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The relationship between beta and equity returns: Evidence from up and down markets

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1. Background and aims of project

There is intense debate in the finance literature on the performance of beta and its relationship with equity returns. In a striking finding, Fama and French (1992) show that after controlling for size, there is no relationship between beta and returns. This landmark paper led to the development of the Fama-French three-factor model, which is an augmentation of the Capital Asset Pricing Model (CAPM) with a size and book-to-market factor. It is reasonable to contend that the Fama-French model has supplemented the CAPM as the dominant asset-pricing model in the literature. One of the reasons this has occurred is that evidence by Fama and French (1992) and others shows that there is no cross-sectional relationship between beta and returns. This is inconsistent with the central prediction of the CAPM, which is that there should be a positive relationship between beta and returns. Studies by Bhardwaj and Brooks (1993) and Pettengil, Sundaram and Mathur (1995) in the U.S. and by Faff (2001) in Australia make the case for beta and argue that the relationship between beta and returns needs to be examined separately in up and down markets. All three of these studies find that in up (down) markets, there is a positive (negative) relationship between beta and returns. Moreover, Pettengil et al. (1995) propose a theoretical argument for why this should occur.

Over the past 30 years, numerous researchers have identified patterns in the cross-section of equity returns that the CAPM has failed to explain, these patterns have been termed anomalies, as they are inconsistent with the joint hypothesis that the market is efficient and that the CAPM is correctly specified. The two most notable anomalies are associated with firm size and the ratio of

book-to-market equity. Fama and French (1992) show that after controlling for beta, there is a relationship between both size and book-to-market with returns. Similar evidence is presented in Australia by Chan and Faff (2003). An issue that has been neglected in the Australian literature is whether the nature of the size and book-to-market effects differs in up and down markets and whether they even exist once a conditioning based on market states has occurred. Further, a limitation of the prior literature that examines the relationship between beta and returns in differing market states is that it does not directly control for the size and book-to-market effects.

The major aim of this proposed project is to examine the relationship between beta and returns in both up and down markets using data drawn from the Australian equities market. Prior to doing so, I will first test whether there is a relationship between beta and returns without conditioning on market states. Additionally, I aim to examine the relationship between size and book-to-market equity with returns both on the full sample and in up and down markets. Finally, I will test whether any observed relationship between beta and returns is robust to the inclusion of size and book-to-market in the analysis.

2. Description of approach; Significance and innovation

I will rely on two methodologies: a portfolio returns analysis and a Fama-MacBeth (1973) regression analysis. With the portfolio returns analysis, stocks will be sorted into deciles based on the variable of interest and the returns of the decile-sorted portfolios will be analysed. The aim is to identify any patterns in the returns of the decile-sorted portfolios. Using beta as an example, I will first sort stocks into deciles based on beta without conditioning on the market state. I will then analyse the returns of the ten beta sorted portfolios to identify any trends. Then, I will replicate the portfolio construction for both up and down markets and repeat the returns analysis. Following standard convention, an up (down) market is one where the excess return on the market (i.e. the market return less the return on a risk-free asset) in a given month is positive (negative). The aim of the portfolio returns analysis is to provide preliminary evidence on the relationship between beta and returns on the full sample and in up and down markets. A similar analysis will be performed for both size and book-to-market.

Size and book-to-market will be measured following standard practice where size is market capitalisation and book-to-market is net tangible assets divided by market capitalisation. Beta will be estimated using the market model with a Dimson adjustment for thin trading on the past 36

months of returns for firms that have at least 24 valid monthly return observations. This methodology is consistent with prior Australian research by Chan and Faff (2003).

The formal statistical analysis will involve Fama-MacBeth regressions on individual stocks. For example, each month, a cross-sectional regression will be run of the firms' returns against beta. The significance of beta will be inferred from the time-series of regression parameters on beta estimated each month. Then, the months will be segregated based on whether they are up or down months. The significance of the parameter estimates on beta will again be analysed, but in this case, they will be analysed separately for up and down months. A similar analysis will be performed for size and book-to-market, and finally, a multiple variable model that includes beta, size and book-to-market will be estimated to examine whether any relationship observed between beta and returns is robust to the size and book-to-market effects.

The Fama-MacBeth methodology I will employ is similar to the method used by Fama and French (1992) in the U.S. and Chan and Faff (2003) in Australia. The major point of differentiation is that in addition to analysing the full sample, I will also examine up and down months separately. To the best of my knowledge, I will be the first to do so and thus, I propose a novel contribution to the literature on examining beta in different market states. Prior literature (for example Bhardwaj and Brooks (1993), Pettengil et al. (1995) and Faff (2001)) examines a dual-beta CAPM and uses a dummy variable to differentiate up and down markets. Regressions of this nature are time series regressions that are performed on portfolios of stocks, in Faff's (2001) case, he examined portfolios formed using industry classifications. The advantage of this approach, in comparison to mine, is that it is a formal test of a dual-beta CAPM. In contrast, my approach is more so a test of the relationship between beta and returns in differing market states. From a practical investment perspective, my approach is much more relevant, as I will provide genuine evidence on the nature of the relationship between beta and returns in differing market states. Moreover, I can also examine whether the relationship between beta and returns in different market states is robust to the size and book-to-market effects. I can do this by directly introducing size and book-to-market into the regressions.

In summary, I propose a method that is a novel contribution to the literature on the relationship between beta and returns in different market states. The method I propose will lead to clear recommendations to investment professionals based on the historic relationship between beta and returns in different market states. Finally, I will directly control for the size and book-to-market

effects in my analysis, which to my knowledge, has not been done before with this type of analysis.

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