Outlier Robust Unit Root Tests in Nonlinear Dynamic Models

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Abstract

In this paper we consider outlier robust (M-estimator based) unit root tests in general first-order nonlinear dynamic models (including STAR and ESTAR type of models) with strong-mixing innovations. The derivation of the tests are facilitated by approximating the nonlinearities by a Taylor-series approximation of arbitrary order. The asymptotic theory presented is general and include not only the main results for outlier robust tests in linear models by Lucas (1995, Econometric Theory), but also much of the theory for LS-based unit root tests in linear and nonlinear models by Phillips (1987, Econometrica), Kapetanios, Shin, and Snell (2003, Journal of Econometrics), and Sandberg (2009, Econometric Theory).

Finite sample properties for our tests are examined by Monte Carlo experiments. In the case of additive outliers it is shown that the corresponding LS based tests are grossly oversized whereas the size of the robust tests is closer to the nominal size. Considering nonlinear models with innovation outliers, the robust tests yield significant power gains over the LS based tests.

The methods of our outlier robust unit root tests are demonstrated in an application to eight real effective exchange rates for major economies.

Key words: Nonlinear dynamics; M-estimator; LS-estimator; Unit root; Strong-mixing; Innovation outlier; Additive outlier; PPP.