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Unit Root Testing in Macroeconomic Time Series: Empirical Evidence from Slovenia and Serbia

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In this paper we are introducing different methods for analyzing unit root in a macroeconomic time series data. The *motivation* for the study is related to the fact that this issue is very important for prediction of the variable co-movements, and pre-testing for multivariate analysis.

The *contribution* of our paper is on collected secondary data for two small Western Balkans economies, e. g. Slovenia and Serbia. Macroeconomic data in its series has up to our best knowledge not been unit root tested and analyzed for the trends, structural breaks, and time-varying asymmetries. Therefore we are considering modern econometric pre-testing methods for ten macroeconomic variables for Slovenia and ten for Serbia. Aforementioned deterministic components have been analyzed for U.S. macroeconomic data by Sandberg (2016). Further analyze by Bahmani-Oskooee, Chang, Chen, & Tzeng (2016) for Eastern European Countries on quantile unit root has been made. The paper Vandenbussche, Vogel and Detragiache (2015) investigate the housing prices in Central, Eastern and South Eastern Europe.

Therefore the ***novelty*** of our research is regarding comparison to the collected and analyzed data to the unit root testing of the observed countries. Moreover we adapt a comprehensive database of macroeconomic time series variables. For Croatia the structural break of inflation in unit root testing has been performed by Gil-Alana, Mervar, & Payne (2016).

Hoover and Juselius (2015) suggests the unit root test while probably all macroeconomic data are non-stable and non-normal in its series. Therefore they have stochastic trends which allows the data to speak. In the digital economy we are available to test the level of integration for several series of time series in a short time. We are testing macroeconomic variables for Slovenia and Serbia. For the test we have collected *secondary time series data* from several sources, e.g. Eurostat, Statistical offices of Slovenia and Serbia. The data range for Slovenia is from 2000 until 2015, and for Serbia from 2007 until 2015.

We are *testing various variables* available on a quarterly basis such as gross domestic product, and unemployment rate. Moreover we also launch respective variables available on a monthly basis such as consumer price index, money supply, tourist arrivals, prices of services, production prices, labor costs in industry.

The *article considers* simple least squares unit root tests. The initiate are Augmented Dickey Fuller (ADF) test, Kwiatkowski et al. (KPSS) test, Philip Peron (PP) test and vector autoregressive (VAR) misspecification test. The latter is the test for multiple models whereas the first three tests, e.g. ADF, KPSS and PP test, are available for univariate unit root models. In order to obtain appropriate order of integration, we also include some tests with structural breaks, such as Zivot-Andrews (ZA) and Clemente et al., (Clemente-Montanes-Reyes) to overcome potential problem with crisis effects.

Results differ to the tests applied. Mostly all macroeconomic variables are integrated of at least first order of integration. Some variables, e.g. prices are integrated near the second order of integration. This means that they have almost two unit roots near one.

The *innovative* results in our approach of comparative analysis between two small post-socialist economies suggest that the researchers should be patient in their analysis of the level of integration in the data analyzed and which test they would like to use. Also, such a survey for the aforementioned countries has not been done before, which present the *discussion* of the study to all scholars implying macro econometrics in their research. Moreover, in our research we compare results from different software's for the identical unit root approach. There are no limitations in our survey. The *implementation* of the study could be in a basic help and understanding to all researchers in Slovenia and Serbia, but also worldwide for a preparation credible research on macroeconomic data. Moreover the government should take care in a part of such an approach using macroeconomic data while analysis they are ordering should have in their first amendments such as unit root analysis. If it has than the results are applicable.

Keywords: macroeconomic variables, unit root testing, Slovenia, Serbia

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