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# UNIT ROOT TEST FOR BOUNDED PROCESSES

NADEŽDA SIŅENKO[1] AND DIANA ANDREJEVA

*Institute of Mathematics of Latvian Academy of Sciences and University of Latvia*

Akadēmijas laukums 1, LV-1524, Rīga, Latvia

E-mail: [1]nadezdas@navigator.lv

Despite the extensive literature on modelling non-stationary economic time series, a rarely discussed topic is how to interpret and analyze time series whose behavior can be well approximated by means of integrated process (I(1)) but are "limited " in the sense that their range is constrained by fixed bounds [2]. Range constraints represent the standard framework in the context of target zone exchange rates and, more generally, of time series which are subjected to control.

In our study we consider an integrated AR(1) process

$$y_t = \rho y_{t-1} + \varepsilon_t \tag{1}$$

with reflection from boundaries $-a \leq y_t \leq a$, where $\rho = 1$ and $\varepsilon_t$ is a Gaussian white-noise process ($\varepsilon_t \equiv i.i.d.N(0, \sigma^2)$). It is known that when range constraints are not applied, the OLS estimate of $\rho$ is biased to be below its true value of unity [1]. For this reason Dikkey and Fuller [1] proposed to test for a presence of unit root using the following regression:

$$\Delta y_t = \gamma y_{t-1} + \varepsilon_t, \tag{2}$$

where $\gamma = \rho - 1$. Equation (2) can be estimated directly using OLS. Testing of $\gamma = 0$ for regression equation (2) is equivalent to testing of $\rho = 1$ for equation (1). Test statistics has a form $\tau = \frac{\hat{\gamma}}{s(\hat{\gamma})}$, where $s(\hat{\gamma})$ is standard error of $\hat{\gamma}$. In case when there are no range constraints, Dikkey-Fuller test can be performed using Dikkey-Fuller table of critical values, but for case of constraints no critical values for this test were published.

In our study we used Monte Carlo simulations to derive distribution of statistics $\tau$ in standard Dikkey-Fuller test (2) for a random walk process (1) (with $\rho = 1$) subjected to range constraints for different values of bounds $a$. Our results show that distribution of statistics $\tau$ for limited I(1) process approaches classical Dikkey-Fuller distribution (see [1]) as the bound $a$ tends to infinity. The obtained critical values for the statistics $\tau$ allow to test bounded processes for presence of unit root.

**REFERENCES**

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