

# Comparison of Value-at-Risk using regime-switching GARCH models for industrial metals futures

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## Executive Summary

In recent years, the industrial futures market has experienced significant unprecedented levels of risk movement. People's behavior differs from normal market conditions during periods of pandemic. However, traditional GARCH models are inadequate in addressing time-varying regime changes of time series.

This thesis aims to show Markov-switching GARCH (MSGARCH) taking account of structural breaks are more suitable volatility models to predict future Value-at-Risk (VaR), in comparison to GARCH as well as Stochastic Volatility (SV) models. MSGARCH has extra regimes to adapt to time-varying volatility dynamics, hence, it has more model flexibility to deal with abnormal phenomena during the crisis.

The dataset contains Aluminum, Copper, Nickel, Lead, Tin, and Zinc futures prices quoted on London Metal Exchange (LME). First, We investigate the basic statistic property of the log return of futures prices. Then, we implement models to fit each time series. For in-sample analysis, the Akaike information criterion (AIC) as well as their in-sample estimated conditional volatility are used for comparison, the results present MSGARCH models have a good balance between model goodness of fit and complexity. Moreover, MSGARCH is more likely to capture extreme volatility dynamics than the other two models. In order to evaluate the accuracy of forecasting VaR, the conditional coverage test is adopted. The higher p-value produced by the conditional coverage test indicates the model is more accurate in predicting future VaR.

We mainly find that MSGARCH models provide the most accurate one-day-ahead VaR forecasts

at both 1% and 5% risk levels for both long and short trading positions. In addition, Stochastic Volatility models do not yield better results in comparison to GARCH models despite much longer estimation time.

This thesis emphasizes the significance of utilizing MSGARCH capable of accommodating shifts in volatility regimes. It shows evidence that supports the effectiveness of Markov-switching GARCH models when predicting VaR for industrial futures.