

FISHER'S COMBINED PROBABILITY TEST FOR CROSS-SECTIONAL INDEPENDENCE IN PANEL DATA MODELS WITH SERIAL CORRELATION

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Abstract: Testing cross-sectional independence in panel data models is of fundamental importance in econometric analysis with high-dimensional panels. Recently, econometricians began to turn their attention to the problem in the presence of serial dependence. The existing procedure for testing cross-sectional independence with serial correlation is based on the sum of the sample cross-sectional correlations, which generally performs well when the alternative has dense cross-sectional correlations, but suffers from low power against sparse alternatives. To deal with sparse alternatives, we propose a test based on the maximum of the squared sample cross-sectional correlations. Furthermore, we propose a combined test to combine the p-values of the max based and sum based tests, which performs well under both dense and sparse alternatives. The combined test relies on the asymptotic independence of the max based and sum based test statistics, which we show rigorously. We show that the proposed max based and combined tests have attractive theoretical properties and demonstrate the superior performance via extensive simulation results. We demonstrate the practicality of the proposed tests through two empirical applications.

Key words and phrases: Asymptotic independence, cross-sectional dependence, heterogeneous panel data models, high dimensionality.

1. Introduction

In this paper, we consider the problem of testing cross-sectional independence in heterogeneous panel data models. In statistics and econometrics, panel data occur frequently, which contain observations of various types obtained over multiple time periods for any single unit. In the study of panel data models, the cross-sectional dependency is an important concept, described as the interaction between cross-sectional units, which could arise from the behavioral interaction between units (Breusch and Pagan, 1980; Feng et al., 2022). To make theoretical study easier, experts often assume cross-sectional independence in the model setups. If data across units are dependent, inferences under the assumption of cross-sectional independence would be inaccurate and misleading; see literature

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