

DESCRIPTION FOR THE GENERAL PUBLIC

Volatility plays a key role in many financial and macroeconomic issues. Volatility models of financial instruments that are commonly used in practice are largely based solely on closing prices. However the application of information about low and high prices may lead to much more accurate estimates of volatility. The outcomes of empirical and simulation studies show that the variance estimators constructed based on open, low, high, and closing prices are from more than five up to even more than seven times more efficient than estimators constructed exclusively on closing prices. Despite the good statistical properties, these estimators have not found their widespread use in empirical studies, due to the fact of the omission of the time dependence of variance. In recent years, however, numerous dynamic univariate models have been constructed based on the price range, which is the difference between high and low prices. The scaled price range is a significantly more efficient estimator of daily variance than the absolute or squared returns. The use of low and high prices generally leads to more accurate estimates and forecasts of volatility. For most financial assets additional information on low and high prices is equally available as in the case of the closing price. Consequently, the problems pertinent to the obtainment and processing of intraday data do not occur here.

In financial applications, however, the use of univariate models rarely turns to be sufficient. Investment portfolios consist of many assets whose returns are often related (in the mean or variance) and additionally have time-varying conditional variances. The analysis of multivariate processes is therefore necessary for the construction and valuation of portfolios of financial instruments and the management of its risk. In spite of the existence of the overwhelming evidence that the use of low and high prices yields more accurate estimates of volatility, there are few studies, in which those prices are applied to the construction of multivariate models. Therefore, the major objectives of the project are the following: (1) The evaluation of forecasts' accuracy of the variance and covariance of returns constructed based on multivariate volatility models with the use of low and high prices for selected processes from the Polish and international financial markets; (2) The analysis of the usefulness of multivariate volatility models using low and high prices for the portfolio of assets.

The project can be divided into two major research areas:

- 1) modelling and forecasting the covariance matrix of returns,
- 2) applications of portfolios of assets.

Re 1. The evaluation of the usefulness of volatility models based on low and high prices for modelling financial processes will be made. On the one hand, the ability of the considered models to describe the characteristics of financial time series will be assessed. On the other hand, the properties of the covariances and variances of returns estimated based on these models will be examined. The next step in the research will be the comparative analysis of forecasts of the covariance matrix of returns for the competing models. Extensive research on selected processes of the Polish and international financial markets are also scheduled in the project.

Re 2. It is planned to analyse the advantages resulting from the usage of low and high prices from the point of view of statistical properties of the applied models and investment efficiency. Studies conducted within the project will aim to answer the question whether the inclusion in the construction of a portfolio of the time-varying variances and covariances of returns by applying the multivariate volatility models based on low and high prices increases the efficiency of assets allocation.