# An Investigation of Stationarity Properties of the Turkish Tourism Income Variable

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## ABSTRACT

Tourism has a significant impact on economic growth as put forth by the tourism-led growth hypothesis. Turkey's earnings from tourism were 31.5 billion dollars in 2015 according to TURKSTAT. This implies that tourism is an important industry for Turkey and has a significant impact on economy. Therefore, the question whether a policy implementation in tourism is long-lasting or not is critical for both the industry and whole economy. This study researches the persistence of policies in tourism industry, employing tourism income series for period of 2009M1-2015M12 and tests the stationarity of this series using traditional unit root tests as well as a wavelet-based unit root test developed by Fan and Gencay (2010). Both seasonally adjusted and unadjusted series have been used. The empirical results point out that the traditional unit root test has a proclivity to report that tourism income series is I(1) or non-stationary. On the other hand, the wavelet-base unit root test indicates that tourism income is stationary. The empirical result of wavelet-based test implies that impact of a shock on this sector is transitory. The income in tourism industry will return more or less back to its meaning the following year.

**Key words:** *Tourism Income, Unit Root, Wavelet, Stationarity Analysis*
JEL Classifications: F43, L83, O47

## 1. INTRODUCTION

International tourism has substantially special importance for all economies. According to World Tourism Organization (2017), world tourism costs %10 GDP of world, it creates one in ten of jobs or employment, it costs 1.5 trillion US$ in world exports, and also it corresponds to %7 of world's exports and %30 of services exports. Tourism is generally accepted as one of the most rapidly developing industries. It has a significant impact on economic development of countries where this industry flourishes. Tourism provides positive contributions for achieving economic growth target by generating new employment possibilities, creating new income opportunities, promoting foreign investment, information and technology transfer and economic activities (Ertuğrul and Mangir, 2013).

Tourism industry affects most of the macroeconomic variables in economy. A study conducted by AKTOB (2014) reports that in Turkey, 54 sectors are directly affected through input purchases by tourism sector and the monetary value of these purchases goes up to 26 billion dollars within a year. Furthermore, income from tourism was 31.5 billion dollars in

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2015 according to TURKSTAT. This is an indication that tourism emerges as an important industry due to its significant impact on economy.
The economic significance of industry is also reflected in academic publications. There is a huge and an increasing literature that focuses on the effects of tourism sector on macroeconomic variables. All these papers employ and focus different econometric techniques for different countries. The common feature of these papers is that they start to conduct econometric analysis by researching stationarity properties of the variables in order to find out whether a policy shock in tourism is long lasting or not. Model selection for time series analysis depends on stationarity characteristics of researched variables.

Stationarity analysis is starting point of time series analysis. Gujarati (2004) describes stationarity as follows; "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".

Technically employment of a non-stationary variable may lead to a spurious regression problem which in turn leads to misleading empirical findings. Non-stationarity indicates that distributional properties of the series do not remain constant over time. On the other hand, stationary variables exhibit mean reversion properties which means it has constant long-term mean and variance which are time invariant. However, a non-stationary series doesn't have any long run mean and also the variance is time independent (Enders, 2004). An extension of the aforementioned statements indicates that stationarity analysis matters in policy making as well as being a pre-analysis tool in multiple time series analysis. When the variables are stationary, (policy) shocks will be temporary and effects of shocks vanish over time and variables return to their long term means. In practical sense, stationarity is closely related to the persistence of the series against policy implementations.

The aim of this study is to investigate stationarity properties of tourism income variable of Turkey by using both conventional unit root tests, including ADF, PP and Ng-Peron tests and finally with a wavelet-based unit root test developed by Fan and Gencay (2010). In empirical analysis, we choose tourism income variable as a proxy for tourism sector for different reasons. First, as emphasized by Cannas (2012), tourism income reflects the inherent characteristics of tourism sector. Moreover, the other reason for us to use this variable is that it is widely used in the empirical literature. Unlike other studies, however, we employ tourism income series of Turkey for 2009M01-2015M12 periods. Furthermore, in this study, tourism income variable is tested for stationarity by using a wavelet based test. Most of papers in the empirical literature employ only conventional unit root test. Wavelets are relatively new tools for data analysis, although the first steps towards utilizing them began in 1910 with Alford Haar, interest in this tool intensified especially during the early 1980's (Salimath, 2011). As Woodward et al. (2011, p.441) mentioned, Wavelet methods can be viewed as variations of the classical Fourier analysis in which short waves (or "wavelets") are used in place of the classical sines and cosines. The main advantages of wavelet methods are that they can easily be implemented on non-stationary series and they are very well suited for analysis of cyclical phenomenon within a series, such as business cycle or seasonality (Radunovic, 2009).

To analyze the income dynamics of tourism sector, either seasonality may be striped of series using "seasonal adjustment" methods or tools that take seasonality are used. In this study, both approaches are followed. The reasoning behind undertaking this tedious work lies within the nature of seasonality. If the seasonality in series is deterministic, both approaches amount to same thing. Alleyne (2003), Gasmi (2013) and Gil-Alana (2005) suggest that if seasonality is stochastic instead of deterministic, seasonal adjustment could cause some important information loss and this could make results less reliable.

The paper is organized as follows: Section II presents the literature survey; Section III introduces the data and methodology. Section IV presents empirical results and the last section concludes.

## 2. LITERATURE

Tourism income variable is employed as an important proxy of tourism sector in empirical analysis. There is a huge literature focusing on economic development and tourism sector relationship. That tourism affects economic growth is a well-accepted argument in literature. According to this argument, tourism sector has important contributions for economies' long-run growth performance via different channels. This relationship is known as the Tourism-Led Growth Hypothesis (TLGH; Shan and Wilson, 2001). Moreover, the effects of tourism sector on macro economy are researched for different countries with different techniques.

| *Nu.* | Author(s) | Country(ies) | Period | Stationarity Tests and Results |
|---|---|---|---|---|
| *1.* | Balaguer and Contavella-Jorda (2002) | Spain | 1975:1-1997:1 | I(1). ADF and PP |
| *2.* | Yıldırım and Öcal (2004) | Turkey | 1962-2002 | I(1). ADF |
| *3.* | Dritsakis (2004) | Greece | 1960:1-2000:4 | I(1). ADF and KPSS |
| *4.* | Oh (2005) | Korea | 1975:1- 2001:1 | I(1). DF, ADF and PP(1988) |
| *5.* | Özdemir and Öksüzler (2006) | Turkey | 1963-2003 | I(1). ADF, PP and DF-GLS |
| *6.* | Bahar (2006) | Turkey | 1963-2004 | I(1). ADF |
| *7.* | Yavuz (2006) | Turkey | 1992-2004 | I(1). ADF |
| *8.* | Khalil et.al (2007) | Pakistan | 1960-2005 | I(1). ADF and PP |
| *9.* | Aslan (2008) | Turkey | 1992:1-2007:2 | I(1). ADF and PP |
| *10.* | Çetintaş and Bektaş (2008) | Turkey | 1964-2006 | I(1). ADF and PP |
| *11.* | Kızılgöl and Erbaykal (2008) | Turkey | 1992:1-2006:1 | I(1). ADF |
| *12.* | Chen and Chou-Wei (2009) | Taiwan-South Korea | 1975:1-2007:1 | I(1). PP(1988), KPSS (1992), Zivot&Andrews (1992) |
| *13.* | Hepaktan and Çınar (2010) | Turkey | 1980-2008 | I(1). ADF |
| *14.* | Yamak et.al (2012) | Turkey | 1968-2006 | I(1). ADF and PP |
| *15.* | Polat and Günay (2012) | Turkey | 1969-2009 | I(1). ADF |
| *16.* | Tang (2013) | Malaysia | 1974:2009 | I(1). Zivot and Andrews(1992) |
| *17.* | Çoban and Özcan (2013) | Turkey | 1963-2010 | I(1). ADF |
| *18.* | Ertuğrul and Mangir (2013) | Turkey | 1998:1-2011:3 | I(1). ADF, PP, KPSS, Ng-Peron, Zivot-Andrews and Lee&Strazicich (2003) |
| *19.* | Wang and Xia (2013) | China | 2001-2011 | I(1) |
| *20.* | Gautam (2014) | Nepal | 1975-2012 | I(1). ADF |
| *21.* | Coşkun and Özer (2014) | Turkey | 1992:1-2014:1 | I(1). ADF, PP and KPSS |
| *22.* | Bayramoğlu and Arı (2015) | Greece | 1980-2013 | I(1). ADF and PP |
| *23.* | Özcan (2015) | Turkey | 1963-2010 | I(1). ADF,PP,ERS |
| *24.* | Kanca (2015) | Turkey | 1980-2013 | I(1). ADF and PP |
| *25.* | Balıkçıoğlu and Oktay (2015) | Turkey | 2003:1- 2014:2 | I(1). ADF and PP |

**Table 2.1** Literature Survey

The papers in literature which focuses on the investigating stationarity properties of tourism income variable are presented in Table 2.1.

When we look into Table 2.1, we notice that the papers employ unit root tests mostly focusing on conventional unit root tests and unit root tests with structural breaks, while all papers concluded that tourism income variable is stationary after differencing which means I(1).

## 3. DATA AND METHODOLOGY

We employ tourism income variable which is gathered from database of the Ministry of Culture and Tourism covering 2009M1-2015M12 period. Tourism income variable is then transformed with natural logarithm. We use both seasonally-adjusted and seasonally-unadjusted logarithmic tourism income variables in parallel with the existing literature. The seasonal adjustment is implemented using the Tramo-Seats method.

Time series econometrics literature states that employing a non-stationary variable may cause problem of spurious regression. Consequently, the stationarity property of tourism income variable plays a key role in the validity of forecasts and econometric models. Hence, all applied work utilizing tourism income variable employ unit root tests to obtain the integration order of the series. Furthermore, the stationarity property of tourism income by itself is a valid concern for policymaking. When the variables are stationary, (policy) shocks will be temporary and the effects of shocks vanish over time and the variables return to their long term means. Due to its relevance both to empirical analysis methods and policy implementation, stationarity of tourism income variable has been tested in many studies. In almost all of these studies, tourism income series is found to be non-stationary.

In the empirical analysis, we first employ conventional unit root tests including ADF, PP, and Ng-Perron tests. Then continuous wavelet transformation and the wavelet-based unit root test developed by Fan and Gencay are employed in order to investigate stationarity properties of tourism income variable further.

Wavelets are both useful tools for exploratory analysis of series as well as for providing additional tools for investigating unit root behaviour of series. Wavelets are functions of small waves, hence the diminutive ‘let’ at the end. In other words, wavelet functions, unlike waves such as sine and cosine functions emerge at a point in time and decay to zero after a finite period.

Technically, the wavelet function $\Psi$ is a real valued function in that its integral is zero, $\int_{-\infty}^{\infty}\Psi(t)dt = 0$ and the integral of its square is equal to one, $\int_{-\infty}^{\infty}\Psi(t)^2 dt = 1$. There are various wavelet functions, but this study utilizes a Morlet type wavelet for the transformation. A wavelet transform then represents the original time series in time-frequency domain utilizing the aforementioned wavelet functions. Wavelet transform corresponds to decomposition of the series into various frequency components using wavelet basis, which is obtained from the wavelet function $\Psi$ as follows:

$$\Psi_{a,b}(t) = a^{-½}\Psi\left(\frac{t-b}{a}\right) \qquad a > 0$$

where $a$ is the scaling parameter and $b$ is the translation parameter. The scaling parameter specifies the frequency and the translation parameter specifies the time. Therefore, the original series is decomposed into its frequency components without the loss of time domain. The CWT is defined as the inner product of the time series $x(t)$ and the basis wavelet $\Psi_{a,b}(t)$:

$$\mathrm{CWT}_x(a,b) = \langle X,\Psi_{a,b}\rangle = a^{-½}\int_{-\infty}^{\infty}\Psi^*\left(\frac{t-b}{a}\right)dt$$

where * indicates the complex conjugate of the function. Using the CWT method, this study obtains the wavelet power spectrum (WPS) of tourism income series. The wavelet power spectrum has an interpretation as time-frequency wavelet energy density (Carmona et al., 1998) and is the division of absolute value of CWT squared by scaling parameter:

$$\mathrm{WPS}_x(a,b) = a^{-1}\mathrm{CWT}_x(a,b)|^2$$

When calculating each value for scaling parameter and the translation parameter WPS, it is observed that they provide information about how well the wavelet function at that point in time describes the original series at different scales. However, WPS is not only a diagnostic tool, but has a very useful interpretation; WPS values specify the frequency components of the series at a period in time.

The Fan-Gencay unit root test also uses wavelet transform, but instead of the CWT the test makes use of discrete wavelet transform (DWT). The main difference between CWT and DWT is essentially the scaling parameter, in which the CWT takes values on a positive continuous scale, whereas DWT only takes specific positive scaling parameter values such as two and its larger exponents. Furthermore, the Fan-Gencay unit root test also uses another wavelet, namely Haar wavelet. The test uses wavelet coefficients $W$ and scaling coefficients $V$ to construct test statistics, which are not the same thing as translation and scaling parameters. Roughly speaking, wavelet coefficients are the values at each time point of the transformed series at the specified scale, and the scaling coefficients are the remaining part of the series, which was not captured by the specified scale and the previous ones. Although it may seem counterintuitive at first, it's called the scaling coefficients because at the next scale, these remaining values would be used to get the wavelet coefficients. The reason behind is the fact that DWT is implemented through the pyramid algorithm developed by Mallat (1989, 1998). In order to construct the test statistic, Fan and Gencay (2010) first transforms the demeaned and detrended series using unit scale DWT. The reason Fan and Gencay (2010) uses demeaned and detrended series is that the alternative hypothesis of the test is set in such a way that the investigated series is a zero mean stationary process. $V_{t,1}^{M}$ and $V_{t,1}^{d}$ denoting the unit scale DWT scaling coefficients of the demeaned $\{y_t - \bar{y}\}$ and detrended $\{\tilde{y}_t - \bar{\tilde{y}}\}$ series respectively the demeaned test statistic is based on

$$\hat{S}_{T,1}^{LM} = \frac{\sum_{t=1}^{T/2} (V_{t,1}^{M})^2}{\sum_{t=1}^{T} (y_t - \bar{y})^2}$$

and the detrended test statistic is based on

$$\hat{S}_{T,1}^{Ld} = \frac{\sum_{t=1}^{T/2} (V_{t,1}^{d})^2}{\sum_{t=1}^{T} (\tilde{y}_t - \bar{\tilde{y}})^2}$$

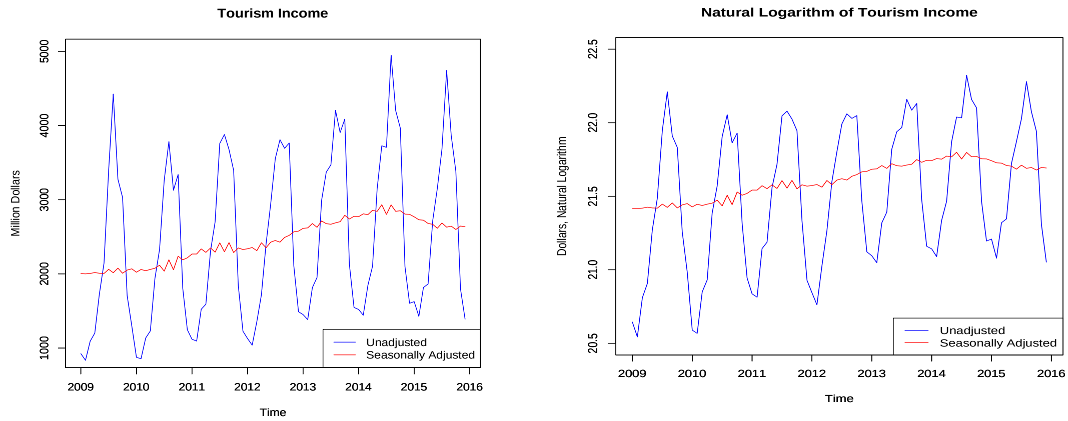
where $T$ is the length of the series, which has to be equal to a any positive integer exponent of two. Finally Fan-Gencay test evaluates the null hypothesis of unit root against the alternative of zero mean stationarity.

## 4. EMPIRICAL RESULTS

Figure 4.1 shows tourism income variable on the right and the logarithmic transformed variable on the left. They both present seasonally-adjusted and unadjusted series.

Traditional unit root tests do not work well with series unadjusted for seasonality. Although in classical time series analysis, seasonal adjustment is a widespread practice, this approach may lead to loss of very useful information depending on the circumstance being investigated. For instance Franses (1996) has indicated that economic agents may take the seasons into account in their decision making process or while forming expectations. Tourism industry is such a sector that seasons have a significant effect on the decisions of individuals. Furthermore Butler (2001) stated that seasonality has long been one of the most distinctive features of tourism. Consequently, seasonal adjustment may lead to loss of valuable information about tourism sector. The use of wavelet-based techniques prevents such a loss since they are equally suited to work with seasonal data.

**Figure 4.1** Graph of the Variables




| | | | | |
|---|---|---|---|---|
| **ADF Test Results** | | | | |
| LNINCOME | -1.560 | | Δ LNINCOME | -2.441** |
| LNINCOME_SA | -1.568 | | Δ LNINCOME_SA | -2.172** |
| ADF critical values for LNINCOME and LNINCOME_SA %1=-3.524 and %5=-2.902 | | | ADF critical values for Δ LNINCOME and ΔLNINCOME_SA %1=-2.597 %5=-1.945 | |
| **PP Test Results** | | | | |
| LNINCOME | -3.842* | | | |
| LNINCOME_SA | -1.415 | | Δ LNINCOME_SA | -14.502* |
| PP critical values for LNINCOME and LNINCOME_SA %1=-3.511 and %5=-2.897 | | | PP critical values for Δ LNINCOME and ΔLNINCOME_SA %1= -2.593 %5=-1.944 | |
| **Ng-Perron Test Results** | | | | |
| | $MZ_a$ | $MZ_t$ | MSB | MPT |
| LNINCOME | -11.138 | -2.359 | 0.211 | 2.201 |
| LNINCOME_SA | -0.389 | -0.462 | 1.187 | 83.626 |
| Δ LNINCOME_SA | -79.538 | -6.305 | 0.079 | 0.308 |

Ng-Peron critical values for LNINCOME, LNINCOME_SA, ΔLNINCOME and LNINCOME_SA series; MZa, MZt, MSB, MPT respectively;
%1 significance level -13.80, -2.58, 0.17 and 1.78
%5 significance level for -8.10, -1.98, 0.23 and 3.17
* denote %1 significance level ** denote %5 significance level

**Table 4.2** Conventional Unit Root Test Results.

In the empirical analysis, both conventional unit root tests and wavelet based unit root tests are used. We employ logarithmic seasonally adjusted and logarithmic seasonally unadjusted tourism income variables which is mostly preferred in the empirical literature. First, we investigate stationarity properties of the variables employing the widely used conventional unit root tests in the literature including ADF from Dickey and Fuller (1979), PP from Phillips and Perron (1988) and Ng-Peron from Ng and Peron (2001). The results of conventional stationary tests are presented in Table 4.2.

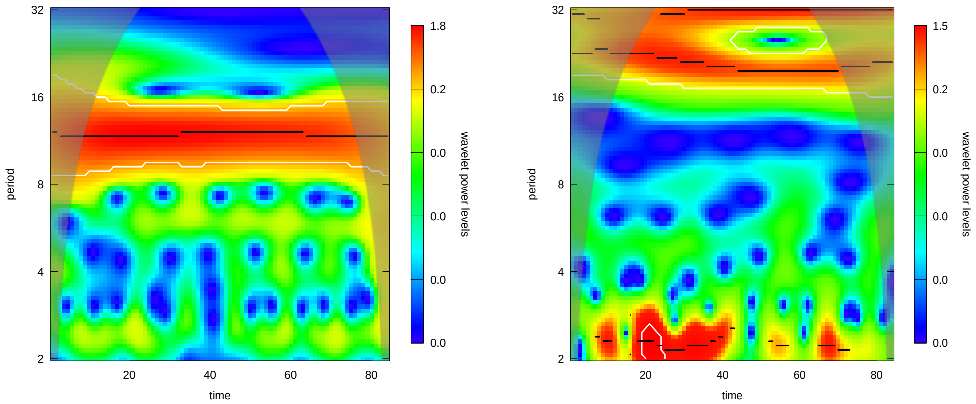
For ADF and PP tests, the null hypothesis indicates that the variables show unit root. According to Table 4.2, the ADF test suggests that both LNINCOME and LNINCOME_SA variables are I(1), which means they are stationary after differencing. However, the PP test suggest that the LNINCOME variable is I(0) which means stationary at level and that the LNINCOME_SA variable is I(1).

For Ng-Peron test, for MZa and MZt tests the null hypothesis suggest the series have unit root as ADF and PP tests while for MSB and MPT tests the null hypothesis suggests that the series are stationary. According to Ng-Peron test results LNINCOME variable is found I(0) and LNINCOME_SA variable is found I(1) parallel with PP test results.

To sum up, the LNINCOME_SA variable is found to be I(1) according to all conventional test results. However; the LNINCOME variable is found to be I(1) for the ADF test and as I(0) for the PP and NG-Perron tests. Ng-Perron tests have more power over other traditional tests for small samples (Ertuğrul and Soytas, 2013). So we accepted LNINCOME variable I(0).

Traditional unit root tests provide detailed information on the dynamic behaviour of the series; however, their shortcoming is in their inability to capture non-linear and seasonal behaviours in the series. On the other hand, wavelet analysis has a distinct advantage in these areas. Figure 4.2 exhibits the wavelet power spectra (WPS) of seasonally unadjusted and seasonally adjusted variables. The unadjusted variable is presented on the left and the seasonally adjusted variable is presented on the right.

**Figure 4.2** WPS of Seasonally Unadjusted and Seasonally Adjusted Variable




A WPS displays the frequency components of a time series during specific periods in time. Therefore it makes it easy to observe the dominant frequencies and changes in those frequencies at distinct points in time. Moreover, Figure 4.2 displays periods instead of frequencies on the vertical axis, making it further easier to interpret the result of the WPS. The period on the vertical axis shows the duration of time of one cycle in a repeating event, in other words, the period expresses how long it takes between recurring events. The bars on the right-hand side of both graphs show the wavelet power levels. Roughly, it is a measure of the strength of the recurrence of cyclical events. The seasonality in the unadjusted series (left graph) is the most evident example. The wavelet power levels are highest around the period 12, which means that same types of behavior in the series occurs every year. Additionally, starting around the ninth observation (September 2009) it is seen that there is certainly periodic behavior in the series with 6-month cycles throughout the series. Though it is not prominent as the 12-month cycle, it still is differentiated from the surrounding blue area. Another such inconspicuous recurring behavior in the unadjusted series is at period 3, which indicates the type of event portrayed at this period occurs quarterly. Moreover, it is obvious from the graph that the behavior is abandoned for a short time around the fortieth observation (March - April 2012), which might be due to political unrest.

The right hand side of the Figure 4.2 displays WPS of the seasonally adjusted series. The most remarkable thing is the absence of the wide red belt around the 12-month period which was the most striking feature of the graph on the left. This evidently points out that Tramo-Seats successfully filtered out the 12-month seasonal events form the series. Moreover, the seasonality around the 6-month period has been filtered out as well. On the other hand, some less obvious behavioral patterns emerge clearly. Especially the quarterly behavior is more apparent in the WPS of the seasonally adjusted series. The graph demonstrates that this behavior pattern is not omniscient in the series; but that it emerges and disappears time and again. Finally, the trend or the long-term behavior is the most apparent feature of the seasonally adjusted series. There is intense gathering of power spectra levels on the top of the graph. Interestingly two separate recurring events are observed: The first one focuses approximately around a 32-month or may be longer period and the other moves about the 24-month period. The first pattern is plainly the trend noticeable in seasonally adjusted series in Figure 4.1. However, one should be warned that it is not obvious whether this trending behavior is really an integral part of the series or emerges due to the Tramo-Seat procedure. The second long term behavior pattern is the 2-yearly recurrence. Although the same warning applies to this case as well, this 2-year period behavior may be pointing out to an important fact about tourism demand decisions of economic agents. When deciding about touristic activities, economic agents might be taking into account a longer time horizon such as two years instead of one-year horizon as generally accepted.

Following the conventional unit root analysis both employing the seasonally adjusted and unadjusted series, the stationary dynamics of the series are further investigated by the Wavelet-based unit root test developed by Fan and Gencay (2010). As mentioned before, the main advantage of the Fan and Gencay (2010) test is that it takes into consideration nonlinearities and seasonality within the variables. When we take into consideration the seasonal characteristic of tourism income variable, the Fan–Gencay unit root test is suitable for advanced research of the dynamics of tourism income.

| Test Statistic | No Seasonal Adjustment | Seasonal Adjustment | Critical Values 1% | 5% | 10% |
|---|---|---|---|---|---|
| $\hat{S}_{T,1}^{LM}$ | -2420.527 | -62743.62 | -40.38 | -27.38 | -21.70 |
| $\hat{S}_{T,1}^{Ld}$ | -1549.133 | -222223.7 | -50.77 | -36.54 | -30.23 |

**Table 4.3** The empirical result of Fan and Gencay (2010) unit root test.

The empirical result of the Fan–Gencay unit root test is presented in Table 4.3. The demeaned test statistics are reported in the first row and de-trended test statistics are reported in the second row. The empirical results for the seasonally unadjusted variable is reported in the second column and the results for the seasonally adjusted variable is reported in the third column and the remaining columns provide the critical values for the test statistics. Both test statistics reported in Table 4.3 is smaller than the critical value at one percent significance level. This indicates that the null hypothesis of unit root is rejected for both seasonally adjusted and non-seasonally adjusted variables. In sum, according to Fan and Gencay (2010) test, both seasonally adjusted and non-seasonally adjusted variables are found I(0).

## 5. CONCLUSION

Seasonality is an inherent characteristic of tourism and the Turkish tourism sector is no exception. Tourism income of Turkey certainly reflects this fact; Figure 4.1 clearly supports this statement. Further research by WPS illustrates a strong seasonal behavior with twelve-month cycles. Moreover, WPS also points out that there is a less prominent seasonality with six month and three month cycles.

Conventional unit root tests can't reject the null hypothesis of the unit root when implemented on seasonally adjusted series. On the other hand, these unit root tests do not reach a consensus about the unit root behavior of the unadjusted series. However, the Wavelet-based Unit Root Test strongly rejects unit root hypothesis for both the seasonally adjusted and seasonally unadjusted series.

Wavelet based methods are suitable for the analysis of series which depict nonstationary, nonlinear and seasonal attributes. The difference between the empirical results of conventional unit root tests and the wavelet-based test may arise from the nonlinear structure that lies in tourism income series (which is a topic for further study) or prominent seasonality in tourism sector or both. Unless the difference is a result of nonlinearity, the dissimilarity between the findings of conventional unit root tests and the wavelet tests points out that seasonality might be stochastic. Hence, rather than seasonal adjustment, utilizing methods that incorporate seasonality will yield more reliable findings.

Finally, the result of the wavelet-based unit root test indicates that whether we take seasonality into consideration or not, tourism income series exhibit no unit root behavior. This means that the impact of a shock on this sector is transitory. The income in tourism sector will return more or less back to its mean for any season after a shock. The benefit of this finding is the reassurance that a bad season will rarely be followed by another bad season while on the other hand the reverse is true as well.

Most of the papers in the empirical literature which employ conventional unit root tests found that tourism income variable is I(1) and continue the modelling with this assumption, which may lead to biased econometric results.

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