Asset Pricing Models Utilizing the Equi-Correlation Structure of Multivariate Volatility Models

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Abstract

This study evaluates the performance of traditional asset pricing models in the Japanese stock market and then examines the effectiveness of new factors designed to capture correlation structures. We augment the Capital Asset Pricing Model as well as the Fama–French three-factor, Carhart four factor, and Fama–French five-factor models with two types of correlation-based factors. The first is the Industry Equi-Correlation (IEC) index, which captures the average inter-industry correlation, following Wang et al. (2020). The second is a factor derived from principal component analysis (PCA) and applied to intra-IEC (IIEC) indices, which are constructed for 33 Tokyo Stock Exchange industries using the Block DECO framework of Engle and Kelly (2012). Using 100 size-and-characteristic sorted portfolios as test assets, we evaluate 16 distinct models with Fama–MacBeth regressions, the Hansen–Jagannathan distance, and the Gibbons–Ross–Shanken test. Our results confirm that the explanatory power of traditional Fama–French factors is limited in the context of the Japanese market, whereas the IEC and PCA factors exhibit low correlations with existing factors, suggesting that they capture distinct risk sources. Most significantly, incorporating these correlation factors, particularly the principal component factor derived from IIEC, is found to consistently and substantially improve model performance across all evaluation metrics. Models that include the PCA factor demonstrate the best overall performance in our comprehensive model rankings. These results strongly suggest that inter- and intra-industry correlation structures are priced risk factors that are essential for explaining the cross-section of Japanese equity returns.