

Estimating covariance matrix with high frequency data for Currency Portfolio Optimization

Rancy Chepchirchir

Abstract

The covariation between asset returns plays a crucial role in modern finance both in portfolio optimization and risk management. The paper is an effort towards estimating a covariance matrix using high-dimensional, high-frequency data (quadratic covariation) from the perspective of portfolio selection. An investors' or a portfolio managers' objective is to solve the portfolio optimization problem i.e. ensure risk is minimized for any given return through huse of covariance matrices and subsequent rebalancing. Besides significant increase in the sample size for estimation of the covariance matrix, use of HFD also enables for better adaptation to the local volatilities and local correlations among a vast number of assets thus an improved estimation of portfolio variance. One-minute forex data were used across the six major world currencies; i.e. EUR/USD, EUR/JPY, EUR/CHF, EUR/GBP, EUR/AUD and EUR/CAD for the period 03/01/2016 17:00 to 26/12/2016 01:38 with a robust check using out-of- sample 30-minute EUR/USD data as from 08/12/2016 01:00 to 07/02/2017 11:30. The paper employ sa quasi- maximum likelihood estimator that is rate efficient as well as consistent on the basis of time synchronization approach and compares volatility estimates to that from traditional models in which returns follow the geometric Brownian Motion. Covariance matrix estimates based on intraday returns and daily returns are constructed and evaluated. The results tend to be in favor of the high-frequency data. However, these results could be biased towards an investor or portfolio manager with a shorter rebalancing interval.