On the distribution of tests for cointegration rank

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Abstract: This paper analyses the likelihood test for the hypothesis of reduced cointegration rank in a Gaussian vector autoregressive model. In finite samples the rejection probability for the hypothesis may be quite different from the promised asymptotic size. This is explained by the lack of similarity properties which arise as the analysis combines canonical correlation and autoregressive methods. In both cases tests are often non-similar. It is concluded that the test for cointegration rank cannot provide particularly strong evidence for the rank. Some alternative graphical diagnostics are therefore discussed.

1. Introduction

Empirical evidence of economic equilibria may be found by cointegration analysis using the idea that a linear combination of two stochastically trending processes may be stationary. One of many tests for the number of cointegrating relations is suggested by Johansen (1988, 1995a). This test has appeal as a likelihood ratio test in a Gaussian vector autoregressive model, although only an asymptotic distribution approximation of the test is given. Simulation studies of the test show that under the hypothesis the rejection probability of the test may be quite different from the promised asymptotic size, see for example Toda (1995). An example based on an application is the following. Johansen and Juselius (1990) consider the money demand in Denmark and analyse four variables, the logarithm of real money stock and of real production and interest rates for bonds and deposits. The data are quarterly for the period 1974:1 to 1987:3 and are analysed with a second order model with a non-zero level. One of many tests in the analysis is a test for at most one cointegrating relation. The rejection probability for the hypothesis, evaluated at the maximum likelihood estimate under the hypothesis, is simulated as 22% at an asymptotic 5% significance level. The aim of this paper is to explain this discrepancy.

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