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Applicability Analysis of Arbitrage Pricing Model in Chinese Stock Market

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Abstract: This paper presents the fundamentals and benefits of the arbitrage pricing model, emphasizing the significance of utilizing arbitrage pricing theory to the growth of the stock market. Firstly, the thesis analyzes and summarizes the mature research on the arbitrage pricing model abroad. This paper, taking into account the unique circumstances of the Chinese stock market, summarizes and contemplates the empirical examination of the arbitrage pricing model's applicability in the Chinese stock market. Most research lines in the Chinese market have been found to be in agreement with the arbitrage pricing principle, yet some studies have come to the contrary result. The fundamental reason is that the analysis of the model needs to be further improved, and China's stock market needs to be developed. Proposals to foster the growth of China's stock market are finally put forth.

Keywords: Arbitrage pricing model, China's stock market, Empirical analysis

1. Introduction

Arbitrage pricing model, China's stock market, Empirical analysisIn recent years, the development of China's research on financial asset pricing theory has also experienced a process of gradual deepening from scratch. At the same time, its research scope is no longer limited to the academic field, but gradually enters the market field to guide investment practice. The capital asset pricing model remains the foundation for the current popular textbooks' introduction of asset pricing theory, while arbitrage pricing theory is overly broad. Nevertheless, with the swift expansion of China's economy, securities investors have a more comprehensive comprehension of "standardized trading and rational investment", prompting them to search for effective asset pricing models to implement in order to acquire superior returns. Therefore, arbitrage pricing theory has been paid more and more attention. In this new situation, due to the particularity of China's securities market, whether the arbitrage pricing model established based on Western developed markets is effective for China's securities market will become an important issue, especially on this basis to study the rationality of stock pricing, yield factors, and other issues will play a positive role.

2. The definition of the asset pricing model

In 1976, Ross put forward the concept of arbitrage pricing (APT). This hypothesis postulates that the return rate of various securities is influenced by one or more elements, and that these factors are connected since they all react to them. Unlike the capital asset pricing model based on mean variance, the arbitrage pricing model is founded on the one-price theorem. Fewer assumptions are present, such

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as no single investment period, no tax issue, investors can borrow and lend money at risk-free rates, and portfolios are selected based on the mean and variance of returns. This makes it more advantageous as a financial market analysis tool to help understand arbitrage opportunities and pricing differences in capital markets.

Based on the pertinent data for the United States from 1958 to 1984, Nai-FuNai-Fu Chen, Richard Roll, and Stephen Ross developed an effective CRR model and noted that the return of American securities was primarily influenced by five macroeconomic factors: First, the impact of a sudden shift in the rate of inflation on the returns on securities is examined [1]. Second, we gauge the spread determinants that influence security returns by contrasting the trend of unexpected spreads between senior and junior bonds. Thirdly, it looks at how unanticipated changes in industry production affect returns on securities. Fourthly, it examines how unexpected long-term bonds and short-term bonds' price differences affect both the long-term and short-term returns on securities. Fifth, the impact of outside variables is assessed, including changes in the unexpected inflation rate.

Antje Berndt and Lulian Obreja studied the asset pricing theory based on the European securities market and proved that systemic risk is not the only source of the volatility of securities returns [2]. The common factors (CMF) including length of term, credit rating, etc. are found out, and regression analysis is carried out on these factors based on the pricing model of ICAPM and KTV. Conclusion: In the European securities market, systemic risk can explain 21% of asset returns, and common factors can explain.63%, leaving the remaining 16% unexplained.

The research on the arbitrage pricing model in foreign countries started earlier and is more mature. However, in contrast, in the early 1990s, China's securities market had just begun to improve, and there were few studies on arbitrage pricing theory. Considering the special situation of China's stock market, the applicability of the arbitrage pricing model in China's stock market remains to be verified.

3. Summary of relevant studies

3.1. Study on the number of common factors

Wu Bao et al., in the book Research on Financial Engineering, briefly introduced the estimation method of the number of factors affecting the return rate of Chinese stocks but did not test the arbitrage pricing theory [3]. They only take 30 stocks included in the SSE 30 Index as samples and use the maximum likelihood method to do factor analysis and find that there are only 6 factors affecting the return rate of Chinese stocks. However, because there are too few observation points in the time series, and the Shanghai Composite Index itself lacks sufficient representatives, the stocks selected for this component index are mostly large-cap stocks with good performance, while small-cap stocks, junk stocks, and other stocks are excluded, the credibility of the research results is limited, and the number of factors affecting stock returns is likely to be underestimated

Zhang Yan's empirical examination of the Shanghai stock market demonstrated that, despite the presence of multiple common factors, the single-factor model still has a powerful explanatory power, thus its research value cannot be denied [4]. The group above 86.7% has at least one significant risk premium factor, the group above 53.3% has at least two significant risk premium factors, and only a few groups have at least three significant risk premium factors when the risk-free rate of return is assumed to be 3.5% using the daily rate of return data. The evidence suggests that security yields are influenced by at least two, and maybe three, common elements.It demonstrates that the Chinese stock market may benefit from the three-factor approach. The existence of the third risk premium component cannot be fully established at the same time. Along with the model's inherent issues, this illustrates how China's stock market has developed rapidly and lacks a consistent framework, making it difficult to identify all of the elements that influence it. Additionally, the model's autovariance test

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is simply a weak test, therefore the outcome is unsatisfactory. This raises additional questions regarding the arbitrage pricing model's applicability in China.

Then, Sun Junmin et al. used factor analysis to screen 11 factors and discovered four pieces of data that reflected the overall economic level of the nation, the inflation rate, the growth rate of fixed asset investment across society, and the current state of interest rates, which could very well reflect all factors [5]. In an empirical test to determine whether the capital asset pricing of Shanghai B shares complies with the arbitrage price model, Yin Kang applied modern securities portfolio theory and discovered that the cumulative contribution rate of variance of the nine factors reached 85.7%, meaning that these nine factors could account for nearly 86% of the factors affecting the stock market [6].

By using the daily yield data from the Shanghai A-share market, Chen Renke evaluated the arbitrage pricing model and continued his investigation on the prohibition of short selling in Chinese stock market trading [7]. First, the number of factors is determined using principal component factor analysis and maximum likelihood factor analysis, respectively, and then the estimated factors are subjected to a significance test. The inference is made that, in some instances, the arbitrage pricing theory holds true for the Chinese stock market. In addition, it is discovered that the significance level and data type have a significant impact on the factor analysis results and that the model's stability is low. The hope of improving the stability of the model is put forward Scholars generally believe that the arbitrage pricing model is still applicable in China's stock market, but China's stock market system is not perfect.

3.2. Research on influencing factors

Scholars must delve into the particular elements that influence the stock market, in addition to the numerous shared ones. Tian Dawei took the BIRR model in arbitrage pricing theory as a reference and selected 33 macroeconomic factors, the Shanghai Composite Index, and 10 randomly selected stocks as research objects [8]. First, he preliminarily screened macro factors by combining stepwise regression and robust regression. The vector autoregressive model is then employed to select four macro risk factors for the macro factor arbitrage pricing model pertinent to China's stock market: total energy production, foreign direct investment, the seven-day interbank offered rate (monthly average) and the national consumer price index.

Zhang Wei identified the macroeconomic parameters of the arbitrage pricing model based on the Chinese market in the empirical research of A-shares [9]. The five main elements are, in order, general economic development, inflation, the state of both domestic and international business activity, overall economic expansion, and future economic growth optimism. This model's suitability for the Chinese A-share market as well as the impact of industry and business size on the market's return on investment are confirmed.

3.3. Studies of questionable applicability

While most scholars have concluded that arbitrage pricing model is suitable for the Chinese stock market, many scholars have also concluded that it is not suitable for the Chinese stock market, which provides us with more thoughts on improving the model and factor stability. In order to evaluate the Arbitrage Pricing Model of the Chinese Stock Market, Liu Lin and Qin Wanshun conducted a factor analysis on the stock prices of Shanghai and Shenzhen [10]. They found that nine factors significantly affect the return rate of Chinese stocks, compared to the number of factors in the American stock market. The arbitrage pricing model failed the test of applicability to the Chinese stock market, which led to this result. However, there are other issues with the conclusion: Brown and Weinstein confirmed that as the number of components chosen rises [11], the likelihood that the consistency

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hypothesis would be rejected during the inter-group return generation process will likewise rise. If the notion of uniformity in yield generation among groups is often denied, it is inappropriate to characterize the yield generation process with this amount of factors, thus rendering the arbitrage pricing model of the corresponding figure futile. They believe that this is probably because China's stock market has not met the requirements of full competition, and there may be arbitrage opportunities in the market, that is, China's stock market is still in the development stage of "emerging and transforming", and many systems and regulations need to be improved and supplemented. The panel data of Shenzhen A-share companies from 1999 to 2003 was used by Cao Hongying and Yang Yuxiang to empirically test the Arbitrage Pricing Model in the Chinese Securities Market [12]. They found that the correlation between market capitalization, price-earnings ratio, company size, and book value and China's stock return rate was not statistically significant. Arbitrage pricing theory is shown to be inapplicable to the current Chinese securities market after comprehensive investigation. She believes this is due to the short duration of the market's development, the vast disparity between China and developed countries in terms of market regulation, the caliber of listed companies, securities laws and regulations, and other facets, as well as the lack of resource allocation.

3.4. Study on the effectiveness of APT model

Although the APT model had several limitations, Reinganum used the stock data shared by the New York Stock Exchange and the American Stock Exchange from 1962 to 1973 to demonstrate that there was a negative correlation between business size and the daily excess return of shares.Using data from 486 listed businesses from the Shanghai stock market as a sample, Yang Hu et al. performed a study to assess the effectiveness of the arbitrage pricing model in China's securities market [13]. The study's findings show that the arbitrage pricing model cannot be used to analyze the Shanghai stock market. Using a set of variables, a statistical analysis and empirical test of China's Shanghai and Shenzhen stock markets,the determination of the number of factors in the arbitrage pricing model, and the establishment of the model, was conducted by, demonstrating that the Chinese stock market is an efficient market and adheres to the arbitrage pricing model [14]. Zhang Baochun believes that due to the unsatisfactory conditions of APT itself and the immaturity of China's securities market at this stage, the application of mainstream Western capital pricing models in China is limited [15].

3.5. Research on APT model revision

The applicability of the arbitrage pricing model in China is limited and affected by various factors. Researchers improve the applicability of the model to a certain extent through the following two aspects

In his empirical test of the Shenzhen stock market, Li Jiaorui considered two significant changes in the trading system during the development of China's stock market: one is the change from the T+0 trading rule to the T+1 trading rule [16]; The second is the implementation of the system of rising and falling limits. Dummy variables are introduced to improve the arbitrage pricing model. The results show that the non-systemic risk of the stock market has a great impact on the stock price, investor confidence, and investment decision, and the model after the introduction of dummy variables is closer to the reality than the model before the introduction, which also indicates that China's Shenzhen stock market conforms to the arbitrage pricing model.

Considering the low quality of the data itself, Zhang Wei built a model according to the industry and scale, used macro factors to explain and forecast nine basic factors, and then used the predicted value of basic factors to further generate views on individual stocks or industries [9].

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4. Conclusion

Through the literature review on the applicability of the arbitrage pricing model in the Chinese market, we know that the current research mainly focuses on the establishment and application of the arbitrage pricing model, and has made some progress. However, we also find that the existing arbitrage pricing model has some problems and limitations in the practical application of the Chinese market. The influence of existing factors on the return rate of Chinese stocks is not significant and unstable, and further research is needed. In addition, although the arbitrage pricing model based on factor analysis has achieved some results in the research of the Chinese market, there is still room for improvement to improve the accuracy and stability of the model. To sum up, the applicability of the arbitrage pricing model in the Chinese market is still an important topic, and it is necessary to further explore the arbitrage pricing model applicable to the Chinese market and improve the existing model to improve its forecasting ability. In future research practice, we can further explore the applicability of the arbitrage pricing model in different market environments and put forward corresponding improvement methods. Such research is of great significance not only for improving the decision-making ability of investors but also for effectively promoting the stable development of China's securities market.

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