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Capital asset pricing model with fuzzy returns and hypothesis testing

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Over the last four decades, several estimation issues of the beta have been discussed extensively in a large literature. An emerging consensus is that the betas are time-varying and their estimates are impacted upon the return interval and the length of the estimation period. These findings lead to the prominence of the practical implementation of the Capital Asset Pricing Model. Our goal in this paper is two-fold: After studying the impact of the return interval on the beta estimates, we analyze the sample size effects on the preceding estimation. Working in the framework of fuzzy set theory, we first associate the returns based on closing prices with the intraperiod volatility for the representation by the means of a fuzzy random variable in order to incorporate the effect of the interval period over which the returns are measured in the analysis. Next, we use these fuzzy returns to estimate the beta via fuzzy least square method in order to deal efficiently with outliers in returns, often caused by structural breaks and regime switches in the asset prices. A bootstrap test and an asymptotic test are carried out to determine whether there is a linear relationship between the market portfolio fuzzy return and the given asset fuzzy return. Finally, the empirical results on French stocks reveal that our beta estimates seem to be more stable than the ordinary least square (OLS) estimates when the return intervals and the sample size change.