# Industry Diversification and Optimal Industry Combination of Portfolios

Mingyu Lyu[1, †], Xiaolong Qiu[2, *, †], Zijian Liu[3, †], Xu Yang[4, †]

[1]*School of social science University of California Irvine Irvine, California, 92697*
[2]*School of social science University of California Irvine Irvine, California, 92697*
[3]*College of Computer science Sichuan University Chengdu, China*
[4]*Electrical Engineering & Information Technology Shandong University of Science and Technology Qingdao, China*
[1]*mlyu4@uci.edu,*xiaolq1@uci.edu,*[3]*liuisaiah@163.com,*[4]*lukasyangxu@163.com*
*There authors contributed equally*

**ABSTRACT**

The importance of asset diversification has been tested and proven many times in the past few decades. Investors can allocate their money into different asset classifications, such as stocks, golds, and funds. Undoubtedly, returns and risks vary across different types of assets. A huge number of risk lovers are keen to invest in stocks and equity funds due to their fascinating revenues. However, the equity market covers a wide variety of industries. How could one reasonably allocate assets to obtain a fair gain with low risks? We aimed at figure out the optimal combination of 20 industries that construct minimum variance, maximum Sharpe ratio, and maximum drawdown portfolios separately among 64 industries in China. Basically, we gathered industries index data in 2014 and 2015 and utilized Excel functions to do our experiment. Eventually, 7 industries showed up in both years' minimum variance portfolios. If certain industries appeared in minimum variance portfolios over and over again, these industries usually had relatively low risks and could offer suggestions for investors. Some implications could also be found from maximum Sharpe ratio and maximum drawdown experiments.

***Keywords:*** *industry diversification; minimum variance portfolio; industry combination, maximum Sharpe ratio portfolio; maximum drawdown portfolio.*

## 1. INTRODUCTION

### *1.1. Background:*

As we all know, eggs cannot be put in the same basket, and the essence of this behavior is diversification of risk. Investment, without doubt, is a risky behavior, and the optimal investing strategy is to make a portfolio to maximize return and minimize or even avoid risk for investors. Portfolio optimization is the process of selecting the best portfolio, out of the set of all portfolios being considered, according to some important factors. Therefore, if we can find the optimal portfolio, the investment risk will be reduced dramatically, meaning that the investment efficiency can be improved. In this paper, we mainly focus on finding out the optimal portfolio. Specifically, we select twenty industries from sixty-four industries in China to form the industry with the smallest fluctuation, the largest Sharpe ratio, and the maximum drawdown, forming the optimal portfolios. All these three factors are important standards to measure whether the specific industry is worth investing in. The purpose is to offer non-professional investor some useful investment reference, and it can also minimize the risk of investment. To be more specific, there are thousands of industries in China, so it is difficult and complicated for investors to determine which industry they can invest. Especially during economic crisis, investment in industry in Chinese market was almost depressed, so the profitable investment became more difficult for investors with increased risk. By comparing the index, including fluctuation, Sharpe ratio, and maximum drawdown, the investors can choose the industry with low fluctuation and minimize the risk. We also examined how the economic crisis can affect certain industries. Under this circumstance, investors have a basic understanding of the Chinese market, so they can choose the appropriate industries to invest according to fluctuation, Sharpe

 

ratio, and maximum drawdown. It can also provide the investors with the reference about industry functions. For example, if the investors want to invest in stock, manufacturing, and textile, they can have a better understanding of allocating funds in each industry.

### *1.2. Motivation:*

The three most important indicators in our paper are variance, Sharpe ratio, and maximum drawdown. Maximum drawdown is a crucial indicator to measure strategic risk, which implies the largest loss the investor might face. Sharpe ratio is the measure of excess return beyond the risk-free rate of return for each unit of risk. Without doubt, the main purpose of investing is to obtain the maximum return, but profits and risk coexist. Under this circumstance, choosing the optimal portfolio to maximize return and to minimize risk is something that many investors should consider. As we all know, Chinese investment market is complicated, and different investors have different demand for investment. For instance, different individuals have different risk tolerance, so risk lovers can choose a portfolio with higher risk and higher returns.

However, risk aversion can choose a relatively conservative portfolio according to their demand. There are many factors that can influence the market, such as sources, or public policy. For instance, the prospect of education industry depressed after the Double Reduction Policy, and the real estate industry also faced many problems. However, by calculating these three important factors, the investors can have a better understanding of the stability of the industry directly. After that, investors can obtain more information based on these three indices, deciding whether to invest or not. It also provides investors with the opportunity to realize the challenges and opportunities in this industry. Meanwhile, fluctuation reflects whether the industry is stable or not. Education industry, for example, has high Sharpe ratio and fluctuation rate under the double reduction policy, so the investors can avoid choosing this industry to minimize the risk of investment. Thus, based on the three important indices, we can analyze some industries with higher risk and some industries with lower risk. The investors can choose the portfolio with highest returns at the maximum risk they can afford. Portfolio optimization, at least, offers investors with the opportunity to minimize the risk of investment, and this is also the motivation for us to conduct this research.

### *1.3. Result:*

In conclusion, we have figured out 3 optimal combinations of 20 industries that construct minimum variance, maximum Sharpe ratio, and maximum drawdown portfolios separately among 64 industries in China. Basically, we gathered industries index data in 2014 and 2015 and utilized Excel functions to do our experiment. Finally we find optimized portfolio only containing less than 10 industries, which indicates that constructing portfolio by a single criterion tends to concentrate investment on a few industries. As a result, in order to diversify our investment, we should take more factors into consideration.

### *1.4. Contribution:*

A large number of previous studies have examined the relative importance of country factors in determining equity returns and concluded that country factors prevail over industry factors.[1] To examine the correctness of this finding, some experts gathered industry index data from 21 developed countries and presented evidence to show diversification across global industries providing more risk reduction than country factors. They calculated the Sharpe ratios of different countries, such as Japan, Australia and Britain, and Sharpe ratio of different industries, such as life insurance and commercial banking. Finally, they found that the Sharpe ratios of industry factor combinations were higher than those of national factor combinations, reaching a conclusion that portfolio diversified across industries brought a higher return to risk ratio. An alternative way to examine the performance of industry-based portfolio and country-based portfolio is to compare portfolio's volatility. By using the same data, they discovered that the volatility of industry-based portfolio was obviously smaller, reflecting a lower risk.[2] These studies have showed how industry factors mattered for an investor and paved a solid foundation for our research. Therefore, on the basis of these studies, we would explore more about the industry factors in Chinese financial market. How could investors allocate their assets across different industries to acquire a higher return to risk ratio? Which industries could they avoid in a specific time? These are the main objectives we intend to explore.

## 2. METHOD

### *2.1. Data*

The data needed for this study are: the 64 industry indexes data in the Chinese stock market, including monthly return rate of these industries and monthly risk-free return rate. In this paper, we selected the sampling interval from January 2014 to December 2015. All the industry indexes were downloaded from Straight flush (http://www.10jqka.com.cn/). Industry index data includes almost all industry categories in the Chinese financial market, which can improve the representatives of our data.

(1) *Sharpe ratio*

Sharpe ratio inherits modern portfolio theory about mean and variance. The basic idea of this ratio is to use the ratio of the fund's income in a period of time and the standard deviation of income as the index to measure fund performance. The Sharpe ratio in a broad sense can be reflected by formula (1).SF= RF (1) σ[1]

RF is the return of the fund over a period of time, and σF is the standard deviation of the return of the fund over the period. This measure describes the level of return per unit of risk (the standard deviation of return). In investment practice, people tend to compare investment returns with some benchmarks, such as risk-free interest rate and market index returns, which to some extent represent the opportunity cost of investment. In order to more clearly show the difference among returns of the fund and the benchmark, another widely used form of Sharpe ratio is calculated by the excess return and standard deviation of the fund relative to the benchmark, with RB representing the return of the benchmark over the same period: If sigma F uses the returns of a market index as a benchmark, the Sharpe ratio represents the basis.The excess return of exponential investment represents the return of the fund on securities selection, which can be expressed as:

SF = RF - RB σF[4]

(2) *Maximum drawdown*

Maximum drawdown is a measure of risk control ability. It refers to the peak of the fund net curve to the bottom of the largest. The maximum drawdown of the fund cannot be measured by a single product, so we need to consider many factors.[5]

Maximum drawdown is an important risk index: it reflects the risk control level of the manager, forms the investment experience of investors and determines the returns of investors.

Suppose that we have an underlying asset whose price process at time t is given by St. For example, the price process could be a stock price, index, interest rate or exchange rate. Denote by Mt its running maximum up to time t: (1) Mt = max Su. u∈ [0,t]

Drawdown Dt is defined as the drop of the asset price from its running maximum: (2) Dt = Mt − St.

Maximum drawdown MDDt is defined as the maximal drop of the asset price from its running maximum over a given period of time: (3) MDDt = max Du. u∈ [0,t]

Assume that you have an investor who enters the market at a certain point and leaves it at some following point within a given time period. Maximum drawdown measures the worst loss of such an investor, meaning that he buys the asset at a local maximum and sells it at the subsequent lowest point, and this drop is the largest in the given time period. This represents the worst period for holding this asset and could be written mathematically as:

(4) MDDt = sup (−qu)dSu. qu ∈ {0,1} 0

one switch (0 → 1) and (1 → 0)

Similarly, we can define the concepts of draw up, and maximum draw up. Draw up Ut is defined as the

increase of the asset price from its running minimum:

Ut = St − mt,

where

(6) mt = min Su. u∈ [0,t]

Maximum drawup MDUt is given by
(7) MDUt = max Uu. u∈ [0,t] [3]

(3) Minimum variance

The risk of a portfolio can be measured by the fluctuation of the stock, the greater the volatility of the portfolio means greater risk. Bali found a negative correlation between volatility and expected returns.[6] For the relationship between the return rate of stock portfolio and its volatility, Haugen and Baker's empirical results show that according to market value plus weighted market portfolios are not efficient, in other words, we can find a portfolio with the same return as the market but less volatility.[7] In this paper we use variance σ to measure the risk coefficient of our portfolio. Since portfolio can disperse the risk of a single stock, the volatility of a single stock cannot constitute the risk of a portfolio through linear portfolio, more studies use covariance matrix as a measure of risk for further analysis.[8] Numerous domestic and foreign empirical evidence shows that,[9] the abnormal returns of stocks are mainly related to market value, value (book-to-market ratio) and momentum,[10] three factors are involved. Considering that there is no monthly momentum effect in China's stock market, therefore, this paper only considers from the perspective of yield.When the expected return of the portfolio is given, the weight of individual assets in the portfolio can be adjusted to get minimum risk. In Chinese stock market the short selling is not allowed, so we do not consider short buying in our portfolio. We set the sum of the weights of all assets is 1, and weight x≥0 indicates that the weights of all assets are non-negative (i.e., short selling is not allowed), then through optimizer exercise which changes the weight of each industry in portfolio, we can get the minimum variance portfolio.

## *2.2. Method*

These data were utilized to calculate the covariance between each two industries. To find out the optimal combination of industries that construct to a minimum

variance portfolio, we analyzed and took advantage of portfolio variance formula first. Below is the portfolio variance formula 2: $\sigma_p^2 = \sigma^2(R_p) = \sum_{i=0}^{n}\sum_{j=0}^{n} W_i W_j Cov(R_i, R_j)$. Assume each industry takes up 5% of the portfolio. For easily calculating, the impact of weight was ignored. Then we utilized excel data analysis to calculate covariance between industries and obtain a covariance matrix. Below are some results from our experiment.

**Table 1** Covariance matrix of 6 industries

| | Food processing and manufacturing | Retail | Building materials | Traditional Chinese medicine | Beverage manufacturing | Bus |
|---|---|---|---|---|---|---|
| Food processing and manufacturing | 0.001454843 | | | | | |
| Retail | 0.001477015 | 0.001826186 | | | | |
| Building materials | 0.001425714 | 0.001384327 | 0.002032786 | | | |
| Traditional Chinese medicine | 0.001465058 | 0.001675662 | 0.001191831 | 0.001954101 | | |
| Beverage manufacturing | 0.001265748 | 0.001428233 | 0.000753141 | 0.00174651 | 0.002373296 | |
| Bus | 0.001073907 | 0.001238685 | 0.00135734 | 0.001008799 | 0.000519082 | 0.002423857 |

Assume each industry takes up 5% of the portfolio. For easily calculating, the impact of weight on portfolio variance was ignored. We simply multiply the covariance between industries and industry variance itself to find the optimal combination. The final 20 industries that construct a minimum variance portfolio is shown in Table 2.

**Table 2** 20 industries construct minimum variance portfolio in 2014

| | | | | |
|---|---|---|---|---|
| Food processing and manufacturing | Retail | Building materials | Traditional Chinese medicine | Beverage manufacturing |
| 0.15% | 0.18% | 0.20% | 0.20% | 0.24% |
| Packaging and Printing | Railway transportation | Logistics | Building Decoration | Gas and Water |
| 0.27% | 0.27% | 0.28% | 0.28% | 0.29% |
| Bus | New chemical materials | Real estate development | White goods | Paper industry |
| 0.24% | 0.24% | 0.25% | 0.25% | 0.26% |
| Clothing home textiles | Chemical and pharmaceutical | Chemical synthetic materials | Trade | Whole car |
| 0.29% | 0.30% | 0.30% | 0.31% | 0.31% |

Then we use the same method to get the minimum variance portfolio with 2015 data. The final 20 industries and their variances are shown in Table 3.

**Table 3** 20 industries construct minimum variance portfolio in 2015.

| | | | | |
|---|---|---|---|---|
| Bank | Whole car | Gas and Water | Insurance and others | Beverage manufacturing |
| 0.60% | 0.80% | 1.13% | 1.19% | 1.31% |
| Coal mining and processing | Building materials | Retail | Basic chemical | Electricity |
| 1.46% | 1.50% | 1.60% | 1.60% | 1.64% |
| Logistics | Transportation equipment service | Traditional Chinese medicine | Food processing and manufacturing | Railway transportation |
| 1.67% | 1.68% | 1.73% | 1.73% | 1.75% |
| Forestry and Plantation | Extraction service | Non-ferrous smelting processing | Steel industry | Aquaculture |
| 1.76% | 1.81% | 1.81% | 1.89% | 1.91% |

Finally, we compared the portfolio results of 2014 and 2015 and found that there were 8 industries included in both years' portfolios.

**Table 4** Comparison of 2 portfolios

| | | | | |
|---|---|---|---|---|
| **Food processing and manufacturing** | **Retail** | **Building materials** | **Traditional Chinese medicine** | **Beverage manufacturing** |
| Bus | New chemical materials | Real estate development | White goods | Paper industry |
| Package and Printing | **Railway transportation** | **Logistics** | Building Decoration | Gas and water |
| Clothing home Textiles | Chemical and pharmaceutical | Chemical synthetic materials | Trade | **Whole car** |

| | | | | |
|---|---|---|---|---|
| Bank | **Whole car** | Gas and Water | Insurance and others | **Beverage manufacturing** |
| Coal mining and processing | **Building materials** | **Retail** | Basic chemical | Electricity |
| **Logistics** | Transportation equipment service | **Traditional Chinese medicine** | **Food processing and manufacturing** | **Railway transportation** |
| Forestry and Plantation | Extraction service | Non-ferrous smelting processing | Steel industry | Aquaculture |

**Table 5** Industries' monthly close price and maximum drawdown

| Industry | Other electronics | Medical equipment service | Electronics manufacturing | Media | New materials | Agricultural service |
|---|---|---|---|---|---|---|
| January | 1385.518 | 3278.041 | 1598.861 | 1864.141 | 1874.889 | 2071.073 |
| February | 1505.31 | 3616.919 | 1568.936 | 1741.163 | 2036.608 | 1999.469 |
| March | 1404.361 | 3540.603 | 1431.128 | 1580.136 | 1932.944 | 1826.217 |
| April | 1378.739 | 3286.051 | 1434.08 | 1573.654 | 1913.057 | 1758.393 |
| May | 1424.974 | 3432.406 | 1541.842 | 1629.931 | 1995.216 | 1796.812 |
| June | 1536.252 | 3740.972 | 1652.063 | 1813.097 | 2170.252 | 1883.326 |
| July | 1612.665 | 3501.067 | 1651.693 | 1719.897 | 2451.806 | 2023.264 |
| August | 1818.911 | 3770.466 | 1798.651 | 1898.063 | 2494.031 | 2213.035 |
| September | 2067.96 | 4321.652 | 2010.459 | 2053.082 | 2772.957 | 2452.912 |
| October | 2179.84 | 4528.151 | 2030.482 | 2078.554 | 2783.24 | 2475.797 |
| November | 2381.028 | 4359.107 | 2149.589 | 2090.388 | 2916.474 | 2507.194 |
| December | 1955.036 | 3793.32 | 1797.891 | 1880.796 | 2448.213 | 2262.449 |
| Max drawdown | 17.89% | 16.23% | 16.36% | 15.58% | 16.06% | 15.10% |

Maximum drawdown means the maximum loss from a peak to trough during a specific period. We collected monthly close prices for each industry from 2014 to 2015 to calculate their maximum drawdown rate. For instance, the maximum drawdown for medical equipment service happened in November and December, which was (4528.151-3793.32)/4528.151*100%=16.23%. We used the same method to calculate all 64 industries' maximum drawdown and summarized 20 industries which had the highest drawdown in 2014, listing them in table 6.

**Table 6** 20 Maximum drawdown industries in 2014

| other electronics | electronics manufacturing - ring | medical equipment service | new materials | media | extraction service | Optical Electortrons | Agricultural services | Computer Application | Environmental engineering |
|---|---|---|---|---|---|---|---|---|---|
| 17.89% | 16.36% | 16.23% | 16.06% | 15.S8% | 15.32% | 15.28% | 15.10% | 14.63% | 13.71% |
| Transportation equipment service | Computer equipment | auto parts | Communion-cation service | Communication equipment | Household Light Industry | Semiconductor and original | General Equipment | Aquaculture | financial securities |
| 13.68% | 13.53% | 12.96% | 12.48% | 12.29% | 11.95% | 11.92% | 11.58% | 11.38% | 10.76% |

We also analyzed the period that maximum drawdown happened for these 20 industries. The same method was used with 2015 data. And 20 industries which had the highest drawdown were listed in table 7 and table 8.

**Table 7** Maximum drawdown time

| other electronics | electronics manufacturing | medical equipment 4 service | new materials | media | Extraction service | Optical Detector •ranks | Agricultural services | Computer Application | environmental engineering |
|---|---|---|---|---|---|---|---|---|---|
| dec | dec | nov dec | dec | feb-apr | feb-apr | sept-dec | feb-apr | dec | march april |
| Transport | Compute | auto | communi | Com- | Househol | semicond | General | Aquacult | financial |

| ation equipment service | r equipment | parts | cation service | communication Equipment | d d Light Industry | uctor and original | Equipment t | ure | securities |
|---|---|---|---|---|---|---|---|---|---|
| dec | march april | dec | feb-apr | dec | dec | dec | dec | dec | feb march |

**Table 8** 20 Maximum drawdown industries in 2015

| bond | communication services | oil mining | optical electronics industry | Optical Electronics | steel industry | computer application) n industry | trade | Nonferrous smelting and processing | new material s |
|---|---|---|---|---|---|---|---|---|---|
| 54.07% | 53.40% | 52.94% | 46.73% | 46.73% | 46.68% | 46.28% | 45.97% | 45.92% | 44.38% |
| Communication apparatus | audio-visual equipment | Semiconductor and original | computer equipment | coal mining and processing | instrumentation | New chemical materials | Chemical products | Chemical synthetic materials | Airport shipping |
| 44.06% | 43.09% | 42.94% | 42.92% | 42.41% | 40.36% | 40.25% | 38.67% | 37.88% | 36.53% |

**Table 9** 20 industries with highest Sharpe ratio

| | | | | |
|---|---|---|---|---|
| Special | Securities | Pharmaceutical business | building materials | building decoration |
| 3.30% | 9.60% | 4.01% | 3.08% | 3.56% |
| Bank | Instrument and meter | Logistics | Trade | Auto Parts |
| 4.18% | 3.67% | 3.51% | 4.02% | 4.49% |
| Gas water | Insurance and Other | Packaging and printing | Electric power | Electrical equipment |
| 2.74% | 4.63% | 2.90% | 4.09% | 3.39% |
| Real estate development | Non-automobile delivery | The bus | Port of shipping | Rail transportation |
| 3.39% | 4.13% | 2.70% | 4.33% | 4.57% |

In the maximum Sharpe ratio portfolio we plan to focus on the Sharpe ratio, for all those industries, we calculated the Sharpe ratio for each industry. Then we include 20 industries in our portfolio, regardless of scale, we rank these 64 industries by Sharpe ratio and choose top 20 industries with the maximum Sharpe ratio. This analysis is displayed in figure 9..

In order to simplify the model and focus on industry characteristics research, We calculated the average interest rate on China's 10-year government bonds in 2014 (a constant) as the risk-free rate, in figure 1.


**Figure 1** China 10-year bond average interest rates

Initially all industries have the same weights, further to maximize the Sharpe ratio of our portfolio, we change the weight of each industry. Then by analyzing the weights of industries in the optimized portfolio, we can see which industries are worth investing in 2014. We also did the same research with the data in 2015, to find if these "best industries" are still have a good performance.

## 3. RESULT AND DISCUSSION

### *3.1. Result*

Then we want to do further study to find the real minimum variance of the portfolio by changing weights of each industry. All calculations are based on formula 3: $\sigma_p^2 = \sigma^2(R_p) = \sum_{i=0}^{20}\sum_{j=0}^{20} W_i W_j \mathrm{Cov}(R_i, R_j)$ . We utilized Excel solver to test this by changing weight cells. There are 2 constraints: first, the sum of weights equals to 1; second, all weight cells are greater than 0. The solver output for this test is listed in tale 10.

**Table 10** Final output of minimum variance portfolio

| Industry | Building materials | Beverage manufacturing | Real estate development | Railway transportation | paper industry | Packaging and Printing | bus |
|---|---|---|---|---|---|---|---|
| weight | 28.09% | 8.53% | 13.23% | 16.16% | 0.62% | 10.36% | 23.01% |

We could clearly see that there were only 7 industries included in the final output. Based on our discussion, we believed that this was due to two reasons. First, there were only two restrictions, and we didn't take other things, like return, into consideration. Also, since there were 20 industries in this portfolio, some would be excluded for the optimal result.

For the equal weighted portfolio, the monthly expected return is 4.01%, and the Sharpe ratio in this case is 0.810. Then we use solver function to maximize the expected Sharpe ratio by changing the weight on each industry. The maximum Sharpe ratio we get is 1.054, and the monthly expected return in this case is 4.47%.

**Table 11** Output with 2014 data

| | |
|---|---|
| Equally weight result | |
| Sum of weights | 1 |
| Portfolio expected return | 4.01% |
| Portfolio sd | 4.53% |
| Expected Sharpe ratio | 0.810 |
| Max Sharpe ratio result | |
| Sum of weights | 1 |
| Portfolio expected return | 4.47% |
| Portfolio sd | 3.91% |
| Expected Sharpe ratio | 1.054 |

We find there are five industries in the optimized portfolio, and they are securities, bank, auto parts, bus and rail transportation. We find that these industries are all related to finance and transport. The weight of each industry was displayed in table 12.

**Table 12** Weight of each industry

| | |
|---|---|
| Securities | 0.015808264 |
| Bank | 0.225873045 |
| Auto parts | 0.489500483 |
| The bus | 0.027909023 |
| Rail transportation | 0.240909186 |

The results of the same exercise with 2015 data can be seen in table 5. The maximum Sharpe ratio we get is 0.907, and the monthly expected return is 10.72%.

**Table 13** Output with 2015 data

| | |
|---|---|
| Equally weight result | |
| Sum of weights | 1 |
| Portfolio expected return | 10.14% |
| Portfolio sd | 14.90% |
| Expected Sharpe ratio | 0.657 |
| Max Sharpe ratio result | |
| Sum of weights | 1 |
| Portfolio expected return | 10.72% |
| Portfolio sd | 11.44% |
| Expected Sharpe ratio | 0.907 |

Only building materials, building decoration, and Real estate development were included in the optimizer portfolio. Their weights were listed respectively.

**Table 14** Weights of 3 industries

| | |
|---|---|
| Building materials | 0.482709413 |
| Building decoration | 0.415506133 |
| Real estate development | 0.101784455 |

### *3.2. Discussion*

From the results we can learn that in 2014 we can get relatively high returns for the risks they take by investing in finance and transport. While these industries did not have a good performance in the next year. The industries with the highest Sharpe ratio is building and real estate. Another difference in 2015 is that the average return is much higher than that of the previous year, but the Sharpe ratio did not improve. We guess this is because Chinese stock market experienced a financial crisis in 2015, so many investors choose to invest in real estate instead of stocks.

## 4. CONCLUSION

In conclusion, we have figured out 3 optimal combinations each contains 20 industries. At first we calculate the The average historical monthly returns, standard deviation, and Sharpe ratio for each month. Then we construct minimum variance, maximum Sharpe ratio, and maximum drawdown portfolios separately among 64 industries in China. Basically, we gathered industries index data in 2014 and 2015 and utilized Excel functions to do our experiment. We find that the minimum variance portfolio mainly includes the consumer beverage industries, that electronics industry has the largest portion in the maximum drawdown portfolio and that maximum Sharpe ratio portfolio mainly includes finance and transport industries. Finally we find optimized portfolio only contains less than 10 industries, which indicates that constructing portfolio by a single criterion tends to concentrate investment on a few industries. As a result in order to diversify our investment, we should take more factors into consideration. Investors who want to choose a portfolio based on a certain metric, such as volatility, Sharpe ratio, etc., rather than focusing on a particular industry may be concerned by our finding.The results of our research help to study the characteristics of different industries in China's financial market.

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