一、 项目介绍

受广东酒店管理职业技术学院经管学院的委派，本人于 2020 年 9 月至 2021 年 9 月前往香港理工学院进行海外交流学习。理大在 Quacquarelli Symonds(QS)最新公布的世界排行榜中位列第 65 位，且理大商学院 (PolyU Business School)在 EduRank.org 的商业相关研究表现位列亚洲第一，全球二十四。

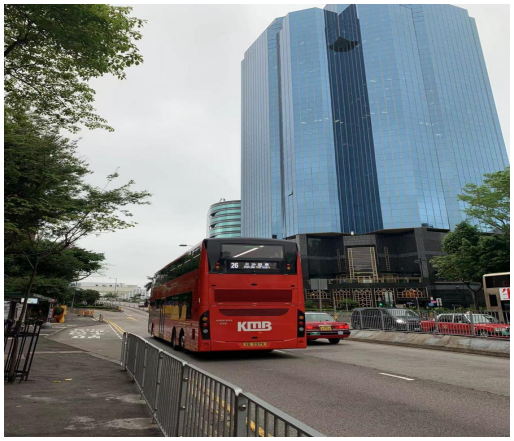
会计和金融分析理学硕士旨在为学生提供会计和金融核心知识以及将数据分析和技术应用于相关实践的技能。它使会计和金融从业者能够跟上最新的数据分析应用程序和技能。课程重点为：数据分析的知识和技能；会计和财务方面的核心知识；数据分析在会计和金融中的应用；系统的培训和发展数据分析技能和解决财务和会计业务问题的能力；利用大数据提供的机会解决会计、金融和商业问题。

必修核心课程有：Accounting for Business Analysis; Contemporary Issues in Accounting Information Systems; Investments; Principles of Corporate Finance; Quantitative Methods for Accounting and Finance; Applications of Computing and Technology in Accounting and Finance I; Business Analytics in Accounting and Finance; Financial Analysis and Valuation with Programming; Applications of Computing and Technology in Accounting and Finance II。

选修课程有：Accounting and Financial Analytics Project；Auditing Framework；Corporate Risk Management；Derivative Securities；Fixed Income Securities；Management Accounting；Security Analysis and Portfolio Management；Business Intelligence and Decisions；Data Structures and Database Systems；Artificial Intelligence Concepts。

二、 项目流程

1. 交流图片



2. 学习成果

FINAL PROJECT-Investment in Want Want

Contents

Introduction

Want Want China Holdings Limited, an investment holding company founded in 1962, manufactures, distributes, and sells food. The company is also involved in the trading of beverages, raw materials, machineries, etc. It serves customers through a sales and distribution network primarily in China. The company also exports its products to North America, East Asia, the South East Asia, and Europe.

Part 1 Risk Profile

1.1 Standard Deviation

Volatility is a statistical measure of the dispersion of returns for the Want Want and market index. In most cases, the higher the volatility, the riskier the security. We measure the volatility by calculating the standard deviation and variance. However, it is more difficult to grasp variance than the standard deviation because variances represent a squared result that may not be meaningfully expressed on the same graph as the original dataset. Therefore, the standard deviations are usually easier to picture and apply, it is expressed in the same unit of measurement as the data, which isn't necessarily the case with the variance.

A standard deviation is calculated as the square root of variance by determining each weekly return's deviation relative to the mean. Want Want's standard deviation is greater than Hang Seng Index's SD, which means that Want Want has the larger variance between each price and the mean, which shows a bigger price range. If investors are interested, they need to know that Want Want's

future price is expected to be less predictable, and the price perhaps change dramatically over a short time period in either direction.

However, a lower standard deviation is not necessarily preferable, investors could expect aggressive growth funds to have a high standard deviation from Want Want, as they are willing to make aggressive bets to generate higher-than-average returns.

The biggest drawback of using standard deviation is that it can be impacted by outliers and extreme values. Standard deviation assumes a normal distribution and calculates all uncertainty as risk, even when it’s in the investor's favor—such as above-average returns.

1.2 Beta

Beta is a measure of the systematic risk of a security or portfolio compared to the market as a whole. It is used in the capital asset pricing model (CAPM), which describes the relationship between systematic risk and expected return for assets. CAPM is widely used as a method for generating estimates of the expected returns of assets, considering both the risk of those assets and the cost of capital.

A beta approximates the overall volatility of Want Want's returns against the returns of Hang Sang Index. The beta calculation is used to help investors understand whether a stock moves in the same direction as the rest of the market. It also provides insights about how volatile a stock is relative to the rest of the market.

Base on the calculation of 10-year historical data, Want Want with a beta of 0.7555 has historically moved 75% for every 100% move in the underlying index, which means that the Want Want is

theoretically less volatile than the market. Including this stock in a portfolio makes it less risky than the same portfolio without this stock.

1.3 Jensen's Alpha

Alpha is used in finance as a measure of performance, indicating when a trader, or portfolio manager has managed to beat the market return over some period. Jensen's alpha takes into consideration the capital asset pricing model (CAPM) and includes a risk-adjusted component in its calculation.

We assume the risk-free rate is equal to the average value of monthly rate of Hong Kong Government Bonds from the website: https://m.cn.investing.com/rates-bonds/hong-kong-10-year-bond-yield-historical-data , and get the alpha is equal to 0.0062, which means that there is an excess return of an investment of Want Want relative to the return of the benchmark index. In order to improve accuracy of the forecast, we calculate the 20-years average return for Hang Seng Index, and then get a relatively higher excess return equal to 0.0192. There seems to have a return if we invest Want Want. Moreover, we need to realize the importance of considering fees in conjunction with performance returns and alpha.

1.4 Treynor Ratio

The Treynor ratio, also known as the reward-to-volatility ratio, is a performance metric for determining how much excess return was generated for each unit of risk taken on by a portfolio. It allows investors to adjust a portfolio's returns for systematic risk. A higher Treynor ratio result means a portfolio is a more suitable investment.

Based on the calculation of annual market return for 20-years period and 10-years period, we get the result of Treynor ratio equal to 0.0948 and 0.0649 respectively, which indicates that it is worthwhile to invest Want Want comparing to the stable market. Moreover, the positive result indicates that investment in Want Want is successful in providing compensation to investors for taking on investment risk. The premise behind this ratio is that investors must be compensated for the risk inherent to the portfolio, because diversification will not remove it.

A main weakness of the Treynor ratio is its backward-looking nature. Investments are likely to perform and behave differently in the future than they did in the past. The accuracy of the Treynor ratio is highly dependent on the use of appropriate benchmarks to measure beta. This measure is similar to the Sharpe ratio, although the Sharpe ratio uses a portfolio's standard deviation to adjust the portfolio returns, so we will introduce it comprehensively in the Part 3.

Part 2 Market Valuation

2.1 PE Ratio

The P/E ratio of a stock is a wildly used tool for measuring the markets' temperature. It is calculated by dividing a stock's price by the company's earnings per share.

P/E Ratio = Price per share / Annual earnings per share

The P/E ratio suggests how much investors are willing to pay for each rupee of a company's earnings. Higher the P/E, more expensive is a stock, as investors are willing to pay more for each rupee of a company's earnings.

For this valuation process, firstly, We get the PE ratio of the target company Want Want and its

peer company TONGYI. Use Want Want's P/E ratio divided by the uni-president's P/E ratio between 2016-2019. And then we calculated a simple average of ratios in order to forecast the P/E ratio for our target company in 2020. After all these valuation process, we found that the forecast P/E ratio(16.614x) is higher than the actual figure(16.074x). It seems that the target stock is undervalued.

P/E Ratio	2016	2017	2018	2019	2020
Want Want	18.706	21.883	17.231	22.152	Actual:16.074
Peer	34.819	26.793	25.05	23.12	21.641
Ratio	0.537	0.817	0.688	0.958	
Average Ratio	0.75				
Forecast Value	16.614				

Limitation

Like any other fundamental designed to inform investors on whether or not a stock is worth buying, the price-to-earnings ratio comes with a few important limitations that are important to take into account, as investors may often be led to believe that there is one single metric that will provide complete insight into an investment decision, which is virtually never the case. Companies that aren't profitable, and consequently have no earnings—or negative earnings per share, pose a challenge when it comes to calculating their P/E.

One primary limitation of using P/E ratios emerges when comparing P/E ratios of different companies. Valuations and growth rates of companies may often vary

wildly between sectors due both to the differing ways companies earn money and to the differing timelines during which companies earn that money. As such, one should only use P/E as a comparative tool when considering companies in the same sector, as this kind of comparison is the only kind that will yield productive insight.

Moreover, because a company's debt can affect both the prices of shares and the company's earnings, leverage can skew P/E ratios as well. For example, suppose there are two similar companies that differ primarily in the amount of debt they take on. The one with more debt will likely have a lower P/E value than the one with less debt. However, if business is good, the one with more debt stands to see higher earnings because of the risks it has taken

Another important limitation of price-to-earnings ratios is one that lies within the formula for calculating P/E itself. Accurate and unbiased presentations of P/E ratios rely on accurate inputs of the market value of shares and of accurate earnings per share estimates. The market determines the prices of shares through its continuous auction. However, the source for earnings information is ultimately the company themselves. This single source of data is more easily manipulated, so analysts and investors place trust the company's officers to provide accurate information. If that trust is perceived to be broken the stock will be considered more risky and therefore less valuable.

To reduce the risk of inaccurate information, the P/E ratio is but one measurement that analysts scrutinize. If the company were to intentionally manipulate the numbers to look better, and thus deceive investors, they would have to work strenuously to be certain that all metrics were manipulated in a coherent manner, which is difficult to do. That's why the P/E ratio continues to be one of the centrally referenced points of data to analyze a company, but by no means the only one.

2.2 Enterprise Multiple

Another ratio used to do the relative valuation is enterprise multiple, which is also known as the EV multiple. It equals enterprise value divided by EBITDA.

EV=Enterprise Value = Market Capitalization + Total Debt – Cash and Cash Equivalents

EBITDA = Earnings before interest, taxes, depreciation and amortization

The enterprise multiple takes into account a company's debt and cash levels in addition to its stock price and relates the value to the firm's cash profitability. Similar as PE ratio, a higher EV multiple usually means stock overvaluation and a lower one means stock undervaluation. From the chart below, we can see that the predicted EV multiple of Want Want is 9.653, which is slightly larger than the ratio 9.561 in 2020. So Want Want is undervalued by 1%.

EV/EBITDA Multiple	2016	2017	2018	2019	2020
Want Want	11.284	11.385	11.263	9.797	Actual:9.561
Peer	8.954	8.593	8.64	9.037	7.765

Ratio	1.26	1.32	1.30	1.08	
Average Ratio	1.24				
Forecast Value	9.653				

Limitation

There is also a limitation when we use enterprise multiple to do the valuation. An EV multiple is a metric used for finding attractive buyout targets. But sometimes the stock with low EV multiple is because it deserves (e.g. the company is struggling and won't recover). This creates the illusion of a value investment, but the fundamentals of the industry or company point toward negative returns.

Investors assume that a stock's past performance is indicative of future returns and when the EV multiple comes down, they often jump at the opportunity to buy it at a "cheap" value. So knowledge of the industry and company fundamentals can help investors assess the stock's actual value.

2.3 Price to Free Cash Flow Ratio

The third ratio is price to free cash flow ratio. This ratio is considered a more exact measure compared with price to cash flow. Because it uses free cash flow, which has minus capital expenditures from a company's total operating cash flow, thereby it can reflect the actual cash flow available to fund non-asset-related growth. What's more, it indicates a company's ability to generate additional revenues. A higher value for price to free cash flow indicates that the company is overestimated and its stock is expensive. A lower

ratio indicates an underestimated company. After compared with its peer company, the forecast P/FCF ratio of Want Want is 14.783, which is larger than the ratio 14.018 in 2020. So Want Want is undervalued by 5%.

P/FCF Ratio	2016	2017	2018	2019	2020
Want Want	16.838	12.12	12.862	17.472	Actual:14.018
Peer	18.562	18.393	15.076	13.242	15.816
Ratio	0.91	0.66	0.85	1.32	
Average Ratio	0.93				
Forecast Value	14.783				

Limitation

The limitation of P/FCF is cash flow in the denominator can be calculated in several ways to reflect different types of cash flows. For example, free cash flow to equity holders is calculated differently with cash flow to stakeholders. In order to avoid any confusion, it is important to specify the type of cash flow being applied to this metric.

2.4 Summary-Advantages and Disadvantages of Relative Valuation

Relative valuation is so popular because it does have some advantages. The main advantage of relative valuation, especially for beginners in the world of stock investing, is its simplicity.. The calculation of the ratios usually consists

simply of a simple arithmetic operation, usually a division, without going into the complexity of the calculation of the cash flow discount.

Although relative valuation is simple in its calculation, this does not mean that we are dealing with a valuation method with limited resources, but rather that another advantage of relative valuation is its adaptability which means that there is no limited number of ratios, so we can create new ratios to compare companies in a more precise way. For example, to value telecommunications companies it is common to use a ratio of profit per customer to calculate their efficiency.

However, it also has shortcomings. Since it is based only on occasional observations based on multiples of stock prices, which may fluctuate with changes in the mood of market participants, the calculation of intrinsic value using relative valuation is prone to errors. Another limitation is that the key variables such as risk, growth or cash flow potential are ignored.

In conclusion, Valuation is as much an art as a science, and the use of relative valuations is part of that combination. When using the relative valuation method to value a company, it involves a lot of assumptions. We should use relative valuations as a starting point for further analysis. Then we can use the discounted cash flow and the reverse cash flow or some other valuation method to determine the intrinsic value of the company and the market's estimate of the company's growth.

Part 3 Portfolio Formation

Knowing that WANT WANT CHINA (00151.HK) is an undervalued stock, it is time to establish an optimal portfolio with our target stock -- WANT WANT CHINA (151.HK) and the market portfolio -- TRACKER FUND (2800.HK).

In our project, we use 3 important indicators - Sharpe ratio, maximum drawdown (MDD), Calmar ratio to measure this stock is ideal or not. Most people might only think of total return, Sharpe ratio, but it is not enough to measure risk. Just like bitcoin, the total return of it is very outperforming, but it is too risky to invest. Most of the investors are seeking after the highest return and the lowest risk.

The first one is the Sharpe ratio, also known as the reward-to-volatility ratio, which is widely used for calculating the risk-adjusted return and evaluating fund managers' performance. The higher Sharpe ratio is, the greater expected return is corresponding to volatility.

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

where:

R_p = return of portfolio

R_f = risk-free rate

σ_p = standard deviation of the portfolio's excess return

The advantage of this ratio is intuitive and easy to calculate. Hence, it is widely used in the practice. On the other hand, Sharpe ratio still has some disadvantages as it ignores the diversification potential of the portfolio. Nevertheless, this analysis limited the number of portfolios that may satisfy the requirements of a wide range of investors. Also, this is the foundation of the mutual fund industry.

The second one is the Maximum Drawdown (MDD). It is the maximum observed loss from a peak

(the highest stock price) to a trough (the lowest stock price after the highest stock price appeared) of a portfolio and it is an indicator of downside risk over a specified period. A low maximum drawdown is preferred as this indicates that losses from investment were small. The worst maximum drawdown would be -100%, which means the investor loses all the money.

$$Maximum\ Drawdown\ (MDD) = \frac{Trough\ Value - Peak\ Value}{Peak\ Value}$$

Since most of the investors thirst for the highest return and the lowest risk in their portfolios, Maximum Drawdown is a pretty good indicator as it mainly measures downside risk over a period.

	Peak Value	Trough Value	MDD (Maximum Drawdown)
0151.HK	11.0644	4.1722	-0.6229
2800.HK	32.9000	22.0000	-0.3313
HSI	32654.4492	21709.1309	-0.3352

This is the comparison between WANT WANT CHINA (00151.HK) and TRACKER FUND (02800.HK).

As you can see, the MDD of WANT WANT is higher so that the downside risk is also higher.

Furthermore, Calmar Ratio equals to average excess return (return minus the risk-free rate) over Maximum Drawdown (the largest loss from any monthly/weekly/daily data to any subsequent monthly/weekly/daily data). Calmar Ratio is similar to Sharpe ratio as Calmar Ratio with volatility (standard deviation) replacing maximum drawdown as a risk measure. It is a criterion of the performance of the fund industry.

$$Calmar\ ratio = \frac{R_P - R_f}{Maximum\ Drawdown}$$

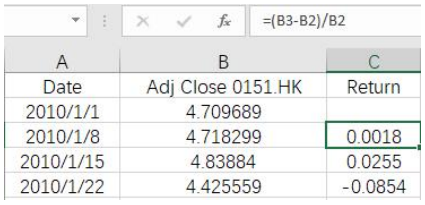
The higher the Calmar ratio, the better it performed on a risk-adjusted basis during the period. A high ratio suggests that the return of the investment was not at risk of momentous drawdowns. On the other hand, a low ratio indicates that the risk of drawdown is greater. In addition, different investors might not have the same risk tolerances, the Calmar ratio will help investors balance their risk attitude within their investment decisions or asset allocation.

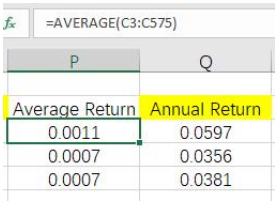
Next, this part is about how we calculate the above indicators that will be used to find an optimal portfolio. The parameters that we need to acquire is shown in these three equations:

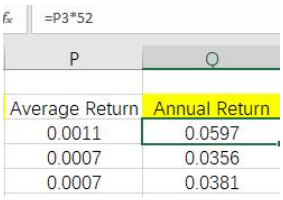
$$Sharpe\ Ratio = \frac{R_P - R_f}{\sigma_P} \qquad MDD = \frac{Trough\ Value - Peak\ Value}{Peak\ Value}$$

$$Calmar\ ratio = \frac{R_P - R_f}{MDD}$$

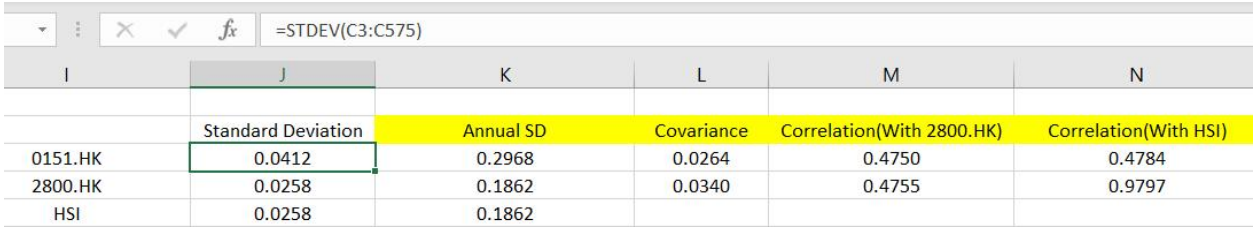
Therefore, we need to calculate 0151.HK and 2800.HK's annual return (R_P), annual standard deviation (σ_P), trough value and peak value. The R_f can be obtained from some financial website directly and here we get $R_f = 0.0107$. Firstly, we acquire weekly data of 0151.HK and 2800.HK from Yahoo finance, calculate the Return and the Average Return. And then we used the Average Return to get the Annual Return. The process is shown in these figures.







Then we used some functions in Excel to get the SD, annual SD, Covariance, Correlation and we also obtained 0151.HK and 2800.HK's Trough Value, Peak Value and calculated the MDD. The process is shown in these figures.



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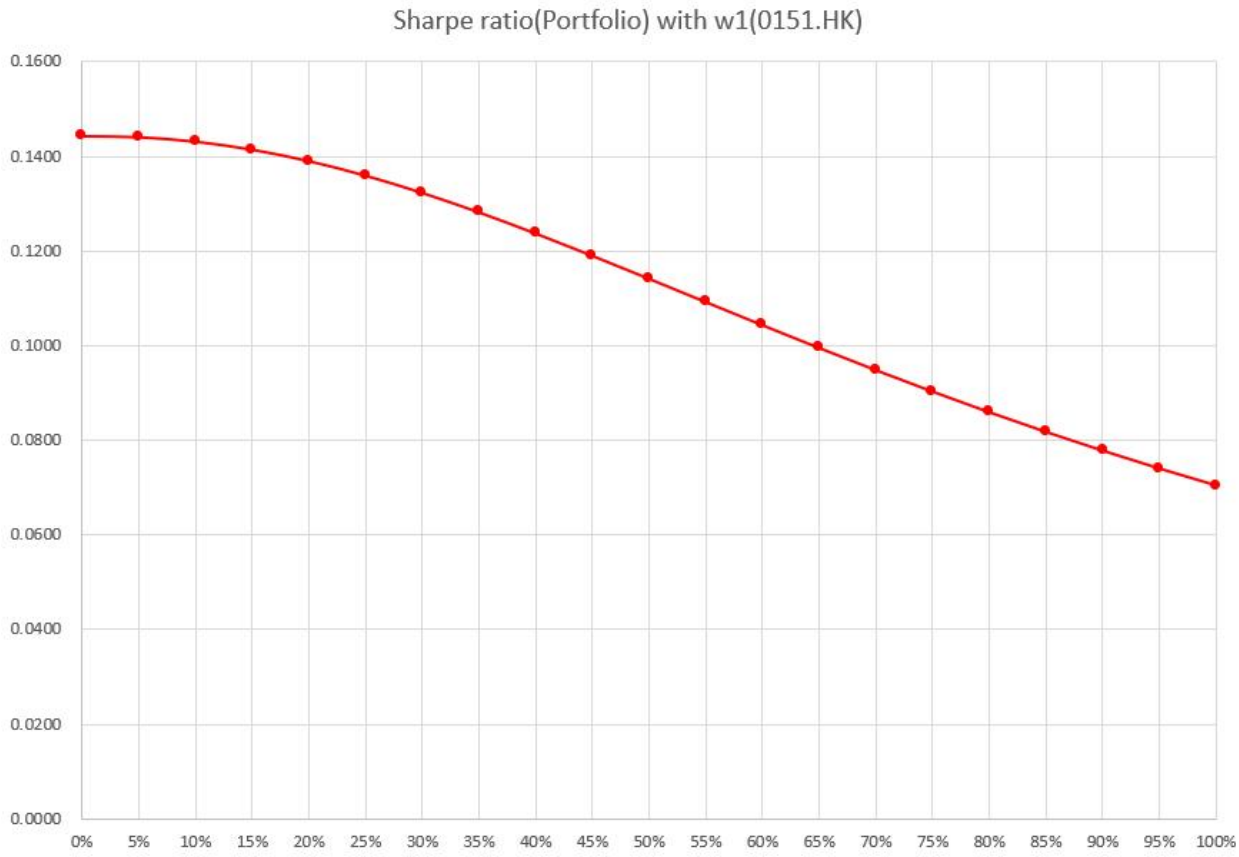
R	S	T
Peak Value	Trough Value	MDD (Maximum Drawdown)
11.0644	4.1722	-0.6229
32.9000	22.0000	-0.3313
32654.4492	21709.1309	-0.3352

In order to find the optimal portfolio, we used two methods to find the best weights for 0151.HK and 2800.HK. Therefore, we need to calculate the portfolio's Return and SD, this process is shown in the following figure. After calculating Sharpe ratio, Maximum Drawdown and Calmar Ratio, the first way is to draw a figure to show the Sharpe ratio of the portfolio and the weight of 0151.HK. The different portfolio weights are in this excel file for calculation. According to different portfolio weights, we calculate different Sharpe ratios and Calmar ratios of the portfolio. Since Maximum Drawdown unvaried in the past 10 years, it would not change over the different portfolio weights.

Sharpe ratio(2800.HK)	0.1340	Expected Return1(0151.HK)	0.0316	Calmar Ratio(0151.HK)	0.0959
Rm	0.0381	Expected Return2(2800.HK)	0.0376	Calmar Ratio(2800.HK)	0.1076
Expected Return(2800.HK)	0.0376	σ1(0151.HK)	29.68%		
Beta(2800.HK)	0.9798	σ2(2800.HK)	18.62%		
		ρ	0.4750		
		Rf	0.0107		
		σ12	2.62%		
w1(0151.HK)	w2(2800.HK)	R(Portfolio)	σ^2(Portfolio)	σ(Portfolio)	Sharpe ratio(Portfolio)
0.00%	100.00%	0.0376	0.034663519	18.62%	=(K21-L17)/M21
5.00%	95.00%	0.0373	0.033997769	18.44%	0.1442
10.00%	90.00%	0.0370	0.033683302	18.35%	0.1432

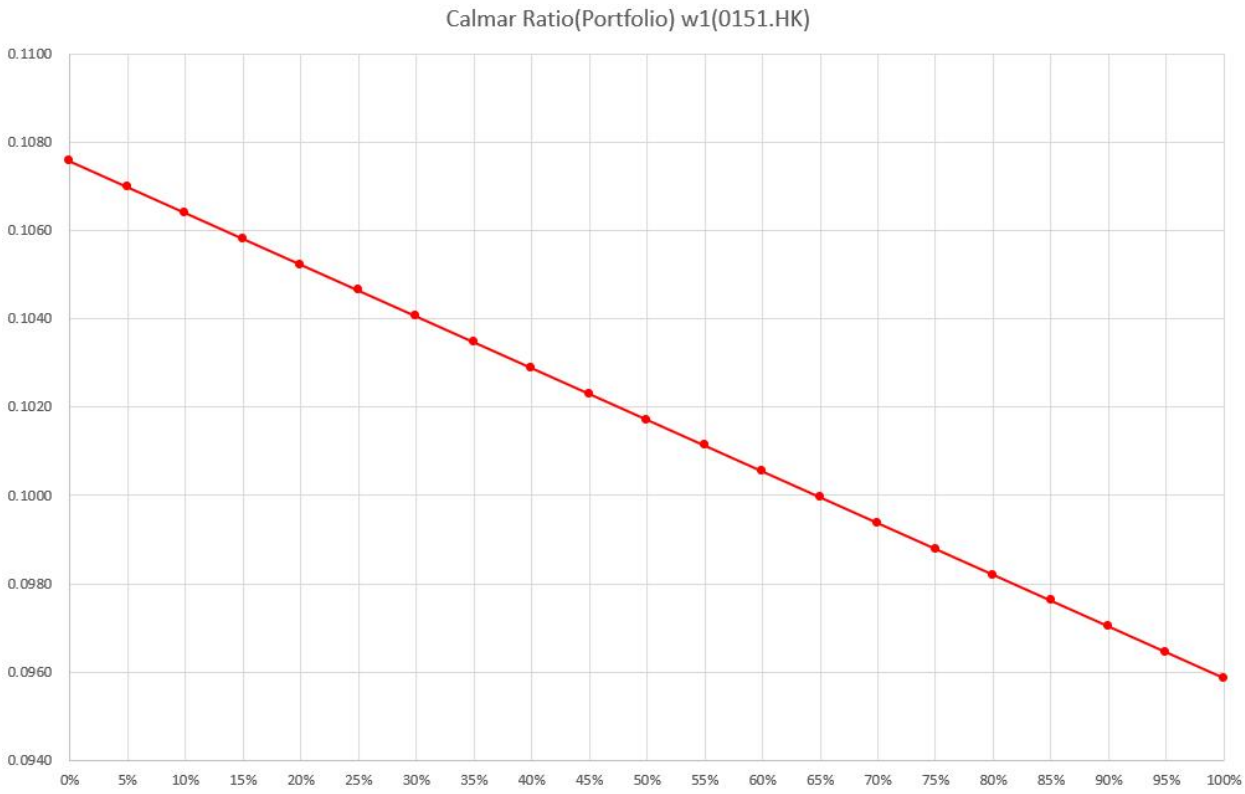
Finally, we obtained a figure about Sharpe ratio of the portfolio and the weight for 0151.HK. As you can see in this figure, unfortunately, when $w_1 = 0\ or\ 5\%$ (0151.HK's weight), the portfolio can get the best profit.



The second way we used is to calculate the Calmar ratio of the portfolio, the related process is shown in the following figure.

Sharpe ratio(2800.HK)	0.1340	Expected Return1(0151.HK)	0.0316	Calmar Ratio(0151.HK)	0.0959	0.0958
Rm	0.0381	Expected Return2(2800.HK)	0.0376	Calmar Ratio(2800.HK)	0.1076	0.1074
Expected Return(2800.HK)	0.0376	σ1(0151.HK)	29.68%			
Beta(2800.HK)	0.9798	σ2(2800.HK)	18.62%			
		ρ	0.4750			
		Rf	0.0107			
		σ12	2.62%			
w1(0151.HK)	w2(2800.HK)	R(Portfolio)	σ^2(Portfolio)	σ(Portfolio)	Sharpe ratio(Portfolio)	Calmar Ratio(Portfolio)
0.00%	100.00%	0.0376	0.034663519	18.62%	0.1444	0.1076
5.00%	95.00%	0.0373	0.033997769	18.44%	0.1442	0.1070
10.00%	90.00%	0.0370	0.033683302	18.35%	0.1432	0.1064
15.00%	85.00%	0.0367	0.03372012	18.36%	0.1415	0.1058
20.00%	80.00%	0.0364	0.034108222	18.47%	0.1391	0.1052
25.00%	75.00%	0.0361	0.034847608	18.67%	0.1360	0.1046

And we also drew a figure to show the relationship between the portfolio's Calmar ratio and the weight of 0151.HK(w_1). The figure is shown as followed, similarly, this figure showed the weight of 0151.HK in the optimal portfolio is 0%.



In conclusion, the Sharpe ratio of WANT WANT CHINA (00151.HK) is 0.07 while TRACKER FUND (02800.HK) is 0.14, which means that TRACKER FUND is better. The greater expected return of TRACKER FUND is corresponding to any level of volatility. In addition, Maximum Drawdown of WANT WANT CHINA is from 11.06 to 4.17 which is –62.3%. On the other hand, Maximum Drawdown of TRACKER FUND is only -33.1%. Hence, the downside risk of TRACKER FUND is lower. A low maximum drawdown is preferred as this indicates that losses from investment were small. Furthermore, Calmar Ratio is used to evaluate the risk of drawdown is greater or not. Hence, the Calmar ratio of WANT WANT CHINA is 0.096 while TRACKER FUND is 0.108. A low ratio indicates that the risk of drawdown is greater.

By and large, if we only consider risk and return, there are three factors to evaluate this stock is ideal or not, including (a) Sharpe ratio -- higher is preferable. (b) Maximum drawdown (MDD) – lower is better. (c) Calmar ratio – higher is desirable. Hence, the optimal portfolio would be 0%

WANT WANT CHINA (00151.HK) + 100% TRACKER FUND (2800.HK).

Reference:

https://www.investopedia.com/terms/a/alpha.asp
https://www.investopedia.com/terms/b/beta.asp
https://m.cn.investing.com/rates-bonds/hong-kong-10-year-bond-yield-historical-data
https://www.investopedia.com/terms/t/treynorratio.asp

三、 项目总结

通过一年的海外学习交流，提高了自身数据分析技能和解决财务和会计业务问题的能力，学会利用大数据提供的机会解决会计、金融和商业问题等。相信这次的学习经历能为我往后的教学活动打下坚实基础，帮助学生拓宽视野。