BigData Finance

Deliverable D3.3

MSCA-ITN Training for Big Data in Financial Research and Risk Management "BigDataFinance"

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This is Deliverable D3.3 of the Work Package 3 (WP3) in "Training for Big Data in Financial Research and Risk Management" (BigDataFinance) Innovative Training Network Marie Sklodowska-Curie project 2015-2019.

Name of the deliverable: "A report on the analysis of the structure and dynamics of volatility in financial markets"

Description

The main objective of this deliverable is to investigate the underlying dynamics of volatility in financial markets. In this report, Giorgio Mirone specifically analyses the relationship between the volatility of a futures and that of its underlying asset. As it is well known that, according to the fundamental theory of asset prices, under the assumption of no arbitrage, the log-price process of a stock S_t must follow a semimartingale process ($S \in \mathcal{SM}$) on a filtered probability space $\left(\Omega, \mathcal{F}, (\mathcal{F}_t)_{t\geq 0}, \mathbb{P}\right)$. Mirone works in this classical framework and shows that, under suitable assumptions on the interest rates dynamics, the volatility of the log-price of an asset should equal the volatility of the log-price of a futures contract written on the asset itself. He subsequently discusses how relaxing the initial assumptions might cause deviations from the shown equality and to which extent these deviations will be negligible. Empirically, however, when working with high-frequency data the presence of *microstructure noise* (an ensamble of market microstructure "frictions" as, e.g., bid-ask spreads, misrecorded transactions, outliers and price discreteness) will lead to error in the measurement of the two volatilities. As the noise can seriously disrupt volatility measurement, the creation of noise-robust volatility measures (also known as realized measures, RM) has been a very active field in recent years. Exploiting the aforementioned findings between spot and futures volatility, Mirone contributes in a number of ways to this area of research. The two articles presented in this report lay out the theoretical details on the volatility dynamics of stock and futures and methods that Giorgio developed during his time as ESR.

Project title: Identifying the structure of volatility using high-frequency and news data

Date, place: June 21st, 2018, Aarhus, Denmark

Name, position: Giorgio Mirone, Marie Sklodowska Curie Fellow, Aarhus University & Center for Research in Econometric Analysis of Time Series, CREATES

Title: Inference from the futures: Ranking the noise cancelling accuracy of realized measures
CREATES Working Paper Series
Author: Giorgio Mirone

Abstract: We consider the log-linear relationship between futures contracts and their underlying assets and show that in the classical Brownian semi-martingale ($\mathcal{BSM}$) framework the two series must, by no-arbitrage, have the same integrated variance. We discuss the negligibility of stochastic interest rates using empirical evidence and in simulations. We then introduce the concept of noise cancellation and propose a generally applicable methodology to assess the performance of realized measures when the variable of interest is latent, overcoming the problem posed by the lack of a true value for the integrated variance. We carry out formal testing of several realized measures in the presence of noise and conduct a thorough simulation analysis to evaluate the estimators' sensitivity to different price and noise processes, sampling frequencies and stochastic components.
Paper available at: Inference from the futures

Title: Cross-sectional noise reduction and more efficient estimation of the integrated variance
CREATES Working Paper Series
Author: Giorgio Mirone

Abstract: We propose a straightforward approach to obtain a more efficient estimate of the integrated variance of an asset through a cross-sectional combination with a futures contract written on it. Our method constructs a variance-preserving series with reduced noise size as a linear combination of the underlying asset and the futures and base measurement of the integrated variance on this new series. We first illustrate how a theoretically but infeasible optimal series can be obtained and then suggest a feasible procedure to attain noise reduction. In a simulation study, we verify how prevalent estimators of integrated variance applied to such noise-reduced series outperform estimators applied directly to the asset price. Finally, we apply the method to an empirical data set and, through the stabilized signature plot; we show how the noise-reduced series provides consistent integrated variance estimates using naive realized measures at very high frequencies.
Paper available at: Cross-sectional noise reduction