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THE STRUCTURE OF TOURISM REVENUES IN TURKEY: EVIDENCE FROM FRACTIONAL INTEGRATION UNDER MULTIPLE STRUCTURAL BREAKS

This paper investigates time series properties of the tourism revenues in Turkey over the period from 1997:01 through 2010:03. First, we determine the integration order by using different versions of Robinson tests. Second, we test if the tourism revenues show any structural changes over the sample period under consideration by using Bai and Perron multiple structural break tests. The results show that the tourism revenues follow a nonstationary long memory process when we ignore potential structural breaks. When we take structural breaks into consideration and adjust data for the breaks, we still find some evidence of nonstationary long memory behavior in tourism revenues. These results imply that shocks to tourism revenues in Turkey have a permanent effect.
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Introduction

Tourism industry, being a part of the national economy, is a significant source of export revenues and attracts investment and scarce economic resources in different countries and destinations. Government concerns the socio-economic benefits of tourism and the necessity to protect national resources. The aim of the government interventions is to increase benefits and minimize the damages of tourist flow on social, cultural, environmental assets of the country. According to the World Tourism Travel Council (WTTC), the contributions of travel and tourism sector to GDP, total employment and total investment are 9.8%, 8.6% and 9.8%, respectively. Because of the increasing importance of tourism sector in terms of its contribution to the national economy, the theoretical and empirical studies about the tourism are increased in recent years.

In Turkey as well as other countries, tourism is one of the largest and fastest growing industries and an important source of employment. In regards to the total tourist arrivals to Turkey, it seems that the number of foreign visitors has accelerated rapidly in the last two decades. International tourist arrivals (tourism revenues) to Turkey increased from 8.6 million (US$ 5.6 billion) in 1996 to 26.3 million (US$

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16.7 billion) in 2008. Since 1996, tourist arrivals and tourism revenues have grown except 1999 and 2006. Decline of 1999 and 2006 can be explained both internal and external factors such as 1998 Russian financial crisis, 1999 earthquake, increase in terrorism and bird-flu disease. On the other hand, tourism in Turkey has generated 5.2 percent of GDP and 618.000 jobs and it is also a major producer of government revenue, accounting for US$ 3.5 billion of taxes in 2001 (MOT, 2002). In 2009, the number of tourist arrivals to Turkey was 27.1 million and tourism revenue was US$ 21.2 billion. It is expected to reach US$ 22.5 billion in 2010. According to the 2011 program of State Planning Organization, the total value of tourism to Turkey is projected as US$ 23.8 billion for 2011.

In the tourism literature, there are two main approaches, based on regression models (Melenberg and Van Soest, 1996; Kuledran and King; 1997) and pure time series analysis (Kim, 1999; Lim and McAleer, 2002; Goh and Law, 2002). On the other hand, there are interesting works about the issues range from "determinants of demand for international tourist flows" to "sustainable tourism development" (Akış, 1998; Alipour, 1996; Baum and Mudambi, 1996; Halıcıoğlu, 2004; Mudambi and Baum, 1997; Seckelmann, 2002; Tatoğlu et al., 2002; Tosun, 1999; Tosun and Jenkins, 1996; Uysal and Crompton, 1984; Yüksel et al., 1999).

This paper deals with the analysis of time series properties of the tourism revenues in Turkey over the period from 1997:01 through 2010:03. The difference of this paper is that we examine the behavior of the tourism revenues by means of using fractionally integrated techniques in the context of structural breaks. First, the integration order is determined by using different versions of Robinson(1994a) tests without allowing for structural breaks. Since Granger and Hyung(1999) and Diebold and Inoue(2001) suggest that the long memory property in the data may be due to the presence of structural breaks or regime switches, in other words, structural breaks or regime switching can generate spurious long memory behavior in an observed time series, we consider that tourism revenues may be affected by structural breaks. For this purpose, to determine potential structural breaks in the tourism revenues, we use multiple structural break tests suggested by Bai and Perron (1998, 2003). This procedure allows to test endogenously for the presence of multiple structural breaks, and has a number of advantages over traditional approaches. In the next step of the analysis, we also determine the integration order by using Robinson(1994a) tests after adjusting potential structural breaks.

The plan of the remainder of the paper is as follows: Section 2 presents the Robinson tests for fractional integration and Bai and Perron tests for multiple structural breaks. Section 3 discusses the data and empirical results. Finally, Section 4 gives some concluding remarks.

2. Methodology

In this section, different versions of Robinson(1994a) tests for fractional integration and multiple structural break tests suggested by Bai and Perron (1998, 2003) are described.

2.1. Robinson Tests for Fractional Integration

In order to examine time series properties of the tourism revenues in Turkey, Robinson(1994a) tests are used in this paper. Robinson(1994a) considers the following regression model,

$$y_t = \beta' z_t + x_t \quad , \quad t = 1, 2, ... \tag{2.1.1}$$

where y_t is the observed time series for $t = 1, 2, ...T$, $\beta = (\beta_1, ..., \beta_k)'$ is a $(k \times 1)$ vector of unknown parameters, z_t is a $(k \times 1)$ vector of deterministic regressors such as an intercept or a linear trend. And the regression errors x_t can be explained as follows:

$$(1 - L)^d x_t = u_t \quad , \quad t = 1, 2, ... \tag{2.1.2}$$

where L is the lag operator and u_t is an $I(0)$ process. Here, d can take any real value. If $d = 0$ in Equation (2.1.2), $x_t = u_t$ and a "weakly autocorrelated" x_t is allowed for. When $d > 0$, x_t is said to be "strongly autocorrelated" or "strong dependent". Clearly, the unit root case corresponds to $d = 1$ in (2.1.2). If $d > 0$, X_t is said to be long memory (Granger and Joyeux, 1980; Hosking, 1981). If $0.5 < d < 1$, the process is nonstationary and exhibits long memory while the process is stationary and exhibits long memory, if $0 < d < 0.5$. It is important to note that when $d < 0.5$ the process is stationary as well as mean reverting with the effect of the shocks dying away in the long run and when $0.5 \le d$ the process is non-stationary even if the fractional parameter is significantly less than 1.

Robinson(1994a) proposes Lagrange Multiplier (LM) test to test unit roots and other forms of nonstationary hypotheses, embedded in fractional alternatives. The null hypothesis of the test can be seen in below:

$$H_0 : d = d_0 \tag{2.1.3}$$

Specifically, the test statistic is given by:

$$\hat{r} = \frac{T^{1/2}}{\hat{\sigma}^2} \hat{A}^{1/2} \hat{a} \tag{2.1.4}$$

where T is the sample size and

$$\hat{a} = \frac{-2\pi}{T}\sum_{j=1}^{T-1}\psi(\lambda_j)g(\lambda_j;\hat{\tau})^{-1}I(\lambda_j)\,;\;\; \hat{\sigma}^2 = \sigma^2(\hat{\tau}) = \frac{2\pi}{T}\sum_{j=1}^{T-1}g(\lambda_j;\hat{\tau})^{-1}I(\lambda_j)\,;$$

$$\hat{A} = \frac{2}{T}\left(\sum_{j=1}^{T-1}\psi(\lambda_j)^2 - \sum_{j=1}^{T-1}\psi(\lambda_j)\hat{\varepsilon}(\lambda_j)' \times \left(\sum_{j=1}^{T-1}\hat{\varepsilon}(\lambda_j)\hat{\varepsilon}(\lambda_j)'\right)^{-1} \times \sum_{j=1}^{T-1}\hat{\varepsilon}(\lambda_j)\psi(\lambda_j)\right)$$

$$\psi(\lambda_j) = \log\left|2\sin\frac{\lambda_j}{2}\right|; \qquad \hat{\varepsilon}(\lambda_j) = \frac{\partial}{\partial\tau}\log g(\lambda_j;\hat{\tau}_j)\,; \qquad \lambda_j = \frac{2\pi j}{T}\,;$$

$$\hat{\tau} = \arg\min_{\tau\in T^*}\sigma^2(\tau)$$

where $I(\lambda_j)$ is the periodogram of u_t and T^* is a compact subset or the Euclidean space.

The main advantage of the Robinson(1994a) procedure is that it tests unit and fractional roots with a standard null limit distribution, which is unaffected by inclusion or not of deterministic trends. Under certain regularity conditions, Robinson(1994a) showed that the test statistic is

$$\hat{r} \to_d N(0,1) \text{ as } T \to \infty. \qquad (2.1.5)$$

Thus, a one sided $100\alpha\%$ level test of Eq(2.1.3) against the alternative $H_1 : d > d_0$ is given by the rule "Reject H_0 if $\hat{r} > z_\alpha$" where the probability that a standard normal variate exceeds z_α is α and conversely, a one sided $100\alpha\%$ level test of Eq(2.1.3) against the alternative $H_1 : d < d_0$ is given by the rule "Reject H_0 if $\hat{r} < -z_\alpha$". Empirical applications of the test with this version and other versions can be found in Gil-Alana and Robinson(1997, 2001), Gil-Alana(1999, 2000, 2001, 2002b).

Several works including Granger and Hyung(1999) and Diebold and Inoue(2001) show that the long memory property in the data may be due to the presence of structural breaks or regime switches. This is called "the spurious long memory process". In other words, structural breaks or regime switching can generate spurious long memory behavior in an observed time series. For these reasons, to take structural breaks into consideration, we also use the multiple structural break tests suggested by Bai and Perron (1998, 2003) for consistent estimation of multiple break points in this paper.

2.2. Bai and Perron Tests for Multiple Structural Breaks

In order to test multiple structural breaks in the data, an alternative method is suggested by Bai and Perron(1998, 2003). Their procedure considers the following multiple structural break model with m breaks ($m+1$ regimes):

$$y_t = x_t^{'}\beta + z_t^{'}\delta_1 + u_t, \quad t = 1,...,T_1$$
$$y_t = x_t^{'}\beta + z_t^{'}\delta_2 + u_t, \quad t = T_1+1,...,T_2$$
$$\cdots\cdots\cdots\cdots\cdots\cdots$$
$$y_t = x_t^{'}\beta + z_t^{'}\delta_{m+1} + u_t, \quad t = T_m+1,...,T. \tag{2.2.1}$$

where y_t is the observed dependent variable at time t, x_t is $(p\times 1)$ and z_t is $(q\times 1)$ and β and δ_j ($j=1,...,m+1$) are the corresponding coefficient vectors, and u_t is the disturbance term at time t . Here, T is the sample size and $T_1 < T_2 < ... < T_m < T$. The break points ($T_1,...,T_m$) are treated as unknown and are estimated together with the unknown coefficients when T observations are available. The estimation method is based on least squares principle. For each m - partition ($T_1,...,T_m$), denoted $\{T_j\}$, the associated least squares estimate of δ_j is obtained by minimizing the sum of squared residuals $\sum_{i=1}^{m+1} \sum_{t=T_{l-1}+1}^{T_i} (y_t - z_t^{'}\delta_i)^2$.

Bai and Perron(1998, 2003) suggest several statistics for consistent estimation of the number and location of breakpoints ($T_1,...,T_m$) and the parameters ($\delta_1^{'},...,\delta_{m+1}^{'}$):

- $SupF_T(k)$ test, i.e., a $SupF$ - type test of the null hypothesis of no structural break *versus* the alternative of a fixed number of breaks k .
- Two maximum tests of the null hypothesis of no structural break *versus* the alternative of an unknown number of breaks given some upper bound, i.e., $UD_{\max}$ test, an equal weighted version, and $WD_{\max}$ test, with weights that depend on the number of regressors and the significance level of the test.
- The $SupF_T(l+1|l)$ test, i.e., a sequential test of the null hypothesis of l breaks *versus* the alternative of ($l+1$) breaks.

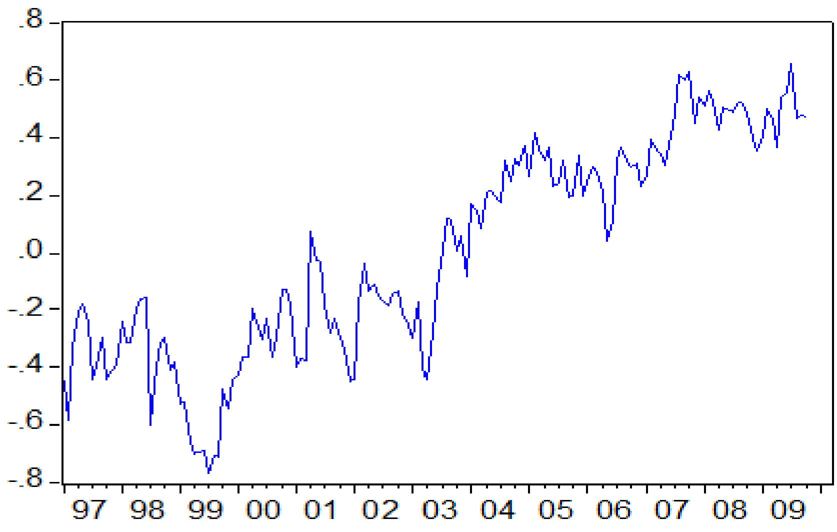
The asymptotic distributions of these three tests are derived in Bai and Perron(1998) and asymptotic critical values are tabulated in Bai and Perron(1998, 2003) for $\varepsilon = 0.05 \ (M = 9), 0.10 \ (M = 8), \ 0.15 \ (M = 5), \ 0.20 \ (M = 3)$, and $0.25 \ (M = 2)$. The procedure of Bai and Perron follows these steps: First, calculate the $UD_{\max}$ and $WD_{\max}$ statistics. These tests are used to determine if at least one structural break is present. In addition, the $SupF_T(k)$ test is calculated for the hypothesis of 0 break *versus* k breaks. If these tests show evidence of at least one structural break, then the number of breaks can be determined by the $SupF_T(l+1|l)$ test. The number of breaks can also be chosen by the Bayesian information criterion, BIC (Yao, 1988); and the Schwarz modified criterion, LWZ (Liu, Wu and Zidek, 1997).

3. Data and Empirical Results

The data analysed in this paper correspond to the tourism revenues (million dollars) in Turkey over the period from 1997:01 through 2010:03. The monthly data is obtained from the Association of Turkish Travel Agencies. We convert it into the natural logarithms and adjust for seasonality before the analysis by using seasonal dummies. The illustration of the data can be seen Figure 1.

Figure 1

Plot of the logarithmic and seasonally adjusted tourism revenues data



We observe that tourism revenues appear to be nonstationary and may be affected by structural breaks over the sample period. Before determining the structural breaks, we start analysis by ignoring potential structural breaks and apply different versions of tests developed by Robinson(1994a) to examine the long memory properties of the data. These tests have standard null and local limit distributions and they are efficient against appropriate parametric alternatives. Under the null hypothesis $H_0 : d = d_0$, we examine the case with a linear time trend and model the $I(0)$ disturbances to be both white noise and AR(1) processes. The one sided test statistics $\hat{r}$ for tourism revenues with $d_0 = 0, 0.05, 0.10, 0.15, 0.20, 0.25, ..., 0.50, ..., 1, 1.05, 1.10$ are reported in Table 1. For a given d_0, significantly positive values of $\hat{r}$ are consistent with the orders of integration higher than d_0, whereas significantly negative ones consistent with the orders of integration smaller than d_0. A notable feature is the fact that $\hat{r}$ monotonically decreases with d_0. This is something to be expected since it is a one sided test statistic.

Table 1

Robinson test results before adjusting for structural breaks

d_0	White noise disturbances	AR(1) disturbances
0	13.54	55.38
0.05	12.40	45.68
0.10	11.23	37.58
0.15	10.04	30.86
0.20	8.86	25.32
0.25	7.69	20.75
0.30	6.55	16.95
0.35	5.46	13.76
0.40	4.43	11.04
0.45	3.47	8.68
0.50	2.58	6.59
0.55	1.76	4.72
0.60	1.01**	3.01
0.65	0.34**	1.45**
0.70	**-0.27****	**0.02****
0.75	-0.82**	-1.29**
0.80	-1.31**	-2.49
0.85	-1.75	-3.58
0.90	-2.14	-4.56
0.95	-2.49	-5.45
1.00	-2.81	-6.25
1.05	-3.09	-6.98
1.10	-3.35	-7.65

In bold: The smallest value across the different values of d_0.

****** indicates nonrejection values of the null hypothesis at the 95% significance level.

The results in the table show that if the disturbances are white noise, H_0 (2.1.3) cannot be rejected for $d_0 = 0.60, 0.65, 0.70, 0.75$ and 0.80. On the other hand, if the disturbances are assumed to be an AR(1) process, the non-rejection values take place at $d_0 = 0.65, 0.70$ and 0.75. The lowest statistic across the different values of d_0 occurs when $d_0 = 0.70$ in both disturbances. It is important to note that if $0.5 < d < 1$, the process is nonstationary and exhibits long memory. Our findings show that tourism revenues are a nonstationary process with long memory when we ignore potential structural breaks. This result shows that shocks to tourism revenues in Turkey have a permanent effect. As mentioned before, Granger and Hyung(1999) and Diebold and Inoue(2001) suggest that the long memory property in the data may be due to the presence of structural breaks or regime switches. In other words, structural breaks or regime switching can generate spurious long memory behavior in an observed time series. Following these studies, we consider that tourism revenues may be affected by structural breaks over the sample period. In order to determine potential structural breaks in the data, the multiple structural break tests suggested by Bai and Perron (1998, 2003) are used in the next step of the analysis. Bai and Perron procedure allows us to test for multiple breaks at unknown dates, so that each break point is successively estimated by using a specific-to-general strategy in order to determine consistently the number of breaks. The test statistics are implemented in a Gauss programme and the results are tabulated in Table 2. The maximum permitted number of breaks is set at $M = 5$ and a trimming $\varepsilon = 0.15$ is used to determine the minimal number of observations in each segment [$h = [\varepsilon T]$ with the sample size T].

The results in the table show that both $UD_{\max}$ and $WD_{\max}$ statistics are highly significant which implies that at least one break is present in tha data. All the $SupF_T(k)$ tests are significant, with k running between 1 and 5, so that at least one break would be present. But, the significance of these tests does not provide enough information about the exact number of breaks. The number of breaks can be chosen by the $SupF_T(l+1|l)$ test or the BIC and LWZ criterions. It is seen that $SupF_T(l+1|l)$ test is significant for $l = 1$. Both the BIC and LWZ criterions select 3 breaks and the break dates are identified around 2000:03, 2003:06 and 2007:05. These breaks occur during the eartquake took place in the midst of tourism season at 17th of August in 1999, during the Second Supreme National Council on Tourism which was held by Ministry of Tourism in 2002 and during the Ninth Five Year Development Plan which was prepared in line with the international developments and basic trends regarding the 2007-2013 period, respectively. Using these structural breaks, we adjust tourism revenues data and re-estimate the one sided test statistics $\hat{r}$ with $d_0 = 0, 0.05, 0.10, 0.15, 0.20, 0.25, ..., 0.50, ..., 1, 1.05, 1.10$. The Robinson test results after adjusting structural breaks are reported in Table 3.

Table 2

Bai and Perron test results

Specifications		
$z_t = \{1\}$ $q = 1$ $p = 0$ $h = 23$ $M = 5$ $\varepsilon = 0.15$		
Tests	Hypothesis	Statistics
SupF_T(k) Test:	$H_0:$ 0 break *vs* $H_1:$ 1 break	81.97*
	$H_0:$ 0 break *vs* $H_1:$ 2 breaks	108.277*
	$H_0:$ 0 break *vs* $H_1:$ 3 breaks	129.280*
	$H_0:$ 0 break *vs* $H_1:$ 4 breaks	96.540*
	$H_0:$ 0 break *vs* $H_1:$ 5 breaks	110.795*
UD_{max} Test:	$H_0:$ 0 break *vs* $H_1:$ an unknown break	129.280*
WD_{max} Test:	$H_0:$ 0 break *vs* $H_1:$ an unknown break	277.327*
SupF_T (l+1 | l) Test:	SupF_T (2 | 1)	49.872*
	SupF_T (3 | 2)	6.513
	SupF_T (4 | 3)	1.329
	SupF_T (5 | 4)	0.000
Number of Breaks:	BIC: 3	LWZ: 3
Break Dates:	2000:03 - 2003:06 - 2007:05	

* denotes that the tests are significant at 1% level.

As can be seen from the table, if the disturbances are white noise, the non-rejection values take place at $d_0 = 0.40, 0.45, 0.50, 0.55, 0.60, 0.65$ and 0.70. If the disturbances are assumed to be an AR(1) process, H_0 (2.1.3) cannot be rejected for $d_0 = 0.50, 0.55$ and 0.60. The smallest statistic across the different values of d_0 occurs when $d_0 = 0.55$ in both white noise and AR(1) disturbances. It is clear that adjusting structural breaks significantly reduces the integration order but we still find some evidence of nonstationary long memory behavior in tourism revenues. It can be concluded that shocks to tourism revenues have a permanent effect.

Table 3

Robinson test results after adjusting for structural breaks

d_0	White noise disturbances	AR(1) disturbances
0	8.86	25.63
0.05	7.82	21.40
0.10	6.79	17.82
0.15	5.80	14.77
0.20	4.85	12.14
0.25	3.95	9.86
0.30	3.10	7.83
0.35	2.31	6.02
0.40	1.58**	4.37
0.45	0.91**	2.86
0.50	0.30**	1.47**
0.55	**-0.25****	**0.19****
0.60	-0.76**	-1.00**
0.65	-1.21**	-2.09
0.70	-1.63**	-3.09
0.75	-2.00	-4.01
0.80	-2.34	-4.84
0.85	-2.64	-5.60
0.90	-2.92	-6.29
0.95	-3.17	-6.92
1.00	-3.40	-7.50
1.05	-3.61	-8.03
1.10	-3.80	-8.53

In bold: The smallest value across the different values of d_0 .

** indicates nonrejection values of the null hypothesis at the 95% significance level.

4. Conclusions

In this paper, the time series properties of the monthly tourism revenues in Turkey over the period from 1997:01 through 2010:03 are analyzed with and without allowing for structural breaks. Before starting the analysis, we convert the data into the natural logarithms and adjust for seasonality by using seasonal dummies. First, we ignore the potential structural breaks in the data and determine the integration order by using different versions of Robinson(1994a) tests. The findings show that the tourism revenues follow a nonstationary long memory process. Following Granger and Hyung(1999) and Diebold and Inoue(2001), we consider that tourism revenues may be affected by structural breaks over the sample period and our results can be spurious when we ignore structural breaks. For determining potential structural breaks in the data, we apply the multiple structural break tests suggested by Bai and Perron (1998, 2003). According to the both BIC and LWZ criterions, 3 breaks are identified around 2000:03, 2003:06 and 2007:05 which occur during the

August 1999 eartquake, the Second Supreme National Council on Tourism and the Ninth Five Year Development Plan, respectively. After adjusting these structural breaks, we re-estimate the one sided test statistics $\hat{r}$. The corresponding results show that adjustment for structural breaks significantly reduces the integration order but tourism revenues still follow a nonstationary long memory behavior. It can be concluded that the shocks have a permanent effect on the tourism revenues of Turkey.

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