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Traditional beta, downside risk beta and market risk premiums

Guy Kaplanski*

SFK Finance and Projects, HaArbaa st., 21, Tel Aviv, Israel

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Abstract

The article develops a downside risk asset-pricing model, which is based on Conditional-VaR (Mean-shortfall) risk measure. As in the traditional model the model leads to a monetary separation and yields a CVaR beta analogous to the traditional beta. An empirical study indicates that CVaR beta, which considers also downside risk, has greater explanatory power than the traditional beta. This is especially true in the case of a bearish market. Moreover, a combined model, which uses both betas, outperforms both the traditional and the CVaR models.

The results indicate that in a bullish economy, risk premiums may be partially explained by the traditional beta. However, in a depressed economy investors are most likely more concerned about downside risk, which is poorly captured by the traditional beta. This downside risk can best be captured by CVaR beta, which is based on historical data and avoids assuming any prior distribution.
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1. Introduction

Ever since Sharpe and Lintner presented the Capital Asset Pricing Model (CAPM), the model has been extensively investigated both theoretically and empirically, although

* Tel.: +972 2 5333947; fax: +972 3 6852543.
E-mail address: guyk@sfk.co.il.

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without having reached any irrefutable conclusions. The evidential anomalies that refute the CAPM cannot be denied.[1] However, they are themselves a puzzle that has only been partially solved.

Fama and French (1996, p. 1956) correctly claim that "*It is, of course, possible that the apparent empirical failures of the CAPM are due to bad proxies for the market portfolio. In other words, the true market is mean-variance efficient, but the proxies used in empirical tests are not*". Thus, the empirical failures of the CAPM may be due to poor proxies of the market portfolio, which are not mean-risk efficient. Therefore, if the standard deviation is not the appropriate risk measure, then there is no reason to expect that a mean-standard deviation efficient portfolio will represent an overall portfolio selected by risk-averse investors. Furthermore, failure to employ the appropriate risk measure may increase the impact of factors such as the size of the firm or the book-to-market ratio, which may be partially correlated with the appropriate risk measure.

Despite the well-known limitations of the standard deviation as a risk measure in the case of non-normal distributions,[2] relatively little effort has been made to replace the standard deviation and its variations by a better risk measure that might resolve the CAPM dispute.[3] In this paper, it is assumed that a "correct" measure of risk, under realistic assumptions about the nature of the distribution, may yield a better risk-expected return relationship. The paper does not attempt to explain the model anomalies, but instead provides an alternative explanation for the poor performance of the traditional CAPM by suggesting alternative risk factors, which may better explain the equilibrium risk-return tradeoff. This approach is strongly supported by empirical findings. For example, Zhou (1993) claims that under the assumption of elliptical distributions "*. . . empirical studies that ignore the non-normality are likely to over-reject the theory being tested*". Fong (1997) finds that the Generalized Student-*t* distribution which "*provides a significantly better fit to the data than the normal distribution or the symmetric Student-t distribution . . . outperforms OLS and Student-t betas in forecasting ability*". Similarly, Harvey and Siddique (2000) strengthen Kraus and Litzenberger's (1976) findings that the incorporation of skewness adds significant explanatory power to the cross-sectional variation of expected returns.

The paper develops and tests an equilibrium pricing model based on the Conditional-VaR (CVaR) non-linear risk measure.[4] This risk measure offers two major advantages over

[1] For recent studies and a survey of known anomalies, see Kathori, Shanken, and Sloan (1995), Kim (1997), Campbell (2000) and others.

[2] For reviews and analysis of these limitations, see, for example, Markowitz (1959) and Mao (1970a, 1970b).

[3] Among these works are Elton and Gruber's (1974) Coefficient of Variation asset pricing model, Bawa, Elton, and Gruber's (1979) model for Paretian distributions, Hogan and Warren's (1974) Semi-Variance model, Bawa and Lindenberg's (1977) comprehensive Lower Partial Moment (LPM) CAPM and Shalit and Yitzhaki's (1984) Mean-Gini asset pricing model.

[4] One might mistakenly consider the CVaR pricing model to be an application of Bawa and Lindenberg's (1977) LPM CAPM. However, in spite of the similarity there is a fundamental difference in the basic assumptions of the two models. According to the LPM model investors recognize all the results below a certain reference point as a source of risk. In contrast, in the case of CVaR the risk is measured only in terms of the loss below a certain confidence interval. Hence, CVAR weights all large losses with high confidence intervals but ignores losses with sufficiently small confidence intervals. In other words, the CVaR model assume that investors assess risk in a completely different process than that assumed by the LPM model, whereby the attitude toward risk is determined not only by the size of the loss but also by the probability of this loss to occur.

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