The Beta Estimation Based on the Kalman Filter

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Abstract

Regarding the single factor model in finance, this paper presents β estimation based on the Kalman filter and smoothness priors. After this new approach is explained, I apply the method to the Japanese stock markets (TOPIX and 22 stock prices in the 1st section of the Tokyo Stock Exchange). In this paper I propose a new statistical approach which modifies the Capital Asset Pricing Model in finance. The CAPM is a single period model and the β of the CAPM is invariant in the model, nevertheless earlier studies show the βs of real stock markets are time varying. For this reason a new approach is necessary. In this paper I assume that β changes gradually over time (my assumption is well known as smoothness priors of Bayesian procedure), and under this assumption β is estimated based on the Kalman filter. Using my approach, the time varying βs of real stock markets can be estimated. Applying my method to the Japanese stock markets shows that the fluctuations of βs of Japanese enterprises can be measured. According to my results, I conclude the fluctuations of βs are consistent with the moves of enterprise risks. Additionally I emphasize this "the Kalman filter based" approach is a simple algorithm rather than non-Gaussian and non-linear filtering algorithms proposed in many studies. The simpleness of the Kalman filter presents practical advantages, however the Kalman filter also holds restrictive assumption.

Key words : Kalman filter, single factor modeling, markets risks.

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