Comparison of the Applicability of CAPM and Fama-French Model in Different Regions

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ABSTRACT
Asset pricing has always been a popular topic in economic research. The research on the relationship between risk and the stock expected return has attracted much attention, and many theoretical models have experienced evolution and upgrading. Capital Asset Pricing Model (CAPM), as a single factor model, mainly studies the relationship between the expected return of assets and risky assets in the securities market and evaluates how the equilibrium price is formed. It considers that the main factor affecting the stock return is a non-systematic risk. Afterward, Fama and French proposed the three-factor model. It believed that the coefficient β could not fully explain the differences in the returns of different stocks, and then added the scale factor and book to market ratio factor to improve the explanatory performance of the model. Therefore, the excess returns can be regarded as compensation for the risk factors not reflected by β in CAPM. Based on the application in different countries and regions, this paper compares the two models.

Keywords: *Asset pricing theory, CAPM, Fama-French model*

1. INTRODUCTION

As is commonly known, asset pricing is one of the most researched areas of finance. Markowitz develops a mean-variance model and suggests that rational and risk-averse investors should select the most efficient portfolios based on the mean and variance [1]. Sharpe and Lintner use this concept to develop a capital asset pricing model (CAPM). They argue that stock returns are only linearly related to the overall systemic risk of the stock market. In other words, the expected return on equities is directly proportional to the market's systematic risk [2-3]. CAPM employ beta to calculate the market's expected return and the expected return of a hypothetical risk-free asset in order to depict the asset's sensitivity to a non-diversifiable risk. To explain fluctuations in stock returns, this model is developed by modelling market risk, market value risk, and book-to-market value risk, among other things. In their research, they discovered that the two elements of stock market value and book-to-market value ratio can explain the majority of variations in stock prices, and that these two indicators can take the place of other risk factors (such as E/P, for example) [4].

The establishment of the Fama-French model presupposes that practitioners will quickly abandon CAPM in favour of it. However, Graham and Harvey found that 73.5 percent of 392 U.S. CFOs still rely on the CAPM to some extent when evaluating the cost of equity, even after the Fama-French model is implemented [5]. Brounen, Abe de Jong, and Koedijk conducted a comparable survey of 313 European enterprises and discovered that on average, roughly 45 percent of firms use the CAPM [6].

The objective of this paper is to investigate the applicability of the CAPM and Fama-French model in different regions. According to each country's own characteristics, their stock market might be influenced by different factors. For example, most of the European countries are developed countries, while most Asian countries are at the emerging developing process. Which asset pricing model is better for specific regions according to their characteristics is the question that would be found out.

2. DEVELOPING COUNTRIES IN ASIA

Since China is a sizable emerging market with a rapidly maturing stock market, a large number of empirical tests have been conducted based on the Chinese stock market. Liu and Baek give empirical evidence that the Fama-French three-factor model may be more beneficial as a pricing index in the Chinese

market than a risk-based model. Additionally, their findings indicate that investors who hold firms with a modest market capitalization or a high BE/ME ratio typically earn larger returns. Investors in the Shanghai stock market who hold companies with a large market capitalization or a low BE/ME ratio typically earn poorer returns. However, investors in value stocks typically get a higher rate of return in the Shanghai stock market, while growth firms typically earn a higher rate of return in the Chinese market [7]. The coefficients of the financial crisis dummy variables imply that the 2008 global financial crisis has had no effect on the three components' explanatory power. This gives additional evidence that the Fama-French model is superior to the CAPM in explaining volatility in stock returns in the Chinese market. There is one thing need to be paid attention is that according to Fama and French hypothesized that enterprises with greater BE/ME ratios are less profitable, and that tiny stocks are less profitable than large stocks [8]. However, the further findings of this investigation contradict these hypotheses. This could be explained by the Chinese capital market's characteristics, which include a state-owned system and a lack of capitalization. Despite this inconsistency, the Fama-French model has been shown to be more appropriate in the Chinese stock market than the CAPM.

As the applicability of the Fama-French model is better than CAPM in the Chinese stock market might be explained by the features of the Chinese capital market which are state-owned system and non-capitalization. Therefore, India, which is also a developing country, but is capitalized and influenced by the economy of UK, has attracted lots of empirical tests. According to Connor and Sehgal, market, size, and value as Fama-French factors all exert a significant influence on random returns in the Indian stock market, and India's equity market's cross-sectional dispersion of their mean returns could be explained by the linear exposure to these factors. These three factors have been discovered that could explain cross-section mean returns rather than the market factor alone [9]. As a result, mean returns calculated by the one-factor CAPM model would be rejected. To be more statistical, Sehgal and Balakrishnan used data from 465 of India's most active companies between 1996 and 2010 to construct portfolios using a twofold sort of criterion based on size/value. They substantiate the existence of significant size and value impacts in the Indian stock market. In comparison to a single factor CAPM, the Fama-French three-factor model is a stronger predictor of returns on company characteristic sorted portfolios [10]. Taneja demonstrated that while the Fama French Model's efficiency as a good predictor cannot be overlooked in India, either of the two components (size or value) may improve the model. This is because a high degree of connection exists between the returns on the size and value factors [11].

Sutrino and Nasri also showed a similar conclusion that the Fama-French three-factor model is superior to the CAPM in explaining the excess return on stock portfolios in Indonesia, which is also a developing country with capitalization. Although the Fama-French three-factor model outperforms the CAPM, the findings imply that other factors should be considered when developing asset pricing models that more accurately describe stock return variability in the Indonesian stock market[12].

Besides, Randeniya and Wijerathna conclude that the Fama-French factors adequately explain the cross-sectional returns on the Sri Lankan stock market and provide a superior match to the CAPM model. Additionally, the study demonstrates that the Fama-French theory of 'small-cap-high-value' stocks outperforming the market is accurate in the Sri Lankan context, and that utilizing this theory, an Index Fund can be constructed and traded based on expectations using the Fama-French prediction [13].

All these research have similar findings that the Fama-French model has a better explanation for the stock returns for the stock market with developing country in Asia whether it is capitalization or non-capitalization than the CAPM model.

3. CAPITALIST DEVELOPED COUNTRIES IN EUROPE

There is the doubt that whether the developed countries will show similar results with the developing countries. The UK as the largest economy in Europe has been tested empirically by several researchers.

Results of Karp and Vuuren’s research examined that both CAPM and Fama-French models are limited in their explanatory ability, however, the Fama-French model significantly outperforms CAPM in all portfolios [14]. Similar to this, in the examination of UK pension funds, Adami et al. have proved that although Fama-French model could not fully explain the return, it is still the best model compared with the CAPM and Fama-French plus Carhart model [15].

As the past colony of the UK, the economy of Australia has been benefited a lot, which tends to have similar results with the UK stock market. Gaunt expands on the size impact, the book to market (BM) effect, and the ability of the Fama French three-factor model to account for these factors and improve the CAPM's capacity to price assets. He discovers that the three-factor model outperforms the CAPM in terms of explanatory power and provides evidence that the BM factor plays a role in asset price. By and large, this study reveals that the three-factor model explains reported Australian stock returns better than the CAPM. However, the majority of this enhanced explanatory power is attributable to just one of the two extra variables, size. Additionally, the

model fails to account convincingly for differences in returns between equities when crudely subdivided by underlying business risk. The less risky (more profitable) equities offer a higher raw return, and this advantage increases when risk-adjusted returns are calculated. The most straightforward behavioral explanation for this phenomenon is that investors are reluctant to react to increases in profitability [16-17].

Moreover, Czapkiewicz and Skalna verify the performance of the Fama-French model for the Polish market use the monthly data from the Warsaw Stock Exchange for the period December 2002 to January 2010. They find that the cross-sectional mean returns are explained by exposures to the three factors as stated by Fama-French model, and not by the market factor alone [18]. These results are consistent with previous studies of developed markets.

According to Wickert et al.'s testing, there is a lack of association between beta and return in the Italian stock market, and the CAPM has a low overall explanatory power. In all tests conducted, Arbitrage Pricing Theory outperforms the CAPM. This is because it takes into account a variety of potential causes of systemic risk. Due to the absence of institutional investors and the fact that private investors in Italy frequently regard the stock market as a place to gamble rather than invest, market "irrationality" may occur, undermining the CAPM's assumptions [19]. The Fama-French model was not examined in this study, which implies that, in addition to the Fama-French model, additional asset pricing models are applied in the specific stock market based on its features. While the CAPM is usually less appropriate in the European stock market.

4. EMERGING CAPITALIST COUNTRIES LED BY THE UNITED STATES

US stock market would be paid most attention among all the developed countries as the USA is considered widely as the most active financial market.

Piela's research demonstrates that not only the Fama-French model, but also the CAPM have sufficient explanatory power to explain the S&P 500 index's statistical behavior across the whole research period. While in comparison to CAPM, the Fama-French model may appear to be the superior solution because to its greater explanatory power [20].

Choi tests both Capital Asset Pricing Model and Fama-French Three-Factor Model on the US stock market. As the adjusted R2 increases significantly for all the 25 portfolios as the switch from CAPM to Fama-French Three-Factor model, suggests Fama-French Three-Factor model outperforms CAPM in explaining US stock market returns. Additionally, Fama- French Model had a lower mean squared error and higher correlation between actual and predicted value, suggesting that Fama-French Three-Factor Model has a better ability in forecasting stocks' returns than CAPM [21].

However, Lam compares the Fama-French three-factor model and the CAPM using two data sets. A portfolio is built around a company's size and book-to-market equity ratio, whilst another is built around an industry. These two portfolios are subjected to time series and cross-sectional examinations throughout two unique periods. No compelling evidence exists that the three-factor model is superior to the CAPM. Additionally, test findings from different data sets and periods vary. Therefore, the utility of the Fama-French model and CAPM is doubtful in US, which needs to be checked by further studies.

By comparing the CAPM and Fama-French model, Wang et al. found that because the estimated β coefficients in the two models are both around 1, the market factor cannot explain the difference in portfolio returns well, and the value factor can explain the difference in portfolio returns to a certain extent. The result obtained through regression analysis is that the higher acceptability R2 in the Fama-French model indicates that the Fama-French model can explain benefits and risks better than CAPM. In CAPM, the data corresponding to different periods is obtained. The results are different. This is because both the value factor and the market factor are affected by the preferences of investors. Therefore, whether the CAPM and Fama-French models are in line with reality depends on the selected period and the behaviour of investors at this stage.

5. CONCLUSION

The theory of asset pricing looks to be at a crossroads at the moment. The CAPM, the typical asset pricing model, has been demonstrated to be ineffective at explaining time-series returns. Even after correcting for systematic risk, fundamentally cheap (value) equities routinely outperform costly (growth) stocks. Behavioural finance proponents claim that psychological biases will result in the under-pricing of value companies and the over-pricing of glamorous stocks, which, when resolved, result in the greater returns associated with value stocks. The CAPM's traditional supporters have replied with an extended three-factor risk model. They assert that the only risk that can account for any systematic variation in return between equities is risk. Which route asset pricing hypothesis emerges victorious from the current fork in the road is dependent on refined testing.

As concluded from the previous research mentioned, it might be inferred that the developing countries in Asia prefer to use the Fama-French model rather than CAPM, while when constructing the model in European and US stock market, the conclusion might not be given easily.

What is certain is that although the CAPM and Fama-French model both have the explanatory power, Fama-French model is preferred in most situations. There are several asset pricing models could be chosen, not only Fama-French model and CAPM. Practitioners should find a suitable pricing model to reduce the uncertainty. In the future studies, it should be focused on choosing the most suitable asset pricing model to evaluate and forecast the expected return.

REFERENCES

[1] H. Markowitz, Portfolio Selection: Efficient Diversification of Investments, in: Cowles Foundation for Research in Economics, vol. 12(3), 1959, pp. 12-100.

[2] W. F. Sharpe, Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk, in: The Journal of Finance, vol. 19(3), 1964, pp. 425-442.

[3] J. Lintner, The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets, in: The Review of Economics and Statistics, vol. 47(1), 1965, pp. 13-37.

[4] E. Fama, K. French, common risk factors in the returns on stocks and bonds, in: Journal of Financial Economics, vol. 33(1),1993, pp. 3-56.

[5] J.R. Graham, C.R. Harvey, The Theory and Practice of Corporate Finance: Evidence from the Field, in: Journal of Financial Economics, vol. 60, 2001, pp. 187-243.

[6] D. Brounen, A. Joing, K. Koedijk, Corporate Finance in Europe Confrontying Theory with Practice, in: Financial Management, vol. 33, 2004, pp. 71-101.

[7] T. Liu, J. S. Baek, Comparison Study on Asset Pricing Model in Chinese Stock Market: CAPM and Fama-French Model, 2019.

[8] E. Fama, K. French, Multifactor Explanations of Asset Pricing Anomolies, in: Journal of Finance, vol. 51(1), 1996, pp. 55-84.

[9] G. Connor, S. Sehgal, Tests of the fama model in india, in: Fmg Discussion Papers, 2001.

[10] S. Sehgal, A. Balakrishnan, in: Vision:The Journal of Business Perspective, vol. 17(2), 2013, pp. 119-127.

[11] Y. P. Taneja, Revisiting fama french three-factor model in Indian stock market, in: Vision:The Journal of Business Perspective, vol. 14(4), 2010, pp. 267-274.

[12] B., Sutrisno, R. Nasri, Is more always better? an empirical investigation of the capm and the fama-french three-factor model in Indonesia, in: Social Science Electronic Publishing, 2019.

[13] R. Randeniya, J.K. Wijerathna, The application of the fama and french factor model for the sri lankan stock market, in: Annual Research Symposium, 2012.

[14] A. Karp, G.V. Vuuren, The capital asset pricing model and fama-french three factor model in an emerging market environment, in: International Business & Economics Research Journal (IBER), vol. 16(4), 2017, pp. 231.

[15] R., Adami, O. Gough, S. Mukherjee, S. Sivaprasad, An empirical analysis of the performance of pension funds: evidence from uk, in: Studies in Economics and Finance, 1997.

[16] J. Halliwell, J. Heaney, J. Sawicki, Size and book to market effects in Australian share markets: a time series analysis, in: Accounting Research Journal, vol. 12, 1999, pp. 122–137.

[17] C. Gaunt, Size and book to market effects and the fama french three factor asset pricing model: evidence from the australian stockmarket, in: Accounting & Finance, vol.44(1), 2014, pp. 27-44.

[18] A. Czapkiewicz, I. Skalna, The CAPM and Fama-Fremcj Models in Poland, in: Przeglad statystyczny, vol. 57(4), 2010, pp. 128-141.

[19] K. Wickert, H. Schmuck, W. Demtröder, K. Baron, Capital asset pricing model and arbitrage pricing theory in the italian stock market: an empirical study, in: Optics Communications, vol. 51(1), 1984, pp. 1-5.

[20] K. Piela, Evaluation of efficiency and explanatory power of the capm and the fama-french asset pricing models: evidence from the u.s. equity markets, in: Social Science Electronic Publishing, 2013.

[21] S. W. Choi, An Empirical Study of Capital Asset Pricing Model and Fama-French Three-Factor Model, 2017.

[22] K. Lam, Is the Fama-French three factor model better than the CAPM?, 2005.

[23] X.Q. Wang, X. Xin, C. Sui, Comparative research of CAPM and fama-french model, in: Journal of Xuechang University, vol. 25(5), 2006, pp. 3.