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Covariance Estimation using High-Low Prices with Implications for Futures vs Spot Volatility

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Abstract

In this study, we propose a new covariance estimator New Cov based on daily high-low prices. The estimator is unbiased relative to the usual covariance estimator Old Cov for a random walk process. However, empirical findings for two assets namely: Nifty Futures and Nifty Spot over the period 2001-2016 present a different picture. New Cov is upward biased relative to Old Cov which is not possible under a random walk model, there by suggesting level dependence in the volatility. Through simulations, we show that a Constant Elasticity of Variance model can capture this bias. We find that the level effect is stronger in Nifty futures than Nifty spot making it more volatile. The empirical findings reject random walk processes in indices. The approach can be used without using high frequency data, one can readily use OHLC prices to understand the data.

I. Introduction

VOLATILITY ESTIMATION IS an ever intriguing area in the gamut of finance literature. A plethora of research has gone into developing various volatility estimators that can estimate and forecast volatility. From using just daily closing prices, much interest has centered on using intraday price data as research advanced. One of the practical merits of using intraday opening, high, low and closing (OHLC) data is that they are easily available and the amount of time and resources required to collect the data is very less. Moreover, it ensures that all the information about the market is encompassed in these prices as compared to when we use closing prices alone.

Range based volatility estimators that make use of such OHLC prices have been extensively used and proved efficient when compared to the classical volatility estimators that were based solely on open-close prices.

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Notes

1 We also undertook simulations with $\rho_x = \rho_y = 0.2$ for $\rho_{xy} = 0.975$, 0.5 and 0.25 across 1,00,000 paths, N = 10, 20, 30, 40, 50 steps in the CEV process over K = 1 month. We obtained similar results as when $\rho_x = \rho_y = 0.4$

2 Defined as per Bloomberg Database

3 Even though Nifty Index started in 1994, Nifty Futures started in 2000 and data is available for the four prices only from 1st Jan 2001. So we have chosen a uniform data period for both the assets namely: 2001-2016.

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