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Identifying portfolio-based systematic risk factors in equity markets☆

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ABSTRACT

Four prominent new asset pricing factors have recently been proposed. We test whether these factors fulfill the necessary conditions to qualify as risk factors. We show that the investment and betting-against-beta factors fulfill these conditions. However, the profitability and quality factors do not fulfill these conditions pointing towards non-risk-based explanations.

1. Introduction

The academic literature devotes considerable attention to exploring risk factors that may link stock returns to systematic risk. In their seminal paper, Fama and French (1993) proposed a three-factor asset pricing model accounting for the size and value factor in addition to the market factor. The authors showed that the three-factor model provides a better description of stock returns than the traditional Capital Asset Pricing Model (CAPM). In the wake of Fama and French's (1993) research, and motivated by multifactor asset pricing model theory, several other portfolio-based risk factors have been proposed in the academic literature. From a theoretical point of view, a risk factor should capture systematic risk and should be ideally linked to consumption risk, as pointed out in Cochrane (2001, p. 41).

In line with Cochrane's (2001) stochastic discount factor framework, Charoenrook and Conrad (2008) propose an interesting addition to the debate on the risk–return relationship in asset markets. The authors set out the necessary conditions for a portfolio-based zero-cost portfolio to be a candidate risk factor. First, a priced factor's conditional variance should be related to the factor's conditional mean, whereas a positive relation between the conditional mean and variance signals a positive

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risk premium for the factor. Second, a conditional factor's mean should be explained by its conditional variance. Charoenrook and Conrad (2008) employ their proposed approach to test whether the size, book-to-market, momentum and liquidity factor qualify as risk factors, in the sense that they satisfy the necessary conditions. They find that the necessary conditions are fulfilled for the size, liquidity and book-to-market factors over the period 1963–2003. As an alternative to Charoenrook and Conrad's (2008) procedure, Pukthuanthong and Roll (2014) extend Moskowitz's (2003) research by proposing a protocol for determining which factor candidates are related to risks and which candidates are related to mean returns. Their procedure is very different from Charoenrook and Conrad (2008) and requires accounting for considerable data restrictions. Their results indicate that only the risk premium associated with momentum appears to be statistically significant.

More recently, other prominent factors have been discussed. Among those, four interesting factors are Franzzini and Pedersen's (2014) betting-against-beta zero-cost strategy (BAB), Asness et al. (2014) quality factor (QMJ), and Fama and French's (2015) investment and profitability factors (CMA and RMW). While some papers provide alternative explanations for those factors, it may be surprising that no study has yet explored whether these factors actually satisfy the condition necessary for characterizing those as risk factors in line with asset pricing theory. This paper addresses this gap in the literature.[1]

The purpose of this study is to test whether a positive conditional risk–return relationship exists for the BAB, QMJ, CMA, or RMW factors. We use a sample period from July 1963 to August 2015 and employ GARCH-in-mean models in the spirit of Charoenrook and Conrad (2008) to estimate and test whether the necessary conditions are fulfilled for those potential candidates. We also perform a further robustness check in the form of a sample-split test and examine orthogonalized factors.

The current research contributes to the existing literature as follows. This is the first study to formally test whether prominent zero-cost strategies recently proposed in the literature, which are featured as risk factors because they may be associated with some systematic risk, fulfill the necessary conditions derived from asset pricing theory in the spirit of Charoenrook and Conrad (2008) and Cochrane (2001). The study extends that of Charoenrook and Conrad (2008) and tests whether the conditional variances of the BAB, QMJ, CMA, and RMW factors are related to the corresponding factor's conditional mean. Finally, we argue that a rejection of the necessary conditions would point toward a non-risk-based explanation.

Our results indicate that the BAB and the CMA factors incorporate a positive relation between conditional mean and conditional variance, whereas the intercept is statistically not different from zero, implying that the conditional risk fully explains its conditional mean. These results are in line with Charoenrook and Conrad's (2008) findings for the size, liquidity, and the book-to-market factor, and suggest that the necessary conditions for those factors are fulfilled. Surprisingly, we do not find such evidence for the QMJ or the RMW factors suggesting that future research may be needed to investigate whether non-risk-based arguments could explain those phenomena.

Our paper is organized as follows. The next section presents the data. The third section provides a brief overview of the theoretical background. The fourth section presents the results, whereas the last section concludes.

2. Data

Data were downloaded from Kenneth French's and AQR's data libraries.[2] We examined four factors. For each one of these prominent factors the prior literature presents some theoretical explanations. First, Franzzini and Pedersen (2014) show that funding constrains flattens the original capital-allocation-line. The underlying reason is that funding constrained investors tend to overweight high beta assets. Adrian et al. (2014) connect the leverage of financial intermediary with the return of assets. Moreover, the leverage of financial intermediaries is related to the funding constrains driving the betting-against-beta factor. Franzzin and Pedersen (2014) suggest that funding constrains can be accounted for in the asset pricing model by adding their BAB factor. Second, Asness et al. (2014) propose a QMJ factor. Thereby, quality is, motivated by the Gordon growth formula, measured by evaluating four characteristics: profitability, payout, safety and growth. Third, valuation theory states that firm value is a function of investments and the profitability of those investments. According to Fama and French (2006), firms invest more when the return on investments is high in comparison to the cost of capital. As a consequence, after controlling for firms' investments, profitability should be positively related to expected returns. Further, after controlling for firms' profitability, investments should be negatively related to expected returns. Fama and French (2015) use these arguments for establishing a new asset-pricing model incorporating CMA and RMW, which they derived via a valuation model.

Table 1 reports the descriptive statistics and correlation matrix for the four proposed factors. The BAB factor has the highest unconditional mean with an economic magnitude of 0.90% per month. Moreover, we observe that both the BAB factor and the RMW factor have excess kurtosis and negative skewness suggesting that those factors are exposed to crash risks. The correlation matrix shows that the RMW factor and the QMJ factor have the highest correlation. Moreover, the CMA is least correlated with the other factors.

[1] In a more recent paper, Buchner and Wagner (2016) suggest an alternative explanation for the BAB factor. They derive the pricing errors that are induced by the standard CAPM's linearity assumption and argue that the BAB factor could be an artefact of the spurious OLS regression effect.

[2] AQR data library: https://www.aqr.com/library/data-sets. Kenneth French data library: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html.