

Volatility of Trading Volume and Fundamental Profit to Cost Analysis

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Abstract: This study combines fundamental and volatility analysis to develop investment strategies for the Chinese stock market, focusing on 2015-2023. By analyzing stock data such as daily trading volumes and financial indicators, it identifies potential investment opportunities. The research excludes stocks with delisting risks or those listed for less than two years. Two main strategies are explored: the Alpha Volatility strategy, which selects stocks based on the 20-day standard deviation of trading volume, and the Alpha Fundamental strategy, which focuses on profitability and leverage. Initial tests of the volatility strategy showed poor performance, but after refining, it achieved a cumulative return of 38.44% and a Sharpe ratio of 1.18. The fundamental strategy's refinement, however, led to underperformance, with a cumulative return of -15.22%. Combining the two strategies did not yield favorable results, with an out-of-sample test showing a cumulative return of -4.77%. The study highlights the challenges of integrating fundamental and volatility factors, as well as the need for further refinements to adapt to market conditions.

Keywords: investment strategies, Chinese stock market, volatility analysis, fundamental analysis, alpha strategies.

1. Introduction

In the global financial market, especially in China's volatile and uncertain stock market, investors need precise strategies. This study combines fundamental and volatility analysis to provide stable returns by identifying undervalued stocks and managing risk. Two alpha strategies are tested: the first targets volatility, with outliers removed using the Interquartile Range (IQR) method for improved performance; the second focuses on profitability and leverage, assessing a company's cost structure and adjusting earnings to provide a clearer picture of profitability.

The essay will detail these two alpha strategies, covering their economic rationale, raw alpha, refined alpha, and results.

2. Specification

2.1. Data

Universe: The analysis focuses on all stocks in Chinese stock market. For the fundamental analysis, stocks with a delisting risk warning or those listed for less than two years are excluded to ensure data reliability and stability, as newly listed or high-risk companies may not provide sufficient historical data or may introduce excessive volatility, which could distort the analysis.

Data Sets: The dataset includes daily high and low stock prices, trading volume, and shares outstanding for selected industry stocks over the past month for a volatility analysis. Additionally, monthly EBIT, various costs, and total profit will be used for a fundamental analysis. Finally, divide the data into a training set and a test set based on the time range.

Data Sources: Data is obtained from financial platforms JoinQuant. Execution costs refer to the China Securities Regulatory Commission.

Date Range: The analysis covers from Chinese stock 2015-01-01 to 2023-12-31. We use 2015-01-01 to 2021-12-31 as in sample data, and 2022-01-01 to 2023-12-31 as out of sample data.

2.2. Analysis

Summary Statistics:

In the volatility analysis, the standard deviation of volume is computed for each stock, while in the fundamental analysis, adjusted earnings to cost ratio by leverage to provide clearer insights into financial health and enabling performance comparisons within the industry and market.

Trade Execution Costs:

During periods of market turbulence, rapid changes in market conditions and heightened volatility can lead to order execution delays, causing trades to be executed at less favorable prices. Or, during periods of high turnover, increased trading activity can lead to higher liquidity but also heightened volatility. In both two situations, to mitigate the risk of significant trading losses due to excessive market volatility, it is crucial to set bid-ask spread at specific price points. This helps control the potential losses that investors can tolerate, ensuring that trades are executed within acceptable risk parameters. In Chinese stock market, there are 1 ‰ Commission and 1 ‰ Stamp Duty. The bid-ask spread considers to be 5 ‰. The total fee is 6.1 ‰.

2.2.1.Strategy Detail 1-Alpha Volatility

Economic Intuition

The larger the factor value of the 20-day trading volume standard deviation factor, the greater the volatility and liquidity of the stock. Higher volatility and liquidity indicate higher investor attention, which is often accompanied by a premium on the stock. Therefore, we expect that stocks with higher factor values are likely to decline on the following day [1]. In the other words, stocks with a larger 20-day trading volume standard deviation tend to generate smaller returns.

Raw Alpha

Sort stocks based on the factor values of the 20-day average trading volume standard deviation, then select the top 10 stocks with the smallest factor values for long positions and the top 10 stocks with the largest factor values for short positions. Adjust the portfolio daily based on the closing price, maintaining holdings of the 10 stocks with the smallest factor values and the 10 stocks with the largest factor values.

$$\text{Formula: 20-day trading volume standard deviation} = \sqrt{\sum_{i=1}^n (V_i - \bar{V})^2}$$

- $N=20$ indicates a statistical period of 20 days.
- V_i is the trading volume on day i .
- $\bar{V}$ is the average trading volume over these 20 days, calculated as follows: $\bar{V} = \frac{1}{N} \sum_{i=1}^N V_i$

The number of long and short stock are the same that will be found in the return comparison. With a daily trading frequency [2].

Refined Alpha

We found that when the 20-day trading volume standard deviation is low, the returns do not always show an upward trend. Therefore, we speculate that stock prices may have some influence on the standard deviation. To address this, we screened out stocks with no price growth based on monthly prices during the back testing period. Specifically, we compared the closing price of the last trading day of each month with the closing price of the first trading day of the month to determine if the stock price increased: if the month-end closing price is higher than the month-start closing price, it is defined as a stock with price growth. Through this method, we excluded stocks that did not experience price growth within the specified period, allowing for a more accurate analysis of the relationship between trading volume standard deviation and returns [3]. We aim for market neutrality, balancing long and short positions to minimize exposure to market-wide movements and systematic risk [8]

$$\text{Formula: } R_{portfolio} = w_{long} \cdot \sum_{i=1}^n R_{long_i} + w_{short} \cdot \sum_{i=1}^n R_{short_i}$$

- $w_{long} = 0.5, w_{short} = -0.5$

For each investment, the capital allocation is given by: $1 = \left| \frac{\sum Capital_{long_i}}{Capital_{total}} \right| + \left| \frac{\sum Capital_{short_i}}{Capital_{total}} \right|$

where $Capital_{long_i}$ and $Capital_{short_i}$ are the investment amounts allocated to each long and short stock respectively, and $Capital_{total}$ is the total amount of investment. The capital fixed 1,000,000 yuan each month for trading with a monthly trading frequency.

2.2.2.Strategy Detail 2 -Alpha Fundamental

Economic Intuition

Profitability and leverage are key factors influencing a company's financial health. While leverage can boost returns by increasing debt, it also raises risk. To accurately evaluate operational efficiency, it's important to isolate the company's earnings-to-cost ratio from the effects of leverage [4]. By focusing on a refined earnings-to-cost measure, adjusted for debt-related interest expenses, we can better assess how efficiently a company generates profits independent of its borrowing. This highlights companies with genuine operational strength, reducing investment risk by identifying those that rely less on debt for profitability. As a result, these companies are better candidates for investment, with lower exposure to the risks associated with high leverage [5]. Identifying such companies helps investors capitalize on mispriced stocks before the market corrects inefficiencies caused by information gaps or irrational behavior.

Raw Alpha

The formula assesses profitability by adding back interest and dividing it by all relevant costs, providing a comprehensive view of the company's cost structure. Net Interest Expense serves as a proxy for financial leverage, assuming that higher interest costs signal greater leverage. Net Profit is used to gauge how much of the company's earnings come from core operations, as opposed to debt-driven gains [6, 7].

This creates a Risk-Return Trade-off ratio, where companies with lower leverage (higher R_L) face less risk because they rely less on debt for profitability, making them more stable and attractive investments.

$$\text{Formula: } R_i = \frac{EBIT}{R_{expenses}} \div R_L$$

- R_i represents the ratio for stock i
- EBIT is Earnings Before Interest and Taxes = Operating Income + Interest Expense
- $R_{expenses}$ is sum of Operating Cost, Financial Expense, Administration Expense, and Sale Expense
- R_L is leverage adjustment ratio = $\frac{Net\ Interest\ Expense}{Net\ Profit}$

In this alpha, we will adjust the raw by normalized ratio in different bases. We will conduct comparisons at 3 levels: within the company itself, across the entire market, and within specific industries. We'll look for year-over-year or quarter-over-quarter trends, with a particular focus on whether a decline in certain metrics (like expenses) indicates improved operating efficiency. If the company has rank top 20% in market, top 10% in industry and have positive quarterly trend, we will invest in this company. We will short and long the same number of stocks, which number will be found out during the return comparison.

Refined Alpha

In this alpha, we will adjust the raw by centered ratio in 2 bases and replace the number of long or short method with market neutral method. We will conduct comparisons at 2 levels: across the entire market, and within specific industries. If the company has ranked top 50% in market and top 50% in industry, we will long this company. Conversely, we will short the stock.

We aim for market neutrality, balancing long and short positions to minimize exposure to market-wide movements and systematic risk [8].

$$\text{Formula: } R_{portfolio} = w_{long} \cdot \sum_{i=1}^n R_{long_i} + w_{short} \cdot \sum_{i=1}^n R_{short_i}$$

- $w_{long} = 0.5$, $w_{short} = -0.5$

For each investment, the capital allocation is given by: $1 = \left| \frac{\sum Capital_{long_i}}{Capital_{total}} \right| + \left| \frac{\sum Capital_{short_i}}{Capital_{total}} \right|$

where $Capital_{long_i}$ and $Capital_{short_i}$ are the investment amounts allocated to each long and short stock respectively, and $Capital_{total}$ is the total amount of investment. The capital fixed 1,000,000 yuan each month for trading with a monthly trading frequency.

3. Implementation

3.1. Raw Alpha Volatility- Result



Figure 1: Cumulative Volatility Raw Alpha return%

In the test set, the time range from 01/01/2015 to 12/31/2021 was used, with the number of holdings ranging from 15 to 25 stocks. The test results showed that the optimal return was achieved with 24 holdings, so twice the 24 stocks were used as the number of positions for long and short operations.

All stocks were divided into three groups based on their factor values: the 24 stocks with the highest factor values were placed in the first group for short positions, the 24 stocks with the lowest factor values were placed in the second group for long positions, and the remaining stocks were placed in the third group, not participating in trading. Long and short trading operations were executed daily at the close price, and positions were rebalanced at the next day's close after market fluctuations, calculating the daily return. The cumulative return plot shows a steady decline, reaching around -80%, indicating significant and consistent underperformance. The strategy begins with a sharp drop in early 2015, followed by a persistent downtrend through 2021, with no substantial recovery. The lack of upward corrections suggests issues with stock selection, factor weighting, or sensitivity to adverse market conditions, especially during downturns like 2016 and 2020. To address these issues, it would be essential to reassess the factors driving the strategy, improve risk management practices, and consider optimizing cost efficiency to prevent further decline and improve future returns. (Figure1)

Table 1: Volatility Raw Alpha in sample test result

Data of Result	
Final cumulative return	-83.25%
Annualized return	-23.22%
Sharpe ratio	-1.72
Maximum drawdown	-84.87%
Volatility	14.68%

No benchmark was set during this test, meaning the strategy's performance evaluation was entirely based on its own return results. However, the test results showed a cumulative return of -83.25% and an annualized return of -23.22%, indicating poor performance during the period. The Sharpe ratio

was -1.72, showing that the strategy failed to achieve positive returns despite taking on risk, with unsatisfactory risk-adjusted performance. The maximum drawdown was -84.87%, reflecting the strategy's largest loss during the test period, highlighting the severe loss risk investors might face in the worst-case scenario. The volatility was 14.68%, indicating significant price fluctuations during the test, demonstrating high stock price volatility that did not translate into positive returns.

This strategy adjusts long and short positions based on factor value rankings, which theoretically has the potential to capture daily market gains, but in practice, it performed poorly. The continuously declining trend of the cumulative return curve further indicates significant deficiencies in the strategy's performance during the selected period, proving it to be unfeasible.

3.2. Raw Alpha Fundamental- Result

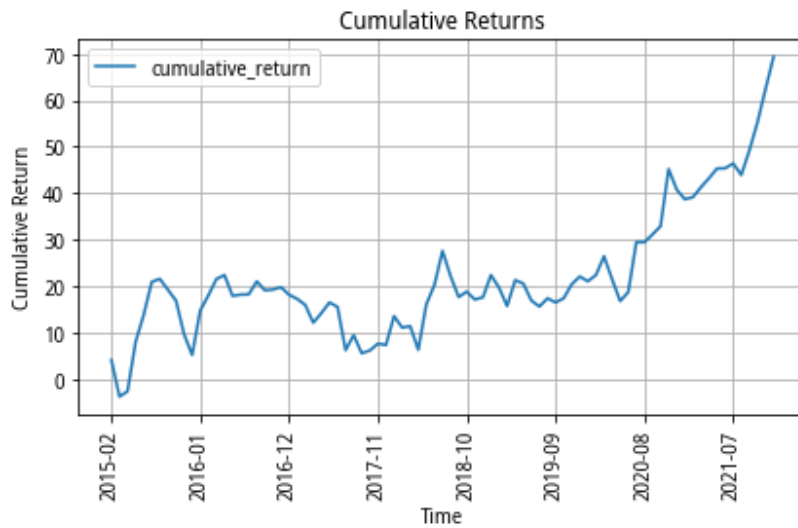


Figure 2: Cumulative Fundamental Raw Alpha Return%

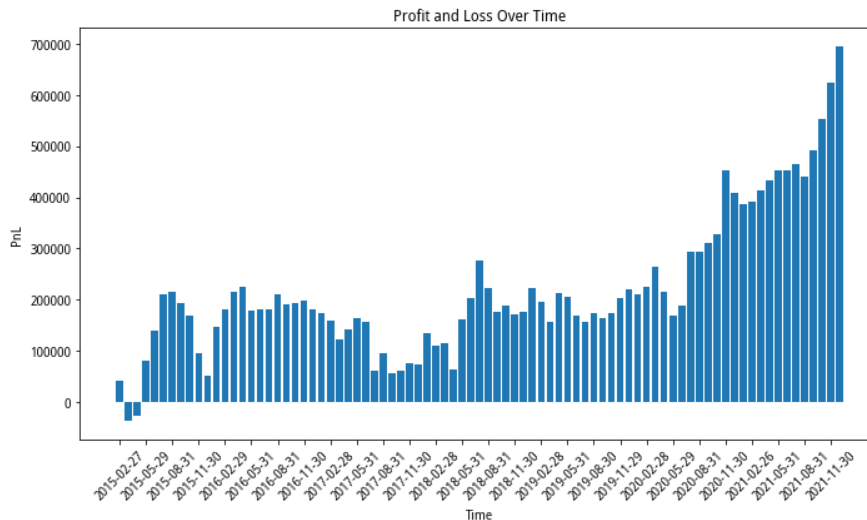


Figure 3: Cumulative Fundamental Raw Alpha Profit and Loss Over Time

In this raw alpha test, we used the in-sample data with range 2015-01-01 to 2021-12-31, with zero benchmark. It means the strategy's performance evaluation was solely based on its own returns. We have a monthly trade frequency because of the various period of releasing quarter financial report.

During testing, we found majority of large n (>60) selection have negative return. This may be raised from 2 reasons: formula design and outlier refinement.

Both cumulative returns plot and PnL plot show an initially volatile period with sharp fluctuations, followed by a relatively stable phase, and then a strong upward trend toward the end. Early on, the strategy experienced significant ups and downs, suggesting high volatility and potential inefficiencies. Afterward, there is a flatter middle period with minimal changes, indicating a phase of low returns or consolidation. In the later stages, however, the cumulative returns rise sharply, reflecting a sustained positive performance, likely due to improved stock selection, factor optimization, or favorable market conditions. While the final sharp rise suggests strong growth, it could also imply increased exposure to certain market risks, highlighting the importance of maintaining careful risk management to preserve gains. Overall, the strategy demonstrates a recovery from early volatility and finishes with robust cumulative returns. (Figure2, Figure3)

Table 2: Fundamental Raw Alpha in sample test result

Data of Result	
Final cumulative return	69.41%
Annualized return	7.82%
Sharpe ratio	0.61
Maximum drawdown	-13.76%
Volatility	12.88%

The strategy has relatively high return when 7 long and 7 short stocks, achieving a final cumulative return of 64.91% and an annualized return of 7.82%. However, the Sharpe ratio of 0.61 suggests that the returns do not fully compensate for the risk taken, indicating room for improvement in risk-adjusted performance. The maximum drawdown of -13.76% reveals a significant peak-to-trough decline, highlighting considerable volatility. With a volatility of 12.88%, the strategy experienced substantial fluctuations in returns. Overall, while the strategy has delivered positive returns, its high volatility and significant drawdowns indicate a higher risk profile.

4. Refinement

4.1. Strategy Detail 1-Alpha Volatility

After completing the test on the test set, the return rate was negative, and we will make the following improvements. First, we will incorporate the interquartile range (IQR) method to remove outliers. We will start by extracting the 20-day volume data and then handling the outliers. The handling of outliers is as follows: calculate the Q1 and Q3 of the trading volume, then compute $IQR = Q3 - Q1$. Data points that are below $Q1 - 1.5 * IQR$ or above $Q3 + 1.5 * IQR$ are considered outliers. Additionally, we need to determine whether the stock price is trending upwards by checking if the closing price 20 days ago is higher than the current closing price. This helps us assess the stock's trend. We aim to exclude stocks with low volatility but with prices that remain unchanged or are declining. We will long top one third lowest standard deviation and short remain one third standard deviation.

$$Long = If(\sigma_{Volatility_i} \leq P33_{\sigma_{market}}, Price_{endmonth} \geq Price_{startmonth})$$

$$Short = If(\sigma_{Volatility_i} > P67_{\sigma_{market}}, Price_{endmonth} < Price_{startmonth})$$

- P33 and P67 means the first third and last third percentile in the data

Volatility Refined Alpha with Refinement Result

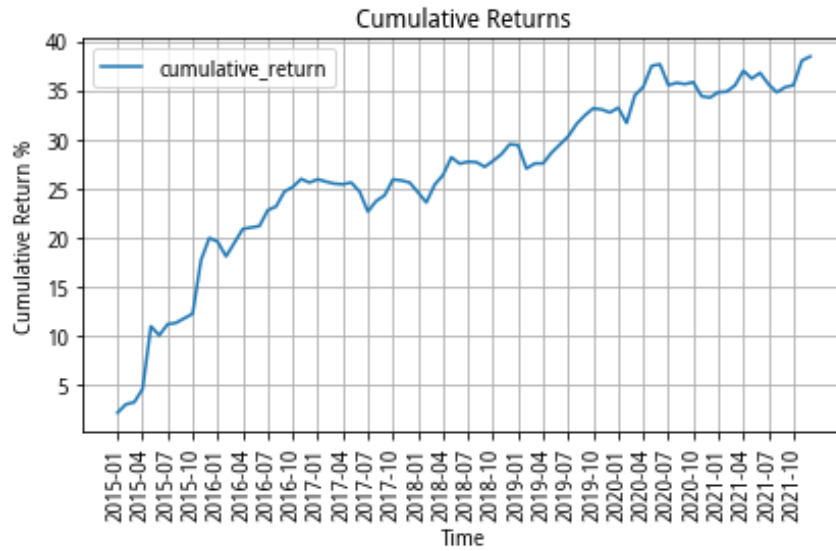


Figure 4: Cumulative Volatility Refined Alpha Return%

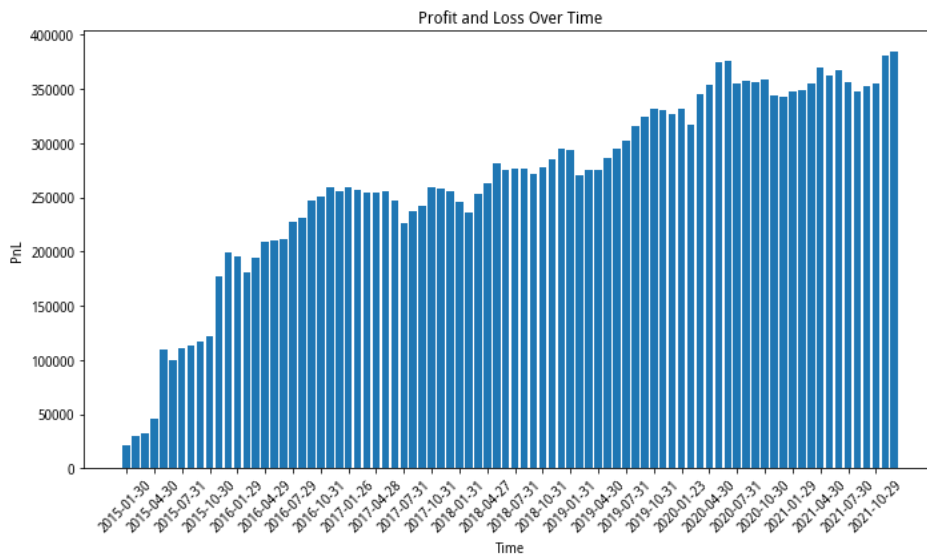


Figure 5: Profit and Loss Plot for Volatility Refined Alpha

The data shows the in-sample return from 2015-01 to 2021-12-31 with 0 benchmark and no execution fees. In the linear plot for cumulative return% and PnL plot, return shows a consistent upward trend, with some moderate fluctuations throughout. The strategy begins with a sharp rise, indicating strong early performance, followed by occasional drawdowns that are quickly recovered. The steady overall increase in cumulative returns suggests the strategy is performing well, delivering positive returns over time. Despite some short-term dips, the general trajectory remains upward, reflecting effective stock selection, risk management, or market conditions that favor the strategy. The slight dips suggest there were periods of market corrections or short-term volatility, but the overall trend is resilient and positive, indicating the strategy's ability to generate sustained growth. (Figure 4, Figure 5)

Table 3: Volatility Refined Alpha with refinement in sample test result

Data of Result	
Final cumulative return	38.44%
Annualized return	5.49%
Sharpe ratio	1.18
Maximum drawdown	-2.64%
Volatility	4.64%

The strategy delivered a strong performance with a final cumulative return of 38.44% and an annualized return of 5.49%, indicating steady growth over time. The Sharpe ratio of 1.18 reflects efficient risk-adjusted returns, while the low maximum drawdown of -2.64% demonstrates effective risk management. With a volatility of 4.64%, the strategy has shown moderate fluctuations, making it a stable and attractive option for investors seeking both solid returns and manageable risk.

4.2. Strategy Detail 2 -Alpha Fundamental

$$\text{Formula: } R_{i_adjusted_m} = \frac{R_i}{\text{average}(\sum_{i=1}^{n_{\text{market}}} R_i)}, \quad R_{i_adjusted_in} = \frac{R_i}{\text{average}(\sum_{i=1}^{n_{\text{industry}}} R_i)}$$

$$\text{Long} = \text{If}(R_{i_adjusted_m} \geq P60_{R_{i_adjusted_m}}, R_{i_adjusted_in} \geq P70_{R_{i_adjusted_in}})$$

$$\text{Short} = \text{If}(R_{i_adjusted_m} < P40_{R_{i_adjusted_m}}, R_{i_adjusted_in} < P30_{R_{i_adjusted_in}})$$

- P70, P60, P40, and P30 mean the 70th, 60th, 40th, and 30th percentile in the data

For handling of outliers: we will interquartile range (IQR) to calculate the Q1 and Q3 of the R_i , then compute $\text{IQR} = Q3 - Q1$. Data points that are below $Q1 - 1.5 \times \text{IQR}$ or above $Q3 + 1.5 \times \text{IQR}$ are considered outliers

Fundamental Refined Alpha with Refinement Result

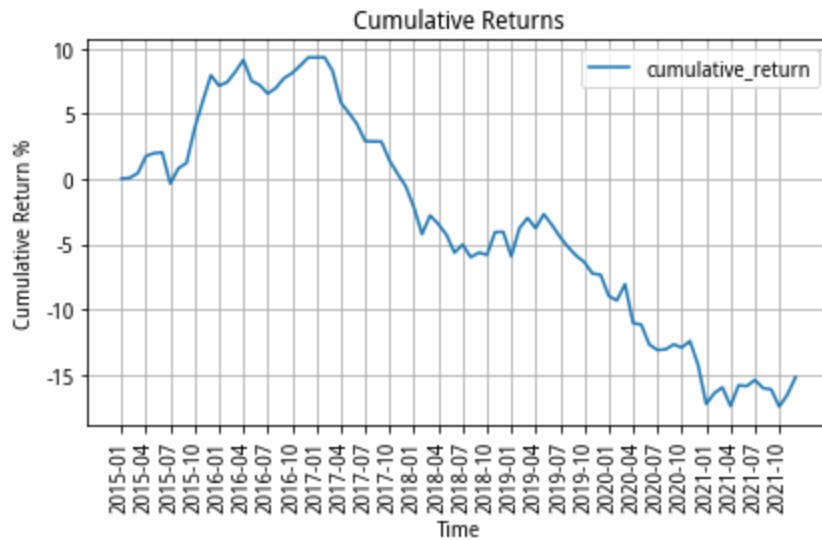


Figure 6: Cumulative Fundamental Refined Alpha Return%

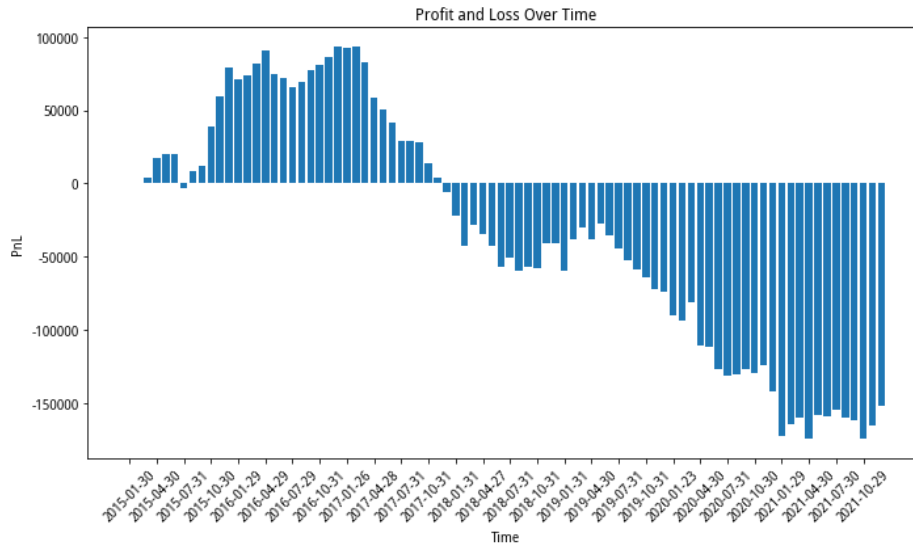


Figure 7: Profit and Loss Plot for Fundamental Refined Alpha

The data shows the in-sample return during 2015-01 to 2021-12-31 with 0 benchmark and no execution fees. In the cumulative return plot and PnL plot, return initially rises in 2015 but enters a prolonged decline starting in mid-2016, with losses continuing until a slight recovery in late 2021. This shift suggests that the strategy was unable to adapt to changing market conditions, resulting in a prolonged downturn. (Figure 6, Figure 7)

Table 4: Fundamental Refined Alpha with refinement in sample test result

Data of Result	
Final cumulative return	-15.22%
Annualized return	-2.17%
Sharpe ratio	-0.54
Maximum drawdown	-24.52%
Volatility	4.03%

The refined Fundamental Alpha resulted in an overall return of -15.22% with a Sharpe ratio of -0.54, indicating underperformance and poor risk management over the period from 2015-01-01 to 2021-12-31. The strategy experienced a maximum drawdown of -24.52%, reflecting significant risk, while the 4.03% volatility suggests moderate price fluctuations. Despite low volatility, the strategy failed to generate adequate returns, making it impractical for real-world use. Overall, the strategy's poor returns, high drawdown, and negative Sharpe ratio make it unsuitable for practical use without major revisions.

4.3. Combined alphas Refinement

Refinement for 2 Alphas Combined

In this approach, we developed a methodology to combine multiple alphas using Principal Component Analysis (PCA), specifically applied to a fundamental alpha and a volatility alpha. Because F and V are correlated with each other, they can introduce redundant information. PCA can eliminate collinearity and avoid model overfitting by generating principal components that are not related to each other. Also, PCA extracts the principal components with a large explanatory variance,

while weakening or removing the smaller explanatory variance (which can be noisy) to make the data clearer [9].

For the fundamental alpha, we first compute two components: the market return and the industry return. These are then weighted to form an adjusted return $R_{adjusted}$, where market R is given a weight of 0.7 and industry R is weighted at 0.3, reflecting their respective impacts. This weighted sum provides a more refined representation of a stock's performance in both market-wide and industry-specific contexts.

For the volatility alpha, we use the volume standard deviation, which captures price fluctuations and investor sentiment through trade volumes. Both outputs from the fundamental alpha and volatility alpha are then standardized to ensure comparability across different scales. PCA is subsequently applied to these standardized factors, with the first principal component (PC1) representing the combined influence of both alphas.

PCA generates two principal components. We keep the first principal component (PC1) as the new composite factor, as it accounts for most of the variance. The final output of PC1 is used to rank stocks. We employ a long-short strategy based on this ranking: the top 40% of stocks are selected for long positions, while the bottom 40% are shorted. This approach seeks to capture the relative strength and weakness of stocks by integrating both fundamental and volatility signals into a unified decision-making framework [10].

The key steps of the process can be summarized as follows:

1. Fundamental Alpha Calculation:

$$R_{adjusted} = 0.7 * R_{i_{adjusted_m}} + 0.3 * R_{i_{adjusted_in}}$$

2. Standardization:

Standardize $R_{adjusted}$ and the volatility alpha (volume standard deviation) to prepare for PCA.

3. PCA Application:

Apply PCA to the standardized values, with PC1 representing the combined alpha effect.

4. Long/Short Strategy:

Rank stocks based on PC1, long the top 40% of stocks, and short the bottom 40%.

This framework ensures a balanced and systematic way of integrating multiple factors (fundamental and volatility alphas) into a cohesive investment strategy.

Combined Alpha with Refinement Result

In sample result



Figure 8: In sample Combined alpha Cumulative Returns%

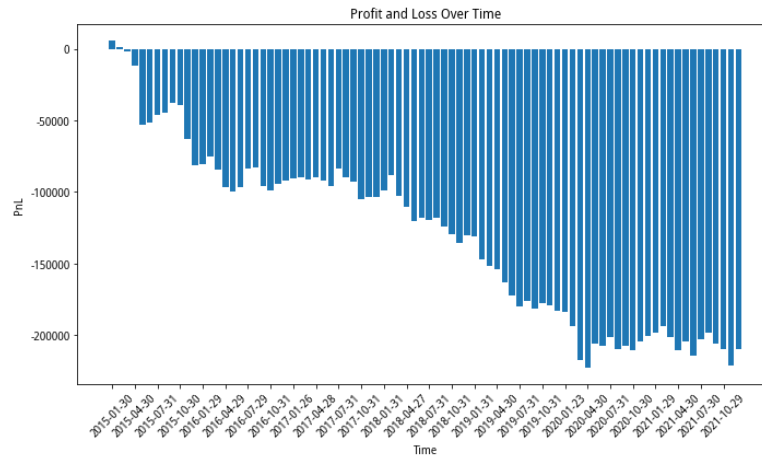


Figure 9: In sample Combine Alphas Profit and Loss Value Over Time

The portfolio experienced a final cumulative return of -21.02% with 0 benchmark during 2015-01-01 to 2021-12-31. The cumulative return graph and PnL graph show a consistent decline, particularly after brief periods of stability. The overall trajectory demonstrates difficulty in achieving positive returns, with several sharp drops in performance and minimal recovery. The results reflect the challenges faced during this six-year period in the Chinese stock market, where the portfolio struggled to maintain growth and experienced substantial losses. (Figure 8, Figure 9)

Table 5: Combined Alpha with refinement in sample test result

Data of Result	
Final cumulative return	-21.02%
Annualized return	-3.00%
Sharpe ratio	-0.98
Maximum drawdown	-22.74%
Volatility	3.07%

It has an annualized return of -3.00%, indicating a persistent downward trend in overall performance. The Sharpe ratio of -0.98 suggests that the returns generated did not justify the risks taken, with the portfolio underperforming relative to a risk-free asset. The maximum drawdown of -22.74% highlights significant losses from peak to trough during this period, suggesting vulnerability in adverse market conditions. The volatility of 3.07% indicates moderate fluctuations, but given the negative performance, the risk did not translate into positive returns.

5. Conclusion

For both the Volatility and Fundamental alphas, we selected the refined versions for out-of-sample testing as they account for outlier management and market neutrality, leading to more risk-tolerant and stable outcomes. These refined alphas were then combined using the PCA method, and the out-of-sample testing was conducted based on this combined approach.

5.1. Out of sample result

In the out of sample, our return measure in 0 benchmark during 2022-01-01 to 2023-12-31. The portfolio's performance statistics reflect a challenging period in the Chinese stock market, particularly during the COVID-19 pandemic, when the SSEC index declined by about 20% and the CSI 300 index

fell by around 30% over the past two years. In this test we use 1 ‰ Commission, 1 ‰ Stamp Duty, and 5 ‰ bid-ask spread to be the cost of trade.

Volatility Refined Alpha with refinement:

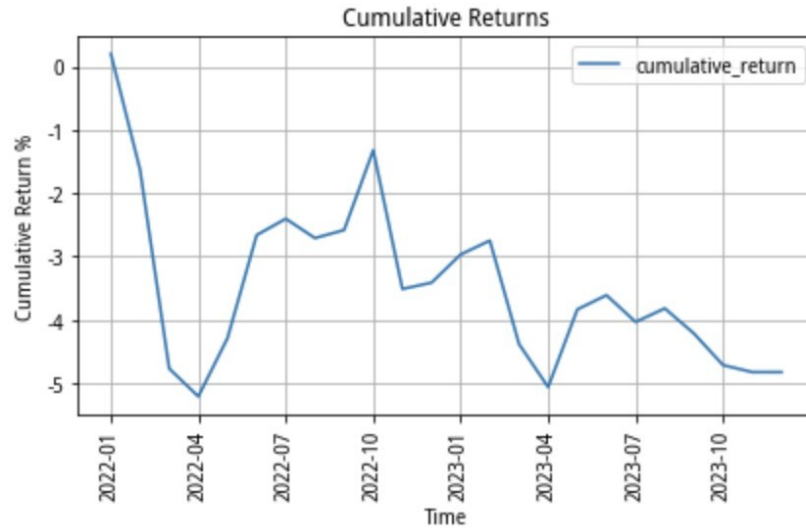


Figure 10: Out of sample Volatility Refined Alpha with refinement Cumulative Returns%

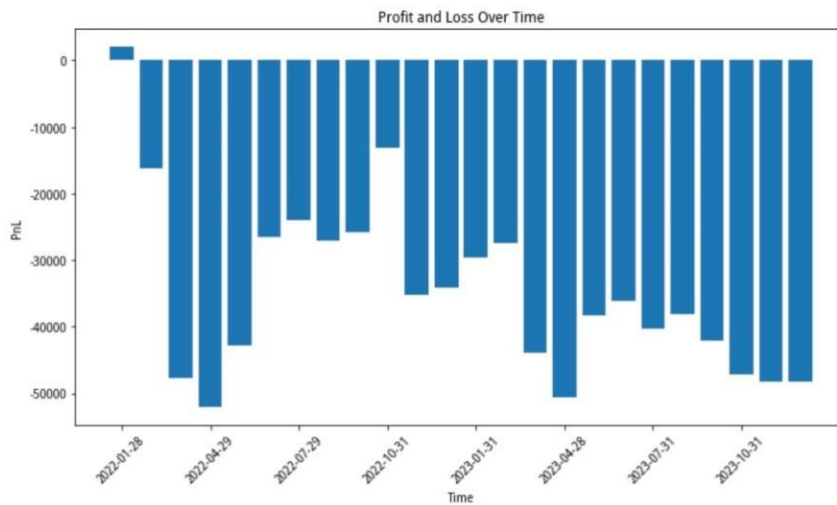


Figure 11: Out of sample Volatility Refined Alpha with refinement Profit and Loss Value Over Time

The portfolio experienced a final cumulative return of -4.38%. The cumulative return graph and PnL graph show a sharp decline starting from 2021-01 to 2021-04, particularly after brief periods of stability. Although the return recovers in next 6 months, the declines started again and hard to recovered the loss. The results reflect the challenges faced during this 2-year COVID 19 period in the Chinese stock market, where the portfolio struggled to maintain growth and experienced substantial losses. (Figure 10, Figure 11)

Table 6: Volatility Alpha with refinement out of sample test result

Data of Result	
Final cumulative return	-4.38%
Annualized return	-2.41%
Sharpe ratio	-0.63
Maximum drawdown	-5.40%
Volatility	3.83%

The analysis of the investment strategy yielded a final cumulative return of -4.83%, indicating an overall decline in value. The annualized return stood at -2.41%, reflecting the average yearly loss. The Sharpe ratio of -0.63 suggests that the returns were not proportionate to the risk taken, with negative risk-adjusted performance. The strategy experienced a maximum drawdown of -5.40%, highlighting the peak-to-trough decline during the investment period. The volatility was recorded at 3.83%, representing the extent of variability in returns. Overall, the strategy showed negative performance across key metrics, pointing to a need for further refinement or adjustment.

Fundamental Refined Alpha with refinement:

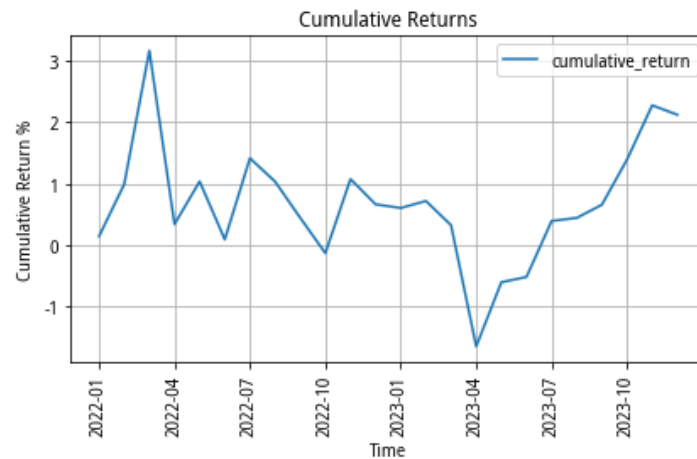


Figure 12: Out of sample Fundamental Refined Alpha with refinement Cumulative Returns%

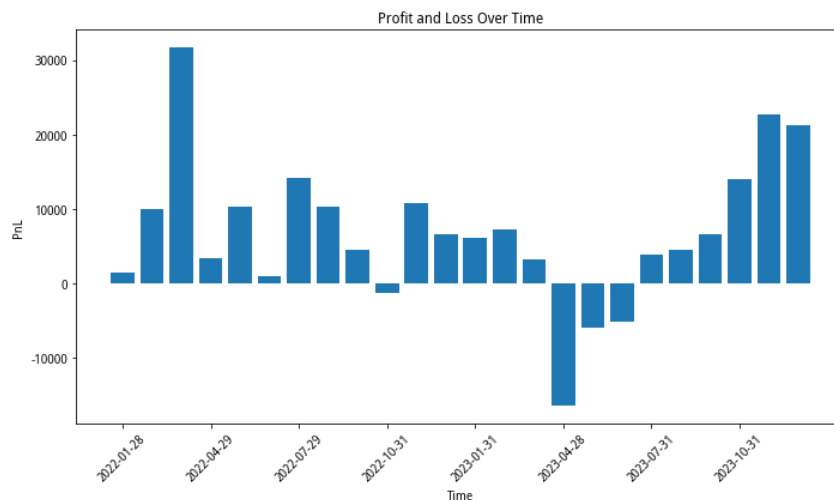


Figure 13: Out of sample Fundamental Refined Alpha with refinement Profit and Loss Value Over Time

Both the cumulative returns plot and the PnL plot reveal an initial period of volatility, marked by a sharp increase around the third month. This was followed by a relatively stable phase, characterized by a steady decline that maintained positive returns over the subsequent 12 months. Notably, there was a sharp decline in April 2021, which was followed by a recovery trend. Despite significant declines in the SSEC and GSI during this period, the strategy displayed resilience and risk tolerance, demonstrating robust cumulative returns and a stable recovery capability.

Table 7: Fundamental Alpha with refinement out of sample test result

Data of Result	
Final cumulative return	2.12%
Annualized return	1.06%
Sharpe ratio	0.29
Maximum drawdown	-4.66%
Volatility	3.70%

The investment strategy achieved a final cumulative return of 2.12%, reflecting a modest overall gain. The annualized return was 1.06%, indicating a small but positive average yearly increase. With a Sharpe ratio of 0.29, the strategy demonstrated a positive risk-adjusted return, though it was relatively low, suggesting that returns were only modestly favorable compared to the risk taken. The maximum drawdown was -4.66%, representing the largest peak-to-trough decline during the period. The volatility stood at 3.70%, highlighting the variability in returns. While the strategy exhibited positive returns and a favorable Sharpe ratio, the relatively low risk-adjusted return and notable drawdown suggest room for further optimization.

Combined Alphas with refinement:

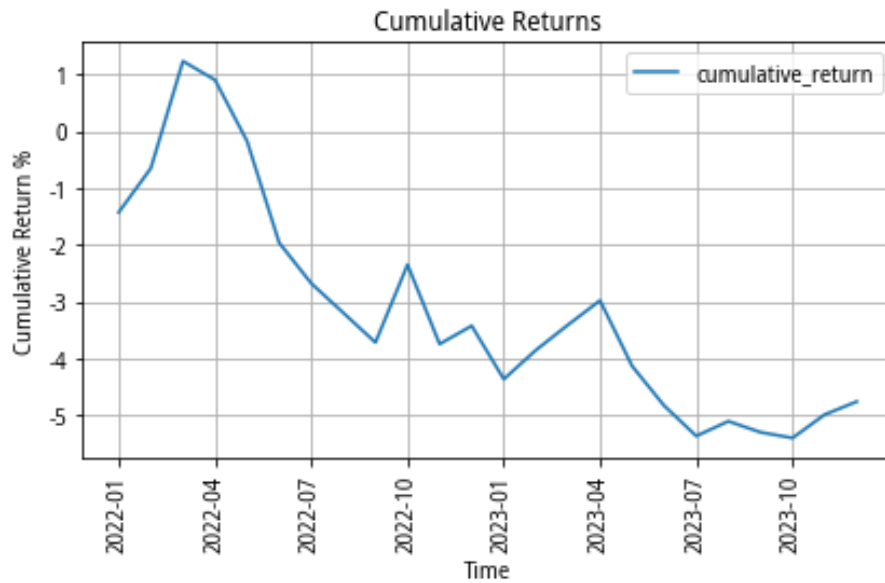


Figure 14: Out of sample Combined Alpha Cumulative Returns%

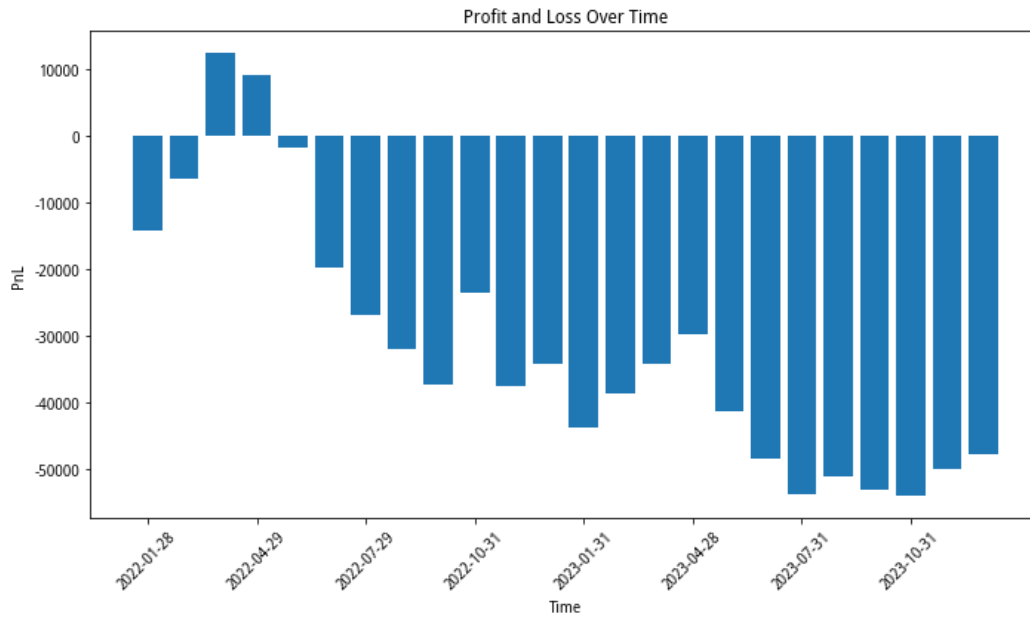


Figure 15: Out of sample Combined Alpha Profit and Loss Value Over Time

In the graphs, the cumulative return shows a steep drop early on, followed by a continued decline with minor fluctuations, ultimately reflecting an overall loss, though less severe than the broader market. The drawdown chart illustrates increasing losses over time, consistent with the general market conditions during COVID-19, where recovery was difficult to achieve. While both the SSE and CSI 300 experienced sharper declines, the portfolio's relative performance during this period underlines its stronger risk management in the face of significant market pressure, even though it faced its own challenges in maintaining positive returns. (Figure14, Figure15)

Table 8: Combined Alpha with refinement out of sample test result

Data of Result	
Final cumulative return	-4.77%
Annualized return	-2.38%
Sharpe ratio	-0.76
Maximum drawdown	-6.56%
Volatility	3.13%

Despite the broader market downturn, the portfolio's final cumulative return of -4.77% and annualized return of -2.38% indicate that the strategy has shown some degree of resilience compared to the larger market indices. However, the Sharpe ratio of -0.76 highlights that the portfolio did not sufficiently compensate for the risks taken. The maximum drawdown of -6.56% points to vulnerability during market declines, while the 3.13% volatility shows moderate risk exposure. Compared to the broader market's sharper drop, the portfolio's smaller losses suggest that the trading strategy demonstrated better risk resistance during this volatile period.

5.2. Conclusion

This paper explored the effects of fundamental and volatility factors on stock returns. Both in-sample and out-of-sample results for the combined alpha strategy yielded negative returns, highlighting the inherent complexity in integrating different alpha strategies. However, during the research, we found

that profitability and leverage level are crucial factors to corporate financial health. The benefit-cost ratio and leverage adjustment ratio used in the study effectively reveal the operating efficiency of the company without relying on high leverage. This finding provides an important basis for investors to identify stocks that are undervalued in the market. While this study also acknowledges the limitations of the strategy. In the case of high market volatility, execution costs and bid-ask spreads may affect trading results.

Future research should focus on exploring combinations with other market factors and technical indicators to enhance the strategy's effectiveness. Additionally, optimizing trade execution strategies to minimize these risks remains a critical area of focus. Overall, this study provides investors with a practical framework for stock selection in the Chinese stock market, emphasizing the potentials for combining fundamental and volatility analysis. By incorporating these factors into their portfolio construction, investors can better manage risks and improve returns. Continuous market monitoring and adaptive strategies will enable investors to respond more effectively to market fluctuations and seize potential opportunities.

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