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Investment Horizon Dependent CAPM: Adjusting beta for long-term dependence

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Financial basics and intuition stresses the importance of investment horizon for risk management and asset allocation. However, the beta parameter of the Capital Asset Pricing Model (CAPM) is invariant to the holding period. Such contradiction is due to the assumption of long-term independence of financial returns; an assumption that has been proven erroneous. Following concerns regarding the impact of the long-term dependence assumption on risk (Holton, 1992), this paper quantifies and fixes the CAPM's bias resulting from this abiding –but flawed- assumption. The proposed procedure is based on Greene and Fielitz (1980) seminal work on the application of fractional Brownian motion to CAPM, and on a revised technique for estimating time-series' fractal dimension with the Hurst exponent (León and Vivas, 2010; León and Reveiz, 2011a).

Using a set of 85 stocks from the S&P100, this paper finds that relaxing the long-term independence assumption results in significantly different estimations of beta. According to three tests herein implemented with a 99% confidence level, more than 60% of the stocks exhibit significantly different beta parameters. Hence, expected returns are biased; on average, the bias is about ± 60bps for a contemporary one-year investment horizon. Thus, as emphasized by Holton (1992), risk is a two-dimensional quantity, with holding period almost as important as asset class. The procedure herein proposed is valuable since it parsimoniously achieves an investment horizon dependent CAPM.

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