

# **Gaussian and Normal Mixture Quasi Maximum Likelihood Estimators for Non-Stationary TGARCH(1, 1) Models**

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The threshold GARCH (TGARCH) models have been very useful for analyzing asymmetric volatilities arising from financial time series. Most research on TGARCH has been directed to the stationary case. This paper studies the estimation of non-stationary first order TGARCH models. Gaussian quasi-maximum likelihood estimation (G-QMLE) and normal mixture quasi-maximum likelihood estimation (NM-QMLE) for non-stationary TGARCH models are proposed. We show that the proposed estimators are consistent and asymptotically normal under mild regular conditions. The impact of relative tail heaviness of the innovations distribution and quasi-likelihood distributions on the asymptotic efficiency has been thoroughly discussed.

Keywords: QMLE; normal mixture; consistency; asymptotic normality; efficiency