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Analysis on CAPM and Sharpe Ratio in Market Investment

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ABSTRACT
Market investment is always a popular method to make a profit. With different investment means, there are tens of thousands of portfolios in the market for investors to choose and combine. In order to maximize profit and minimize risk, some evaluation must be done to those portfolios. Many capital asset pricing models are used in calculating the present value and expected value of the portfolios, and one of the most popular is the model called CAPM (this refer in particular to the model from William Sharpe and John Lintner) The Sharpe ratio is also a necessary index in evaluating the value of the portfolios, which indicates the rate of the expected return against an extra unit of risk taken. The analysis on CAPM are mainly theoretical, and the core function of CAPM will be introduced. Through collecting data from The Morning Star website(cn.morningstar.com), three funds are analyzed to explain the characteristic of Sharpe ratio, which will lead to a persuative conclusion. The conclusion shows that these two models are simple and easy to understand, which means they are very popular, but they have made many assumptions that are not according with the real market environment and they made too many simplifications, which may lead to inaccurate results.

Keywords: *CAPM, Sharpe ratio, market investment, risk management*

1. INTRODUCTION

The Capital Asset Pricing Model of William Sharpe (1964) and John Lintner (1965) which is known as CAPM is used to determine the value of a market portfolio. And the Sharpe ratio is one of the indexes derived from the CAPM, it is used to evaluate the value of investment of a portfolio. Sharpe ratio index is based on many assumptions which make the models easy to use and easy to understand. They assume that investors are always avoiding risk. The average and variance are their only concern in their short-period investment return[1]. This research aims to explain what is CAPM, how the Sharpe ratio is used and analyze the advantages and disadvantages of these two models. Especially for Sharpe ratio, there are three market funds which represent three levels of risks: an equity fund, a traditional fund and a monetary fund. The equity fund has the highest level of risk while the monetary fund has the lowest. A relatively convincing conclusion can be derived as the samples are universal. In this paper, the usage of the CAPM and the Sharpe ratio will be indicated in a simpler way.

1.1. Status, Analysis and Comparison of Funds

The first fund chosen is an equity bund coded 002621 Lombarda China Fund consumption theme stock A, it is supposed to be a high-risk fund.

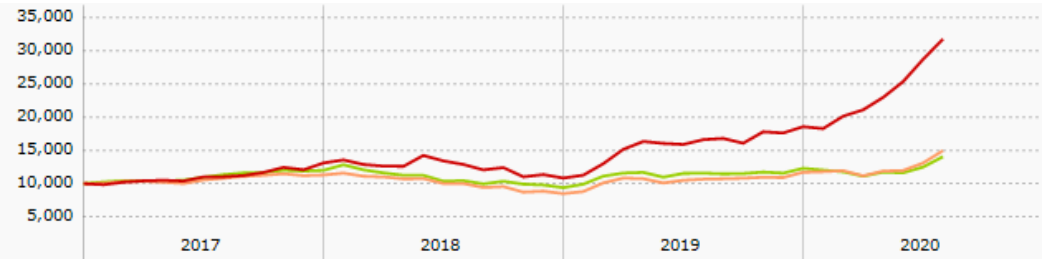

Figure 1. The return to time graph of 002621 Lombarda China Fund consumption theme stock A

Since 2017, the return of this fund has been continuously rising, which is shown as the red line. The total return of this fund is around 85.98% since 2020. In the first quarter of 2020, it has 11.53% in return while in the second quarter it has 47.21%. The average return is 4.43%. This fund has a variance of 23.59%, which is really high. It is clearly shown that the fund has a high risk and also an excellent performance. However, because of its high risk, the fund is usually bought for short-term investment. As the investors want to get more revenue as possible, they will not be pleased for taking the risks of long- term investment.

The second fund chosen is China AMC Bond Fund A/B coded 001001. It is a normal bond fund, which is supposed to have a medium risk.

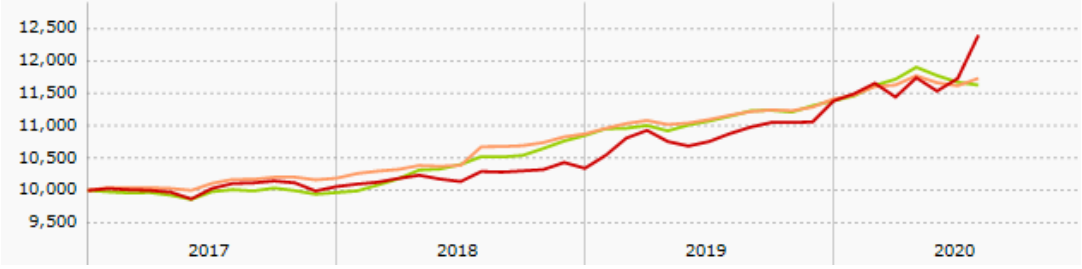

Figure 2. The return to time graph of 001001 China AMC Bond Fund A/B

It also has an upward trend of return since 2017. As the risk is not as high as the first fund, the return is also lower, only 9.84% for total in 2020. There is 0.53% in return in the first quarter and 2.52% for return in the second quarter. The average return in short term is irrefutable. It is well illustrated that the return curve of the fund is more stable than the first fund for the variance of this fund is only 5%. It is respectively stable, so many investors choose this for a normal investment, rather than a short-term or a long-term investment.

The third fund 000621 E Fund Cash Income Fund is a monetary fund. It has the least rate of risk and also the least return.

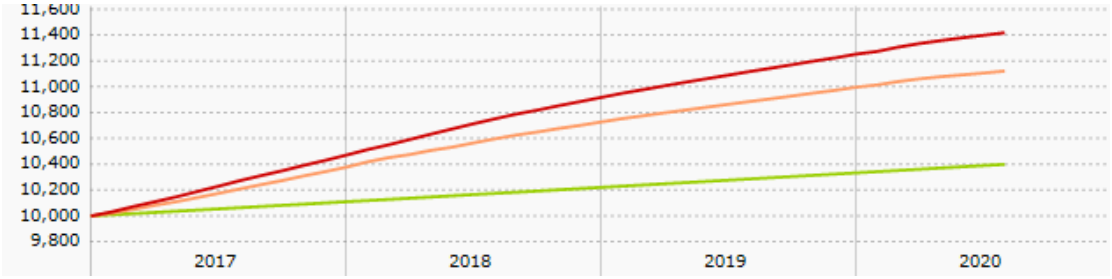

Figure 3. The return to time graph of 000621 E Fund Cash Income Fund

This monetary fund is more stable than the two above for its return curve is almost an upward straight line. The total return in 2020 for this fund is 1.65%. The average return is 0.29%. This return is really small compared with the return of equity fund and normal fund. However, the variance of this fund is only 0.25%, which means the volatility of this fund is almost ignorable. This kind of fund hardly causes a loss for the investors. The investors can do large amount of investments through this kind of fund to get a stable revenue.

1.2. Analysis On CAPM and Sharpe ratio

1.2.1. Introduction and limitation of CAPM

The CAPM is the base of the Sharpe ratio. It is a theory based on Markowitz's model which listsa series of assumptions. Here are some core assumptions.

1. Investors are able to purchase and sell all market funds through a competitive market price, which besides taxes and transection costs. They can also buy and sell loans at the risk-free interest rate.

2. Investors hold only efficient portfolios of traded securities, which means those portfolios have the maximum return for a given level of utility, in order to maximize the profit and minimize risk taken.

3. Investors have the same need and the same expectation to all portfolios, including the volatilities, correlations and expected returns. [2]

The method how this model determines the most efficient investment level of different portfolios can be expressed by a diagram.

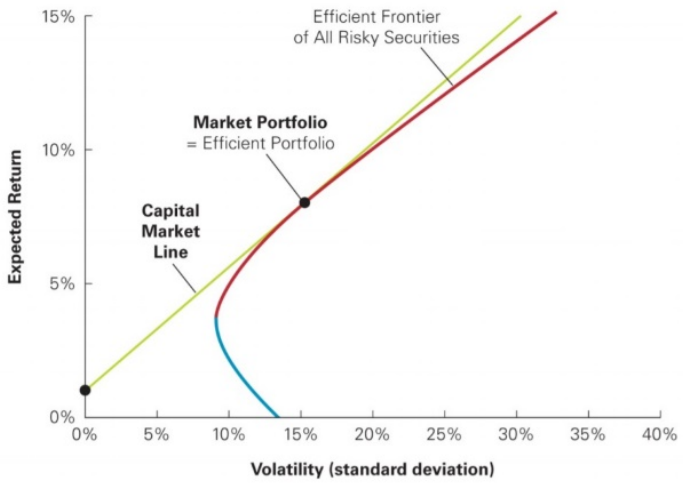

Figure 4. The expected return to volatility diagram.

Every portfolio has a capital market line which represents the relationship between the expected return and the volatility. Through investigating the market, the efficient frontier of all risky securities can be determined, which shows the most efficient investment frontier of portfolios. The intersection of capital market line and the frontier is the most efficient portfolio, which is the only option for investors in the hypothetical market in the model.

The formula to calculate the expected return of a given market portfolio can be written like this:

E(ri)=Rf+βim(E(rm)-rf)

E(ri) is the expected return of a market portfolio

Bim is the beta coefficient which represent the ratio of the return of the portfolio against the return of the market. It is also known as the systemic risk of a portfolio.

Rf is the risk- free interest rate

E(rm) is the expected return of the whole market.

However, there is also many limitations for CAPM. After all, it is just a model and it is not able to stimulate the real market. In real market, the investors can't get full information about portfolios they are going to invest. And because of the differentiations of investors, every investor gives his own opinion and estimate. What's more, when associating with the losses that already happened, the investors may take large risks in order to win losses back. [3] All of this will lead to a differentiation in portfolio choosing, which means the market portfolio is not chosen by everyone. Moreover, there exists speculators who have no idea of investment. They only buy some short-term and high-risk funds only expecting for a return in short time.

1.2.2. Introduction, application and limitation of Sharpe ratio

Sharpe ratio is much easier to understand as it has an obvious purpose, showing us how to make a rational investment. The Sharpe ratio is a rate shows that if the investors take one unit more risk, how much extra return will they get.

The formula of the Sharpe ratio:

$$\text{SharpeRatio} = \frac{E(Rp) - Rf}{\sigma p} \quad (1)$$

E(Rp) is the expected return of the portfolio

Rf is the risk-free interest rate

σp is the covariance of the extra return of the portfolio

High Sharpe ratio shows that the portfolio is worthy to invest because when take the same risk, the return will be respectively higher than those have lower Sharpe ratio.[4]

Back to three funds mentioned before. The first fund, 002621 Lombarda China Fund consumption theme stock A, has a Sharpe ratio of 1.58. The second fund 001001 China AMC Bond Fund A/B has the Sharpe ratio of 1.17 and the third one 000621 E Fund Cash Income Fund has the Sharpe ratio of 9.71. Regardless of the time period, the third one is obviously the best one to invest, because while taking the same risk it has the largest return. This is a basic application of the Sharpe ratio to measure the value of investment of a single fund, which is regarded as an important standard in this situation. The Sharpe ratio is a very simple index and easy to understand. That is the reason why it is widely used.

There exists the limitation of the Sharpe ratio model. Measuring the risk via standard deviation is not very scientific. Because it assumes the investigated portfolio is the only investment of the investors. Which means that when evaluate a single funds, the Sharpe ratio can be significant. Also, the Sharpe ratio is a linear. However, the efficient frontier of all risky securities is a curve. When measure the performance of funds that have large standard deviation the Sharpe ratio may give an incorrect idea.

What's more, Sharpe ratio does not evaluate the relativity of the funds which is very important. Some funds have return which is relative. [5] According to Sharpe ratio, investors may choose two funds which have a negative relationship of return. That may leads to a loss in return of investors.

2. CONCLUSION

Previously, the advantages and disadvantages of CAPM and Sharpe ratio have been analyzed. The main reason for the disadvantages is the assumption they have made. These assumptions can only generalize some obvious essential factors of the market and the main purpose of the rational investors which cannot be a real performance of the investors in the market.

Also, in order to simplify the complex calculation of the market index, some exactitude professional method is cut off. For example, in Sharpe ratio the variance is the only basis of risk expectation, which is not very accurate.

However, these two models are popular among the professional investors for they are simple to understand and relatively reliable.

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