TESTING THE CHARACTERISTICS OF STATIONARITY: AN APPLICATION ON THE BORSA ISTANBUL NATIONAL 100 INDEX

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Abstract

Testing the stationary nature of economic time series has become an important issue for researchers to make their desirable predictions and determine the relationships between other financial time series. Within the same context, the aim of this study is to investigate the stationary characteristics of closing values of the BIST 100 Index. Primarily, we apply traditional unit root tests. Secondly, we practice Zivot-Andrews, Lumsdaine-Papell, Lee-Strazicich and Carrion-i Silvestre tests with structural breaks. According to tests, the BIST 100 has different stationarity characteristics. Our empirical findings may procure comprehensive direction and substructure for researchers to identify stationarity of BIST 100.

Key Words: *The Borsa Istanbul National 100 Index, Stationarity, Structural Breaks*

Jel Codes: *C18, C22, G12*

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1. Introduction

In several studies testing characteristic of stationarity, (in other words testing for unit roots in financial time series) has become common and important implementation. According to Gujarati (2003:797), *"A stochastic process is said to be stationary if its mean and variance are constant over time and the value of the covariance between the two time periods depends only on the distance or gap or lag between the two time periods and not the actual time at which the covariance is computed"*. If a time series is non-stationary, it is accepted that the series implies a trend and this case causes a spurious regression.

The key focus of unit root tests is that the researcher wishes to decide whether a time series is generated by a stochastic trend process, a process where shocks have a permanent effect, or a stationary time series, where shocks only have a temporary effect (Franses&Hobijn, 1997:1). Dickey-Fuller (DF) and Augmented Dickey-Fuller (ADF, 1979), Phillips-Perron (PP, 1988) and Kwiatkowski, Phillips, Schmidt and Shin (KPSS, 1992)'s unit root test have been used for researchers extensively. These classical unit root tests would denominate the previously non-stationary series as stationary. In general, these tests have received criticism for not taking structural breaks into consideration.

There are several studies that several unit root tests have been implemented and supported with several econometric tests. The studies which investigate the stationarity of Istanbul Stock Exchange are aimed at determining the impact of variables such as gold prices, oil prices, inflation rate, export and import on stock returns, or stock performance commonly. Other studies are directed to identify the integration and understand the causality of Istanbul Stock Exchange with foreign indices. In consequence, determining the unit root is the first step for all time series analysis.

Çil Yavuz's study in 2004 used classical unit root tests to determine the stationarity of Istanbul Stock Exchange (ISE National 100 Index). According to results, National-100 Index is non-stationary and has a unit root. Kasman et al. (2010), Aslan&Kula (2011), Yıldırım&Yıldırım (2012), Ertugrul&Soytas (2013) have included unit root tests with structural breaks in their studies. Kasman et al. (2010), investigates the validity of purchasing power parity (PPP) with the LM test for the eleven central and eastern European transition countries and three market economy countries; Cyprus, Malta, and Turkey. Similar methodology is used in Aslan&Kula's study in 2004 that during period of 1975-2001 they employed the LM unit root using data on per capita income among 67 provinces in Turkey. Yıldırım&Yıldırım (2012) investigated the validity purchasing power parity again during 01.1990-12.2009. They employed classical unit root tests and unit root tests with break(s) like Zivot&Andrews, Lee Strazicich, Lumsdaine&Papell. Ertugrul&Soytas (2013) investigated the Turkish industrial production index (01.2005-06.2012) with use of traditional and relatively more recent tests. According to findings, results of traditional and relatively more recent tests represent opposite properties.

In this study, we analyze monthly closing prices to investigate the stationarity structure of Borsa Istanbul National 100 Index, which is commonly used for academicians and researchers. We design our study in five sections. The first section gives information about stationarity and literature review. The second section reports methodology on unit root test with structural break(s). The third section presents data and emphasizes the empirical results, and the final section concludes the article.

2. Methodology

Primarily, we apply the classical unit root test Augmented Dickey-Fuller (ADF, 1979), Phillips-Perron (PP, 1988) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS, 1992) which are used in literature frequently. Secondly, we employ the Dickey-Fuller GLS, ERS point optimal test that was generated by Elliot, Rothenberg & Stock (1996) and Ng-Perron (2001) test, which can be, stated "relatively more recent tests".

According to Aslan&Kula (2011:542), "*Augmented Dickey&Fuller (1979) (ADF, hereafter) type models do not allow researchers to analyze the impact of structural changes in the economy. These structural changes, which could be due to shocks, have an influence on macroeconomic variables*". Unit root tests with structural breaks have two types "endogenously" that are described with one break and two breaks. Zivot-Andrews (ZA, 1992) illustrated the unit root test by incorporating one structural break in the data series. Zivot-Andrews (1992), used Perron (1989)'s A, B and C models but in practice, Model A and Model C have been employed. ZA can be explained using the following equations:

Model A
$$Y_t = \hat{\mu}^A + \hat{\theta}^A DU_t(\hat{\lambda}) + \hat{\beta}^A t + \hat{a}^A Y_{t-1} + \sum_{j=1}^{k} \hat{c}_j^A \Delta y_{t-j} + e_t \qquad (1)$$

Model B
$$Y_t = \hat{\mu}^B + \hat{\gamma}^B DT_t^*(\hat{\lambda}) + \hat{\beta}^B t + \hat{a}^B Y_{t-1} + \sum_{j=1}^{k} \hat{c}_j^B \Delta y_{t-j} + e_t \qquad (2)$$

Model C $$Y_t = \hat{\mu}^C + \hat{\theta}^C DU(\hat{\lambda}) + \hat{\beta}^C t + \hat{\gamma}^C DT_t^*(\hat{\lambda}) + \hat{a}^C Y_{t-1} + \sum_{j=1}^{k} \hat{c}_j^C \Delta y_{t-j} + e_t \quad (3)$$

Model A shows the break in intercept (1), Model B in trend slope (2) and Model C in intercept and also in trend slope (3). DU_t and DT_t are dummy variables that describe structural breaks in intercept and in trend slope, respectively. T_B shows the break time and can be calculated like ($\lambda = T_B / T$). Equations of dummy variables can be shown below (Zivot&Andrews, 1992: 253-254):

$t > T\lambda$	if	$DU_t = 1$	others $DU_t = 0$
$t > T\lambda$	if	$DT_t = t - T\lambda$	others $DT_t = 0$

Zivot-Andrews (1992)'s null hypothesis is defined as

$H_0 : Y_t = \mu + Y_{t-1} + e_t$ meaning that "there is unit root in times series".

Alternative hypothesis is H_1: With one-break times series is stationary.

If the absolute value of the estimated t value is higher than Zivot Andrews (1992)'s critical value, the null hypothesis has been rejected and assumed that times series is stationary. If the absolute value of estimated t value is lower than Zivot Andrews (1992)'s critical value, the null hypothesis has not been rejected.

According to Lumsdaine-Papell (LP, 1997), over a long period of time two-breaks can be observed in times series data. As distinct from Zivot-Andrews (1992) test, in Lumsdaine-Papell (1997)'s Model A and Model C are named as Model AA and Model CC. Model CC which allows to structural breaks in level and in trend can be presented below (Lumsdaine&Papell, 1997: 212):

$$\Delta y_t = \mu + \beta_t + \theta DU1_t + \gamma DT1_t + \omega DU2_t + \phi DT2_t + \alpha y_{t-1} + \sum_{i=1}^{k} c_i \Delta t_{t-i} + \varepsilon_t \quad (4)$$

DU_t and DT_t are dummy variables that describe structural break in intercept and in trend slope respectively. Differing from Zivot-Andrews; T_{B1} and T_{B2} report two breaking times, so two "λ" have come up in the models. "λ" can be calculated like ($\lambda_1 = T_{B1} / T$) and ($\lambda_2 = T_{B2} / T$).

t > TB1	if	$DUl_t = l$
t > TB2	if	$DU2_t = l$
t > TB1	if	$DTl_t = t - TB1$ and
t > TB2	if	$DT2_t = t - TB2$

According to Lee-Strazicich (LS, 2003), Zivot-Andrews and Lumsdaine-Papell's endogenous break tests assume no structural breaks under the null hypothesis. Lee-Strazicich (2003) extended the Lagrange Multiplier (LM) test and proposed two structural breaks minimum LM unit root test in null and alternative hypothesis. The equation is computed as the following expression:

$Y_t = \delta' Z_t + e_t$, $e_t = \beta e_{t-1} + \varepsilon_t$ and $\varepsilon_t \sim$ iidN $(0,\sigma^2)$

Z_t, consists of exogenous variables vector. Lee-Strazicich (2003: 1084) specified Model A and Model C as follows:

Model A $\quad Y_t = \delta' Z_t + e_t$, $e_t = \beta e_{t-1} + \varepsilon_t$ and $Z_t = [1, t, D_{1t}, D_{2t}]$ (5)

T_{Bj}, shows the breaking time.

When J, 1,2… t > T_{Bj} if $D_{Jt} = 1$ others = 0

Model C $\quad Y_t = \delta' Z_t + e_t$, $e_t = \beta e_{t-1} + \varepsilon_t$ and $Z_t = [1, t, D_{1t}, D_{2t}, DT_{1t}, DT_{2t}]$ (6)

When J, 1,2,….. t > (T_{Bj} + 1) if $D_{Jt} = 1$ others = 0

"λ" can be calculated as ($\lambda_j = T_{Bj} / T$)

Carrion-i Silvestre (CS)'s test, which was improved by Carrion-i Silvestre, Kim & Perron (2009), can allow multiple structural breaks (i.e., five breaks) endogenously from the data. Carrion-i Silvestre extended the analysis of break points with use of the Bai & Perron (2003) algorithm and quasi-GLS method. This method also can be used on small sample (Silvestre, Kim&Perron, 2009: 1756; Gocer, Mercan&Peker; 2013: 7-8). The equation can be explained as follows:

$y_t = d_t + u_t$

$u_t = a u_{t-1} + \nu_t$ $\quad$ t = 0,……..T

$$P_t(\lambda^0) = \{S(\bar{a}, \lambda^0) - \bar{a}, S(1, \lambda^0)\} / S^2(\lambda^0) \quad (7)$$

$$MZA(\lambda_0) = (T^{-1} \bar{y}_T^2 - s(\lambda^0)^2)(2T^{-2} \sum_{t=1}^{T} \bar{y}_{t-1}^2)^{-1} \quad (8)$$

$$MSB(\lambda_0) = (s(\lambda^0)^{-2} T^{-2} \sum_{t=1}^{T} \bar{y}_{t-1}^2)^{1/2} \quad (9)$$

$$MZ_t(\lambda_0) = (T^{-1} \bar{y}_T^2 - s(\lambda^0)^2)(4 s(\lambda_0)^2 T^{-2} \sum_{t=1}^{T} \bar{y}_{t-1}^2)^{-1/2} \quad (10)$$

$$MPT(\lambda_0) = \left[c^{-2} T^{-2} \sum_{t=1}^{T} \bar{y}_{t-1}^{2} + (1-\bar{c}) T^{-1} \bar{y}_{T}^{2} \right] / s(\lambda_0)^2 \quad (11)$$

3. Data and Empirical Results

The Borsa Istanbul National 100 index is composed of 100 companies, which are selected amongst the companies, traded on the national market and real estate investment trust and venture capital investment trust. The Borsa Istanbul National 100 Index includes the Borsa Istanbul National 50 Index and the Borsa Istanbul National 30 Index constituent companies (http://www.borsaistanbul.com).

3.1. Data

Monthly closing data of the Borsa Istanbul National 100 Index were obtained from Borsa Istanbul web side (http://www.borsaistanbul.com). We use monthly closing (bist), monthly logarithmic closing (lbist), seasonally adjusted monthly closing (bistsa) and seasonally adjusted monthly logarithmic closing (lbistsa) series. The analysis covers the period from 1.1988 to 9.2013. E-views 6.0 and Gauss 10 econometric programs are used for analysis.

3.2. Empirical Results

Table 1: Results of Traditional Unit Root Tests (ADF, PP, KPSS)

ADF TEST				
	Level		**1st Difference**	
	Intercept	**Trend & Intercept**	**Intercept**	**Trend & Intercept**
bist	-0.0681(0)	-2.2883(0)	-18.0989(0)*	-18.1382(0)*
bistsa	0.0158(0)	-2.2660(0)	-18.2038(0)*	-18.2557(0)*
lbist	-1.9074(0)	-0.7889(0)	-16.6699(0)*	-16.8317(0)*
lbistsa	-1.9442(0)	-0.8044(0)	-16.6842(0)*	-16.8523(0)*
Critical Values: Intercept %1 -3.4514 %5 -2.8707 %10 -2.5717 Trend&Intercept %1 -3.9882 %5 -3.4245 %10 -3.1353 Values in parenthesis are lag lengths. * means series is stationary at %1				

PP TEST				
	Level		1st Difference	
	Intercept	Trend & Intercept	Intercept	Trend & Intercept
bist	-0.1816(6)	-2.4662(7)	-18.1599(6)*	-18.1796(5)*
bistsa	-0.0143(3)	-2.3413(4)	-18.2059(3)*	-18.2486(2)*
lbist	-1.8604(3)	-0.8781(3)	-16.6801(3)*	-16.8299(1)*
lbistsa	-1.8976(3)	-0.8867(3)	-16.7229(4)*	-16.8508(1)*
Critical Values: Intercept %1 -3.4514 %5 -2.8707 %10 -2.5717 Trend&Intercept %1 -3.9882 %5 -3.4245 %10 -3.1353 Values in parenthesis are lag lengths. * means series is stationary at %1				
KPSS TEST				
	Level		1st Difference	
	Intercept	Trend & Intercept	Intercept	Trend & Intercept
bist	1.8763(14)	0.4481(14)	0.1345(6)*	0.0214(5)*
bistsa	1.8776(14)	0.4497(14)	0.1584(3)*	0.0208(1)*
lbist	1.8945(15)	0.4965(14)	0.3447(4)*	0.0481(3)*
lbistsa	1.8947(15)	0.4966(14)	0.3490(5)*	0.0474(3)*
Critical Values: Intercept %1 0.7390 %5 0.4630 %10 0.3470 Trend&Intercept %1 0.2160 %5 0.1460 %10 0.1190 Values in parenthesis are lag lengths. * means series is stationary at %1				

Table 1 shows the results of the first generation unit root tests that don't able to analysis the breaking points. According to the results; bist, bistsa, lbist and lbistsa are stationary at the first difference level. The ADF unit root test indicates that all variables are stationary and have no unit root in the first difference level. PP and KPSS tests confirm the ADF results and show all variables are stationary in the first difference level. KPSS is a different test that reverses its null hypothesis.

Table 2: Second Generation Unit Root Tests (DF-GLS, ERS Point Optimal, NgPerron) (Without Breaking Points)

DF-GLS TEST				
	Level		**1st Difference**	
	Intercept	**Trend & Intercept**	**Intercept**	**Trend & Intercept**
bist	0.7875(0)	-1.5460(0)	-17.8134(0)*	-9.7197(1)*
bistsa	0.8703(0)	-1.5281(0)	-17.9155(0)*	-10.0086(1)*
lbist	1.9662(0)	-0.6868(0)	-1.7587(6)	-4.2012(3)*
lbistsa	2.0316(0)	-0.6654(0)	-1.7762(6)	-4.2736(3)*
Critical Values: Intercept %1 -2.5726 %5 -1.9418 %10 -1.6159 Trend&Intercept %1 -3.4704 %5 -2.9092 %10 -2.6036 Values in parenthesis are lag lengths. * means series is stationary at %1 level ** means series is stationary at %5 level				
ERS POINT OPTIMAL TEST				
	Level		**1st Difference**	
	Intercept	**Trend & I ntercept**	**Intercept**	**Trend & Intercept**
bist	37.4802(0)	18.3497(0)	0.3333(0)*	0.9178(0)*
bistsa	37.0346(0)	18.1335(0)	0.3247(0)*	0.9044(0)*
lbist	366.8810(0)	37.1148(0)	0.4407(0)*	1.0011(0)*
lbistsa	383.3486(0)	38.5790(0)	0.4243(0)*	0.9823(0)*
Critical Values: Intercept %1 1.9532 %5 3.2186 %10 4.4110 Trend&Intercept %1 4.0014 %5 5.6384 %10 6.8762 Values in parenthesis are lag lengths. * means series is stationary at %1 level ** means series is stationary at %5 level				
Ng PERRON TEST				
MZa	**Level**		**1st Difference**	

	Intercept	Trend & Intercept	Intercept	Trend & Intercept
bist	1.2264(0)	-5.1945(0)	-153.356(0)*	-102.544(1)*
bistsa	1.3875(0)	-5.2385(0)	-153.304(0)*	-107.044(1)*
lbist	0.9013(0)	-1.6949(0)	-5.0157(6)	-24.4073(3)*
lbistsa	0.9126(0)	-1.6077(0)	-5.0482(6)	-24.9097(3)*
Critical Values: Intercept %1 -13.8000 %5 -8.1000 %10 -5.7000 Trend&Intercept %1 -23.8000 %5 -17.3000 %10 -14.2000. Values in parenthesis are lag lengths. * means series is stationary at %1 level ** means series is stationary at %5 level				
Ng PERRON TEST				
MZt	**Level**		**1st Difference**	
	Intercept	**Trend & Intercept**	**Intercept**	**Trend & Intercept**
bist	0.7968(0)	-1.5295(0)	-8.6487(0)*	-7.0681(1)*
bistsa	0.8802(0)	-1.5115(0)	-8.6527(0)*	-7.2290(1)*
lbist	2.0041(0)	-0.6821(0)	-1.5805(6)	-3.4617(3)*
lbistsa	2.0705(0)	-0.6605(0)	-1.5860(6)	-3.4986(3)*
Critical Values: Intercept %1 -2.5800 %5 -1.9800 %10 -1.6200 Trend&Intercept %1 -3.4200 %5 -2.9100 %10 -2.6200. Values in parenthesis are lag lengths. * means serie is stationary at %1 level ** means series is stationary at %5 level				
Ng PERRON TEST				
MSB	**Level**		**1st Difference**	
	Intercept	**Trend & Intercept**	**Intercept**	**Trend & Intercept**
bist	0.6496(0)*	0.2944(0)*	0.0564(0)*	0.0689(1)*
bistsa	0.6343(0)	0.2885(0)	0.0564(0)*	0.0675(1)*
lbist	2.2234(0)*	0.4024(0)*	0.3151(6)	0.1418(3)*
lbistsa	2.2686(0)*	0.4108(0)*	0.3141(6)	0.1404(3)*

Critical Values: Intercept %1 0.1740 %5 0.2330 %10 0.2750 Trend&Intercept %1 0.1430 %5 0.1680 %10 0.1850. Values in parenthesis are lag lengths. * means series is stationary at %1 level ** means series is stationary at %5 level				
Ng PERRON TEST				
MPT	**Level**		**1st Difference**	
	Intercept	**Trend & Intercept**	**Intercept**	**Trend & Intercept**
bist	34.8839(0)	17.2357(0)	0.3267(0)*	1.2360(1)*
bistsa	34.4890(0)	17.0193(0)	0.3183(0)*	1.1723(1)*
lbist	311.405(0)	36.0398(0)	4.8927(6)	3.9265(3)*
lbistsa	324.724(0)	37.3691(0)	4.8604(6)	3.8441(3)*
Critical Values: Intercept %1 1.7800 %5 3.1700 %10 4.4500 Trend&Intercept %1 4.0300 %5 5.4800 %10 6.6700. Values in parenthesis are lag lengths. * means series is stationary at %1 level ** means series is stationary at %5 level				

Table 2 presents DF-GLS, ERS optimal point and Ng-Perron test results. With exception of Ng-Perron MSB and MPT tests, the null hypothesis for DF GLS, ERS optimal point, Ng-Perron MZ_a and Ng-Perron MZt tests are the same as ADP and PP. As we can see in Table 2, all series generally have stationary characteristics at first difference.

Table 3: Results of Unit Root Tests with Structural Breaks

	ZIVOT ANDREWS TEST			
	Model A		**Model C**	
	Test Statistic	***Breaking Point***	***Test Statistic***	***Breaking Point***
bist	-3.4405	2009M02	-4.1741	2004M05
bistsa	-4.5690	2005M04	-3.7411	1996M03
lbist	0.3662	2011M02	-0.4572	2006M01

lbistsa	0.3357	2011M02	-0.4925	2006M02
Critical Values %1	*-5.34*		*-5.57*	
Critical Values %5	*-4.80*		*-5.08*	
Critical Values %10	*-4.58*		*-4.82*	

(*), (**), (***) mean series are stationary at %1, %5, and % 10 respectevely.

LUMSDAINE-PAPELL UNIT ROOT TEST WITH TWO STRUCTURAL BREAKS

	Model AA	Model CC
bist	-4.9733 (0)	-5.5916 (4)
Breaking Points	1990M09, 1995M12	1997M08, 2003M01
Critical Values	%1=-6.94 %5=-6.24 %10=-5.96	%1=-7.34 %5=-6.82 %10=-6.49
bistsa	-5.1613 (8)	-7.0756 (8)**
Breaking Points	1998M09, 2004M01	1998M07, 2005M11
Critical Values	%1=-6.94 %5=-6.24 %10=-5.96	%1=-7.34 %5=-6.82 %10=-6.49
lbist	-5.6465 (5)	-4.8602 (0)
Breaking Points	2000M06 2006M06	1992M04 2007M11
Critical Values	%1=-6.94 %5=-6.24 %10=-5.96	%1=-7.34 %5=-6.82 %10=-6.49
lbistsa	-4.5216 (0)	-4.2901 (0)

Breaking Points	2006M09 2011M01	1994M08 2003M07
Critical Values	%1=-6.94 %5=-6.24 %10=-5.96	%1=-7.34 %5=-6.82 %10=-6.49
LEE-STRAZICICH UNIT ROOT TEST WITH TWO STRUCTURAL BREAKS		
	Model AA	Model CC
bist	-2.8034	-7.1902*
Breaking Points	1999M11, 2008M03	2001M03, 2011M02
Critical Values	%1=-4.54 %5=-3.84 %10=-3.50	%1=-6.42 %5=-5.65 %10=-5.32
bistsa	-2.9478	-6.2879**
Breaking Points	2008M03, 2008M09	2001M10, 2011M02
Critical Values	%1=-4.54 %5=-3.84 %10=-3.50	%1=-6.42 %5=-5.65 %10=-5.32
lbist	-3.0910	-4.8602
Breaking Points	1998M02 2005M03	1999M01 2005M10
Critical Values	%1=-4.54 %5=-3.84 %10=-3.50	%1=-6.42 %5=-5.65 %10=-5.32
lbistsa	-5.2891*	-8.2078*
Breaking Points	2005M07 2005M10	1998M07 2005M07
Critical Values	%1=-4.54 %5=-3.84 %10=-3.50	%1=-6.42 %5=-5.65 %10=-5.32

CARRION-I SILVESTRE UNIT ROOT TEST WITH FIVE STRUCTURAL BREAKS					
	PT	**MPT**	**MZA**	**MSB**	**MZT**

bist	18.543410*	16.908974*	-25.383498	0.12877026*	-3.2686396
Breaking Points	1996M10, 2000M04, 2003M07, 2007M10, 2010M10				
Critical Values (%5)	8.4478516	8.4478516	-43.905413	0.10645190	-4.6827771
bistsa	14.430157	13.155470	-25.686846	0.13056598	-3.3538282
Breaking Points	1996M01, 2000M04, 2002M11, 2007M10, 2010M10				
Critical Values (%5)	6.8134076	6.8134076	-42.188225	0.10811282	-4.6168922
lbist	3.0974746	2.9617301	-151.74958*	8.6930734 *	0.057285650
Breaking Points	1990M07, 1993M02, 1998M10, 2003M05, 2005M11				
Critical Values (%5)	9.1573156	9.1573156	-4.8254705	0.10296440	-47.053575
lbistsa	3.0883401	2.9343687	-8.5696032	0.058334988	-146.90332*
Breaking Points	1990M08, 1993M04, 1998M11, 2001M06, 2010M12				
Critical Values (%5)	9.2965522	9.2965522	-45.841893	-4.7620705	0.10510878

According to the ZA test, Model A and Model C indicate the structural breaking levels. Model A shows the break in intercept, whereas Model C shows the break in intercept as well as in trend slope. ZA's breaks indicate the different crises for Turkish and global economy. The LP test allows testing two breaking points in level and in trend. As we can see from Table 3, the series are non-stationary, have unit roots, and all of the variables are affected by structural breaks. The impact of the austerity measures package on 5th April 1994 can be seen in Model CC for lbistsa. Additionally 2007 and 2011 were an election year for Turkey. LS extended the LM test and proposed two structural breaks with the LM unit root test in the null and alternative hypothesis. Results of the LS test show that the series have no unit root (with the exception of lbist). Almost all breaking months can be accepted again as economical or political change for the Turkish Economy. The CS test allows the determining of five breaks endogenously from the data at the same time. Results present all the variables are stationary and have no unit root. We accept the alternative hypothesis.

4. Conclusion

In this study we investigate the stationary structure of LBIST 100. We use logarithmic and seasonal adjusted monthly time series between January 1988 and September 2013. Before testing some relationships between variables, researchers apply stationarity tests. We first employ a traditional unit root test like ADF, PP, and KPSS. Then we use new unit root tests like DF-GLS, ERS Optimal, Ng-Perron used as relatively more recent tests. Afterwards, Zivot-Andrews, Lumsdaine-Papell, Lee-Strazicich and Carrion-i Silvestre tests are run with structural breaks. Endogen and exogen variables such as global and national economical or political crises, macro economical variables can affect the series and cause several breaking points. These tests are allowed to determine one, two and five breaking points. Our results show that employing different tests have different results. It's also observed that seasonal adjusted series lbistsa and bistsa do not vary at the stationary level. One of the differences in analysis is that the series with trend are more stationary than the series with intercept. The essential difference of this study is that we practice the Carrion-i Silvestre test with five breaking points and introduce five significant events at the same time in the same series. So our results indicate that LBIST 100 has evidence in different stationary properties and breaking points in different econometric models.

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