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A Study on Diversified Investment Strategies Based on Industry Indexes of China Stock Markets: Comparison of Correlation Diversification and Volatility Diversification Strategies

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Abstract: Diversified investment often involves allocating funds across multiple target assets, such as various industries. Paying attention to the changes in industry indexes is of great significance to investors. This paper selects five industry indexes: commerce, finance, petroleum, real estate, and public utilities. Using the global minimum variance strategy, the most diversified portfolio strategy, the minimum tail dependence strategy, and the equal risk contribution strategy, we compare the strategy allocation weights and portfolio risks of the domestic Shanghai and Shenzhen stock markets and the other stock market. The results show that for the same market, there are significant differences in the fluctuation amplitude and frequency of different industry indexes. The time trends of the same industry and the same period also differ significantly between different markets. Given the differences in industry indexes, the allocation weights, portfolio returns, and portfolio risks of the four strategies also vary in the two markets. Finally, this paper provides possible conjectures on the causes of these differences from the aspects of market structure and investor structure, and puts forward corresponding strategy recommendations.

Keywords: Shanghai and Shenzhen Stock Markets; other Stock Market; Industry Indexes; Diversification; Investment Strategies

1. Introduction

Given the complex and ever-changing financial market environment, the significant differences in risk-return characteristics across different markets and industries pose diverse challenges to investment portfolios. Therefore, the research and comparison of various investment portfolio strategies have become a focal point for both investors and scholars. Currently, domestic and international scholars have achieved certain results in the field of investment strategies and return volatility.

In the international market, Braga et al.[1] achieved a balanced distribution of portfolio returns by evenly allocating asset weights and compared this strategy with the traditional standard deviation-based method through out-of-sample performance analysis of global equity investment data. The study found that this strategy outperformed traditional risk parity strategies in major risk-adjusted performance metrics. In terms of asset allocation, it tends to generate more imbalanced and unstable weights. Persio et al.[2] pointed out that under the current low-yield and rising interest rate and inflation rate environment in financial markets, investors face new challenges, among which predicting the volatility of financial assets is particularly critical. Therefore, the authors proposed a method combining classical statistical models and recurrent neural networks (RNN) for risk control in multi-asset portfolios. This method uses the GARCH model and enhances volatility prediction performance through the RNN architecture. The prediction results are used for risk control strategies. In terms of portfolio allocation, a simplified risk parity method is adopted, ignoring the cross-correlation between assets, but the actual effect is good. Practice has proven that this method can provide a risk parity investment portfolio strategy superior to traditional structures and has demonstrated its effectiveness.

Domestic research has also been conducted on investment strategies and return volatility. The modern portfolio theory of Markowitz remains the foundation of modern investment theory innovation. To assess the applicability, suitability, and impact on risk aversion and investment effectiveness of diversification strategies in the risk investment of new-style research and development institutions, Zhang et al.[3] constructed a model from the perspective of investment theory using a non-dominated sorting genetic algorithm. The results showed that compared with concentrated investment, diversified investment portfolio strategies can reduce non-systematic risks. As the portfolio size expands, diversification can better leverage technological synergy effects. Sheng et al.[4] constructed a risk parity portfolio model based on Conditional Value at Risk (CVaR) and demonstrated the specific implementation of the strategy through detailed numerical calculations. Their research results indicated that the CVaR-based strategy can diversify portfolio risks and enhance portfolio returns, thus having certain advantages in management. Under different portfolio scenarios, the portfolio returns of this risk evaluation strategy are more robust compared to traditional models.

Scholars have also paid attention to the correlation between the China and other stock markets, as well as the impact of policies and the macroeconomic environment on the stock markets. Wu et al.[5] tested the variance structure breakpoints of the linkage between the mainland and other stock markets based on the dynamic SJC-Copula with Markov regime switching and the improved ICSS algorithm. The study shows that there is a time-varying, nonlinear, and asymmetric dependence between the mainland and other stock markets, which changes dynamically with different market states. Factors such as the "Shanghai-other Stock Connect," "Shenzhen-other Stock Connect," and the Sino-US trade war have not only enhanced the interconnectivity between the markets but also increased market volatility and are the main reasons for the changes in the tail dependence between the two markets.

When studying stock market interlinkages, Chen et al.[6] analyzed the static and dynamic spillovers of the Shanghai, Shenzhen, and other stock markets from both temporal and frequency perspectives, based on 29 sector indices from the three markets over the period from June 15, 2011, to December 31, 2020, using the DY and BK methods. The conclusion is that the implementation of the "Shanghai-other Stock Connect" and "Shenzhen-other Stock Connect" has enhanced the return and volatility spillover effects between the Chinese mainland and other stock markets, which is conducive to risk supervision and portfolio optimization. Lin and Zhao[7], Huang and Zhang[8], Wang et al[9], Cao and Lei[10] do some researches on the spillover effects between Shanghai-Shenzhen stock markets and other stock market based on the different aspects. Hai et al[11] also focus on the spillover effect for the internet market.

In summary, scholars have achieved certain research results in the correlation of the China and other stock markets and the volatility of investment strategy returns. Investment strategies are a common concern for investors and researchers. Investors have always sought effective methods to optimize asset allocation, reduce risks, and increase returns. The global minimum variance strategy, the most diversified portfolio strategy, the minimum tail dependence strategy, and the equal risk contribution strategy provide investors with a variety of theoretical choices. However, how do these strategies perform in different market environments? Is there a significant difference in the performance of each strategy in the same market? Faced with the current complex and ever-changing financial market environment and the increasing number of uncertainties, investors' demand for precise investment strategies is more urgent.

This paper selects five industry indexes—commerce, finance, petroleum, real estate, and public utilities—and employs four investment strategies: the global minimum variance strategy, the most diversified portfolio strategy, the minimum tail dependence strategy, and the equal risk contribution strategy. We compare the strategy allocation weights and portfolio risks in the domestic Shanghai and Shenzhen stock markets and the other stock market.

The structure of this paper is as follows: The first part is the Introduction, which elaborates on the research background, significance, literature review, research content, and the specific research methods employed in this paper. The second part is Theoretical

Framework, which provides a detailed introduction to the correlation theory, the four major strategies, and the elements of risk measurement. The third part is the Empirical Study. The fourth part is the Conclusion and Related Recommendations.

2. Theoretical Foundation

The Global Minimum Variance Strategy (GMV) is a portfolio construction approach that aims to minimize the portfolio's return volatility variance while achieving a specific level of return. In other words, it seeks to minimize investment risk under a fixed investment strategy return. The investment objective is to achieve the expected return at a future point in time and to control the fluctuation risk within the acceptable range of the individual investor based on their risk preference. However, this model may not easily achieve diversification. The excessive pursuit of minimizing total risk may lead to the concentration of the portfolio in certain low-risk assets, which have high correlations with each other and thus fail to fully diversify risks.

The Most Diversified Portfolio strategy (MDP), for a set of assets with the same volatility, maximizes the differences in the initial asset profit margins, that is, it seeks to minimize the correlation between assets within the group, thereby constructing the most diversified investment portfolio. Its core objective is to maximize the relative diversification effect of portfolio risk.

In real markets, asset returns often exhibit a distribution with fat tails and high peaks, meaning that the probability of extreme events is higher than what the normal distribution predicts. The most diversified strategy ignores this important characteristic, which may lead to the portfolio's inability to effectively withstand risks in the face of extreme market conditions, resulting in losses beyond expectations. The Minimum Tail Dependence strategy (MTD) focuses on the interdependence shown between different assets or markets under extreme conditions (such as market crashes, natural disasters, etc.). When tail dependence is high, a single extreme event could quickly spread to other assets or markets, triggering a chain reaction.

The Equal Risk Contribution strategy (ERC) takes into account the correlations between assets and requires that each asset in the portfolio contributes equally to the overall risk, that is, the marginal risk contribution of each asset is equal. Compared with Markowitz's mean-variance model, which only considers global risk and may lead to the phenomenon where the portfolio investment risk is "controlled" by a single asset, this model places greater emphasis on the average dispersion of risk.

3. Empirical Study

3.1 Data Sources and Processing

There are differences in the development of the Shanghai and Shenzhen stock markets and the other stock market. There are some differences between the two markets in terms of the coverage, establishment time, and composition of industry indexes. Considering these factors, this paper focuses on the recent performance of industry indexes in the two markets when selecting the sample period for constructing diversified investment strategies. Therefore, we selected the industry indexes of the Shanghai and Shenzhen stock markets and the other stock market from October 2017 to June 2024 for analysis. Considering the coexistence of industry indexes (i.e., the indexes must exist in both markets), the relevance and differences of industry indexes, and the intuitiveness of the constructed results, this paper selected five major industry indexes. These five industries include commerce, finance, petroleum, real estate, and public utilities. These five types of industries have a long history in both the Shanghai and Shenzhen stock markets and the other stock market, with relatively continuous data available. The data used were all collected from the CSMAR database. During the sample period, due to the differences in trading dates between the Shanghai and Shenzhen stock markets and the other stock market (i.e., different statutory holidays), the Shanghai and Shenzhen stock markets experienced 1,633 trading days, while the other stock market had 1,722 trading days. Since the focus of this study is on the differences in allocation between industries under different strategies and the differences in allocation of the same industry under the same strategy in different markets, the impact of trading days and holidays on the sample time series is not considered for the time being.

The database provides the daily closing prices and daily returns of the five major industry indexes of the Shanghai and Shenzhen stock markets and the other stock market. Considering that returns are often used as the object of analysis in financial time series analysis, this section provides a description of the characteristics of the returns.

For ease of distinction, the daily returns of the industry indexes in the Shanghai and Shenzhen stock markets are denoted as R (R_c, R_f, R_p, R_h, R_u)represent the daily returns of commerce, finance, petroleum, real estate, and public utilities, respectively). The daily returns of the industry indexes in the other stock market are denoted as r (r_c, r_f, r_p, r_h, r_u) represent the daily returns of commerce, finance, petroleum, real estate, and public utilities, respectively). Through the analysis of data distribution characteristics, the stationarity of the daily closing prices of the industry indexes in both markets is weaker than that of the daily returns. Therefore, returns are used as the object of analysis in the main text.

Table 1 presents the descriptive statistics of the time series of the industry index returns R for the Shanghai and Shenzhen stock markets and the returns r for the other stock market. Here, Mean represents the mean value, Std represents the standard deviation, Min represents the minimum value, 25%, 50%, 75% represent the 1st quartile, median, and 3rd quartile, respectively, Max represents the maximum value, Skew represents skewness, Kurt represents kurtosis, and N represents the number of observations.

Table 1. Descriptive Statistics of Industry Index Returns in the Hu-Shen and Other Stock Markets

	Mean	Std	Min	25%	50%	75%	Max	Skew	Kurt	N
Panel A:Hu-Shen										
R_C	-0.02	1.28	-7.69	-0.69	-0.06	0.66	7.24	-0.15	7.09	1633
R_F	0.00	1.68	-9.47	-0.91	-0.10	0.77	9.41	0.39	6.90	1633
R_p	0.00	1.43	-7.68	-0.72	-0.01	0.73	7.43	-0.06	6.12	1633
R_h	-0.05	1.76	-9.13	-1.00	-0.18	0.86	8.55	0.41	5.86	1633
R_u	0.02	1.19	-7.68	-0.59	0.01	0.63	7.83	-0.04	7.70	1633
Panel B:other										
r_c	-0.05	1.74	-8.90	-0.99	0.00	0.84	16.30	0.59	9.50	1722
r_f	-0.02	1.24	-5.21	-0.72	0.00	0.65	6.21	0.04	4.69	1722
r_p	0.02	1.78	-12.42	-0.87	0.00	0.92	10.77	0.09	7.73	1722
r_h	-0.08	1.47	-7.83	-0.88	0.00	0.67	9.46	0.41	6.67	1722
r_u	-0.06	0.97	-8.09	-0.56	0.00	0.43	4.91	-0.30	8.22	1722

Commerce Index: In the Shanghai and Shenzhen stock markets, the minimum value of the commerce index is -7.69, the maximum value is 7.24, and the standard deviation is 1.28. In the other stock market, the minimum value is -8.90, the maximum value is 16.30, and the standard deviation is 1.74. This indicates that the fluctuation range of the commerce index in the Shanghai and Shenzhen stock markets is significantly smaller than that in the other stock market, with the other commerce index having higher maximum increases and decreases than the mainland market. In terms of skewness, the skewness of the commerce index in the Shanghai and Shenzhen stock markets is -0.15, indicating left skewness, while the skewness of the commerce index in the other stock market is 0.59, showing a clear right skewness unlike the mainland market. Regarding kurtosis, the kurtosis values for the Shanghai and Shenzhen stock markets and the other stock market are 7.09 and 9.50, respectively, both indicating a leptokurtic distribution with fat tails.

Finance Index: In the Shanghai and Shenzhen stock markets, the minimum value of the finance index is -9.47, the maximum value is 9.41, and the standard deviation is 1.68. In the other stock market, the minimum value is -5.21, the maximum value is 6.21, and the standard deviation is 1.24. Comparing the standard deviations of the Shanghai and Shenzhen stock markets and the other stock market indicates that the volatility in the mainland finance index is significantly higher than that in the other market. In terms of skewness and kurtosis, the values for the Shanghai and Shenzhen stock markets and the other stock market are 0.39 and 6.90, and 0.04 and 4.69, respectively. Both markets show a leptokurtic distribution with

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fat tails, but the mainland market has a more pronounced right skewness in returns, while the other market's distribution is closer to a normal distribution.

Petroleum Index: In the Shanghai and Shenzhen stock markets, the minimum value of the petroleum index is -7.68, the maximum value is 6.12, the mean is 0.00, and the standard deviation is 1.43. In the other stock market, the minimum value is -12.42, the maximum value is 10.77, the mean is 0.02, and the standard deviation is 1.78. Comparing the standard deviations of the Shanghai and Shenzhen stock markets and the other stock market indicates that the volatility in the mainland petroleum index is significantly lower than that in the other market. In terms of skewness, the skewness of the petroleum index in the Shanghai and Shenzhen stock markets is -0.06, indicating slight left skewness, while the skewness in the other stock market is 0.09, showing a clear right skewness unlike the mainland market. Regarding kurtosis, the kurtosis values for the Shanghai and Shenzhen stock markets and the other stock market are 6.12 and 7.73, respectively, both indicating a leptokurtic distribution with fat tails. The distribution characteristics of this industry index in both markets are similar to those of the commerce index.

Real Estate Index: In the Shanghai and Shenzhen stock markets, the minimum value of the real estate index is -9.13, the maximum value is 8.55, the mean is -0.05, and the standard deviation is 1.76. In the other stock market, the minimum value is -7.83, the maximum value is 9.46, the mean is -0.07, and the standard deviation is 1.47. Comparing the standard deviations of the Shanghai and Shenzhen stock markets and the other stock market indicates that the volatility in the mainland real estate index is significantly higher than that in the other market, and the maximum decline in the mainland market exceeds that in the other market. In terms of skewness and kurtosis, the values for the Shanghai and Shenzhen stock markets and the other stock market are 0.41 and 5.86, and 0.41 and 6.67, respectively, both showing a clear right skewness and a leptokurtic distribution with fat tails. The distribution characteristics of this industry index in both markets are similar to those of the finance index.

Public Utilities Index: In the Shanghai and Shenzhen stock markets, the minimum value of the public utilities index is -7.68, the maximum value is 7.83, the mean is 0.02, and the standard deviation is 1.19. In the other stock market, the minimum value is -8.09, the maximum value is 4.91, the mean is -0.06, and the standard deviation is 0.97. Comparing the standard deviations of the Shanghai and Shenzhen stock markets and the other stock market indicates that the volatility in the mainland public utilities index is significantly higher than that in the other market. In terms of skewness and kurtosis, the values for the Shanghai and Shenzhen stock markets are -0.04 and 7.70, and for the other stock market are -0.30 and 8.22, both showing a slight left skewness and a leptokurtic distribution with fat tails.

3.2 Comparison of Industry Asset Allocation

Based on five industries—Commerce (COM), Finance (FIN), Petroleum (PET), Real Estate (HOU), and Utilities (UTI)—this paper employs four strategies: the Global Minimum Variance strategy (GMV), the Most Diversified Portfolio strategy (MDP), the Minimum Tail Dependence strategy (MTD), and the Equal Risk Contribution strategy (ERC). By combining these five industries with the four strategies, we calculate the returns under different strategies to observe the performance of the same strategy in different markets.

In this paper, the GMV strategy is used as the benchmark to comparatively analyze the allocation effects of the other three strategies relative to the GMV benchmark. In Figures 1 and 2, the upper left represents the GMV strategy, the lower left represents the MTD strategy, the upper right represents the MDP strategy, and the lower right represents the ERC strategy. With GMV as the benchmark strategy, each point represents the allocation weight or proportion of the industry under that strategy. The weight is the ratio of the quantity share. The remaining parts show the changes in shares of the three strategies compared to the benchmark strategy.

As shown in Figure 1, the distribution characteristics of the GMV strategy in the Shanghai and Shenzhen stock markets are as follows: Assets are mainly allocated to public utilities (about 50%), followed by commerce and petroleum, which account for approximately 30% and 18%, respectively. The real estate and finance industries are almost excluded. Nearly 98% of the wealth is concentrated in three of the five industries. In the descriptive statistics of industry returns, the finance and real estate industry indexes have the highest volatility, with median returns of -0.18 and -0.10, respectively, and they are also the lowest in the median return sequence. The public utilities index has the highest average return, about 0.02, the smallest return fluctuation, about 1.19, and it is the only one with a positive median return among the five industries.

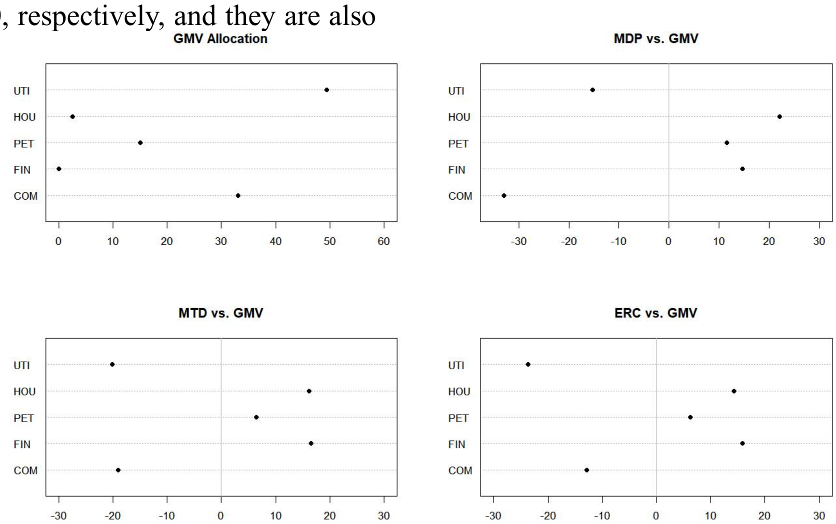

Figure 1. Industry Asset Allocation in the Hu-Shen Stock Markets

In the MDP strategy, asset allocation is mainly in public utilities, accounting for about 32%, followed by petroleum, real estate, finance, and finally commerce. Compared with the benchmark GMV strategy, the changes in the MDP strategy are the reduction of weights in public utilities and commerce, and the increase in weights for real estate, petroleum, and finance, but public utilities still have the highest weight. Through the correlation indicators of industry indexes, it can be seen that there is a strong positive correlation between public utilities and commerce, and there is also a strong correlation between the petroleum and commerce indexes. Therefore, after allocating more to public utilities and petroleum indexes in the strategy, the allocation to the commerce index is the least.

In the MTD strategy, public utilities still have the main weight, followed by petroleum, real estate, finance, and finally commerce, which is similar to the MDP strategy. Compared with the benchmark GMV strategy, the changes in the MTD strategy are also the reduction of weights in public utilities and commerce, and the increase in weights for real estate, petroleum, and finance. However, unlike the MDP strategy, the MTD strategy significantly reduces the weight of public utilities and lessens the reduction in the weight of commerce.

Since the ERC strategy itself emphasizes equal weights and assigns the same weight to each industry, the allocation weight in each industry is the same, at 20%. Therefore, compared with the benchmark GMV strategy, the ERC strategy reduces the weights of public utilities and commerce, and increases the weights of real estate, petroleum, and finance.

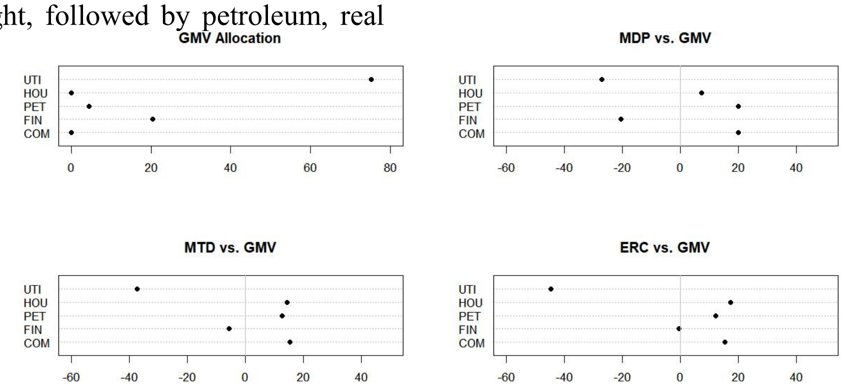

Figure 2. Industry Asset Allocation in the other Stock Market

As shown in Figure 2, the distribution characteristics of the GMV strategy in the other stock market are as follows: Assets are mainly allocated to public utilities (about 78%), followed by finance, which accounts for approximately 19%, while real estate, petroleum, and finance together account for about 3%. Nearly 97% of the wealth is concentrated in two of the five industries. The public utilities index has the smallest fluctuation value and relatively smaller worst-case returns.
In the MDP strategy, asset allocation is mainly in public utilities, accounting for about 50%, followed by petroleum, real estate, commerce, and finally finance. Compared with the benchmark GMV strategy, the changes in the MDP strategy are the reduction of weights in public utilities and finance, and the increase in weights for real estate, petroleum, and commerce. This is consistent with the correlation of industry indexes: The public utilities index has a high correlation with real estate and finance, at 0.59 and 0.56, respectively, and the lowest correlation with petroleum, at about 0.37. Such allocation can largely diversify assets with high correlation, ensuring that assets in the portfolio strategy do not exhibit severe "return synchronicity."
In the MTD strategy, public utilities still have the main weight (about 38%), while petroleum, real estate, finance, and commerce have similar proportions. In the ERC strategy, the distribution characteristics are as follows: The allocation weight in each industry is the same, at 20%. The changes in the MTD strategy are the reduction of weights in public utilities and finance, and the increase in weights for commerce, real estate, and petroleum; the changes in the ERC strategy are the reduction of the weight in public utilities, and the increase in weights for commerce, real estate, petroleum, and finance.
Through the comparison of the allocation strategies of "two markets, four strategies, and five industries," it is not difficult to find the following:
Firstly, in the Global Minimum Variance strategy (GMV), the allocation weight of commerce in the other stock market is relatively low (about 1%), while in the Shanghai and Shenzhen stock markets, it is relatively higher (about 32%). The common point between the Shanghai and Shenzhen stock markets and the other stock market is the increased allocation weight to the public utilities industry. Similarly, the public utilities index in both markets shows a "relatively stable" trend in the time series. The risk of the commerce index in the Shanghai and Shenzhen stock markets is significantly lower than that of the industry index in the other stock market, where its risk is second only to the petroleum industry among the five industries.
In the Most Diversified Portfolio strategy (MDP), the common point is that the allocation weights of public utilities and petroleum are similar, while the differences lie in the allocation weights of real estate and commerce between the two markets. In the Shanghai and Shenzhen stock markets, the allocation weights for real estate and commerce are about 24% and 0%, respectively, while in the other stock market, the allocation weights for real estate and commerce are about 8% and 20%, respectively. In the Minimum Tail Dependence strategy (MTD), the other stock market has lower asset allocation weights in real estate and finance (about 16% and 17%, respectively), while the Shanghai and Shenzhen stock markets have higher asset allocation weights in real estate and finance (about 22% and 21%, respectively).
Secondly, overall, the Shanghai and Shenzhen stock markets show a more dispersed state of asset allocation weights across industries under the four strategies of GMV, MDP, MTD, and ERC. In contrast, the other stock market has a relatively concentrated distribution of asset allocation weights across industries under the same strategies. For specific industries, commerce (COM): In the Shanghai and Shenzhen stock markets, the allocation weight of the commerce industry varies significantly across different strategies. For example, under the MDP strategy, the weight of commerce is almost 0%, while under the GMV strategy, it accounts for about 32%. In the other stock market, the allocation weight of commerce changes relatively little and seems more stable overall, without the significant fluctuations seen in the Shanghai and Shenzhen stock markets.
In summary, the dispersion of industry asset allocation in the Shanghai and Shenzhen stock markets under different strategies is significantly higher than that in the other stock market. The industries in the other stock

market show stronger stability and concentration under different strategies, which may be related to the inherent volatility of the industry indexes, reflecting a certain degree of volatility dispersion. This comparative result provides investors with an intuitive reference for making asset allocation decisions in the Shanghai and Shenzhen stock markets and the other stock market, helping to further optimize investment portfolio strategies.

3.3 Comparison of Investment Risks

Table 2. Key Risk Metrics for Industry Investment in Hu-Shen and other Stock Markets

	SD	ES95	DR	CR
Panel A Hu-Shen index return				
GMV	1.06	3.27	1.20	0.35
MDP	1.15	3.32	1.27	0.26
MTD	1.14	3.32	1.26	0.21
ERC	1.14	3.33	1.25	0.20
Panel B other index return				
GMV	0.94	2.60	1.13	0.54
MDP	1.07	2.75	1.27	0.29
MTD	1.07	2.67	1.26	0.21
ERC	1.10	2.68	1.24	0.20

Table 2 calculates the investment risks of four different investment portfolios, using four metrics: SD (Standard Deviation), ES95 (Expected Shortfall at 95%), DR (Diversification Ratio), and CR (Concentration Ratio) to measure the risk profiles of the portfolios.

In the Shanghai and Shenzhen stock markets:

The SD indicator is highest under the MDP strategy (approximately 1.15), followed by the MTD and ERC strategies, with the GMV strategy having the lowest value (approximately 1.06). This indicates that the GMV strategy has the smallest overall return volatility and is relatively more stable compared to the other three strategies.

The ES95 indicator is highest under the ERC strategy (approximately 3.33), followed by the MTD and MDP strategies, with the GMV strategy having the lowest value (approximately 3.27). This suggests that the MDP strategy has relatively smaller potential losses and is more risk-controllable compared to the other strategies.

The DR indicator is highest under the MDP strategy (approximately 1.27), followed by the MTD and ERC strategies, with the GMV strategy having the lowest value (approximately 1.20).

This indicates that the MDP strategy has the highest diversification, with lower dependence on any single asset or asset class, resulting in more stable returns.

The CR indicator is highest under the GMV strategy (approximately 0.35), followed by the MDP and MTD strategies, with the ERC strategy having the lowest value (approximately 0.20). This suggests that the ERC strategy has the lowest concentration ratio, meaning that the portfolio is less likely to experience significant fluctuations due to adverse movements in individual assets, and can achieve relatively stable returns within the sample period.

In the other stock market:

The SD indicator is highest under the ERC strategy (approximately 1.10), followed by the MTD and MDP strategies, with the GMV strategy having the lowest value (approximately 0.94). This indicates that the GMV strategy has the smallest overall return volatility and is relatively more stable compared to the other three strategies.

The ES95 indicator is highest under the MDP strategy (approximately 2.75), followed by the MTD and ERC strategies, with the GMV strategy having the lowest value (approximately 2.60). This suggests that the GMV strategy has relatively smaller potential losses and is more risk-controllable compared to the other strategies.

The DR indicator is highest under the MDP strategy (approximately 1.27), followed by the MTD and ERC strategies, with the GMV strategy having the lowest value (approximately 1.13). This indicates that the MDP strategy has the highest diversification, with lower dependence on any single asset or asset class, resulting in more stable returns.

The CR indicator is highest under the GMV strategy (approximately 0.54), followed by the MDP and MTD strategies, with the ERC strategy having the lowest value (approximately 0.20). This suggests that the ERC strategy has the lowest concentration ratio, meaning that the portfolio is less likely to experience significant fluctuations due to adverse movements in individual assets, and can achieve relatively stable returns within the sample period.

As shown in Table 2, the overall volatility of industry indexes in the other stock market is relatively smaller compared to those in the Shanghai and Shenzhen stock markets. Horizontally, the concentration of the GMV strategy is lower in the Shanghai and Shenzhen stock markets (approximately 0.35) compared to the other stock market (approximately 0.54). The values of the MTD and ERC strategies in the Shanghai and Shenzhen stock markets are generally higher than those in the other stock market.

Vertically, the standard deviation and expected shortfall values in the Shanghai and Shenzhen stock markets are generally higher than those in the other stock market. However, in terms of the DR and CR indicators, the overall range of values in the other stock market is larger than that in the Shanghai and Shenzhen stock markets.

4. Conclusions

This paper analyzes the characteristics and differences of industry index performance, asset allocation, and investment risks between the Shanghai and Shenzhen stock markets and the other stock market. It compares the application effects of four investment strategies (Global Minimum Variance strategy GMV, Most Diversified Portfolio strategy MDP, Minimum Tail Dependence strategy MTD, and Equal Risk Contribution strategy ERC) in the two markets and reveals the different risk-return profiles of the two stock markets. The following conclusions are drawn:

Firstly, in the time-series analysis of industry index returns in the Shanghai, Shenzhen, and other stock markets, descriptive statistics show that the average returns of industry indexes are not significantly different, and the 25% to 75% return quantiles also show little difference. Compared with extreme values, the other indexes have a larger fluctuation range, while the fluctuation range of the five indexes in the Shanghai and Shenzhen markets is relatively concentrated. Compared with the normal distribution, both markets exhibit a leptokurtic and fat-tailed distribution, with a higher probability of extreme returns. Specifically, the skewness distribution in the Shanghai and Shenzhen stock markets shows a coexistence of left and right skewness, which may reflect the complexity of the market environment and the diversity of industry competition patterns to some extent. In contrast, the skewness in the other stock market is concentrated on the right side, with overall positive returns. This phenomenon may be closely related to the higher industry concentration and concentrated capital flow in the other market. These differences further highlight the different risk characteristics of the two markets.

Secondly, the allocation ratios and return results of the four strategies among the same investment options are significantly different. The GMV strategy, which emphasizes minimizing portfolio volatility under a certain return, often concentrates asset allocation in a few low-volatility assets, resulting in lower overall risk for the strategy. However, this allocation makes the strategy overly dependent on certain assets. While it can maintain lower risk under normal circumstances, it may face greater losses in extreme situations. The MDP strategy, which considers the dispersion of asset allocation to effectively reduce overall portfolio risk, does not fully take into account the fat-tailed characteristics of asset return distributions. The fat-tailed characteristic means that the probability of extreme values in asset returns is higher than that predicted by the normal distribution, which may lead to the MDP strategy performing worse than expected in extreme market conditions. Especially in the other market, the ES95 of the MDP strategy is the highest, indicating a higher possibility of significant losses.

The ERC strategy, which has a lower concentration and more even asset allocation, can theoretically reduce the impact of specific asset fluctuations on the entire portfolio. However, this strategy ignores asset volatility, which may cause certain assets' fluctuations to have a greater impact on the overall portfolio. In the Shanghai and Shenzhen stock markets, the ERC strategy has the highest absolute value of ES95. Finally, the MTD strategy has unique advantages in dealing with extreme risks by optimizing the dependence structure between assets to reduce losses in extreme market conditions. However, the MTD strategy also faces challenges in complex calculations and tail coefficient estimation, which may limit its application in actual investments.

These differences may stem from the differences in market structure and participant behavior patterns. The Shanghai and Shenzhen stock markets have a diverse industry composition with many small and medium-sized market value enterprises, which are easily affected by macroeconomics, policies, and market sentiment, resulting in significant fluctuations in industry indexes. In contrast, the other stock market has a high industry concentration dominated by large blue-chip stocks. Although it is stable, its over-reliance on a few industries limits its risk diversification ability, making it vulnerable to shocks in specific industry fluctuations.

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