Co-integration Rank and the Lag Order Determination in Heteroskedastic VAR Models

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In this paper we investigate the asymptotic and finite sample properties of a number of methods for estimating the co-integration rank and the lag order in integrated vector autoregressive systems driven by heteroskedastic shocks. We allow for both conditional and unconditional heteroskedasticity of a very general form. We establish the conditions required on the penalty functions such that standard information criterion-based methods, such as the Bayesian information criterion [BIC], when employed either sequentially or jointly, can be used to consistently estimate both the co-integration rank and the autoregressive lag order. We also extend the corpus of available large sample theory for the conventional sequential approach of Johansen and the associated wild bootstrap implementation thereof of Cavaliere, Rahbek and Taylor (2014) to the case where the lag order is unknown. In particular, we show that these methods remain valid under heteroskedasticity and an unknown lag length provided the lag length is first chosen by a consistent method, again such as the BIC. The relative finite sample properties of the different methods discussed are investigated in a Monte Carlo simulation study. For the simulations DGPs considered, we find that the two best performing methods are a wild bootstrap implementation of the Johansen procedure implemented with BIC selection of the lag length and an approach which uses the BIC to jointly select the lag order and the co-integration rank.

Keywords: Co-integration rank; Information criteria; Wild bootstrap; Lag length.