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Testing for non-correlation between price and volatility jumps

Jean Jacod* Claudia Klüppelberg† Gernot Müller‡

Abstract

We consider a log-price process X_t, which is observed at discrete times $0, \Delta_n$, $2\Delta_n, \ldots$, and the process has a stochastic squared volatility σ_t^2. Assuming that the price process as well as the volatility process have common jumps, we suggest tests for non-correlation between log-price and squared volatility jumps, or functions of such jumps. Our tests have a prescribed asymptotic level, as the mesh Δ_n tends to 0 and the observation time T_n tends to ∞. The finite sample performance of our test is studied using simulations. We finally apply our tests to real data, and the test rejects the non-correlation hypothesis for the combination of squared log-price jumps and the moduli of the jumps of the squared volatility. This sheds new light on economically motivated statements on causality between price and volatility jumps and on econometric modeling.

MSC2010 Subject Classification: Primary 91G70, 62G10 , Secondary 62M02, 60H30

Keywords: common jumps, discrete sampling, high-frequency data, Itô semimartingale, statistical test, stochastic volatility model

1 Introduction

Models for financial data involving stochastic volatility and allowing for sample path discontinuities in the volatility as well as in the underlying asset price (stock, index, exchange rate) have become popular in recent years. Since Merton's paper [30] there is an increasing number of publications showing empirical evidence of jumps in the asset prices: from the distribution of log-returns viewpoint as in [1, 16, 19], or from a non-parametric statistical viewpoint as in [7, 12, 20] using multipower variations, or [4, 27] with other methods, see also the references in these papers. Naturally, if the asset price process has jumps, one might suppose that the volatility process also exhibits jumps, which is e.g. modeled by a continuous-time GARCH model [26]. However, as in [11], the volatility process can exhibit jumps, although price is continuous. The presence of

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