A Heteroskedasticity Robust Test for Contemporaneous Correlation in Dynamic Panel Data Models

Authors : Andreea Halunga, Chris D. Orme, Takashi Yamagata

Abstract : This paper proposes a heteroskedasticity-robust Breusch-Pagan test of the null hypothesis of zero cross-section (or contemporaneous) correlation in linear panel-data models, without necessarily assuming independence of the cross-sections. The procedure allows for either fixed, strictly exogenous and/or lagged dependent regressor variables, as well as quite general forms of both non-normality and heteroskedasticity in the error distribution. The asymptotic validity of the test procedure is predicated on the number of time series observations, T, being large relative to the number of cross-section units, N, in that: (i) either N is fixed as $T\rightarrow\infty$; or, (ii) $N^2/T\rightarrow0$, as both T and N diverge, jointly, to infinity. Given this, it is not expected that asymptotic theory would provide an adequate guide to finite sample performance when T/N is "small". Because of this, we also propose and establish asymptotic validity of, a number of wild bootstrap schemes designed to provide improved inference when T/N is small. Across a variety of experimental designs, a Monte Carlo study suggests that the predictions from asymptotic theory do, in fact, provide a good guide to the finite sample behaviour of the test when T is large relative to N. However, when T and N are of similar orders of magnitude, discrepancies between the nominal and empirical significance levels occur as predicted by the first-order asymptotic analysis. On the other hand, for all the experimental designs, the proposed wild bootstrap approximations do improve agreement between nominal and empirical significance levels, when T/N is small, with a recursive-design wild bootstrap scheme performing best, in general, and providing quite close agreement between the nominal and empirical significance levels of the test even when T and N are of similar size. Moreover, in comparison with the wild bootstrap "version" of the original Breusch-Pagan test our experiments indicate that the corresponding version of the heteroskedasticity-robust Breusch-Pagan test appears reliable. As an illustration, the proposed tests are applied to a dynamic growth model for a panel of 20 OECD countries.

Keywords : cross-section correlation, time-series heteroskedasticity, dynamic panel data, heteroskedasticity robust Breusch-Pagan test