**Skew–Brownian processes for estimating the volatility of crude oil Brent**

This study proposes a novel econometric model to predict the volatility of Brent crude oil prices, incorporating a unique combination of macroeconomic variables, trade data, and market sentiment indicators. Specifically, the model integrates price pressure (a proxy for inflation), freight shipment index (representing trade data), and gold volatility (as a measure of market sentiment). Two model variants are considered: one assuming Gaussian distribution, and the other incorporating skewness through a Skew–Brownian process. The proposed approach outperforms established baseline models and other existing models in the literature, particularly during periods of market turbulence.

Our analysis emphasizes three key aspects: the optimal distribution for empirical data, model selection, and the choice of explanatory variables. We demonstrate that asymmetric distributions are better suited for representing crude oil price volatility, with combinations of normal, lognormal, and skew-normal densities yielding superior results. We also explore the potential for incorporating a Skew-t distribution in future work. Additionally, our study introduces a non-causal econometric model, which surpasses traditional causal models in terms of predictive performance. This non-causal model highlights the significance of carefully selected regressors, including price pressure, freight shipment data, and gold volatility.

Ultimately, the results underscore the effectiveness of our proposed model—both in the Gaussian and Skew-normal variants—compared to standard models, especially in the context of financial market shocks and volatile periods.

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