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Original article

Computational tools for comparing asymmetric GARCH models via Bayes factors

Ricardo S. Ehlers *

Department of Applied Mathematics and Statistics, University of São Paulo, Brazil

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Abstract

In this paper we use Markov chain Monte Carlo (MCMC) methods in order to estimate and compare GARCH models from a Bayesian perspective. We allow for possibly heavy tailed and asymmetric distributions in the error term. We use a general method proposed in the literature to introduce skewness into a continuous unimodal and symmetric distribution. For each model we compute an approximation to the marginal likelihood, based on the MCMC output. From these approximations we compute Bayes factors and posterior model probabilities.

Keywords: GARCH; Markov chain Monte Carlo; Metropolis-Hastings; Marginal likelihood

1. Introduction

Autoregressive conditional heteroskedastic (ARCH) models of Engle [16] and its generalization, the GARCH model of Bollerslev [8] have been around for a long time now and a large amount of theoretical and empirical research has been produced in the past two decades or so. Most of the work was based on (quasi-)likelihood methods and the generalized method of moments (see for example [9]) and much less attention was paid to inference procedures from a Bayesian perspective. More recently however Bayesian computational methods based on Markov chain Monte Carlo (MCMC) have been utilized to address the complexity of these models (see for example [5,25]).

The GARCH(p,q) model estimates the volatility of a return y_t as

$$\begin{aligned} y_t &= \epsilon_t\sqrt{h_t}, \quad \epsilon_t \sim D(0,1) \\ h_t &= \omega + \sum_{i=1}^{p}\alpha_i y_{t-i}^2 + \sum_{i=1}^{q}\beta_i h_{t-i}. \end{aligned}$$

where h_t is the (unobservable) conditional variance of y_t given previous information $I_{t-1} = \{y_{t-1}, y_{t-2}, \ldots\}$, the ϵ_t are i.i.d. and $D(0, 1)$ denotes a distribution with mean zero and variance 1. Positivity and covariance stationarity constraints

* Correspondence address: Instituto de Ciências Matemáticas e Computação, USP Caixa Postal 668, 13560-970 São Carlos, SP, Brazil. Te.: +55 16 3373 8164.

E-mail address: ehlers@icmc.usp.br

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