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The betting against beta anomaly: Fact or fiction?

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ABSTRACT

This paper suggests an alternative explanation for the recently documented betting against beta anomaly. Given that the equity of a levered firm is equivalent to a call option on firm assets and option returns are non-linearly related to underlying stock returns, linear CAPM-type regressions are generally misspecified. We derive theoretical expressions for the pricing error and analyze its magnitude using numerical examples. Consistent with the empirical findings of Frazzini and Pedersen (2014), our pricing errors are negative, increase with leverage, and become economically significant for higher levels of firm leverage.

The negative abnormal return of portfolios comprised of high-beta stocks, first documented by Black et al. (1972) in the context of the Capital Asset Pricing Model (CAPM), is a widely documented asset pricing anomaly.[2] In a seminal recent paper, Frazzini and Pedersen (2014) coin this observation as the betting against beta anomaly. The authors explain the phenomenon based on debt constraints. According to their model, investors who are constrained with respect to their amount of leverage available, chase returns by overweighting high-beta securities in their portfolios. This behavior of tilting portfolios toward high-beta assets, suggests that high-beta risky assets require lower risk-adjusted

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[2] Subsequent papers that study this anomaly include, among others, Blume and Friend (1973), Fama and Macbeth (1973), Fama and French (1992), 1993), and Baker et al. (2011).

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returns than predicted by the CAPM. Consequently, a portfolio that is long low-beta stocks (which involve low levels of leverage) and short high-beta stocks (which involve high levels of leverage) will generate a positive abnormal return. In their empirical analysis, Frazzini and Pedersen (2014) demonstrate that the predictions of their model hold in both the U.S. and international stock markets. While their evidence is unquestionably compelling, the question arises whether there are alternative plausible explanations for the persistent betting against beta phenomenon. Also, it is important to examine whether the proposed investment strategy in fact yields positive risk-adjusted abnormal returns. Alternatively, its promising performance results may have to be considered as spurious due to possible model misspecification.

In this paper, we suggest a possible alternative explanation for the betting against beta phenomenon. We propose that the betting against beta phenomenon is due to pricing errors, which arise given that the CAPM does not take non-linearities in stock returns into account. Our rationale is as follows. As highlighted by the classic Black–Scholes–Merton model of corporate debt and equity valuation, the equity of a levered firm is equivalent to a call option written on the underlying value of the firm's assets. As is known, option returns are highly skewed and non-linearly related to the returns of the underlying. Therefore, linear CAPM-type regressions of equity returns may suffer from model misspecification.[3] Using the Black–Scholes–Merton model, we derive expressions for the model pricing error under the standard CAPM and analyze its magnitude using numerical examples. Our analysis highlights that the pricing error is negative and becomes economically large as firm leverage increases. That is, consistent with the empirical findings of Frazzini and Pedersen (2014), our theoretical analysis predicts that a portfolio that is long low-beta stocks and short high-beta stocks generates a positive CAPM alpha. However, since the equity is correctly priced under our Black–Scholes–Merton framework, the observed positive alpha is due to the pricing error that is induced by the inadequate linearity assumption of the CAPM. This result questions whether the betting against beta phenomenon is indeed an asset pricing anomaly or whether it is due to the fact that the standard CAPM is an inappropriate setting for analyzing the equity returns of highly levered firms. As the analysis presented in this paper is purely theoretical, our aim here is not to assert that the documented betting against beta phenomenon can fully be attributed to the pricing error that we point out. Such detailed empirical tests are beyond the scope of the present paper. Nonetheless, our findings highlight that care must be taken when we interpret the negative alphas of high-beta stocks as an asset pricing anomaly.[4]

The remainder of this paper is organized as follows. Section 1 outlines the basic model of corporate claims valuation and includes aggregate stock market dynamics. Section 2 derives analytical expressions for the CAPM-induced pricing error and analyzes its magnitude using numerical examples. Section 3 concludes.

1. The Basic Model

In order to provide the background and notation for our argumentation, we first outline the classic Black–Scholes–Merton model of corporate debt and equity valuation. Assume that the market value of a firm's assets, A_t, is risky and follows a geometric Brownian motion given by

$$dA_t = \mu_A A_t dt + \sigma_A A_t dB_{A,t}, \tag{1.1}$$

where $dB_{A,\,t}$ is a standard Brownian motion, and μ_A and $\sigma_A > 0$ are the constant expected growth rate and the constant volatility of the growth rate of the assets, respectively. Further assume a capital structure of the firm that consists of equity and debt, where debt is in the form of a single, face value L, zero-coupon bond maturing at time T. We suppose, for simplicity, that there are no distributions (such as dividends) to debt or equity before maturity time T. In the event that the total value of the assets A_T of the firm at maturity T is less than the contractual payment L due, the firm defaults

[3] These shortcomings of the standard CAPM have been understood for a long time; see for example Grinblatt and Titman (1989), Glosten and Jagannathan (1994), Leland (1999), Goetzmann et al. (2007), and Broadie et al. (2009). However, the model's use is still pervasive both in the industry and in academia.

[4] Note that while this paper focuses on the CAPM, the results equally question the common practice of computing alphas based on multi-factor model specifications.