Empirical Test of CAPM Model in Stock Market

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Abstract: The rapid development of the economy has brought about the continuous accumulation of personal assets, and at the same time, the concept of financial management is rapidly budding and spreading. People's rapidly expanding consumer desire makes stocks, funds, and other products more appealing, leading them to prefer the financial route. However, stocks and funds need investors to bear certain risks, generally speaking, the greater the risk, the more lucrative the investment returns. The CAPM model was born for this reason, and its main content is the relationship between yield and risk and equilibrium pricing. The application of the CAPM model in the stock market has always been the focus of attention. As a core part of the stock market, the banking sector has an inseparable relationship with finance. Therefore, this paper selects eight stocks of banks with long listed times and top market capitalization rankings, conducts empirical analysis on their trading data from 2018 to 2021, and employs the time series detection method to test whether the single factor CAPM model is effective in the Chinese stock market.

Keywords: capital asset pricing model, time series test, the empirical analysis

1.   Introduction

The portfolio theory founded by American economist Markowitz in 1952 is regarded as a modern portfolio theory milestone. This theory describes the return and risk of securities investments with expectations and variance, and explains how investors measure investment risk and how to combine funds to obtain the maximum return.

In 1964, William Sharpe, John Lintner, Jack Treynor, and Jan Mossin established the capital asset pricing model based on portfolio theory. This model primarily investigates the relationship between the establishment of equilibrium prices and the projected return of assets and risk assets on the securities market. The foundation of current financial market price theory is it. The Markowitz theory's underlying assumptions are accepted by the capital asset pricing model. The estimates of anticipated return, variance, and covariance are the same for all investors.

The CAPM model formula is as follows:

$$E(r_i) = r_f + \beta_{im}(E(r_m) - r_f)$$

$E(r_i)$ represents the expected rate of return on the asset. r_f represents the risk free rate, β_{im} represents the systemic risk of asset, $E(r_m)$ means the expected market rate of return in market, and $E(r_m) - r_f$ indicates the market risk premium, which is the difference between the expected market return and the risk-free return.

CAPM offers a very simple conclusion: Only investing in risky stocks can lead to higher returns for investors. This model still occupies a dominant position in modern financial theory, but the validity of the model and its conclusions have also attracted a lot of research doubts, and many scholars have expanded and improved on the basis of it. Mayers considered making some assets non-marketable [1]. Breeden suggested that it should allow multiple time periods and investment opportunities to vary from one time period to the next [2]. Adler and Dumas mentioned the extension of international investment [3].

Scholars from all over the world have conducted empirical research on the CAPM model's effectiveness. Bajpai and Sharma did an empirical test of CAPM in India, which showed that CAPM is of great significance in the Indian stock market and the developed model performs better than the traditional one [4]. After analyzing the Indian stock market, Rahman believed that other risk factors in the model played a non-negligible role in stock pricing [5]. Li & Li reached a similar conclusion by analyzing the Shanghai stock market [6]. Wang et al. drew the conclusion that CAPM is effective to some extent for China's financial, transportation, manufacturing, information transmission, software, and information technology service industries [7].

2.   Data Collection

This paper verifies the effectiveness of the CAPM model in China's stock market by analyzing the stocks of the banking sector. By the end of 2021, China's A-share listed bank stocks would have reached 42. The bank sector plays an important role in the stock market. However, according to the length of listing time and market value ranking, this paper selects 8 bank stocks that have been listed for a long time and rank high in market value. These 8 bank stocks are Bank of China, Industrial and Commercial Bank of China, China Construction Bank, Agricultural Bank of China, China Merchants Bank, China Industrial Bank, Bank of Communications, and Ping An Bank, and their corresponding names are shown in Table 1.

Table 1: Comparison Table of Abbreviations.

Abbreviations	Bank Name
ICBC	Industrial & Commercial Bank of China
CCB	China Construction Bank
ABC	Agricultural Bank of China
CMB	China Merchants Bank
BOC	Bank of China
CIB	China Industrial Bank
BCM	Bank of Communications
PAB	Ping An Bank

As of the end of 2021, the total market value of these eight banks reached US$7,204.072 billion, accounting for 78.68% of the total market value of the top 20 banks (see Table 2). Because these banks have been listed for a long time, their performance in the market and the development of stock data are relatively mature, and the sources of data are abundant and highly verifiable, so they are more suitable as representatives. Therefore, the analysis results for these banks are more representative and can be used to infer and predict the entire banking market.

Table 2: Banks Market Capitalization.

Name	Capitalization
ICBC	16,608.53
CCB	14,950.66
ABC	10,604.49
CMB	10,009.76
BOC	9,390.97
CIB	4,082.13
BCM	3,646.30
PAB	2,747.88

3. Empirical Test and Result

3.1. Test

The sample period selected in this paper is from July 2018 to June 2022. For the rate of return of a single stock, the formula adopted is: $r_{it} = (P_{it} - P_{it-1})/P_{it-1}$. P_{it} is the closing price of stock i at the end of month t. The following empirical analysis was conducted by Eviews 10. The risk free interest rate is shown in Table 3, and the result is shown in Table 4.

Table 3: Risk Free Interest Rate.

Month	Treasury Yields	Month	Treasury Yields	Month	Treasury Yields
7/2018	0.003002	11/2019	0.00249	3/2021	0.002261
8/2018	0.002402	12/2019	0.002524	4/2021	0.002173
9/2018	0.002368	1/2020	0.002403	5/2021	0.002102
10/2018	0.002386	2/2020	0.002178	6/2021	0.00204
11/2018	0.002526	3/2020	0.001796	7/2021	0.002015
12/2018	0.002664	4/2020	0.001279	8/2021	0.001969
1/2019	0.002511	5/2020	0.001172	9/2021	0.00198
2/2019	0.002357	6/2020	0.001589	10/2021	0.002027
3/2019	0.002325	7/2020	0.001932	11/2021	0.002055
4/2019	0.002339	8/2020	0.002171	12/2021	0.002079
5/2019	0.002423	9/2020	0.002231	1/2022	0.00207
6/2019	0.002404	10/2020	0.002332	2/2022	0.002015
7/2019	0.002185	11/2020	0.002524	3/2022	0.001971
8/2019	0.002218	12/2020	0.002439	4/2022	0.001935
9/2019	0.002261	1/2021	0.002205	5/2022	0.001758
10/2019	0.002304	2/2021	0.002342	6/2022	0.001667

3.2. Result and Analysis

Table 4: The β Coefficient of Each Stock.

Stock Number	α	β
ICBC 601398	0.0770000	0.0890000
CCB 601939	0.2690000	1.2800000
BCM 601328	0.0930000	1.3200000
ABC 601288	0.1920000	1.3000000

Table 4: (continued).

PAB 000001	0.1530000	1.0110000
CIB 601166	0.2110000	1.1300000
CMB 600036	0.0590000	1.2200000
BOC 601988	0.1020000	0.0970000

The above table results show that the beta value of eight banks are all close to 1, and Bank of Communications has the highest β value (1.32), and ICBC has the lowest β value, which is 0.089. The result shows that the β value of ICBC and Bank of China's two state-owned banks is relatively low, which means that their income risk strategy is relatively conservative. The β value of other joint-stock banks is higher than that of them, which indicates that the strategy of joint-stock banks is more biased towards income maximization.

As the result, by using the time series detection method to analyze the transaction data of 8 bank stocks in 2018-2021, it is proved that the CAPM model is also invalid in the Chinese stock market. The current development of China's stock market does not fully meet the assumptions of the CAPM model.

4. Conclusion

CAPM model has a lot of strict assumptions, and the mature stock market is also difficult to meet its assumptions. In addition, China's stock market develops relatively late and the securities market is not mature enough, so it cannot fully meet the assumptions of CAPM model. The explanatory variables of the stock return rate also include the scale of equity, the number of shares in circulation and the proportion of shares in circulation. If we want to effectively verify whether the CAPM model is effectively corresponding to the Chinese market, we still need to continue to modify the model to make it continuously perfect.

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