Analysis of Chinese and American Banking Stocks Based on CAPM Model

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Abstract. With the increased globalization of the economy, the effectiveness of the CAPM model as applied to different economies merits further study. At the same time, with the increased use of the CAPM model in various international financial markets, it is also important to analyze the differences between the financial markets of developing and developed countries based on a fundamental financial theory such as the CAPM model. Based on the CAPM model, this paper randomly selects 20 stocks of each bank of China and the United States to calculate the risk coefficient beta and gives a comparison and analysis of the two according to the obtained data indicators, to understand the two markets. The results firstly show that both Chinese and US bank stocks fit the CAPM model. Secondly, the individual indices of US bank stocks are volatile compared to the stable and balanced data performance in China, implying that freer markets should have more possibilities for more intense financial market volatility. This paper provides evidence for the effectiveness of the CAPM in testing different financial markets. It also provides theoretical and data support for the comparison of differences across financial markets based on the CAPM model.

Keywords: CAPM · Chinese · American · Bank stocks

1 Introduction

1.1 Background Information and Motivation

Since Harry M. Markowitz proposed the portfolio theory in 1952, modern investment theory has evolved quickly [1]. The Capital Asset Pricing Model (CAPM) is unquestionably the most important aspect of it. The CAPM model, known as the capital asset pricing model, was developed by American scholars William Sharpe, John Lintner, and others based on modern portfolio theory, and is one of the theoretical foundations of modern finance and one of the theoretical achievements of modern portfolio theory [2]. CAPM implies that every investor follows Markowitz's asset selection theory and has the same anticipated return, variance, and covariance estimates, as well as the ability

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to borrow freely [3]. CAPM primarily analyses the mathematical relationship between the return and risk of risky assets, as well as how much an investor must earn to offset a specific amount of risk [4]. Since its introduction, it has received widespread attention and research due to its simple logical analysis process. It has developed rapidly thanks to the efforts of many economists within the international community and is often used by investors in developed Western countries to solve general problems in financial investment decisions [5].

However, the trend towards economic globalization has further intensified in recent years and in such an international environment, the CAPM model needs to be applied about its validity in the financial markets of developing countries as well. The Capital Market Pricing Model is a general description of investor behaviors that has received a variety of empirical support. When used in international capital markets, it implies that demand for foreign bonds depends on real exchange rate risk and real rates of return [6]. The information transmission, software and information technology services industry has emerged in various developing countries in recent years. In these developing countries, the Chinese government has given high priority and policy support to this phenomenon, all of which has advanced the development of China's financial markets, which means that more investment opportunities will emerge in the country's financial markets. China's financial market started late and although it has developed relatively quickly, there is still scope for improvement. At the same time, Chinese investors have always had a high level of interest in stock investments and financial markets. This all means that the use of CAPM in China is of great significance [7].

1.2 Literature Review

Research on the international use of the CAPM model can be divided into two areas, the first being research on the effectiveness of the CAPM model. The second is a study of the anomalies in the various applications of the CAPM model.

Cambridge, Mass based an international version of the capital asset pricing model by having investors from the US, Germany and Japan choose a portfolio that includes bonds and stocks from these countries to maximize a function of the mean and variance of returns and having investors from each country evaluate returns in their national currency. An empirical research approach was used to test the validity of the CAPM model, and the results of the study showed that the CAPM does have some power in explaining prior returns. It predicts a fairly large risk premium for equities but a small risk premium for bonds [8]. Furthermore, Josipa Daja uses monthly stock returns for nine countries from January 2006 to December 2010 to see if the Capital Asset Pricing Model (CAPM) is adequate for capital asset pricing on the Central and South-East European emerging securities markets. It is specifically determined whether beta, as a systematic risk measure, is valid in observable markets by examining whether high expected returns relate to high levels of risk, i.e., beta. The efficacy of market indices in the nations studied is also investigated [9]. Cambridge, Mass. The National Bureau of Economic Research conducted a maximum estimation based on the more general CAPM to test the restrictions imposed by the CAPM. The use of restrictions on the CAPM model was analyzed through an empirical study, which showed that the model with CAPM restrictions performed better when the variance did not change over time

[10]. In addition, the conditional CAPM stands up over time, according to Jonathan Lewellen's research, and time-variation in risk and expected returns can explain why the unconditional CAPM fails [11].

These studies provide the theoretical prerequisites for testing the effectiveness and application of CAPM in the financial markets of developing countries. However, there are still shortcomings in the studies on the use of CAPM models in international markets, for example, in the sample selection, the sample countries chosen are mostly developed countries, the variables selected are more detailed and there is a lack of intuitive analysis and comparison of data from developed and developing countries [12]. To fill in the gaps in these data analyses and theories, this article does further research.

1.3 Research Contents and Framework

Based on this, this article presents a theoretical and empirical analysis of the development of the CAPM model in international financial markets.

Using the 10-year Treasury rate as the risk-free rate, 20 listed banks in the US and Chinese markets as well as the opening and closing prices of the Shanghai Stock Exchange Index and the Dow Jones Index are selected for the three-year period from 7 May 2019 to 7 May 2022, the two are compared and the corresponding optimization is proposed for the application of the CAPM model in a developing country like China, taking into account the actual situation of China's development. The paper is organized as follows. The first part is the Introduction, the second part is the theoretical and empirical analysis, the third part is the discussion based on the results of the theoretical and empirical analysis, and the fourth part is the conclusion of the whole paper.

2 Methodology

2.1 Sample Data Selection

This article takes the Treasury bond interest rate (10 years) as the risk-free interest rate and selects the closing prices of 20 listed banks in American and Chinese markets to calculate the return of them. Select Shanghai Stock Exchange index and Dow Jones index in the 3 years from May 7th, 2019, to May 7th, 2022.

2.2 Calculate Beta

On the one hand, this paper calculates the stock return rate, and its calculation formula is as follows:

$$r_t = ln(P_t/P_{t-1}) \tag{1}$$

In the formula, r_t refers to t yield of the sample company's stock at time, P_t and P_{t-1} refer to the closing price of the stock at times t and t-1, respectively. On the other hand, this paper uses the same method to calculate the market rate of return:

$$r_{mt} = ln(i_t/i_{t-1}) \tag{2}$$

In the formula, r_{mt} refers to the overall market return in period t. The i_t and i_{t-1} are the closing prices of the market in periods t and t-1, respectively. In this paper, the closing prices of the Shanghai Stock Exchange Index and the Dow Jones Index are chosen for China and the United States, respectively. Therefore, the market revenue can be obtained by bringing the sample data into the above formula.

2.3 Least Square Linear Regression

The CAPM model is the core model of asset pricing theory. Its basic forms are as follows. (K_t-r_f) is the excess rate of return of the company at time T. (K_{rt}-r_f) is the excess rate of return of the market at time T based on this, we carry out the least square linear regression between the two to clarify their correlation and obtain the relevant analysis parameters. Through the least square linear regression with MATLAB software, we finally get the following results.

3 Results

3.1 3 Basic Regression Results

Table 1 presents the beta values, constants, squared correlation coefficients, and correlation coefficient indicators for different banks in China and the United States.

Table 1. Regression Results for U.S. and Chinese Banking Stocks

China						
BANK	CODE	beta	constant	Square of correlation coefficient	correlation coefficient	TEST p
PING AN BANK	000001.SZ	1.196370756	0.00178949	0.359468897	0.599557251	0
BANK OF NINGBO	002142.SZ	1.05123392	0.001082916	0.274749611	0.524165633	0
BANK OF QINGDAO	002948.SZ	0.887581367	-0.001887084	0.302342226	0.54985655	0
JIANGSU SUZHOU RURAL COMMERCIAL BANK	603323.SH	0.946417896	-0.00084344	0.370239182	0.608472827	0
CHINA CITIC BANK	601998.SH	0.630475847	-0.003368902	0.336377194	0.579980339	0
BANK OF GUIYANG	601997.SH	0.801486103	-0.002750029	0.216510742	0.465307148	0
BANK OF CHINA	601988.SH	0.364493647	-0.005507089	0.254908266	0.504884408	0
CHINA CONSTRUCTION BANK CORPORATION	601939.SH	0.544407156	-0.004036603	0.249927966	0.499927961	0

(*continued*)

Table 1. (*continued*)

China						
BANK	CODE	beta	constant	Square of correlation coefficient	correlation coefficient	TEST p
JIANGSU ZIJIN RURAL COMMERCIAL BANK	601860.SH	1.107493683	-0.000450877	0.347639058	0.589609242	0
BANK OF CHENGDU	601838.SH	0.895666001	-6.67397E-05	0.214011981	0.46261429	0
CHINA EVERBRIGHT BANK	601818.SH	0.695545428	-0.002893465	0.281778823	0.530828431	0
BANK OF CHANGSHA	601577.SH	0.922916937	-0.001125217	0.371448348	0.609465625	0
Industrial and Commercial Bank of China	601398.SH	0.389764716	-0.005329939	0.203987465	0.451649715	0
Bank of Communications	601328.SH	0.46899093	-0.004703346	0.287480335	0.536171927	0
Agricultural Bank of China	601288.SH	0.337605596	-0.005754424	0.202080449	0.44953359	0
Bank of Shanghai	601229.SH	0.563987655	-0.004530881	0.168491787	0.410477511	0
Bank of Beijing	601169.SH	0.56944358	-0.00402728	0.418584712	0.64698123	0
Industrial Bank	601166.SH	0.938114745	-0.000495088	0.301160834	0.548781226	0
Bank of Nanjing	601009.SH	0.786536663	-0.00136151	0.250129186	0.500129169	0
BANK OF XI'AN	600928.SH	1.015005231	-0.001219693	0.38945441	0.624062825	0
U.S.						
Agricultural Bank of China	ABCB.O	1.365413424	0.000973364	0.417077272	0.6458152	0
Auburn National Bancorporation	AUBN.O	0.570218095	-0.002233125	0.073081785	0.270336429	1.22E-13
BANCO BBVA ARGENTINA	BBAR.N	1.225943471	-0.001144493	0.128126725	0.357947936	0
BANK FIRST CORPORATION	BFC.O	0.903022171	-0.000751422	0.30794957	0.554932041	0
MACRO BANK	BMA.N	1.217906827	-0.001320963	0.141899228	0.376695139	0
THE BANK OF PRINCETON	BPRN.O	1.119713634	-2.78983E-06	0.3587434	0.598951918	0
BYLINE BANCORP	BY.N	1.070574715	-1.0429E-05	0.300370088	0.548060296	0
Cathay General Bancorp	CATY.O	1.319092611	0.000758436	0.484485382	0.696049841	0
CF BANKSHARES	CFBK.O	0.269195958	-0.002280666	0.03683416	0.191922276	1.84E-07
MAINSTREET BANCSHARES	MNSB.O	0.858259786	-0.000899054	0.222750459	0.471964468	0

(*continued*)

Table 1. (*continued*)

China						
BANK	CODE	beta	constant	Square of correlation coefficient	correlation coefficient	TEST p
CUSTOMERS BANCORP	CUBI.N	1.530892562	0.002239254	0.355185763	0.595974633	0
EAGLE BANCORP MONTANA	EBMT.O	0.570104372	-0.00170563	0.15657855	0.395700076	0
East West Bank	EWBC.O	1.356813868	0.001213027	0.431679417	0.657023148	0
FIDELITY D & D BANCORP	FDBC.O	1.119100055	-0.000676397	0.260755101	0.510641852	0
FIDELITY D & D BANCORP	FNMA.OB	0.935436425	-0.002279695	0.099800014	0.315911403	0
First Savings Financial Group	FSFG.O	0.596567096	-0.003003742	0.037736704	0.194259374	1.298E-07
Heritage Financial Corporation	HFWA.O	0.98803569	-0.000863553	0.319981087	0.565668708	0
Heritage Commerce Corp	HTBK.O	1.191659217	4.93566E-05	0.392841701	0.626770852	0
First internet Bancorp	INBK.O	1.467115345	0.001878997	0.380481684	0.616831974	0
KEYCORP	KEY.N	1.551005044	0.001591694	0.509290833	0.713646154	0

As it reveals in the table, the constant items in each regression model are very close to 0, which indicates that the relationship between the excess rate of return and the risk premium is approximate positive scale. In CAPM model, there is no constant item, the results above convinced the fact approximately.

3.2 Analysis of Beta

The CAPM model itself reflects the difference and change sensitivity between the asset risk and the market portfolio risk. If the beta of the asset is equal to 1, it means that the risk status of the asset is equivalent to the risk of investing in the portfolio of all markets. Similarly, if the beta of one asset is greater than 1, the risk level of the asset is higher than that of investing in all market portfolios. If the beta of one asset is less than 1, the risk level of the asset is lower than the risk level of all market portfolios. In this paper, we can observe the results as before. We can find that the coefficients of each beta obtained by the least square method are mostly greater than one time, indicating that the risk level of most stocks is higher than that of all market portfolios. The risk level of some companies is less than one time, especially in the U.S. stock market.

3.3 Analysis of Relative Parameter

From the values of the test p, we can find that all models are basically valid except for individual stocks, and the square of the correlation coefficient r can explain the

relationship between the system risk and the market average risk, and the significance of the model. The level of R square of American companies is relatively high. The p, which represents if the model is valid (when it is smaller than 0.05) is smaller than 0.05 in most companies, which means the regression model is valid. And the correlation coefficient of each company is around 0.5

4 Conclusion

With the trend of economic globalization and increased trade protectionism, the use of the CAPM model in developing countries is of great significance, in addition to its use in the financial markets of developed Western countries. However, the financial market environments of developed and developing countries are not identical. For example, there are differences between the financial markets of the world's two largest economies, China, and the United States. Faced with such huge differences, stocks do not perform in the same way even in the same region. Based on this situation, this study will first test the validity of the CAPM model in the Chinese financial market and will analyze the differences between the Chinese and US financial markets through the classical CAPM. To make this result more specific and meaningful, the research selects the bank stock as the sample, for which can be regarded as the representative of financial area which the research tries to explain the difference in.

This research selects 20 Chinese and 20 American bank stocks close prize from 2019 to 2022 and deal with it through static ways such as regression by the MATLAB. Just like the CAPM explains, all the things we would like to find is the beta which represents the sensitive relationship between the stock risk itself and risk of the whole market and the R^2 which represents the systematic risk of individual stock and the goodness of fit of the model.

What we have found in the result is meaningful and it can be summarized as the latter. First, overall speaking, Chinese and American banking stocks meet the CAPM model. Just as the analysis before, the linear regression model behaves effectively ($p << 0.5$) and the constant which is set for the regression model is approximately to 0 no matter in the American stocks or in Chinese stocks. It convinced that the CAPM fit well in both banking markets. Second, compared with the stable and balanced data performance of China, the individual index of American bank stock fluctuates, which means the R^2 and beta of American banking stocks reveal in a variable level. However, the beta of Chinese banking stocks is stable at about 1. As for the R^2, American banking stocks reveals more randomness compared to Chinese banking stocks. In some degree, it convinced that American banking market seems to be a freer circumstance which allows its banking stock to fluctuate more violently. On the other hand, the R^2 of the CAPM of Chinese banking stocks fluctuate at the level of 0.5, which can be brought about by the individual government measures. The market which is freer should have to behave more possibility but not stable shape. Besides, the research finds American banking stocks can be more sensitive to risk, which is also reflected in the general higher beta.

The progress of globalization is an opportunity for the development of financial markets in all countries and economies. As one of the foundations of modern financial theory, it is essential that the CAPM model is applied to different financial markets in

different countries. In addition to its widespread use in the financial markets of developed Western countries, it is also important to examine the effectiveness of the CAPM in the financial markets of developing countries such as China. For those who wish to study the effectiveness of the CAPM, this article provides clear conclusions and data to support them. At the same time, it provides a visual analysis and comparison of financial market data from developed and developing countries, which has implications for testing the use of the CAPM model in international markets and provides data analysis and theory for those who wish to investigate the differences between financial markets in developed and developing countries.

As the world's top two economies, the differences between the financial markets of China and the US deserve deeper consideration. In future research, in addition to using the most basic CAPM model analysis, further research can be conducted on the variables in the model, such as the R^2 and beta values for US bank stocks, which have been mentioned above, are shown at a variable level, and more research is needed on the probable outcomes caused by changes in these variables. At the same time, the impact of market policies on financial markets in different countries should be investigated. For example, the selected countries of China and the US have different market policy environments, with the US having a more liberal market environment and China having a predominantly politically planned market environment, both of which have an impact on their financial market environment and affect the movement of values in the CAPM.

5 Author's Contributions

These authors contributed equally.

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