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Portfolio analysis of intraday covariance matrix in the Greek equity market

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ABSTRACT

The intraday nonparametric estimation of the variance–covariance matrix adds to the literature in portfolio analysis of the Greek equity market. This paper examines the economic value of various realized volatility and covariance estimators under the strategy of volatility timing. I use three types of portfolios: Global Minimum Variance, Capital Market Line and Capital Market Line with only positive weights. The estimators of volatilities and covariances use 5-min high-frequency intraday data. The dataset concerns the FTSE/ATHEX Large Cap index, FTSE/ATHEX Mid Cap index, and the FTSE/ATHEX Small Cap index of the Greek equity market (Athens Stock Exchange). As far as I know, this is the first work of its kind for the Greek equity market. Results concern not only the comparison of various estimators but also the comparison of different types of portfolios, in the strategy of volatility timing. The economic value of the contemporary non-parametric realized volatility estimators is more significant than this when the covariance is estimated by the daily squared returns. Moreover, the economic value (in b.p.s) of each estimator changes with the volatility timing.

1. Introduction

The accurate volatility forecasts are very important both theoretically and empirically in portfolio analysis. The main objective of this paper is the evaluation of volatility and covariance forecasts with economic criteria in a portfolio framework. In specific, it is examined whether it is better estimating

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volatility and covariance estimators with intraday or daily data. Volatility has recently been analyzed by Evans and Speight (2010), Haniff and Pok (2010), and Kitamura (2010). In broad terms, they analyze specific characteristics of volatility in an intraday frequency. These characteristics include interdependence, spillovers, periodicities and announcement effects. It is also examined which of the estimators is better in the volatility timing strategy. The present paper is based on the methodology of the volatility timing strategy introduced by Fleming et al. (2003) – FKO (2003) hereafter. Another relative and more recent paper is Kyj et al. (2009). However, the present paper is the first using so many realized volatility estimators in volatility-timing strategy. It is also among the few papers examining the significance of the Greek equity market to a portfolio manager.

Data concern three major indices of the Greek equity market (Athens Stock Exchange; *ASE*): FTSE/ATHEX 20 index, FTSE/ATHEX Mid Cap index, and FTSE/ATHEX Small Cap index. Kyrtsou and Terraza (2000), Niarchos and Alexakis (2003) and Panas (2005) study the properties of either the intraday data or the volatility in the *ASE*. Volatility in the Greek equity market have also been recently examined by Diamandis et al. (2007) and Kenourgios and Samitas (2008).

The results are supportive of using the realized volatility estimators instead of daily squared returns as well as the significance of the economic value of the volatility timing strategy. An investor is willing to pay annually up to 1014 basis points in order to profit from the estimators of the variance and covariance matrix that use intraday data. The economic value is further improved when the high-frequency intraday sampling frequency is the optimal one. The bias correction for the microstructure noise of the intraday data improves results as well. The use of intraday data in forecasting the variance–covariance matrix across the three major *ASE* indices reveals significant economic gains.

The plan of the rest of the paper is as follows. Section 2 presents the methodology concerning the volatility estimators, the types of portfolios and the economic evaluation criteria of both the volatility forecasts and the volatility timing strategy. Section 3 describes the data used in this paper. Section 4 discusses the results and Section 5 gives the concluding remarks with some plausible extensions of the present analysis.

2. Methodology

2.1. In general

The first step in the analysis is the estimation of the variance–covariance matrix of the portfolio with various estimators. The estimators used, apart from the squared daily returns (symbolized as *D*) (as a benchmark), are: (i) the unrestricted realized volatility estimator (*UR*), (ii) the unrestricted realized volatility estimator with the optimal sampling frequency (*UR-Opt*), (iii) the bias-corrected realized volatility estimator (*BCR*) and (iv) its respective estimator with the optimal sampling frequency (*BCR-Opt*). From all the above estimators, Bandi and Russell – BR, hereafter– (2005, 2008) use only the *UR* and *UR-Opt* estimators in their analysis. The correction of the bias coming from the microstructure noise of the intraday data follows the methodology of FKO (2003), which also use the squared daily returns as a benchmark.

The second step is the choice of the portfolio type, under which the volatility timing strategy will be used and evaluated. In present analysis, there are three portfolio types: Global Minimum Variance (*GMV*), Capital Market Line (*CML*) and Capital Market Line with restriction of positive only weights (i.e. long positions) (*CML-Long*). The third step concerns the criteria for the evaluation of both the portfolio performance and the volatility timing strategy. The criteria used are: (i) the portfolio statistics, i.e. mean return, standard deviation, Sharpe ratio and cumulative return (μ, σ, *SR* and *CR* respectively); (ii) the basis points (i.e. *b.p.* – $E(\gamma)$) that an investor is willing to pay annually in order to benefit from the variance–covariance matrix estimators using the intraday data instead of the squared daily returns – $E(\gamma)$ denotes one of the above estimators where the degree of risk-aversion equals γ. In order to produce empirical results, there is a number of portfolio parameters that needs to be given values: (i) the risk-free asset return (R_f) equals to 5%[1]; (ii) the annual target return of the portfolios (*TR*) equals

[1] Trying a value of 2.5% does not significantly change results.