Portfolio optimization under asset pricing anomalies

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Abstract

Fama and French (1993) find that the SMB and the HML factors explain much of the cross-section stock returns that are unexplained by the CAPM, whereas Daniel and Titman (1997) show that it is the characteristics of the stocks that are responsible rather than the factors. But both arguments are largely based only on expected return comparisons, and little is known about how important each of the two explanations matters to an investor's investment decisions in general and portfolio optimization in particular. In this paper, we show that a mean-variance maximizing investor who exploits the asset pricing anomaly of the CAPM can achieve substantial economic gain than simply holding the market index. Indeed, using monthly Japanese data on the first 50 largest stocks over the period 1980–1997, we find the optimized portfolio constructed from characteristics-based model is the best performing one and has monthly returns more than 0.81 percent (10.16 percent annualized) over the Nikkei 225 index with no greater risk.
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1. Introduction

There is a growing literature on the major asset pricing anomaly that the realized cross-section stock returns are not consistent with the predictions of the basic capital asset pricing

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model (CAPM) of Sharpe (1964) and Lintner (1965). Among the competing explanations, Fama and French (1993) find that the anomaly is largely driven by the SMB and the HML portfolios (two zero net investments in which the first is long in small firms and short large ones and the second is long in high book-to-market firms and short low book-to-market ones), whereas Daniel and Titman (1997) show that it is the characteristics of the stocks that are responsible. But both arguments are largely based on expected return comparisons, and little is known about how important each of the two explanations matters to an investor's investment decisions in general and portfolio optimization in particular. Intuitively, if an investor can do much better in terms of profit making by incorporating the true nature of the anomaly into his investment decision, an economic value for the anomaly will be apparent. In other words, if the SMB and the HML portfolios were the true driving sources for the anomaly, it is likely that the investor can do better in his investment by using the SMB and the HML portfolios than by using the characteristics of the stocks. On the other hand, if all the claimed features of an anomaly matter little in both the investor's portfolio decision and the associated results, one may take a somewhat extreme view of Black (1993) that ''most of the so-called anomalies that have plagued the literature on investments seems likely to be the result of data-mining.'' Hence, a study on how an investor may utilize an anomaly not only provides insights on the economic significance of the anomaly, but also help to identify competing explanations for the anomaly.

In this paper, we show how a mean-variance maximizing investor can exploit the asset pricing anomaly of the CAPM to achieve substantial economic gain than simply holding the market index. While many well-known asset pricing anomalies[1] may be analyzed in an analogous utility maximizing framework, we choose to study the CAPM anomaly due to its close relation with all the basic asset pricing models and its wide applications in both investments and corporate capital budgeting decisions. The assumption of a mean-variance investor is to simplify the analysis, and the case of a more general utility function may be solved numerically from the first order conditions as reviewed by Duffie (1988). In assessing the economic importance of the anomaly, we analyze two scenarios. The first is where the investor makes his investment decision based on the CAPM. Following Markowitz (1952), Sharpe (1964) and Lintner (1965), it is well-known that the investor should hold a portfolio of a riskless investment and the market portfolio. In the second scenario, the investor exploits the anomaly by making a dynamic portfolio choice decision based on the time-varying investment opportunity set. More specifically, each of the earlier explanations for the anomaly provides a unique way for the investor at each time t to forecast the means and variances of the security returns, and the forecasts are then used to form his optimal portfolio at time t. All mean-variance maximizing investors who exploit the asset pricing anomaly will hold only portfolios of a riskless investment, and the weight on the optimized portfolio depends on their degrees of risk aversion. Hence, it will suffice to show that the optimized portfolio outperforms the market index substantially in order to prove that the anomaly makes a significant economic difference in investors' investments.

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[1] Such as the size anomaly of Banz (1981) where small firms earn abnormal returns and the momentum anomaly of Jegadeesh and Titman (1993) where individual security returns are found to have significant momentum.