International Journal of Economics and Finance; Vol. 8, No. 11; 2016
ISSN 1916-971X E-ISSN 1916-9728
Published by Canadian Center of Science and Education

An Empirical Review of Asset Pricing Models for the Japanese Share Market

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Received: August 30, 2016 Accepted: September 21, 2016 Online Published: October 25, 2016

doi:10.5539/ijef.v8n11p155 URL: http://dx.doi.org/10.5539/ijef.v8n11p155

Abstract

This paper conducts an empirical review of asset pricing models for the Japanese share market. Researchers are continually attempting to describe a model which explains share returns and share anomalies more accurately. This paper reviews financial literature which applies the most common models to the Japanese share market and analyzes their robustness. Based on the performance of the four models, the characteristics which appear to be significant to the Japanese share market are discussed.

Keywords: share returns, asset pricing

1. Introduction

Many researchers have analyzed share returns in an attempt to determine which factors explain cross-sectional returns. There is evidence that characteristics such as size, book-to-market ratios, earnings-to-price ratios, leverage, past returns, dividend-yield, cash flows, profitability and investment, can explain share returns. The application of asset pricing models and their robustness is a topic which has received considerable attention over the years. Researchers are continually striving to describe a model which explains share returns and market anomalies more accurately than current models. As new models are developed, researchers examine the performance and robustness of the model on different share markets around the world, to determine its effectiveness.

Numerous researchers have tested the performance of asset pricing models on the Japanese share market. Previous literature on the performance of asset pricing models on the Japanese share market has given mixed results. This paper contributes to financial literature by reviewing literature focused on Japan, and attempts to identify the factors which may be significant and contain incremental information for asset pricing in the Japanese share market. The remainder of this paper is as follows. Section 2 reviews common asset pricing models and the literature which examines the performance of the models to the Japanese share market. Section 3 summarizes the empirical review and concludes with a discussion on the characteristics which are significant in Japan.

2. Asset Pricing Models

2.1 CAPM

The Capital Asset Pricing Model (CAPM) was created in the 1960`s, and has received considerable attention over the decades. The Sharpe-Lintner version of the CAPM states that an asset`s excess return is explained by its average realized market risk premium. The model is expressed as follows.

$$R_{it} - R_{ft} = \alpha_i + \beta_i (R_{mt} - R_{ft}) + e_{it} \quad (1)$$

Where $R_{it} - R_{ft}$ is the realized excess return of asset *i* at time *t*, $(R_{mt} - R_{ft})$ is the excess market return, and β_i is beta, the coefficient to sensitivity of the expected excess asset returns to the expected excess market returns.

The general consensus in financial literature is that this model is not appropriate for the Japanese market. Yonezawa and Hin (1992) study long term data from January 1952 to December 1986 by forming sub-periods, and find that the CAPM is invalid for the Japanese market. Research based on recent data also gives the same result. Walid and Ahlem (2009b) analyze daily returns of shares listed on both the first and second section of the Tokyo Stock Exchange from the 1st of October 2002 to the 30th of September 2007, and find that the CAPM is

not an appropriate model for the Japanese market. Bretschger and Lechthaler (2012) test the CAPM model for a significantly longer timeframe. They analyze monthly data for the period of 1984-2009, and draw the same conclusion as Walid and Ahlem, that is, that CAPM is not appropriate for the Japanese share market.

2.2 The Fama French Three-Factor Model

Research in the decades following the creation of CAPM suggested that variables other than beta have power to explain the cross-section of average returns. Fama and French (1992) found that combining the two variables; size and the ratio of book equity to market equity, captures most of the cross-section of average share returns in America. Following on from this, Fama and French (1993) identified three common risk factors in the returns on shares: an overall market factor, a factor relating to firm size, and a factor relating to book-to-market equity. This finding led to the development of the Fama French three-factor model, which is expressed as follows.

$$R_{it} - R_{ft} = \alpha_i + \beta_i (R_{mt} - R_{ft}) + s_i R_{SMB,t} + h_i R_{HML,t} + e_{it} \quad (2)$$

Where $R_{it} - R_{ft}$ is the realized excess return of asset *i* at time *t*, $R_{mt} - R_{ft}$ is the excess market return, $R_{SMB,t}$ is the realized return on the size-factor portfolio, and $R_{HML,t}$ is the return on the book-to-market factor portfolio.

Previous literature relating to this model has mixed results. Research by Kubota and Takehara (1997) showed that the Fama French three-factor model is appropriate for the Japanese market. Likewise, Bretschger and Lechthaler (2012) examine the model using data from July 1984 to July 2009, and find that the model captures common variation in share returns. In contrast to this, research by Daniel, Titman and Wei (2001) employs data from the Tokyo Stock Exchange for the period 1971 to 1997 to test the performance of the Fama French three-factor model. This analysis on Japanese share returns indicates that the value premium is strong, in fact it is substantially stronger in Japan than in America. Furthermore, the results reject the three-factor model for the Japanese market. Walid (2009a) replicates this analysis on the Japanese share market, by comparing the performance of the characteristics model and the Fama French three-factor model. He analyzes data from 2002 to 2007, and documents that size and book-to-market ratio are significantly related to average returns, and the characteristic model is more suitable for the Japanese market. A similar paper by Walid and Ahlem (2009b) presents new evidence on the applicability of the Fama French three-factor model to the recent timeframe of 2002 to 2007. This research reinforces the previous finding that both firm size and book-to-market ratio are significantly related to average returns, and have higher premiums than the market premium. It is clear that research results in financial literature have mixed results, which perhaps can be attributed to the timeframe chosen.

2.3 Carhart Four-Factor Model

Researchers such as Jegadeesh and Titman (1993) have documented that there is a momentum effect in share returns. The Fama French three-factor model`s inability to explain cross-sectional variation in momentum-sorted portfolio returns, motivated Carhart (1997) to create a four-factor model. Known as the four-factor Carhart-model, it is basically the Fama French three-factor model with a momentum factor (UMD) added on.

$$R_{it} - R_{ft} = \alpha_i + \beta_i (R_{mt} - R_{ft}) + s_i R_{SMB,t} + h_i R_{HML,t} + m_i R_{UMDt} + e_{it} \quad (3)$$

Where $R_{it} - R_{ft}$ is the realized excess return of asset *i* at time *t*, $R_{mt} - R_{ft}$ is the excess market return, $R_{SMB,t}$ is the realized return on the size-factor portfolio, $R_{HML,t}$ is the return on the book-to-market factor portfolio and R_{UMDt} is the return on the momentum factor portfolio.

Many researchers have proven that momentum does not exist in the Japanese share market. Asness (2011) analyzed data from 1981 to 2010, and obtained a Sharpe ratio of 0.03, almost zero, which suggests that momentum does not exist in Japan. Bretschger and Lechthaler (2012) study monthly data for the time period 1984 to 2009, and find that the Carhart model performs reasonably well, and performs even better when the period is split into two periods around 1998. Fama and French (2012) test whether asset pricing models capture value and momentum patterns, by utilizing data for 23 countries for the timeframe of 1989 to 2011, with one of the countries being Japan. The results show no momentum in any of the size groups, however value premiums are evident in all size groups, with similar results for both small and large shares. It is results like this that have led many researchers to draw the conclusion that momentum does not exist in Japan.

2.4 The Fama French Five-Factor Model

Fama and French (2015a) created a five-factor model as other researchers stated that the three-factor model is an incomplete model. In particular, Novy-Marx (2013) and Titman, Wei and Xie (2004) say that it is an incomplete model because its three factors do not capture much of the variation in average returns related to profitability and investment. Based on this, Fama and French added the two factors of profitability and investment to the original

Fama French three-factor model. This new model is expressed as follows:

$$R_{it} - R_{ft} = \alpha_i + \beta_i (R_{mt} - R_{ft}) + s_i R_{SMB,t} + h_i R_{HML,t} + r_i R_{RMW,t} + c_i R_{CMAt} + e_{it} \quad (4)$$

Where $R_{it} - R_{ft}$ is the realized excess return of asset *i* at time *t*, $R_{mt} - R_{ft}$ is the excess market return, $R_{SMB,t}$ is the realized return on the size-factor portfolio, $R_{HML,t}$ is the return on the book-to-market factor portfolio, $R_{RMW,t}$ is the return on the profitability factor and R_{CMAt} is the return on the investment factor. Both the profitability factor and investment factor are calculated using data from the annual financial statements.

Since the publication of this model in financial literature, it has receiving considerable attention from researchers, with many rushing to test the robustness of the model on various share markets around the world. Kubota and Takehara (2015) apply this model to shares on the Tokyo Stock Exchange to test if it works well on the Japanese market. They employ data with a long timeframe of 1977 to 2014 in their analysis. Contrary to results for the US market, the authors find that the return dispersions created by the two new factors of investment and profitability are small. Further tests show that these two factors are not statistically significant. Therefore, they concluded that this model is not a good benchmark pricing model for the Japanese share market. Fama and French (2015b) themselves test the effectiveness of their new five-factor model on four regions of the world, with one being Japan. They employ data with a long timeframe, from 1990 to 2015. With regards to Japan, the results show a strong positive relation between average returns and the book-to-market factor, but only very weak relations to profitability and investment. This research confirmed the existence of a strong value effect in Japan, but rejected the new model, and demonstrates that both the profitability factor and investment factor are not significant factors to explain share returns in Japan.

3. Conclusion

Financial literature which tests the robustness of these four models has mixed results, with some research supporting the model, and other research concluding that the specified model is not an accurate pricing model for the Japanese share market. Based on our empirical review of literature relating to the Japanese market, it appears that the Fama French three-factor model may be the most accurate model of the four models, in its ability to explain share returns. It is possible that the timeframe selected for the data analysis affects the results of the research, and whether the research supports the model as being appropriate for the Japanese share market or not.

While research regarding the robustness of asset pricing models is mixed, there is more consistency in the results which explain the important variables in Japan. Regardless of the timeframe chosen, numerous researchers have found evidence of a strong value effect in Japan. A value effect means that shares with high book-to-market ratios tend to have higher average returns than shares with lower book-to-market ratios. Research indicates that the value effect is substantially stronger in Japan than in other countries such as America. Chan, Hamao and Lakonishok (1992) analyze the relationship between share returns and the four variables: earnings yield, size, book to market ratio and cash flow yield. They find that the book to market ratio and cash flow yield have the most significant positive impact on share returns. Research by Walid (2009a) and Walid and Ahlem (2009b), utilizes a more recent data set, and concludes that book-to-market ratio and size are significantly related to average returns. Daniel, Titman and Wei (2001) analyze data with a long timeframe, and conclude that the value premium is strong in Japan. Likewise, Fama and French (2012) find evidence of value premiums in all size groups, both small shares and large shares. Further research replicates this finding, even though a different model is utilized in the analysis. In recent research on the new five-factor model, Fama and French (2015b) document a strong positive relation between average returns and the book-to-market factor.

There is no clear answer as to which model is most appropriate for the Japanese share market, and which characteristics are important, however research on share returns suggests that the value premium is strong, in fact it is substantially stronger in Japan than in other countries. This finding is consistent, regardless of the asset pricing model being analyzed, and provides strong evidence of the existence of a value effect. The reason for the value effect being significantly stronger in Japan than other countries is unclear, however it can be assumed that for an asset pricing model to be successful on the Japanese market, it needs to include the book-to-market factor as one of the variables.

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