price fluctuations.

Figure 2: Expected return and standard deviation of portfolio

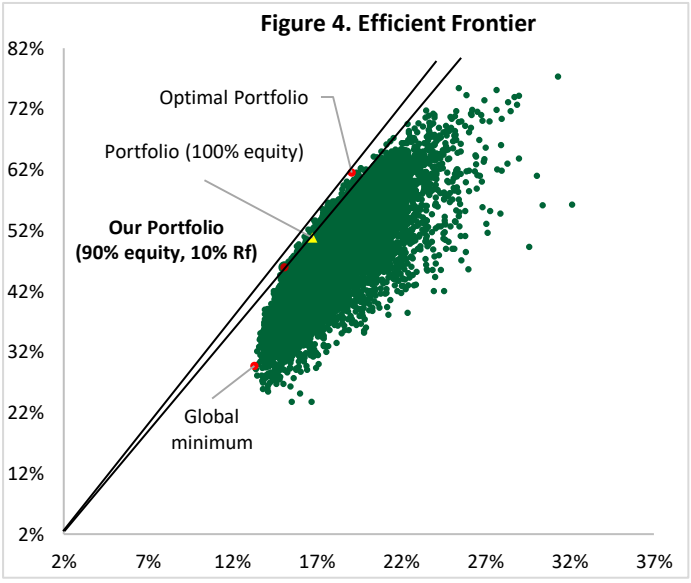
	Our fundamental portfolio (risky + risk-free assets)	100% equity portfolio	Optimal portfolio
Expected return (%/day)	0.20%	0.23%	0.28%
Expected return (%/year)	51.46%	56.95%	70.63%
Std. Dev (%/day)	1.02%	1.13%	1.3%
Std. Dev (%/year)	16.13%	17.93%	20.68%
Sharpe Ratio (daily return)	18.30%	18.34%	19.67%

Source: Group's estimation

We apply the Markowitz model for the equity portfolio allocation, with constraints on individual stock and sector weight limits. We allocate 5% to LOW, 16% to HD, 20% to AXON, 20% to UAL, 14% to EOG, 20% to PGR, and 5% to NVDA. We overweight the Consumer sector, which accounts for 21% of the total equity portfolio, as we believe this industry will benefit immediately in the short term due to the wildfires in California. In contrast, we only allocated 5% to NVDA because DeepSeek's appearance put pressure on Nvidia's operation. If DeepSeek brings a breakthrough technology that outperforms Nvidia's offerings (e.g., faster processors, superior AI hardware, or advanced software solutions), it could disrupt its business model and potentially lead to a loss in demand for its products. We want to limit the allocation for the technology sector to reduce the risk for the whole portfolio. We will change the limit for technology in general and Nvidia specifically when we have enough information about DeepSeek to analyze its effect.

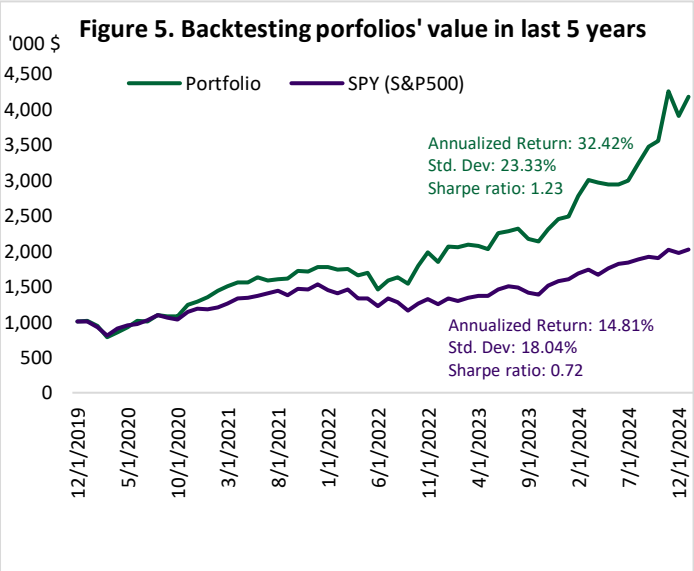


Source: Group's estimation

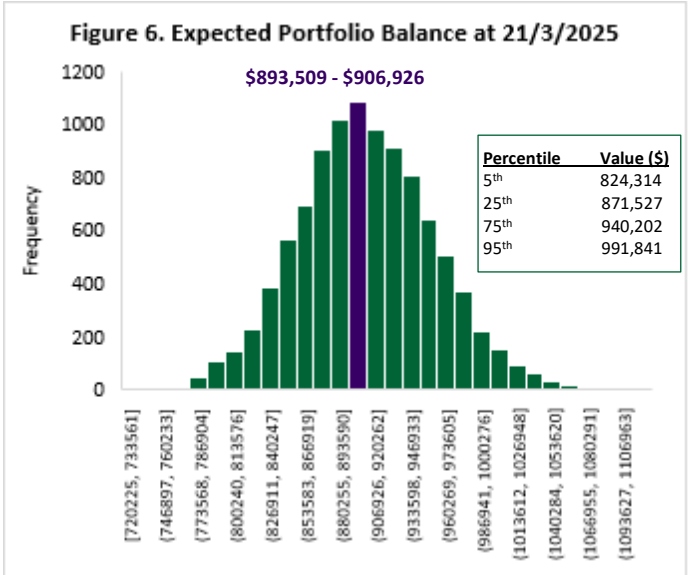


Source: Group's estimation

To evaluate our portfolio's effectiveness in the past, we ran the backtest for the last 5 years to see how the portfolio growth compares with the S&P500 ETF. The result showed impressive performance with the portfolio's annualized return and Sharpe ratio of 32.42% and 1.23, compared with 14.81% and 0.72 of the benchmark, respectively (our more detailed backtesting results about performance and return/risk metrics are shown in table I.1 and I.2 in appendix). We also run Monte Carlo with 10.000 simulations to see our portfolio's value at the end of trading time. Assuming no dividend is paid during investment horizontal, the $800.000 initial investment in 5/2/2025 will become around $893.509 - $906.926 at the end of date 21/3/2025, equivalent to 10.82% - 12.21% return.



Source: Portfolio Visualizer

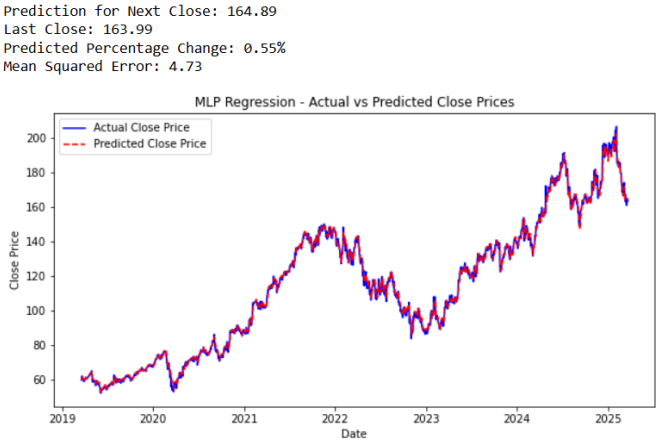


Source: Group's estimation

B. SHORT- TERM TRADING PORTFOLIO

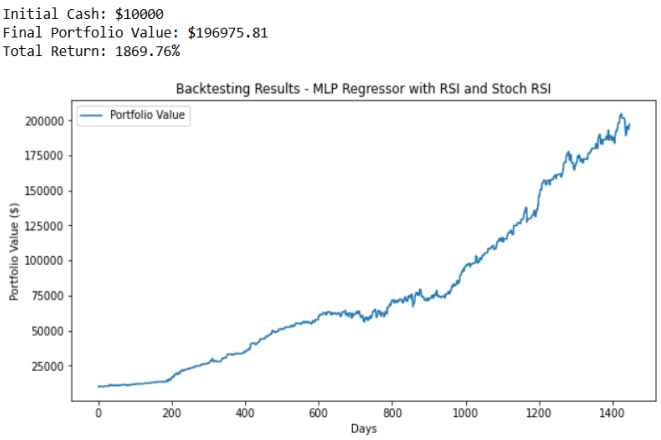
We allocated 20% of the portfolio to time-series and machine learning prediction methods. After running back tests using both time-series and Machine Learning (ML) methods, the ML model using Multi-Layer Perceptron (MLP) provided superior results. We employed this MLP technique on Axon as the back test provided a 259% increase in 4 years using features of 2-, 5- and 14-day Moving Averages, High, Low and RSI values. This model didn't consider sentiment analysis and the unknown element of the Axon partner joining a competitor's firm made the model inaccurate. This meant the model needed further improving and a Stochastic RSI was added as a feature, since it is a useful technical analysis feature for indicating momentum shifts. This new model was applied to Alphabet Inc Class A (NYSE: GOOGL) data, as the back test provided a value increase of approximately 0.29% per day. We acted on this model on Thursday 20th March as the open price for GOOGL was 161.57 and the predicted close was 162.24. We therefore put a long position on GOOGL as we expected the price to rise throughout the day and when the price crossed the threshold of 162.24, we liquidated our position. The data for the model was acquired through Google Finance as it is an accurate and trusted source for financial data and the ML models were ran through Jupyter Notebook (Python).

(Figure 7: GOOGL prediction and previous close for MLP)



Source: Group's estimation

(Figure 8: GOOGL Back Test results for MLP)



Source: Group's estimation

Time-series analysis (TSA) is a statistical technique to uncover trends, patterns and relationships in continuous data to gain insights and output predictions. Python (programming language) has the required in-built libraries to perform time series analysis, the data for the analysis (Alibaba Group Holding Ltd, NYSE: BABA, daily closing price) is fetched from Capital IQ.

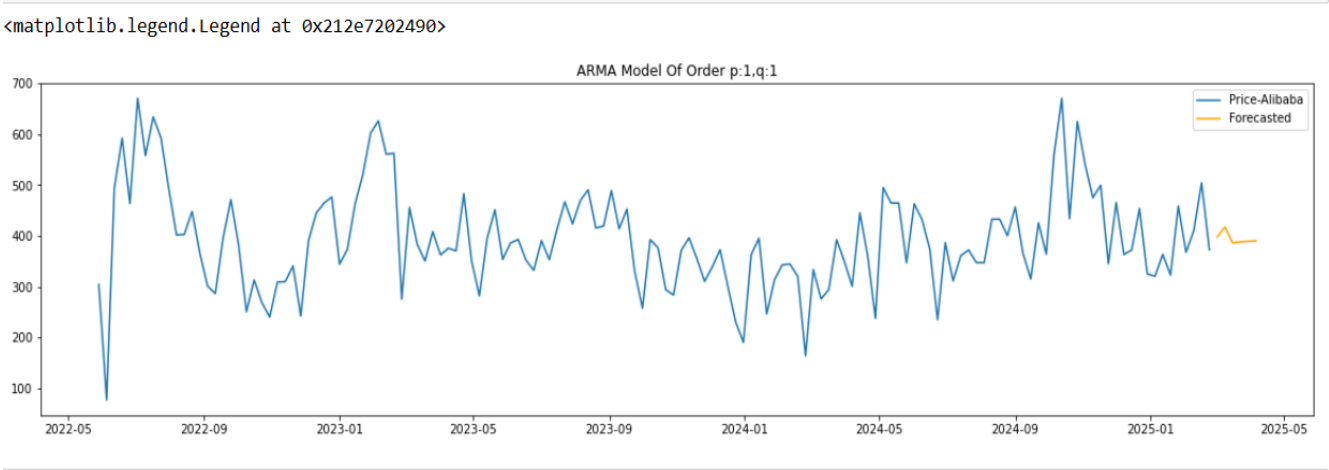
Date and the closing price are the required data to perform TSA, we chose the closing price as we want to predict the closing price for next six weeks (trading period), there are many models which are part of time series analysis and we need to choose the appropriate model as per our data.

Firstly, we must check if the data is stationary (mean and variance being constant over time) and select the model accordingly, the data which we fetched is stationary and has components like trend, seasonality and residuals, based on

the presence of this and the data possessing stationary characteristics we chose the auto regressive moving average (ARMA) model of time series analysis to forecast the closing prices of next six weeks (data is summed into weekly to directly get insights for weekly predictions).

In the ARMA model, the Autoregressive (AR) part uses past values to predict future ones, and the Moving Average (MA) part uses past errors to improve predictions. Together, AR and MA create patterns using the past data and it will forecast the future values based on the underlying patterns.

(Figure 9: Trend of past and forecasted data of Alibaba group holding Ltd)



Source: Group's estimation

(Figure 10: Forecasted values from ARMA model for the next five weeks)

Pricing Date	Price
2025-01-26	458.827284
2025-02-02	367.645504
2025-02-09	410.729319
2025-02-16	504.568322
2025-02-23	372.682827

Source: Group's estimation

The predictions are done in weeks as we took our trading period in weeks, and tried to forecast data and predict the trend of the Alibaba stock, the trend we got after the visualization (Figure 9) has no momentum and it has no major movements, this made us unclear about the outcome of our model for this particular stock, and we decided not to take chance on trading this stock.

C. LITERATURE REVIEW

Topic: Why do equity prices change – what are the main drivers of equity prices and changes in their valuations?

In the 21st century, equity markets have emerged as a pivotal component of the global financial system, facilitating capital formation and providing investors with a variety of avenues for wealth accumulation (Braga and Demasi, 2008). Understanding the elements that affect stock prices is crucial for investors and policymakers (Anuradha Guru, 2009). This literature review aims to provide a comprehensive analysis of the principal determinants of equity pricing and valuation. Firstly, it will consider the fundamental aspects of a company; secondly, the impact of macroeconomic factors and prevailing market conditions; and finally, the role of behavioural influences.

According to Karki (2018), whom analysed the stocks of 150 commercial banks, proposed fundamental factors are commonly viewed as key determinants of stock pricing and valuations, they indicate the underlying financial stability and growth prospects of a company. The findings from Sundaram and Rajesh (2016) empirical analysis indicates that the variables Book Value per Share, Dividend Per Share, Dividend Yield, Earnings Per Share, Firm Size, and Return on Net Worth serve as significant factors influencing the stock pricing of companies. Earnings and revenue growth are critical indicators of a company's operational efficiency and future success potential. A consistent rise in earnings boosts investor confidence and increases stock valuations, demonstrating the company's ability to generate sustainable increasing profits (Fama and French, 1992). However, Pulcini (2022) argues that the ability of firm fundamentals in explaining pricing variability is severely limited, as evidenced by the study of 5,000 stocks from 30 developed countries from a period of 17 years. Pulcini (2022) suggest that stock prices do not fully reflect firm's fundamentals due to market inefficiencies whereby investors may not fully incorporate all relevant information about a company's fundamentals into its stock price, resulting in a gap between the firm's intrinsic value, based on these fundamentals, and its current market price. Spilioti (2019) also supports Pulcini (2022) perspective found that differences between predicted and realized stock prices can be further evaluated by considering both macroeconomic variables and investor sentiment to get a better estimate of the true value of a stock's price, which fundamental analysis does not adequately account for.

Macroeconomic elements significantly influence equity prices, especially during times of increased market volatility, escalating interest rates and geopolitical instability (Hasan & Javed, 2009). Research consistently shows that the sentiment of news plays a crucial role in affecting equity prices in markets worldwide. Communications from central banks, especially statements from the Federal Open Market Committee, shape the relationship between macroeconomic news and stock prices (Gardner et al., 2021). According to (Guo, 2022) Modern Portfolio Theory (MPT) highlights the importance of risk diversification through selection of assets that exhibiting low to negative correlations thus reducing overall portfolio volatility via sector diversification and potentially enhancing returns. This theory also introduced the notion of the efficient frontier, which assists investors in creating optimal portfolios aligned with their individual risk tolerance (Ziółkowski & Borucka, 2016). Traditional asset pricing models such as Capital Asset Pricing Model (CAPM) and Arbitrage Pricing Theory (APT), offers theoretical inputs for comprehending the connection between risk and return

while considering macroeconomic factors in the pricing of the stock. According to Elbannan (2014) CAPM is a valuable tool for investment decision-making and estimating expected share returns enabling investors to calculate risk-adjusted returns, optimize portfolio allocation, and make informed financial decisions based on systematic risk exposure determining the best value for the stock. According to Dhankar and Singh (2005), APT is a multi-factor asset pricing model that explains expected returns based on multiple macroeconomic risk factors, offering a more flexible alternative to the single-factor CAPM which focuses solely on market risk of beta and failing to account for other essential elements, including firm size, market momentum, liquidity, and macroeconomic factors which exerts tangible influence in the stock price. Arbitrage Pricing Theory (APT) recognizes various sources of systematic risk, including inflation, interest rates, GDP growth, and sector-specific disturbances. This adaptability enhances the empirical strength of APT, offering superior explanatory capabilities for stock returns and effectively addressing diverse economic scenarios (Shen, 2025). APT, has undergone significant examination and criticism due to their shortcomings in addressing the complexities of real-world markets such as failing to identify potential for multicollinearity of risk factors present in markets thus affecting the overall intrinsic valuation (Junaedi Tompo, 2023). In contrast machine learning techniques, particularly neural networks, show promise in assisting asset pricing models due to their ability to process large datasets and capture non-linear relationships thus making it an essential factor to consider in the modern day of evaluating equity pricing (Bielinski & Broby, 2021).

Behavioural finance plays a crucial role in understanding equity price movements, highlighting the psychological and cognitive biases that drive investor behaviour and market sentiment which traditional asset theories fail to consider (Andrei Shleifer, 2000). VIX (VIX | S&P Dow Jones Indices, n.d.) serves as a key indicator measuring fear and greed a fundamental psychological influence on equity prices. During economic instability, fear can trigger panic selling, resulting in significant price drops that may not correspond with underlying valuations. On the other hand, an overabundance of optimism and speculation driven by greed can lead to the overvaluation of assets, creating speculative bubbles that ultimately collapse, leading to sudden market corrections. Emphasizing how fear and reward learning contribute to the cyclical nature of boom-and-bust periods (Lo, 2013).

Thus, in conclusion, stock valuation depends on a multitude of factors, such as fundamentals, macroeconomics, and investor behaviour among others. Earnings and financial indicators play a crucial role in determining valuation; however, market inefficiencies and broader economic changes, such as inflation and interest rates, significantly influence equity pricing. Conventional models, including the Capital Asset Pricing Model (CAPM) and Arbitrage Pricing Theory (APT) are useful for computing risk but fail to account for psychological factors, such as fear and greed, contributing to market fluctuations. To achieve a comprehensive evaluation, it is essential to integrate financial analysis, prevailing economic conditions, and the sentiments of investors to ensure precise pricing and accurate valuations when analyzing a particular company or when building a portfolio.

D. TRADING DIARY

Figure 11. Trading diary

Event	Date	Symbol	Price	Quantity	Fee	Exchange	Note
BUY	05/02	AXON	679.73	103	15	NASDAQ	Buy order for 103 of AXON at 680.55 with a commission of 15.00 - 50% of total weight is 20%
BUY	05/02	DAL	68.35	1014	15	NYSE	Buy order for 1014 of DAL at 68.35 with a commission of 15.00 - 50% total weight is 20%
BUY	05/02	EOG	127.28	337	15	NYSE	Buy order for 337 of EOG at 127.55 with a commission of 15.00 - 50%of weightage total weight is 12%
BUY	05/02	LOW	258.15	240	15	NYSE	240 of LOW at 258.25 with a commission of 15.00
BUY	07/02	HD	412.50	42	15	NYSE	Buy order for 42 of HD at 413.00 - 50% of target weight
BUY	07/02	NVDA	128.19	140	15	NASDAQ	Buy order for 140 of NVDA at 126.00
BUY	07/02	PGR	250.46	281	15	NYSE	Buy order for 281 of PGR at 250.50 - 50% of weight
SELL	18/02	DAL	64.50	1014	15	NYSE	A Delta Air Lines plane crash-landed and flipped upside down at Toronto Pearson International Airport on Monday (17/2/2025). Although all 80 on board safe after Delta plane flips over, but the group expect it still affect the company's short-term performance, especially Q1 financial statement.
BUY	18/02	HD	404.31	93	15	NYSE	We rebalance our group's portfolio to match the new optimal portfolio allocation due to restructuring DAL with UAL, with prices updated on February 14, 2025
SELL	18/02	LOW	250.24	100	15	NYSE	We rebalance our group's portfolio to match the new optimal portfolio allocation due to restructuring DAL with UAL, with prices updated on February 14, 2025
BUY	18/02	UAL	104.95	671	15	NASDAQ	UAL is the second-ranked company in the aviation industry, based on our group's evaluation criteria. We restructured DAL shares with UAL to keep the sector's allocation target in the portfolio stable, after selling out all DAL.
BUY	19/02	AXON	660.70	103	15	NASDAQ	We raise the volume to the target weight because of market over reaction
BUY	20/02	AXON	583.99	110	15	NASDAQ	Our Python model predicts a rebound in price today. In addition, we assess that the market is overreacting to the company's current news. So we use source from our trading fund to arbitrage

SELL	24/02	AXON	506.24	110	15	NASDAQ	Reaching the cut loss point of trading fund
BUY	04/03	HD	384.23	89	15	NYSE	We use Dollar-Cost Averaging combined with restructuring our portfolio at the beginning of the month. Market decrease create good opportunity for us to execute
BUY	04/03	NVDA	117.74	152	15	NASDAQ	We use Dollar-Cost Averaging combined with restructuring our portfolio at the beginning of the month. Market decrease create good opportunity for us to execute
BUY	04/03	PGR	283.67	186	15	NYSE	We use Dollar-Cost Averaging combined with restructuring our portfolio at the beginning of the month. Market decrease create good opportunity for us to execute
BUY	17/03	AXON	542.24	31	15	NASDAQ	Rebalance the portfolio based on data in 17/03/2025
BUY	17/03	EOG	124.31	727	15	NYSE	Rebalance the portfolio based on data in 17/03/2025
SELL	17/03	HD	351.17	38	15	NYSE	Rebalance the portfolio based on data in 17/03/2025
BUY	17/03	LOW	226.83	6	15	NYSE	Rebalance the portfolio based on data in 17/03/2025
SELL	17/03	NVDA	116.32	17	15	NASDAQ	Rebalance the portfolio based on data in 17/03/2025
BUY	17/03	UAL	72.63	1108	15	NASDAQ	Rebalance the portfolio based on data in 17/03/2025
BUY	20/03	GOOGL	163.18	1000	15	NASDAQ	Buy price at 161 based on Machine learning model (Short Term Trading)
SELL	20/03	GOOGL	163.42	1000	15	NASDAQ	Sell at 163.33 for 120 profits

Source: HTMW

During the trading period, we executed 25 orders, 19 buy orders and 6 sell orders. We followed strictly with the allocated investment strategy, so that most of the trading was rebalancing action based on our Markowitz model. We realized $22,274 losses during the portfolio restructuring, with AXON having the largest loss at 18,951 *(more detailed will be shown in Appedix.II).*

According to the trading policy outlined in our investment mandate, for the long-term equity portfolio, we will divide purchases into two installments at the beginning of each month to mitigate the impact of volatility. However, due to the negative action in the US stock market, we have postponed the second purchase until 17th March. After this purchase, the proportion of the long-term investment portfolio has increased to exactly our target weight of 70%.

E. PORTFOLIO PERFORMANCE

Figure 12. Ending portfolio statement

Company	Market value ($)	% initial weight in equity portfolio	% ending weight in equity portfolio	% weight in overall portfolio	Rate of return YTM	Total profit YTM
Total equity portfolio	**657,353.85**	**100%**	**100%**	**70.20%**	**-6.26%**	**-43,902.53**
- AXON	132,720.00	20%	20.19%	14.17%	-10.74%	-15,970.63
- UAL	133,193.73	20%	20.26%	14.22%	-11.73%	-17,701.76
- EOG	133,180.88	14%	20.26%	14.22%	-0.06%	-85.85
- HD	65,313.90	16%	9.94%	6.97%	-11.74%	-8,689.44
- LOW	33,152.22	5%	5.04%	3.54%	-11.60%	-4,349.76
- NVDA	32,367.50	5%	4.92%	3.46%	-4.11%	-1,388.83
- PGR	127,425.62	20%	19.38%	13.61%	3.48%	4,283.74
Cash deposit	**279,087.77**			**29.80%**		
- Initial cash - Dividend - Interest debit	277,294.31 518.12 1,275.34					
Total	**936,441.62**				**-6.46%**	**-63,558.38**

Source: HTMW, Group's estimation

The table above shows the allocation of the investment portfolio at the end of 21/03/2025, along with the investment returns for each stock.

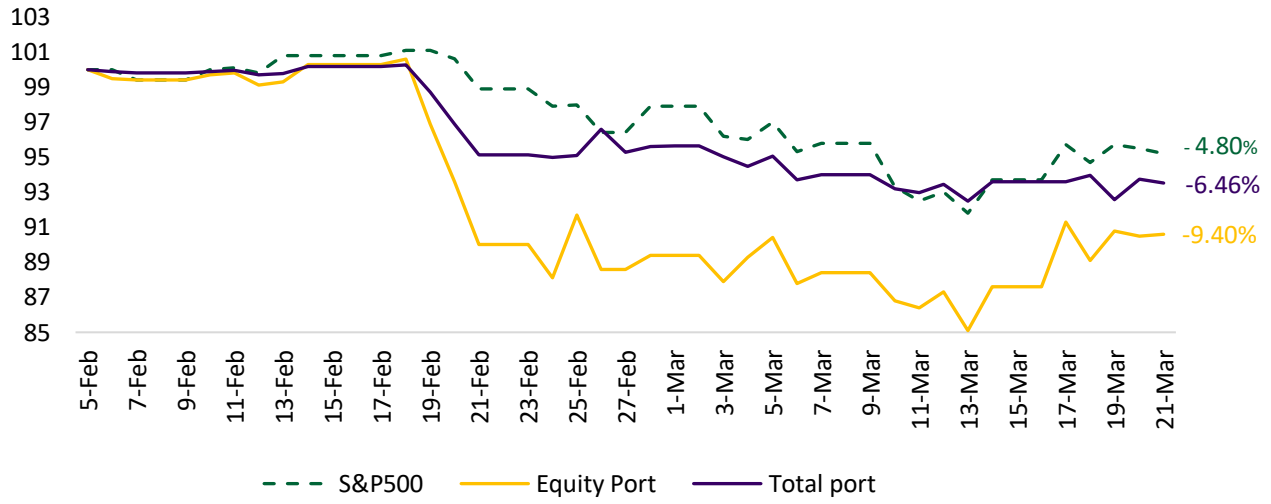
For the long-term equity portfolio, we always maintained a weighting equivalent to 70% of the total portfolio. During the investment period, we restructured the portfolio once, when we switched from holding DAL shares to holding UAL shares, due to concerns that negative information regarding the company's plane crash could negatively impact Q1 operating results and have an adverse effect on individual investor sentiment. Besides that, we reallocated the portfolio twice after initial buying because stock prices had changed significantly. We increased the weight of EOG from 14% to 20% and decreased the weight of HD from 16% to 10%. The beta of the stock portfolio as of 21st March 2025, was 0.89. Although beta increased by 0.07 units from its initial value, as compared to the market portfolio of beta 1, indicating that the portfolio is still well-diversified.

However, the portfolio's investment performance during this period was not good, as shown by the fact that most stocks recorded losses, except for PGR, which made a slight gain of 3.48%. This was due to US stock market's concern about the financial crisis and weaker economy when President Donald Trump continuously imposed tariffs on his trading partners, causing economic instability. In addition, our stock portfolio underperformed the S&P500 index due to AXON recording the most significant decline in the past 2 years (maximum drawdown was 26%), because of worry about increasing competition following the split with Flock Safety (this is one of Axon's partners from 2020).

For the short-term trading portfolio, based on the Python model, we identified two speculative opportunities, including buying AXON and GOOGL. However, with the AXON stock trade, we lost $18,981.71 (-25.43%) due to improper timing, while recording a profit of 0.13% ($210) with GOOGL stock.

The chart below shows the portfolio total return rebased to 100. Due to the significant impact of the sharp decline in AXON and UAL stocks, the return of the risky portfolio *(included long-term equity portfolio and short-term trading portfolio)* began to decline substantially from February 19, 2025, and ended with a return of -9.4%. Since this portfolio only accounts for 70% of the total portfolio, the return of the entire portfolio for the entire trading period was -6.46%. However, this level is still lower than the S&P 500 at -4.8%. Thus, our portfolio did not perform well during the 2-month trading period, as it continuously underperformed the benchmark.

Figure 13. Portfolio total return rebased to 100



Source: HTMW, Snowball Analytics, Groups' estimation

F. CONCLUSION

What we had done well:

- We held a well-diversified investment portfolio based on fundamental analysis and the Markowitz model.
- We always maintained a stable cash ratio to reduce risks and take advantage of speculation opportunities.
- We had established a complete Investment Policy and followed it strictly, ensuring our portfolio was constantly managed according to the set rules.
- We always maintained objectivity during the trading period based on our own analysis. Moreover, thanks to applying the Dollar-cost averaging strategy, we were unaffected by market fluctuations and crowd psychology.

What we have not done well:

- We did not apply technical analysis during trading periods, which makes determining buy and sell points less optimal.
- We sometimes failed to follow our stop-loss rule, resulting in reduced investment efficiency.

APPENDIX

I. Portfolio backtesting

We run the backtest for our simulation portfolio to see how it performed in the past. The results below show that if $700,000 had been invested on January 1, 2019, it would have grown to $3,656,306 by December 31, 2024, reflecting a cumulative return of 422.33%. In comparison, the benchmark investment would have reached $1,805,203, yielding a cumulative return of 157.89% over the same period. That made the annualized return of the risky portfolio reach 26.81%, more than double that of the S&P 500. Although the standard deviation of the portfolio is higher than the benchmark due to the high volatility of AXON and NVDA stocks, the risk-adjusted relative returns are relatively good with a sharpe ratio of 1.22, 1.4 times higher than the S&P 500 ETF.

Figure 14. Portfolio Performance (Jan 2019 - Dec 2024)

Metric	Long-term equity portfolio	SPDR S&P 500 ETF Trust
Start Balance	$700,000.00	$700,000.00
End Balance	$3,656,306.12	$1,805,202.82
End Balance (inflation-adjusted)	$2,910,551.97	$1,437,006.76
Annualized Return (CAGR)	31.72%	17.10%
Annualized Return (CAGR, inflation adjusted)	26.81%	12.74%
Standard Deviation	23.10%	17.39%
Best Year	59.59%	31.22%
Worst Year	3.99%	-18.17%
Maximum Drawdown	-24.71%	-23.93%
Sharpe Ratio	1.22	0.86

Source: Snowball analytics

The following table will describe the risk and return metrics between the equity portfolio and the S&P500 ETF Trust. The portfolio we built has outperformed the benchmark in the period from 2019-2024. Along with a careful assessment of the company's operating efficiency, we expect this portfolio to continue maintaining this growth in the future.

Figure 15. Risk and Return Metrics (Jan 2019 - Dec 2024)

Metric	Long-term equity portfolio	SPDR S&P 500 ETF Trust
Arithmetic Mean (monthly)	2.54%	1.45%
Arithmetic Mean (annualized)	35.12%	18.85%
Geometric Mean (monthly)	2.32%	1.32%
Geometric Mean (annualized)	31.72%	17.10%
Standard Deviation (monthly)	6.67%	5.02%
Standard Deviation (annualized)	23.10%	17.39%
Downside Deviation (monthly)	3.55%	3.08%
Maximum Drawdown	-24.71%	-23.93%
Benchmark Correlation	0.80	1.00
Beta	0.81	1.00
Alpha (annualized)	12.00%	0.00%
R Squared	63.98%	100.00%
Sharpe Ratio	1.22	0.86
Treynor Ratio (%)	26.42	14.98

Modigliani–Modigliani Measure	23.56%	17.39%
Active Return	14.62%	
Tracking Error	13.91%	
Information Ratio	1.05	
Positive Periods	46 out of 72 (63.89%)	48 out of 72 (66.67%)
Gain/Loss Ratio	1.57	1.00

Source: Portfolio Visualizer

Returns-based style analysis shows that our portfolio is more diversified than the ETF trust. The overall portfolio return growth comes from large-cap value stocks (34.04%), large-cap growth stocks (10.95%), mid-cap growth (38.60%), and Small-cap Value stocks (16.41%). In addition, 31.17% of the return will come from other market factors.

Figure 16. Returns Based Style Analysis

Style Category	Long-term equity portfolio	SPDR S&P 500 ETF Trust
Large-cap Value	34.04%	46.24%
Large-cap Growth	10.95%	53.42%
Mid-cap Value	0.00%	0.00%
Mid-cap Growth	38.60%	0.00%
Small-cap Value	16.41%	0.00%
Small-cap Growth	0.00%	0.00%
R Squared	**68.83%**	**99.93%**

Source: Snowball analytics

II. Detailed performance and change in weight of each stock

Figure 17. Detailed performance and weight of each stock in portfolio

Holding	Sector	Initial weight	Final weight	PE	Current Beta	Capital gain ($)	Capital gain ($)	Realized P&L	Total profit ($)
UAL	Airlines	0%	20%	8.4	1.39	-17,702	-11.73%	0	-17,702
DAL	Airlines	20%	0%	5.6	1.34	0	0	-3,904	-3,904
PGR	Financials	20%	20%	19.4	0.42	4,284	3.48%	0	4,284
NVDA	Technology	5%	5%	41.7	1.62	-1,389	-4.11%	-202	-1,591
LOW	Consumer	18%	5%	18.6	1.11	-4,350	-11.60%	-791	-5,141
HD	Consumer	5%	10%	24.0	1.06	-8,689	-11.74%	-2,331	-11,020
AXON	Industrials	20%	20%	139.7	1.05	-15,971	-10.74%	-18,951	-34,921
EOG	Energy	12%	20%	10.3	1.28	-86	-0.06%	0	-86
GOOGL	Communication Services	0%	0%	20.4	1.03	0	0	240	240

Source: Group's estimation, HTMW, Snowball analytics

Final weight was higher than initial weight
Weight was unchanged
Final weight was lower than initial weight

Our initial portfolio consisted of 7 stocks: DAL, PGR, NVDA, LOW, HD, AXON, and EOG. However, we had restructured the portfolio, switching from holding DAL to holding UAL after negative news about the DAL plane crash. Therefore, we recorded a realized loss of $3,904 when we sold this stock. AXON had the largest realized loss of $18,951 because we cut our losses when the stock fell sharply. The realized losses on the other stocks mainly came from reallocation.

III. Detailed trading performance by week

Week 2 (10/2-14/2)

Figure 18. Portfolio return at 14/2/2025

Company	% weight in equity portfolio	% weight in overall portfolio	% change in a week	Profit in week	Total return	Total profit
AXON	20.05%	7.03%	0.61%	429.51	0.54%	379.04
DAL	18.88%	6.62%	-4.04%	-2,788.50	-4.33%	-3,001.44
EOG	12.41%	4.35%	2.22%	946.97	1.59%	684.11
HD	4.90%	1.72%	0.52%	89.46	-0.73%	-126.00
LOW	17.21%	6.03%	-0.06%	-36.00	-2.46%	-1,526.40
NVDA	5.54%	1.94%	6.94%	1,261.40	8.32%	1,492.40
PGR	21.02%	7.37%	4.79%	3,372.00	4.85%	3,411.34
Total	**100.00%**	**35.06%**	**0.94%**	**3,327.84**	**0.38%**	**1,313.05**

Source: HTMW, Snowball Analytics, Group's estimation

During the week, although the higher-than-expected CPI announcement negatively impacted the overall market, it quickly rebounded thanks to strong investor expectations for the information technology sector. As a result, this sector was the primary driver of the 0.79% increase in the S&P 500. Compared to the benchmark, our equity portfolio outperformed, mainly due to Nvidia's recovery of nearly 9% after experiencing a significant 17% decline in the previous week. Additionally, the price of PGR increased 4.79%, driven by investor's expectation that interest rates remain unchanged in the mid-term because of the unfavourable CPI data.

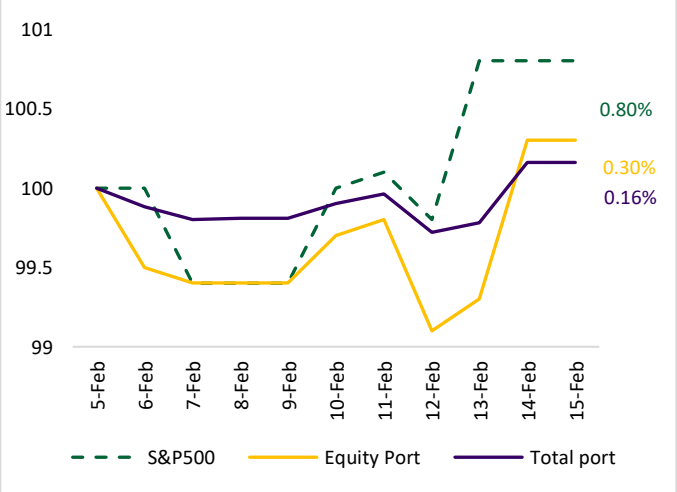
In contrast, DAL experienced a significant decline, due to the company's CIO selling 2.47 million shares, which created anxiety among investors. This volume represents 0.4% of the total outstanding shares, equivalent to 35% of the average daily trading volume.

Figure 19. Overall portfolio at 14/2/2025

Company	Value	% weight in overall portfolio
Equity	351,132.36	35.06%
Cash deposit *- Interest debit* *- Initial cash*	650,456.97 *381.28* *650,075.69*	64.94%
Total	**1,001,589**	**100.00%**

Source: *HTMW, Group's estimation*

Figure 20. Portfolio total return rebased to 100 at 14/2



Source: *HTMW, Group's estimation*

Week 3 (17/2-21/2)

Figure 21. Portfolio return at 21/2/2025

Company	% weight in equity portfolio	% weight in overall portfolio	Total return Last week	Total profit Last week	Total return YTM	Total profit YTM
AXON*	36.00%	17.05%	0.54%	379.04	-19.86%	-40,170.67
UAL	14.28%	6.76%	n/a	n/a	-8.65%	-6,094.26
EOG	9.96%	4.71%	1.59%	684.11	4.52%	1,939.60
HD	11.55%	5.47%	-0.73%	-126.00	-5.35%	-2,940.33
LOW	7.43%	3.52%	-2.46%	-1,526.40	-5.61%	-3,478.20
NVDA	4.18%	1.98%	8.32%	1,492.40	4.76%	853.70
PGR	16.6%	7.86%	4.85%	3,411.34	6.26%	4,405.13
Total	**100.00%**	**47.35%**	**0.38%**	**1,313.05**	**-9.19%**	**-45,485.03**

**We bought 110 shares for our trading fund to speculate from over reaction from investors on Axon.*

Source: HTMW, Snowball Analytics, Group's estimation

In this week, AXON crashed nearly 20% because of worry about increasing competition following the split with Flock Safety (this is one of Axon's partners from 2020). However, according to our observations, Axon and Flock Safety stopped cooperating around the end of October 2024. Moreover, Axon proactively ended this cooperation. Therefore, we believe that Axon itself has carefully considered and had its strategy to maintain growth when there is an increase in competition. In addition, this change cannot immediately have an impact on Axon's 1H business results; therefore, we think Axon's price movements this week were caused by investors' overreaction.

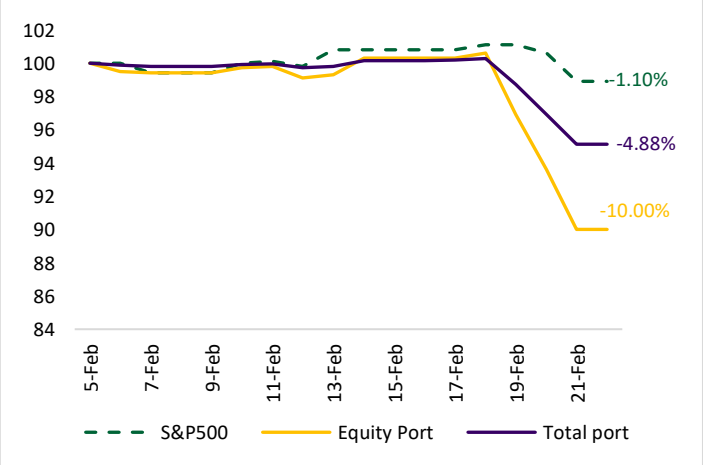
Moreover, on 17/2/2025, a Delta plane crash-landed upside, made us worry about its safety policy after two Delta planes collided on the runway in September 2024. We believe these events will negatively affect customer confidence, thereby affecting business results in the first half of 2025 due to additional costs incurred in overcoming the consequences of the accident. So, we decided to restructure our portfolio, replacing Delta with United Airlines, with a PE valuation of 11.11x, which is 12% lower than Delta.

Figure 22. Overall portfolio at 21/2/2025

Company	Value	% weight in overall portfolio
Equity	450,439.30	47.35%
Cash deposit *- Interest debit* *- Initial cash*	500,735.55 *636.14* 500,099.41	52.65%
Total	**951,222.11**	**100.00%**

Source: *HTMW, Group's estimation*

Figure 23. Portfolio total return rebased to 100 at 21/2



Source: *HTMW, Group's estimation*

Week 4 (24/2-28/2)

Figure 24. Portfolio return at 28/2/2025

Company	% weight in equity portfolio	% weight in overall portfolio	Total return Last week	Total profit Last week	Total return YTM	Total profit YTM
AXON*	27.24%	17.05%	-19.86%	-40,170.67	-14,73%	-18,805.40
UAL	15.75%	6.76%	-8.65%	-6,094.26	-10.61%	-7,474.94
EOG	10.70%	4.71%	4.52%	1,939.60	-0.27%	-114.58
HD	13.40%	5.47%	-5.35%	-2,940.33	-2.52%	-1,384.83
LOW	8.71%	3.52%	-5.61%	-3,478.20	-3.68%	-1,331.40
NVDA	4.38%	1.98%	4.76%	853.70	-2.55%	-457.80
PGR	19.83%	7.86%	6.26%	4,405.13	12.59%	8,862.74
Total	**100.00%**	**47.35%**	**-9.19%**	**-45,485.03**	**-4.93%**	**-20,706.21**

**We sold 110 shares for our trading fund because reaching the cut loss point.*

Source: HTMW, Snowball Analytics, Group's estimation

U.S. equities declined midweek after Trump reaffirmed a **25% tariff** on Canada and Mexico, while also announcing an additional **10% tariff** on China. The **Nasdaq 100** dropped **2.7%**, marking its worst session in months, with **Nvidia (-8.5%)** leading the losses following its earnings report.

We believe that the market is overly fearful of negative market events. We assess that these factors have not significantly affected the fundamentals of the companies in the portfolio, so we continued to maintain the proportion of stocks. For AXON stock, we sold 101 stocks for the short-term trading portfolio because we reached the stop-loss point when the stock continued to fall sharply.

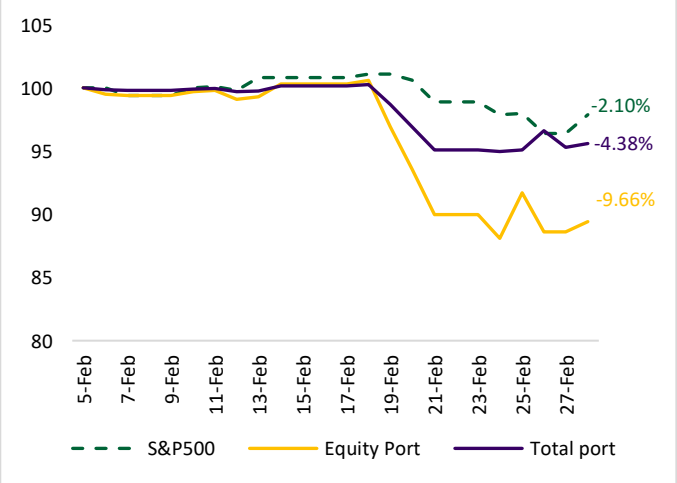
At of the end of February 28, 2025, the return on the long-term equity portfolio had recovered to -9.66% from -10% at the end of last week. However, this is still significantly lower than the S&P 500 index, which had a yield-to-date return of only -2.1%. On the whole portfolio, our return is -4.38%.

Figure 25. Overall portfolio at 28/2/2025

Company	Value	% weight in overall portfolio
Equity	399,069.49	41.73%
Cash deposit *- Interest debit* *- Initial cash*	556,556.35 *785.54* 555,770.81	58.27%
Total	**956,223.74**	**100.00%**

Source: *HTMW, Group's estimation*

Figure 26. Portfolio total return rebased to 100 at 28/2



Source: *HTMW, Group's estimation*

Week 5 (3/3-7/3)

Figure 27. Portfolio return at 7/3/2025

Company	% weight in equity portfolio	% weight in overall portfolio	Total return Last week	Total profit Last week	Total return YTM	Total profit YTM
AXON	22.12%	11.39%	-14,73%	-18,805.40	-19.49%	-25,698.49
UAL	10.85%	5.59%	-10.61%	-7,474.94	-26.04%	-18,338.43
EOG	8.84%	4.55%	-0.27%	-114.58	-1.09%	-468.43
HD	17.49%	9.00%	-2.52%	-1,384.83	-5.84%	-5,200.70
LOW	7.07%	3.65%	-3.68%	-1,331.40	-6.11%	-2,207.80
NVDA	6.51%	3.35%	-2.55%	-457.80	-12.85%	-4,604.92
PGR	27.12%	13.96%	12.59%	8,862.74	5.69%	7,006.35
Total	**100.00%**	**51.50%**	**-4.93%**	**-20,706.21**	**-8.62%**	**-45,297.33**

Source: HTMW, Snowball Analytics, Group's estimation

Stocks faced difficulties this week due to ongoing news about tariffs. At the start of the month, President Trump raised tariffs on Chinese goods to 20% and continued pushing for tariffs on Canada and Mexico, with all three countries responding with retaliation tariffs. China also announced a 15% tariff on some farm products and added several U.S. companies to its export control lists. This affected the market's sentiment and raised their concerns about a possible economic slowdown after weak manufacturing data.

Besides that, excitement around domestic AI technology faded because of a poor outlook from chipmaker Marvell Technology and the introduction of an AI model from China, which was said to rival DeepSeek's performance but with less data.

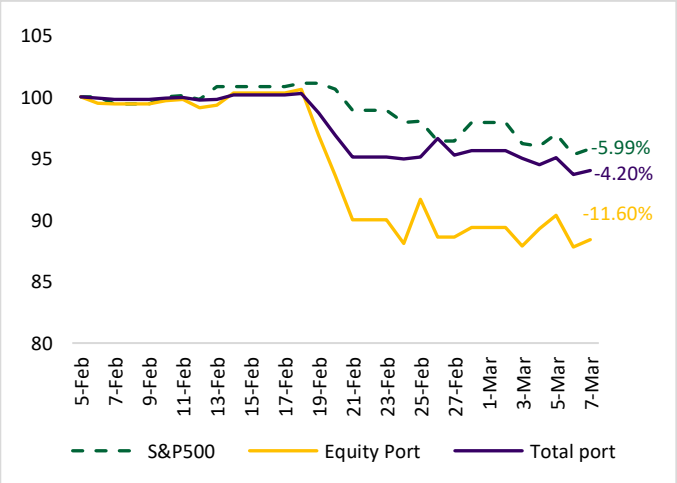
As a result, our long-term equity portfolio saw a negative performance with a return of -11.60% by the end of the week, underperforming the benchmark. Based on our analysis, we stay aligned with the group's strategy.

Figure 28. Overall portfolio at 7/3/2025

Company	Value	% weight in overall portfolio
Equity	480,567.86	51.50%
Cash deposit *- Interest debit* *- Initial cash*	451,951.09 *1,080.85* 450,870.24	48.43%
Total	**931,882.93**	**100.00%**

Source: *HTMW, Group's estimation*

Figure 29. Portfolio total return rebased to 100 at 7/3



Source: *HTMW, Group's estimation*

Week 5 (10/3-14/3)

Figure 30. Portfolio return at 14/3/2025

Company	% weight in equity portfolio	% weight in overall portfolio	Total return Last week	Total profit Last week	Total return YTM	Total profit YTM
AXON	23.45%	12.16%	-19.49%	-25,698.49	-13.34%	-17,588.27
UAL	10.18%	5.28%	-26.04%	-18,338.43	-29.57%	-20,821.13
EOG	8.55%	4.43%	-1.09%	-468.43	-2.91%	-1,246.90
HD	16.27%	8.44%	-5.84%	-5,200.70	-10.99%	-9,797.18
LOW	6.49%	3.36%	-6.11%	-2,207.80	-12.51%	-4,522.00
NVDA	7.16%	3.71%	-12.85%	-4,604.92	-2.62%	-940.32
PGR	27.90%	14.48%	5.69%	7,006.35	10.44%	12,857.86
Total	**100.00%**	**51.88%**	**-8.62%**	**-45,297.33**	**-7.21%**	**-37,842.85**

Source: HTMW, Snowball Analytics, Group's estimation

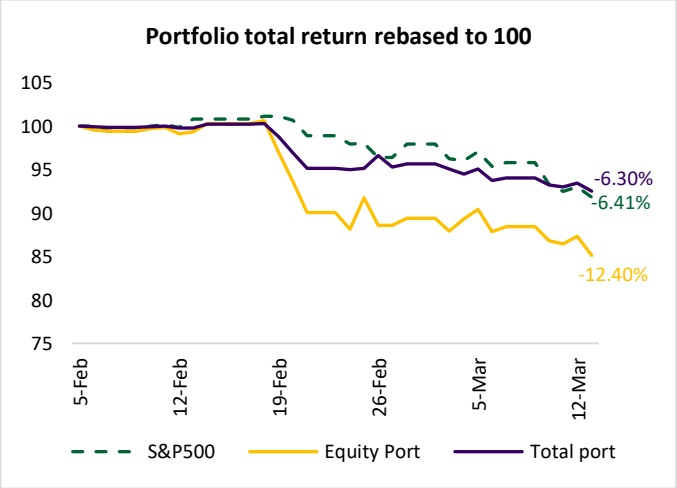
During this week, uncertainty in tariff policies from President Trump was still the main concern for investors. At the start of the week Trump threatened to apply 20% tariffs on all alcoholic drinks from the EU in response to the EU's 50% tariffs on American whiskey and other goods. In addition, U.S inflation data in February was lower than expected, with both consumer and producer prices growing more slowly. Weekly jobless claims were 220K, slightly under predictions but in line with recent trends. This supports our expectation that the central bank will keep interest rates unchanged, which should be positive for PGR. However, high interest rates would have a negative impact on the stock market overall, so our equity portfolio decreased to -12.40% YTD, which is lower than the benchmark of -6.41%. However, the total portfolio outperformed the benchmark with a return was -6.3%

Figure 31. Overall portfolio at 14/3/2025

Company	Value	% weight in overall portfolio
Equity	486,510.86	51.88%
Cash deposit *- Interest debit* *- Initial cash*	453,279.62 *1,204.69* 452,074.93	48.12%
Total	**939,461.25**	**100.00%**

Source: *HTMW, Group's estimation*

Figure 32. Portfolio total return rebased to 100 at 14/3



Source: *HTMW, Group's estimation*

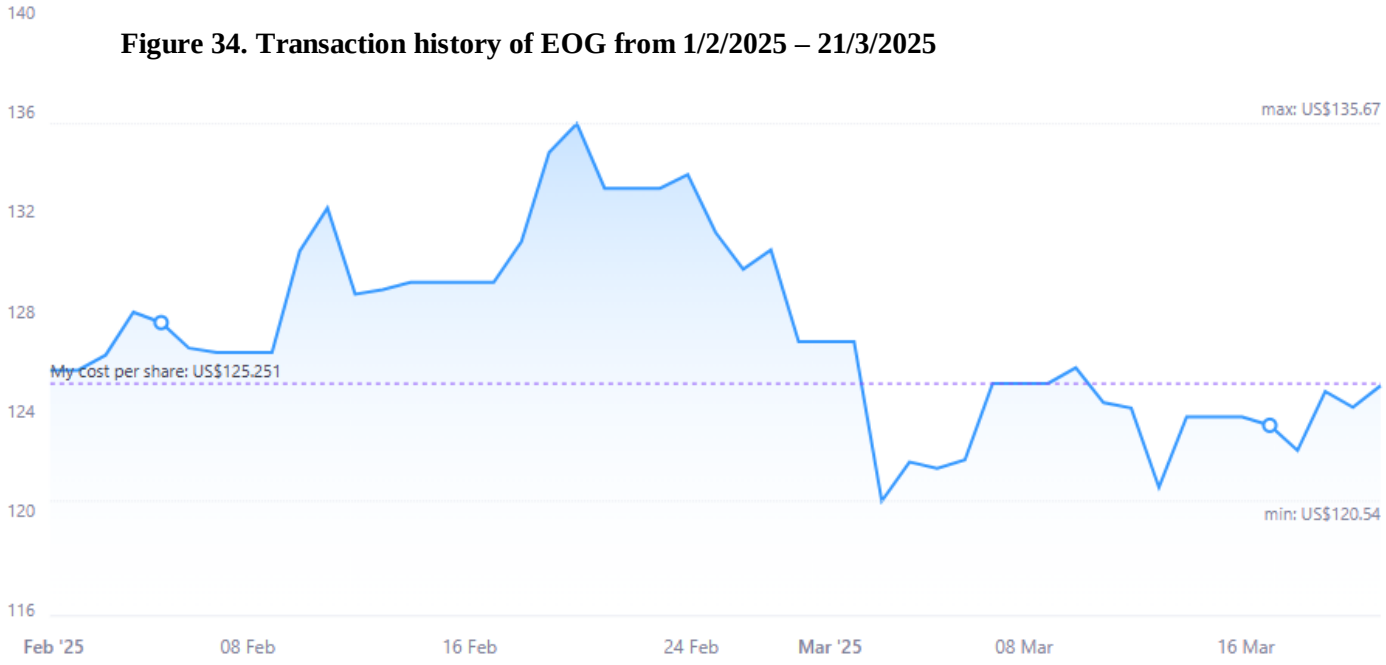
IV. Detailed transaction of each stock

Figure 33. Transaction history of AXON from 1/2/2025 – 21/3/2025

Source: *Snowball Analytics*

We had 5 transaction on AXON stock, included 4 buy order and 1 sel order at price of $499.73/share. My average cost per share was $609.601/share, equivalent with return was -12.25%.

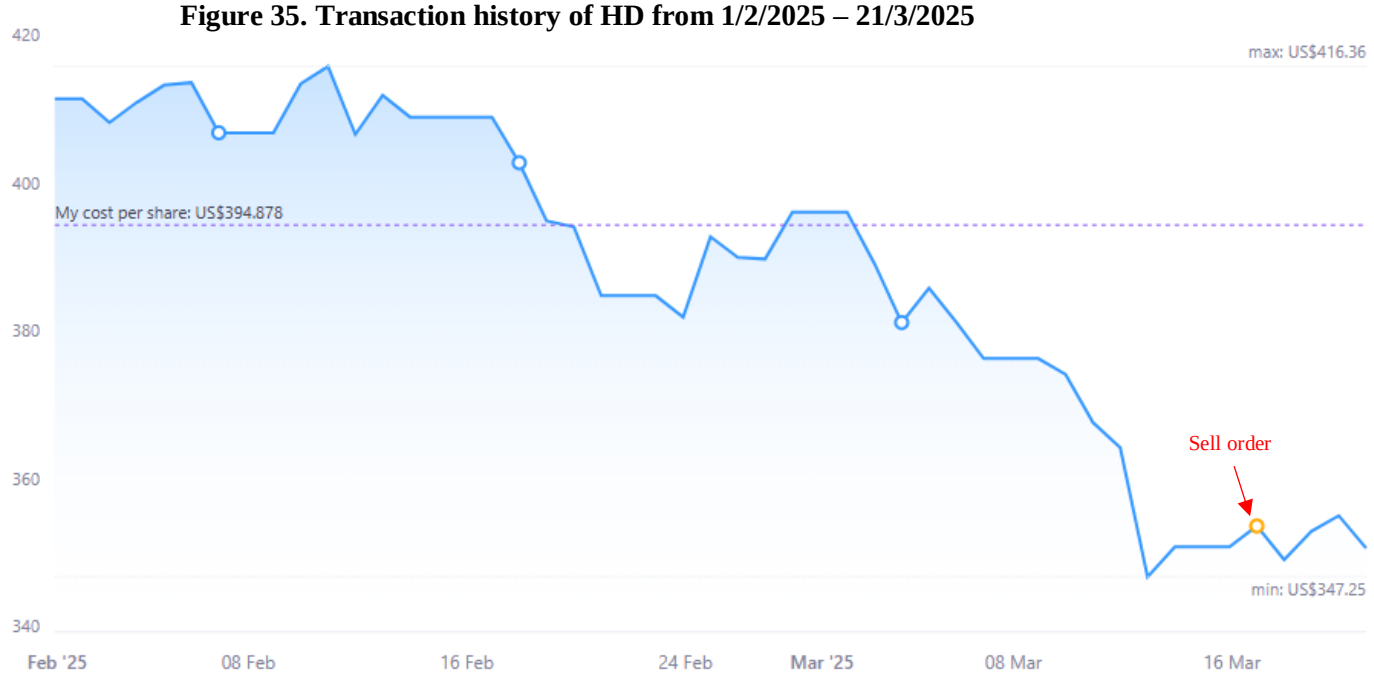
Figure 34. Transaction history of EOG from 1/2/2025 – 21/3/2025



Source: *Snowball Analytics*

With EOG, we only had 2 buy order, with average price was $125.25. With the close price at 21/3/2025 was 126.59, we had 1.07% return from this stock.

Figure 35. Transaction history of HD from 1/2/2025 – 21/3/2025



Source: *Snowball Analytics*

We had 3 buy order and 1 sell order for HD stock. Except the initial order, the remaininig 3 transactions were made to reallocate the portfolio according to target weight. The average price was $394.88, we got -9.30% loss for this stock.

Figure 36. Transaction history of LOW from 1/2/2025 – 21/3/2025

Source: *Snowball Analytics*

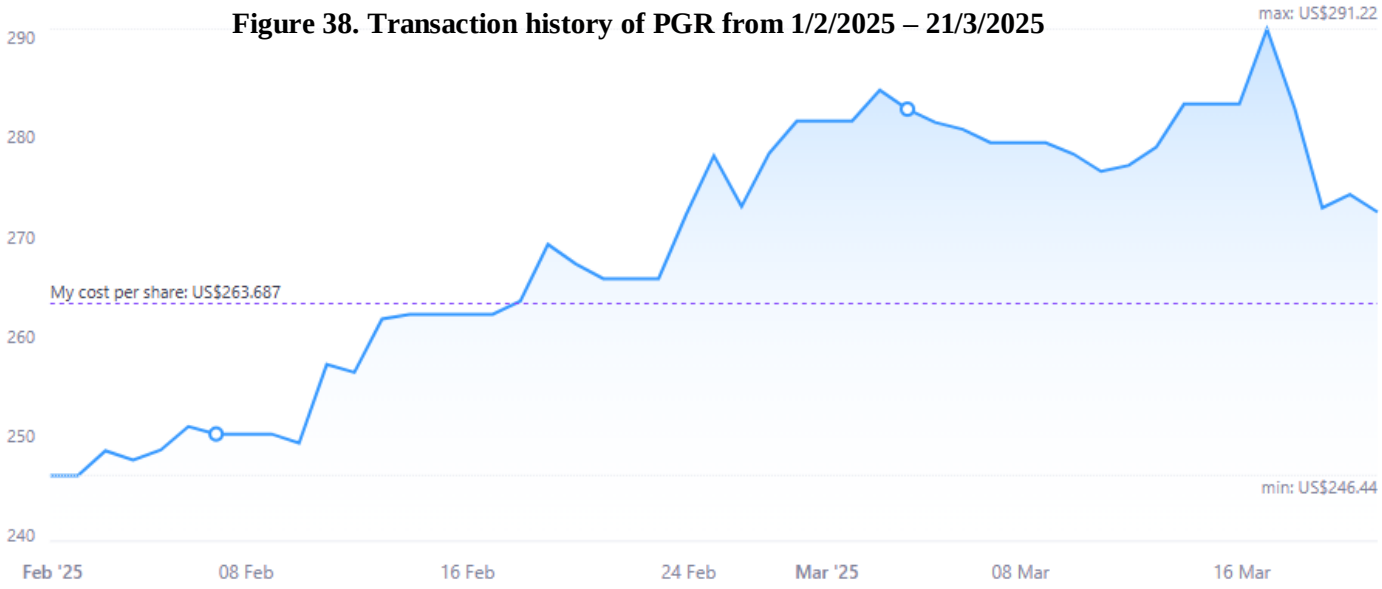
After initial buy, we have one sell-order for reallocation action and another buy order to inceases to target weight. The average price was $256.86, equivalent with the rate of return was -11.07%.

Figure 37. Transaction history of NVDA from 1/2/2025 – 21/3/2025

Source: *Snowball Analytics*

We had 3 transaction on NVDA stock, included 2 buy order and 1 sell order, with average price of $122.41/share. The rate of return for NVDA was -10.41%.

Figure 38. Transaction history of PGR from 1/2/2025 – 21/3/2025



Source: *Snowball Analytics*

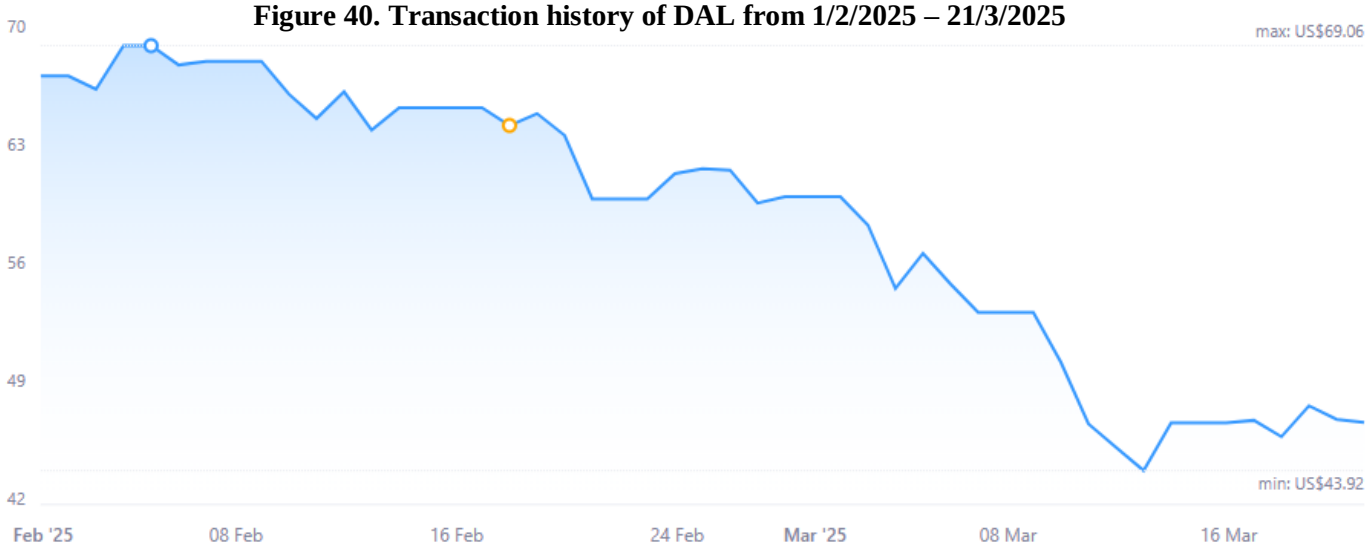
PGR was a good company that can take advantage from high interest rate. After initial buy order, we have another buy order at 4/3/2025 to increase the weight. With avrage price was $263.69, we had 5.75% return.

Figure 39. Transaction history of UAL from 1/2/2025 – 21/3/2025

Source: *Snowball Analytics*

After liquidated DAL, we bought UAL on 18/2/2025 and execute another buy order at 17/3/2025. With our average cost per share was $84.82, we got -17.20% loss.

Figure 40. Transaction history of DAL from 1/2/2025 – 21/3/2025



Source: *Snowball Analytics*

Because of negative events relating to DAL's operating, so that we sold all position in DAL on 17/2/2025 to restructure our portfolio. We got -5.68% loss from this transaction.

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