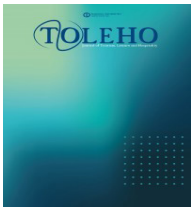
PEER-REVIEWED RESEARCH ARTICLE 2021, 3(2): 82-94 https://toleho.anadolu.edu.tr/



TOLEHO Journal of Tourism, Leisure and Hospitality

ANADOLU UNIVERSITY FACULTY OF TOURISM

THE EFFECTS OF EARTHQUAKES ON TOURISM: EVIDENCE FROM TURKEY

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KEYWORDS

Tourism
Environmental crisis
Earthquake
Turkey
CUSUM

ABSTRACT

Turkey has been hit by many earthquakes during the last century. A 7.4 earthquake that lasted for 45 seconds struck the Marmara Region on 17 August 1999 at 3:02 am. In addition to its destructive effects such as property losses and personal injuries, it also had negative effects on the tourism industry. The cancellation of package tours for foreign tourists in Turkey had a negative impact on travel agencies, hotels and airlines. The purpose of the present study is to outline the economic impact of the 1999 Earthquake on tourist flows. For this purpose, an event study was performed to evaluate the amount of loss between August 1998 and August 2001 due to the drop in the tourism industry. Additionally, the CUSUM and CUSUMSQ test, multiple linear regression (MLR) model and prediction models were employed to identify the patterns of structural change. The results show that the number of tourists decreased by about 20% following the earthquake. The results of the CUSUM and CUSUMSQ estimation analysis based on the control variables suggest that if there had been no earthquakes, the number of future tourists would have been approximately 8% higher than the actual number of tourists who visited Turkey at that time.

1. Introduction

About 66% of Turkey's territory is covered by a total of 326 active faults and it is a tectonically active land where 70% of the population is at high risk of earthquake damage, danger and destruction (Ewing, Kruse, & Özdemir, 2004) An earthquake with a magnitude of 7.4 which lasted for 45 seconds took place on 17 August 1999 at 3:02 am. 17,480 death were reported, 43,953 people were injured and 73,342 buildings were damaged. The earthquake affected a total of sixteen million people in ten cities, which were İstanbul, Kocaeli, Gölcük, Yalova, Sakarya, Tekirdağ, Bursa, Bolu, Eskişehir and Balıkesir (Petal & Turkmen, 2002). İstanbul was one of the cities that received the greatest damage from the disaster. The fact that Istanbul is the biggest, the most popular and the most important touristic destination in Turkey brought about a crisis in every aspect, including the tourism industry in Turkey, which tarnished the safe image of the country creating a negative impact on purchasing decisions of the tourists. With the decreasing demand and cancellations of package tours, many tourism companies, such as travel agencies, hotels and airlines, have faced several difficulties. (Aktürk & Albeni, 2002).

The purpose of the present research is to evaluate the economic effects of the 1999 Earthquake in Turkey on international tourist arrivals with a pioneering approach to understand the effects of a natural disaster on tourist mobility. To suit the purpose of the study, an event study was performed based on international tourist arrival statistics. Besides, the standard division of tourism parameters was employed and CUSUM tests were used to identify the pattern of structural change. The present paper applies the event study methodology, unlike the other prominent studies. There is an extensive body of literature on natural disasters, specifically earthquakes within the context of tourism. For example, Wu and Hayashi (2014) explored the impact of crises on Japan's foreign tourist arrival by applying Auto-Regressive Integrated Moving Average (ARIMA) interference designs that put the spotlight on assessing patterns of change and duration of effects by observing variations in parameters. Mendoza et al. (2012) Explored the role of natural disasters on inbound tourism in Chile using Seasonal Autoregressive Integrated Moving Average (SARIMA) designs of inbound tourism during the eruption. A recent study conducted by Cro and Martins (2017) compared the date of tourism crises and disasters to the dating of the structural breaks employing Bai and Perron's (2003) Structural break test method for the inappropriate structural breaks in tourist arrivals.

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Received 03.01.2021; Received in revised form 22.02.2021; Accepted 23.02.2021

e-ISSN: 2687 - 3737 / © 2021 The Authors. Published by Anadolu University.
http://dx.doi.org/10.48119/toleho.851669

This study focuses on the different studies in that it aims to fill the gap in the existing literature on the ex-post identification of tourism disaster events. This approach, therefore, contributes to the literature on emergencies or disasters in the tourism sector by exploring the effects of the negative shocks to the global market as a result of crises or natural disasters on the tourism industry closing the gap between the tourism industries. Eventually, the study continues by highlighting the findings, defining the limitations and offering directions for future research.

2. Literature Review

2.1. Earthquake and Tourism Sector in Turkey

Crises are paradoxical moments and possibilities from which different alternatives can emerge (Bramwell & Lane, 2011). A crisis is defined by Faulkner (2001) as an action or non-action that interferes with or has a negative personal impact on the continuous functioning of the corporation, reasonable achievement of the company's goals or its viability. Crises could perhaps quickly spread again from the place of origin to distanced areas of the world and communicate in unusual ways based on environmental input, financial market linkages, the role of dynamic and human beings (Biggs, Hall, & Stoeckl, 2012). Earthquakes are among the most significant and unpredictable types of environmental crisis (Vere-Jones, 1995). As reported by Ritchie (2008), whatever the origin of these natural disasters, there may be major economic and social impacts on both the destination and the world economy as a consequence of a decline in international tourist arrivals. Tourism damage caused by a crisis or a disaster also may have significant effects on economic systems (Sausmarez, 2007). Actions must therefore be taken as quickly and efficiently as possible across the crisis period to minimize adverse results and damage caused (Çiftçi, Küçükaltan, &Menteş, 2017).

Considering its strategic position, Turkey is at high risk of being exposed to various types of crises (Kaya, Yetgin Akgün,& Çiftci, 2020). Turkey is one of the destinations that have been seriously affected by earthquakes as it has been hit by a few series of earthquakes in the last decade, which had both geographical and financial outcomes. The crises in Turkey tarnished the safe image of the country and had a negative impact on the purchasing decisions of the tourists. Together with decreasing demand, many businesses and their employees faced difficulties in the tourism industry. The cancellation of package tours for foreign tourists in Turkey had a negative impact on travel agencies (Yetgin, Yılmaz, & Çiftci, 2018). Tourism is the very heart of Turkey's economy, which is mainly based on tourism, automobile manufacturing, petrochemistry, and railway vehicle manufacturing and repair, basic metals, manufacturing of synthetic fibre and yarn, production of lacquer and paint. Yalova, Kocaeli, Bolu, Sakarya four of the most affected cities, had over 7% of GDP and 14% of industrial production compared to other industrial cities in Turkey with a national average per capita income nearly twice the amount of other industrial cities.

A 60-kilometre highway route between Ankara and Istanbul, Gebze-Izmit-Arifiye railway, Adapazari's railway factory and rolling stock, Derince Harbour, local streets and provincial roads were among transport infrastructure that was severely damaged. Traffic between Istanbul and Ankara on the road and motorway was quickly restored (Bibbee, Gönenç, Jacobs, Konvitz, & Price, 2000). The earthquake has some impacts on international tourist arrivals in Turkey as well. According to the Association of Turkish Travel Agencies (2019) report, it suggests that soon after the earthquake, there was a falloff in international visitor arrivals to Turkey during the period between August and December compared

Table 1. The Number of Tourists by Month and Year (1995-2001)

Month/Year	1995	1996	1997	1998	1999	2000	2001
January	274,680	283,616	300,872	346,183	359,046	333,915	359,320
February	302,407	324,910	314,306	371,526	371,727	354,487	404,653
March	368,195	537,452	555,204	476,756	409,483	435,158	547,365
April	535,462	556,109	639,819	642,332	426,558	721,128	884,805
May	732,394	874,942	1,020,894	986,237	691,313	986,376	1,231,562
June	810,419	902,015	1,045,987	1,062,961	784,642	1,079,148	1,387,955
July	1,008,709	1,106,242	1,206,226	1,288,439	931,895	1,525,718	1,776,821
August	1,070,234	1,153,755	1,404,876	1,460,075	1,079,249	1,419,244	1,601,331
September	1,054,871	1,117,429	1,297,455	1,209,256	876,261	1,368,538	1,440,365
October	836,025	909,397	947,462	1,035,237	800,513	1,178,481	1,065,825
November	393,023	452,325	538,368	502,638	435,790	602,396	520,962
December	340,467	395,893	417,535	371,057	320,808	423,564	398,005
TOTAL	7,726,886	8,614,085	9,689,004	9,752,697	7,487,285	10,428,153	11,618,969

Source: TURSAB, Accessed from https://www.tursab.org.tr/istatistikler/turist-sayisi-ve-turizm-geliri, Date of Access: 02.08.2020.

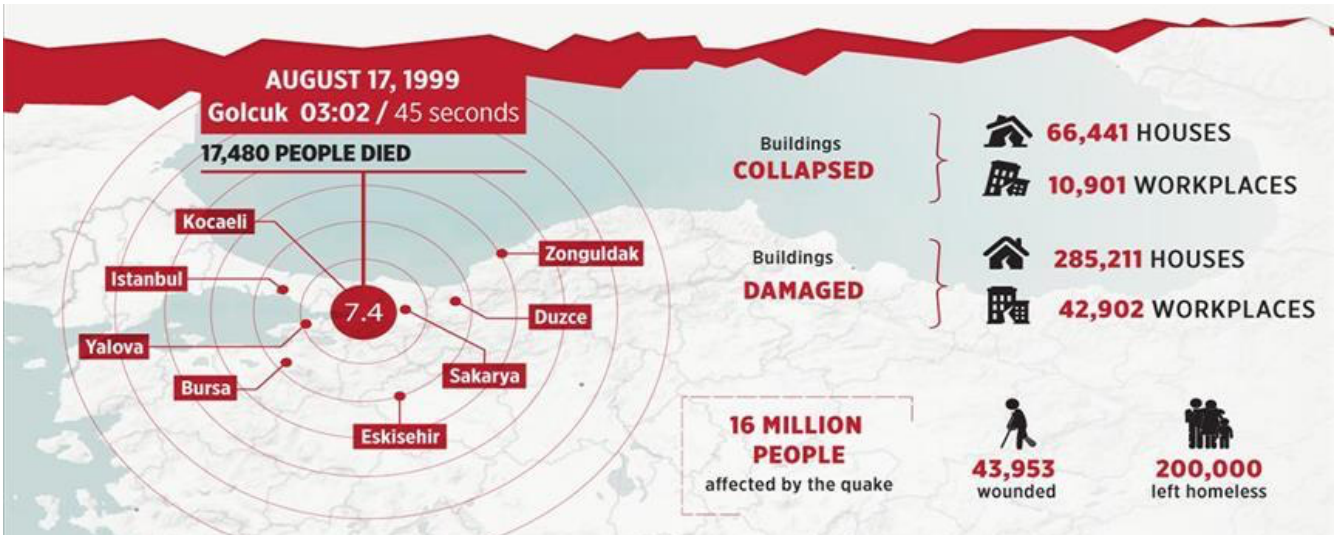


Figure 1. Map of the 1999 Golcuk Earthquake Zone

Source: Anadolu Agency (2018). Accessed from: https://www.aa.com.tr/en/life/turkey-observes-19th-anniversary-of-marmara-earthquake/1234211, Date of Access: 01.08.2020.

to the same period in 1998. Visitors arriving from abroad for the whole year (7,487,285) decreased compared to the prior year (9,752,697). The number of foreign tourists has a direct effect on tourism and the investment of government agencies. Thus decision-makers in either the tourism sector or governmental institutions need to have a reasonable overview of how crises impact the inbound tourist arrivals. With international tourism rapidly dropping in the months following the Earthquake of1999, the Turkish Government immediately concentrated on its North American target market, which had sent 2.5 million USD (Dickey & Kohen, 1999; Goetzl & Healy, 2000; Huang & Min, 2002).

Tourism has been one of the sectors that suffered from the 1999 Earthquake with a 173 million USD loss. The revenue loss from the cancellations of congresses was 15 million USD, and the number of congress participants who had cancellations was 17,600. 8,000 people left their vacation and returned to their countries. There was a 3 million USD financial loss due to the tour cancellations. There were 156,000 reservation cancellations and a financial loss of 105,000 USD due to these cancellations in 1999 and the decline in the tourism sector was 27% (TSPO, 2000; TÜRSAB, 2000).

Table 1 compares the number of tourist by month and year. Before the earthquake, There seems to be a considerable increase in the number of tourists. By September 1999, right after the earthquake, there was a sharp decrease in the number of tourists. Table 2 illustrates the tourism income by year. In 1999, there was a sharp decrease (2,605 million USD) in the tourism income. Liu et al. (2019) indicated that the tourism competitiveness of a country is shaped Studies emphasize the perceived risks of tourism industry service providers, and also the effect of crisis risk management on the competitive advantage of tourism. Mistilis and Sheldon (2006) stated that the tourism industry is fragmented and does not respond easily to disasters. This feature also highlights the need for industry-wide information systems that any business can use during a crisis. Because tourism is an important component of a country's economy responsive and broad-targeted disaster management plans should be prepared beforehand.

Table 2. Tourism Income by Years (1991- 2001)

Year	Income (million USD)
1991	2,654
1992	3,639
1993	3,959
1994	4,321
1995	4,957
1996	5,962.1
1997	8,088.5
1998	7,808.9
1999	5,203
2000	7,636
2001	10,450.7

Source: TURSAB, Accessed from: https://www.tursab.org.tr/istatistikler/turist-sayisi-ve-turizm-geliri, Date of Access: 02.08.2020.

2.2. Earthquake and Tourism Sector in Turkey

Crises are devastating events that primarily have an impact on the surrounding environment and which may spread all over the world if they are failed to be stopped. Any type of crisis can lead to enormous impacts (Çiftçi, Çakır, & Çakır, 2016). To illustrate the general scale of the devastation, the number of houses destroyed and during the 1999 earthquake would be at least four times the number of houses destroyed. 1995 Kobe Earthquake and 12 times the number of damaged buildings in the 1994 Northridge Earthquake (OECD, 2004). Eight cities that were severely affected by the earthquake account for 34.7% of the total GNP and generate

over 46.7% of the national industrial product. The cities of Sakarya, Kocaeli and Yalova held about 6.3% of GNP and 13.1% of the industrial production.

Figure 1 illustrates the earthquake zone. The 1999 Earthquake in Izmit is among the worst earthquakes which have cost far too many lives. Nevertheless, the impacts of the earthquake can indeed be measured solely by the amount of losses, as well as by their effect on rescuers and their life quality regarding the crisis, all of whom have an impact on sustainability. Because sustainable tourism can be defined as the sustainable growth of tourist arrivals and the development of tourism infrastructure (Kontogeorgopoulos, 1999).

3. Methodology

3.1. Data and Variable Selection

The research data are annually reported and limited to the period between 1985 and 2005 to analyse the possible effects of the earthquake. Showing changes due to Turkey's geopolitical risks from the year 2005 onwards on behalf of tourism data can be separated from the effects of the earthquake have been made to such a restriction. However, the data between 1985- 2018 is used for the Maki Cointegration Test. The number of foreigners visiting Turkey is obtained from the Turkish Central Bank, Ministry of Development, Ministry of Culture and Tourism, Turkish Statistical Institute, Ministry of Finance, Ministry of Interior General Directorate of Security. GDP (in USD), the market capitalization of the listed domestic companies (in USD), GDP per capita growth (in USD), GNI (in USD) and Stocks traded, total value (in USD) data are employed as control variables.

Event Study and Principal Component Analysis are widely used in studies on finance and economy to measure the reaction experienced as a reaction to a particular event or as a result of a situation called an important event occurring (Xu, Chang, & Hsu, 2020). This event was identified as a Malaysia Airlines Flight 370 ("MH370") disaster in the study conducted by Zhao et al (2020), and the Event-Oriented Text Retrieval method was tried using Deep Neural Network. Zhao et al. (2020) define the influential meanings of an event as follows:

> *Definition 1.* An event is a specific thing that happens at some specific time and place.
> *Definition 2.* An event is a specific occurrence involving participants. An event is something that happens. An event can frequently be described as a change of state.
> *Definition 3.* An event is an explicit occurrence with or without participants. An event can correspond to multiple topics. An event contains multiple sub-events.

3.2. Model Specification

Event study has been widely used as a method in economics and finance. According to Campbell et al. (1997), an important feature of a successful event study is that it can determine the exact date (date of the earthquake 17.08.1999) of the event. In cases where it is difficult to identify the time and place of an event, conducting a case study might prove less useful. For example, it may be difficult for organizations to determine the effects of legal changes on wealth by employing a case study methodology.

The problem is that legal changes are discussed in the political arena over time, and the associated asset effects are gradually included in the value of a company as the probability of the adopted change increases. Research employing event study methodology has shown that prices respond to new information, as we generally expect in a rational market. The event study methodology is popularly seen in financial services (Binder, 1998; Strong, 1992). By many it that is the damage assessment for instances of legal responsibility in particular situations, such as that of the Tylenol toxicosis case of 1982 (Mitchell, 1989). Mazzocchi (1999) submitted a proposal for non-financial statistics on food price.

To apply the method of event analysis in the tourism sector, it is important to identify the event correctly and determine its constraints (other geopolitical events in the post-earthquake period) that will disclose the results of the current event, irrespective of other consequences. Therefore, the relationship between the earthquake, which is identified as a significant event, and the structural changes observed in macroeconomic variables in the post-earthquake period, and the impact of the event (earthquake) is first analysed using the Maki Cointegration method, followed by the CUSUM test, multiple linear regression (MLR) model and prediction models. This approach will be a guide for calculating the impacts on systemic change of changes which are significant events in the tourism sector.

In the study conducted by Chow (1960), to test the equation between coefficient sets in two linear regressions, the sum of the squares assuming the equation and the sum of the squares without assuming the equation are obtained. The subsequent addition rate, which is adjusted according to the corresponding degrees of freedom, of the difference between these two sums is distributed as the F ratio under the null hypothesis. This sum of second squares is obtained from the first instance of n observations only when the second sample is not large enough to calculate a separate regression. It shows how the general linear hypothesis theory is applied to the problem and how the estimation range and covariance analysis are related to each other and the general linear hypothesis theory.

Page (1954) indicated that the Cumulative Sum (CUSUM) charts are used to detect small shifts in a process mean. Those named after Chow (1960) are most powerful when the break date is known, whereas those based on recursive residuals can help

identify the pattern of structural change, although less powerfully. Brown et al. (1975) tested CUSUM and CUSUMSQ methods developed to investigate the stability of regression relationships over time. Recursive residues, defined to be uncorrelated with zero means and constant variance are introduced and tests based on CUSUM and CUSUM of squares recursive residues are developed. Advanced techniques based on moving regressions in which the regression model is fitted from a data segment moving through the series and regression models with polynomial coefficients over time are examined.

Alternative modelling to the Chow estimation test was developed by Fisher (1970) and a statistical test was conducted on the difference between the estimates where the estimates represent "unconditional values" and the actual values. The aim here is to test the significance of the difference between space and time of the difference between these "excess residuals". An "event window" is defined as a series of periods that may be potentially affected by the event.

The breakpoint test used in the analysis was developed by Perron (1989) and tests of the unit root hypothesis against the alternative hypothesis of trend stability were carried out by breaking the trend that occurred in the Great Crash of 1929 or the 1973 oil price shock. Perron's analysis includes Nelson-Plosser's macroeconomic data series as well as the three-month post-war real gross national product (GNP) series. Tests rejected the unit-root null hypothesis for most of the series. Perron (1989) assumed that the Great crash and oil price shock could be treated as external events. In a study by Perron and Vogelsang (1992), the statistics of interest are similar to those proposed by Perron, to test for the presence of such a change in a stationary time series for unit root, the minimum statistic decreases tested with the general possible breakpoints.

To demonstrate the relative scale of the disaster, the number of the damaged buildings in the 1999 Earthquake was at least 4 times the number of the damaged buildings in the 1995 Kobe Earthquake and 12 times the number of damaged buildings in the 1994 Northridge Earthquake (OECD, 2004). 8 cities that were severely affected by the earthquake account for 34.7% of the total GNP and generate over 46.7% of the national industrial product.

The effects of the earthquake can be divided into direct impacts and indirect effects on the tourism industry. One of the direct effects is the number of tourists, which decreased by 20% in 1999 compared to the previous year. The number of tourists visiting Turkey in 1998 was 9,431,280, which decreased to 7,487,365 in 1999. Tourism revenues decreased by 28% and the loss of direct income was 1.9 billion USD with a significant decrease in exports and tourism revenues (OECD, 2004).

The key indirect effects on the tourism sector holding 7.2% of GDP due to a decline in economic activity and a 1.6%, net decline in GNP growth whereas GDP per capita dropped by 8.63%. In the following year, the value of companies listed on the stock exchange dropped by 144%. Tourism investments and sectoral growth were also adversely affected as a result of the decline in economic activity after the earthquake and it even prevented the sector from reaching its potential in the current year. Centre for Research on the Epidemiology of Disasters (CRED, 2015) stated that the estimated total cost for both losses of income and loss of national wealth varies between 9 and 13 billion USD and 6 to 10 billion USD, respectively. The World Bank (1999) estimated the loss at over 15 billion

Table 3. Descriptive Statistics of Variables

Variable Name	D1	I1	I2	I3	I4	I5
	The Number of Tourist Coming to Turkey (Annually)	GDP Growth % (US$)	Market Capitalization of The Listed Domestic Companies (Billion US$)	GDP Per Capita Growth % (US$)	GNI Growth % (US$)	Stocks Traded, Total Value (Billion US$)
Mean	20.307.184	4.681.360	25.03108	3.123.246	4.696.672	35.514.290
Median	20.472.360	6.258.083	23.598.220	4.603.105	6.198.235	37.788.980
Maximum	36.837.900	11.113.500	44.049.530	9.423.771	11.106.920	60.798.740
Minimum	6.525.202	-5.962.311	12.200.660	-7.357.004	-6.957.255	8.880.015
Std. Dev.	10.498.255	4.703.416	8.937.337	4.620.743	4.969.889	12.005.900
Skewness	0.101.038	-1.067.772	0.586.756	-1.061.049	-1.124.728	-0.172.600
Kurtosis	1.517.433	3.082.994	2.443.969	3.089.169	3.218.518	2.711.358
Jarque-Bera	2.425.410	4.948.052	1.826.825	4.887.188	5.533.449	0.219.351
Probability	0.297.392	0.084.245	0.401.153	0.0868.480	0.062.868	0.896.125
Sum	5.28E+08	121.715,4	650.808,2	81.204.400	122.113.500	923.371.600
Sum Sq. Dev.	2.76E+15	553.053,1	1.996.900	533.781.700	617.495.000	3.603.542
Observations	26	26	26	26	26	26

USD. When the indirect and long-term impacts are carefully calculated, the total cost of a 9-10% drop in GDP in 2000 is estimated at 20 billion USD. The share of the earthquake zone in total imports was 15% and its share in total exports was 5%. Exports and imports decreased by 6% and 11%, respectively. Despite a 27% drop in the foreign trade deficit, its final impact on the economy is difficult to interpret.

Bibbee et al. (2000) indicated that in addition to temporary interruptions in labour supply due to deaths, injuries and motivation, SMEs and large enterprises in the region were also concerned about the possible migration of qualified workers. As a result, the majority of large enterprises participated in care and housing for their employees, who seemed to convince many of them to stay in the region.

Data on Turkish tourism are annually reported and limited to the period between 1985 and 2005 to analyse the possible effects of the earthquake. Although the tourism industry in Turkey has been experiencing some geopolitical risks, such as conflicts, political instability, security issues, and terror (Demir, Simonyan, Chen, & Marco Lau, 2020), the negative impact of the earthquake is obvious from the year 2005 onwards. Descriptive statistics for the variables are shown in Table 3. Next, Multiple Linear Regression and Correlation analyses were performed to reveal the level of relationship between variables. The data was obtained from The World Bank Database.

4. Findings

In the case of a structural break in the applied time series analysis, incorrect results may occur in traditional cointegration tests. Gregory and Hansen (1996) developed a cointegration test that allowed a single structural break followed by Hatemi-J (2008) who developed cointegration tests that allowed two structural breaks. These methods assume one or two structural breaks. In the case of more than two structural breaks in the series, the cointegration test developed by Maki (2012), which provides up to five structural breaks, might be used. The fact that it allows more structural breaks in the series makes the Maki cointegration test preferable. Maki (2012) introduced the cointegration test into the literature using the following four models:

$$y_t = \mu + \sum_{i=1}^{k} \mu_i D_{i,t} + \beta' x_t + u_t \quad \text{Model 1 (1)}$$

$$y_t = \mu + \sum_{i=1}^{k} \mu_i D_{i,t} + \beta' x_t + \Sigma_{i=1}^{k} \beta_i' x_t D_{i,t} + u_t \quad \text{Model 2 (2)}$$

$$y_t = \mu + \sum_{i=1}^{k} \mu_i D_{i,t} + yt + \beta' x_t + \Sigma_{i=1}^{k} \beta_i' x_t D_{i,t} + u_t \quad \text{Model 3 (3)}$$

$$y_t = \mu + \sum_{i=1}^{k} \mu_i D_{i,t} + yt + \Sigma_{i=1}^{k} y_i tD_{i,t} + \beta' x_t + \Sigma_{i=1}^{k} \beta_i' x_t D_{i,t} + u_t \quad \text{Model 4 (4)}$$

The four models (Model 1, Model 2, Model 3, and Model 4) demonstrate with the break in intercept and without trend; with break in intercept and coefficients and without trend; with break in intercept and coefficients and with the trend; and with the break in intercept, coefficients and trend, respectively. The maximum number of fractions in the equations is indicated by k. When k=1, the models are similar to Gregory ve Hansen (1996) and when k=2, the models are similar to Hatemi-J (2008). In the equations, the H:0 hypothesis states that there is no cointegration relationship under the structural break, while the H:1 hypothesis states that there is a cointegration relationship under the structural break (Maki, 2012).

Table 4 indicates that all variables have a unit root at the level for the ADF unit root test. Moreover, at first differences the variables are stationary. Therefore, the null hypothesis which states that series have unit root is rejected. In this case, the long-term relationship between the variables can be investigated. In this context, the long-term relationship between variables is examined with the Maki Cointegration Test. The Maki Cointegration Test, which was developed by Maki (2012), is based on structural breaks developed by Kapetanios (2003) tests. When multiple numbers of breaks exist, Maki Cointegration Test allows structural breaks in a cointegration relationship, which is the main advantage of the test.

Dickey and Fuller (1979) demonstrate that this statistic does not obey the traditional Student t-distribution under the null hypothesis of a unit root, and they derive asymptotic results and simulate critical values for different test and sample sizes. More recently, a much larger range of simulations was introduced by MacKinnon (1991, 1996) than those tabulated by Dickey and Fuller. In addition, for the simulation performance, MacKinnon estimates response surfaces, allowing Dickey-Fuller critical values and values for arbitrary sample sizes to be measured. The variables (D1, I1, I2, I3, I4, I5)

Table 4. Unit Root Test

Augmented Dickey-Fuller (ADF) Test					
Variables	**Symbol**	**Level**		**First Difference**	
		T-Statistics	Prob	T-Statistics	Prob
Tourist number	D1	-1.465623	0.5353	-6.492480*	0.0000
GDP Growth	I1	-1.094997	0.7028	-5.419606*	0.0002
GDP per capita	I3	-1.155965	0.6781	-5.393453*	0.0002
GNI Growth	I4	-1.100027	0.7008	-5.437577*	0.0001
Stocks traded	I5	-2.197124	0.2118	-6.416285*	0.0000

**denotes that the series are stable at 1% significance level. Fixed term model is used.*

included in the analysis (significance level %1, %5, %10) do not have a unit root problem.

Null Hypothesis: D1, I1, I2, I3, I4, I5 contains a unit root:

$$y_t = c + \delta\, t + \phi\, y_{t-1} + \beta_1 \Delta\, y_{t-1} + \ldots + \beta_p \Delta\, y_{t-p} + \varepsilon_t \quad (5)$$

$$H_0 : \phi = 1 \quad (6)$$

$$H_a : \phi < 1 \quad (7)$$

The complexity of regulating their size while the mechanism is stationary but extremely self-regressive is an important argument against the use of tests for the null hypothesis of stationarity. In this case, the so-called KPSS test proposed by Kwiatkowski, Phillips, Schmidt And Shin (1992) is probably the best-known test for stationarity in econometrics: it too frequently rejects the true hypothesis of stationarity, again leading to an undue preference for the hypothesis of unit root non-stationarity. The variables (D1, I1, I2, I3, I4, I5) included in the analysis (significance level %1, %5, %10) have a trend stationarity problem. The trend influence, however, stems from the seasonal characteristics of the data and is not an obstacle to study.

Null Hypothesis: D1, I1, I2, I3, I4, I5 is trend stationery:

$$y_t = c_t + \delta\, t + u_{1t} \quad (8)$$

$$c_t = c_{t-1} + u_{2t} \quad (9)$$

$$u_{2t} \sim i.i.d(0, \sigma^2) \quad (10)$$

$$H_0 : \sigma^2 = 0 \quad (11)$$

$$H_a : \sigma^2 > 0 \quad (12)$$

The key difference between the two tests is that the non-parametric test is KPSS and the parametric test is Leybourne-McCabe. The Leybourne-McCabe stationary test is similar in spirit to one recently suggested by KPSS, but under the respective null (and alternative) hypotheses, the two experiments vary fundamentally in their approaches to the handling of autocorrelation, based on an explicit parametric model. Similar to the KPSS test results, according to Leybourne-McCabe test results, the variables (D1, I1, I2, I3, I4, I5) are included in the analysis (significance level %1, 5%, 10%) have a trend stationarity problem. The trend influence, however, stems from the seasonal characteristics of the data and is not an obstacle to study.

Null Hypothesis: D1, I1, I2, I3, I4, I5 is a trend stationary AR(p) Process:

$$y_t = c_t + \delta\, t + b_1 y_{t-1} + \ldots + b_p y_{t-p} + u_{1t} \quad (13)$$

$$c_t = c_{t-1} + u_{2t} \quad (14)$$

$$u_{1t} \approx i.i.d(0, \sigma_1^2) \quad (15)$$

$$u_{2t} \approx i.i.d(0, \sigma_2^2) \quad (16)$$

$$H_0 : \sigma^2 = 0 \quad (17)$$

$$H_a : \sigma^2 > 0 \quad (18)$$

In checking for a unit root, Phillips and Perron (1988) suggest an alternative (nonparametric) method of controlling for serial correlation. The PP method calculates the non-augmented test DF equation and modifies the coefficient ratio such that the asymptotic distribution of the test statistics is not influenced by the serial correlation. The Phillips-Perron test does a nonparametric correction to the

Table 5. Stationarity Test Results

Variables		Augmented Dickey-Fuller Test				KPSS Test			Leybourne-McCabe Test			Phillips-Perron Test		
D1	The Number of Tourist Coming to Turkey (Annually) DiffDiff	Significance Level	0.01	0.05	0.1	0.01	0.05	0.1	0.01	0.05	0.1	0.01	0.05	0.1
		Null Rejected	true	true	true	false	false	false	false	false	false	true	true	true
		P-Value	0.001	0.001	0.001	0.1	0.1	0.1	0.1	0.1	0.1	0.001	0.001	0.001
		Test Statistic	-98.304	-98.304	-98.304	0.015158	0.015158	0.015158	0.0056721	0.0056721	0.0056721	-98.304	-98.304	-98.304
		Critical Value	-26.635	-19.507	-16.039	0.216	0.146	0.119	0.216	0.146	0.119	-26.635	-19.507	-16.039
I1	GDP Growth % (current US$) DiffDiff	Null Rejected	true	true	true	false	false	false	false	false	false	true	true	true
		P-Value	0.001	0.001	0.001	0.1	0.1	0.1	0.1	0.1	0.1	0.001	0.001	0.001
		Test Statistic	-121.907	-121.907	-121.907	0.020052	0.020052	0.020052	0.016198	0.016198	0.016198	-121.907	-121.907	-121.907
		Critical Value	-26.635	-19.507	-16.039	0.216	0.146	0.119	0.216	0.146	0.119	-26.635	-19.507	-16.039
I2	Market Capitalization of The Listed Domestic Companies (Billion, Current US$) DiffDiff	Null Rejected	true	true	true	false	false	false	false	false	false	true	true	true
		P-Value	0.001	0.001	0.001	0.1	0.1	0.1	0.1	0.1	0.1	0.001	0.001	0.001
		Test Statistic	-108.665	-108.665	-108.665	0.016014	0.016014	0.016014	0.014805	0.014805	0.014805	-108.665	-108.665	-108.665
		Critical Value	-26.588	-19.502	-16.046	0.216	0.146	0.119	0.216	0.146	0.119	-26.588	-19.502	-16.046
I3	GDP Per Capita Growth % (Current US$) DiffDiff	Null Rejected	true	true	true	false	false	false	false	false	false	true	true	true
		P-Value	0.001	0.001	0.001	0.1	0.1	0.1	0.1	0.1	0.1	0.001	0.001	0.001
		Test Statistic	-122.035	-122.035	-122.035	0.020037	0.020037	0.020037	0.016184	0.016184	0.016184	-122.035	-122.035	-122.035
		Critical Value	-26.635	-19.507	-16.039	0.216	0.146	0.119	0.216	0.146	0.119	-26.635	-19.507	-16.039
I4	GNI Growth % (Current US$) DiffDiff	Null Rejected	true	true	true	false	false	false	false	false	false	true	true	true
		P-Value	0.001	0.001	0.001	0.1	0.1	0.1	0.1	0.1	0.1	0.001	0.001	0.001
		Test Statistic	-126.173	-126.173	-126.173	0.020049	0.020049	0.020049	0.016184	0.016184	0.016184	-126.173	-126.173	-126.173
		Critical Value	-26.635	-19.507	-16.039	0.216	0.146	0.119	0.216	0.146	0.119	-26.635	-19.507	-16.039
I5	Stocks Traded, Total Value (Billion, Current US$) DiffDiff	Null Rejected	true	true	true	false	false	false	false	false	false	true	true	true
		P-Value	0.001	0.001	0.001	0.1	0.1	0.1	0.1	0.1	0.1	0.001	0.001	0.001
		Test Statistic	-90.767	-90.767	-90.767	0.015162	0.015162	0.015162	0.014065	0.014065	0.014065	-90.767	-90.767	-90.767
		Critical Value	-26.635	-19.507	-16.039	0.216	0.146	0.119	0.216	0.146	0.119	-26.635	-19.507	-16.039

Table 6. Maki Cointegration Test Results

	Test Statistics	%1 Critical Value	%5 Critical Value	%10 Critical Value	Break Dates
Model 1	-7.652	-7.053	-6.494	-6.220	1994,1996,2010,2012, 2014

Note: While the number of independent variables is four (RV = 4) and the number of fractures (m) is maximum 5, 1%, 5% and 10% critical values are obtained from Maki (2012).

t-test statistics by adding lags of Δyt as regressors in the test equation. The Augmented Dickey-Fuller test solves this problem. The test is robust in relation to unspecified autocorrelation and heteroscedasticity in the test equation disturbance phase. The variables (D1, I1, I2, I3, I4, I5) included in the analysis (significance level %1, %5, %10) do not have a unit root problem.

Null Hypothesis: D1, I1, I2, I3, I4, I5 contains a unit root:

$$y_t = c + \hat{I}'t + \alpha\, y_{t-1} + \varepsilon_t \quad (19)$$

$$H_0 : \alpha = 1 \quad (20)$$

$$H_a : \alpha < 1 \quad (21)$$

The results in Table 6 show that the null hypothesis is rejected at all levels of significance for Model 1. In this case, there is a long-term relationship between the variables according to the Maki cointegration test results. Furthermore, the results indicate that there are five structural breaks dates, which are 1994, 1996, 2010, 2012 and 2014. In 1994, Turkey experienced a currency crisis which resulted in a 6% drop in production, inflation rose to three-digit rates, the Central Bank lost half of its reserves, and the exchange rate (against the US USD) decreased by more than half in the first three months of the year. In 1998, the global economic crisis had a negative impact on tourism in Turkey. In 1999, the earthquake had huge consequences for the tourism industry in Turkey whereas economic crises in 2012 and 2014 had some adverse effects on tourism.

According to CUSUM test results, recursive residuals of the tourist number variable changed after the earthquake and it can help identify the pattern of structural change when the break date is known (Page, 1954; Chow 1960). Figure 1 demonstrates that the number of tourists is affected by the earthquake, which is also seen one year later in 2000 (Figure 2). The CUSUM test was developed to calculate the breakdown of tourist numbers with the 1999 Earthquake and the resulting economic slowdown, with recursive residuals. The aim here is to address the deviation in the number of tourists with a structural break, irrespective of other world political, social, and economic events. The variables used in the model produced are therefore limited to the number of visitors, GDP, GDP per capita, GNI, Stocks exchanged.

When we look at the number of tourist arrivals in Figure 3, we see a dramatic decrease, approximately 20%, immediately after the earthquake. Some of the fluctuations in the number of tourists in the post-earthquake period, in particular, the fluctuations observed as a result of the risks called geopolitical risks (like 2016) are excluded from the scope of the study and the date of the event is taken as the date of the earthquake, 17.08.1999 (Figure 3).

GNP Growth seems to be affected by the earthquake, and it decreased from -0.8% to -1,6% (Figure 4). GNP dropped by 7.6% and 4.9% year-on-year in the third and fourth quarter of 1999, respectively. In the affected area, 140,000 people remained unemployed. The earthquake's fiscal impact was US$ 1,8 billion in 1999, USD 4.2 billion in 2000 (1.0% and 1.9% respectively of GNP) (OECD, 2004).

The estimation test was developed by Chow (1960) and Fisher (1970) used alternative modelling to estimate "unconditional values" and confront the actual values. The aim here is to test the significance of the difference between space and time of the difference between these "excess residuals". An "event window" is defined as a series of time periods that may be potentially affected by the event. The estimation results (Figure 5) shows the loss of tourists due to the earthquake by comparing the expected number of tourists if there had been no earthquakes (the estimation was

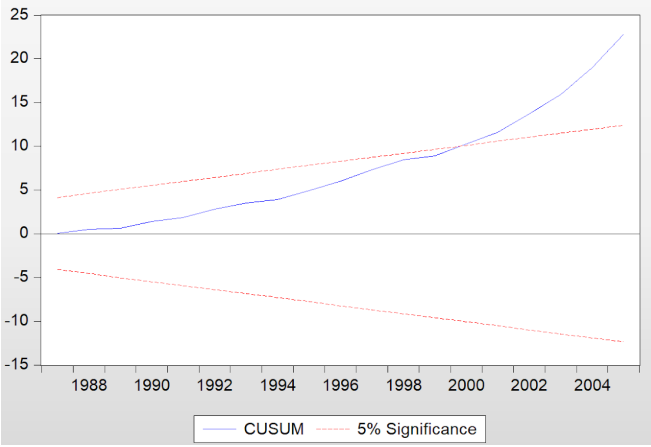


Figure 2. CUSUM Test Results

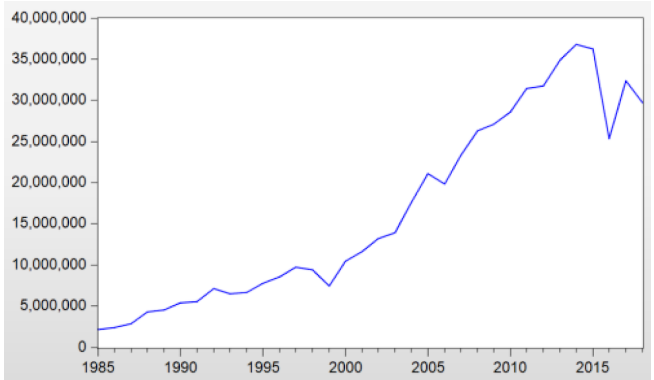


Figure 3. Number of Tourist Arrivals (1985-2018)

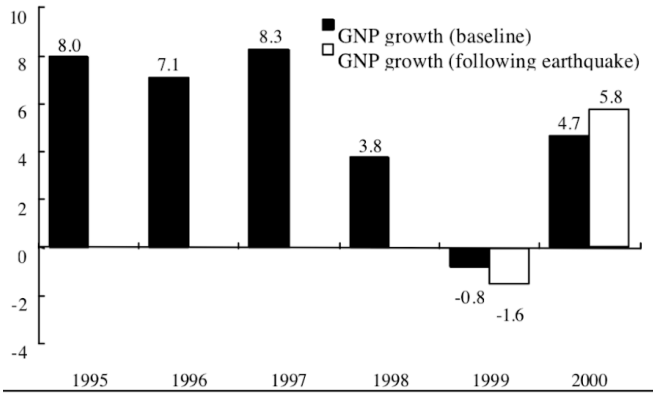


Figure 4. GNP Growth (%)

Source: The World Bank, Turkey Country Office, Marmara Earthquake Assessment, 14 September 1999, Working Paper 27380, 15.

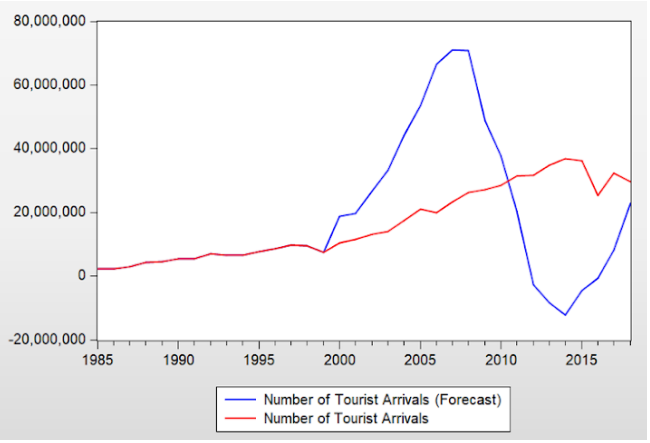


Figure 5. Forecast Analysis Results

produced using control variables such as GDP (USD), the market capitalization of the listed domestic companies (USD), GDP per capita growth (USD), GNI (USD) and Stocks traded, total value (USD) and the actual number of tourists coming to the country). The results of the estimation analysis based on the control variables show that the estimated number of expected tourists would be approximately 8% higher than the number of incoming tourists if there had been no earthquakes.

The analysis of the relationship between the approximate values of the number of tourists in the aftermath of the earthquake (there is already a Maki Cointegration relationship between them) shows that the macroeconomic issues encountered after the earthquake have seriously affected the tourism sector's efficiency. The decrease in productivity experienced due to the inability to make sectoral investments, in particular, due to the post-earthquake economic crisis, was also reflected in the number of incoming tourists with an average 8 percent gap between the actual and expected number of tourists (Figure 5 and Figure 8).

The Regression Model was created with Time Series Errors to evaluate the effect of the deviations (I1-I5) in the independent variables included in the study. The number of visitors (D1) included in the equation as the dependent variable and with the effect of the 1999 Earthquake on the independent variables, which is considered to be a significant event. Regression models with time series errors attempt to explain the mean behaviour of a response (yt, t = 1, ... ,T) by using multiple linear regression (MLR) to compensate for linear predictor effects (Xt). The errors (ut), however, called unconditional disturbances, are time series rather than white noise, which is a divergence from the linear model assumptions. Regression models with time series errors maintain the sensitivity definition of regression coefficients (β) unlike the ARIMA model that contains exogenous predictors (Hyndman, 2010). Multiple linear regression model of time series D1Diff is calculated using the following equation:

$$X_1\beta_1 + \ldots + X_5\beta_5 + \varepsilon_t \quad (22)$$

The results reveal that there is no regression relationship between the dependent variable (D1 number of tourist) and independent variables (I1-I5) (Table 7 and Table 8).

The relationship between the first difference D1Diff series and the generated MLR regression time series is optimized with the ensemble regression model (Figure 6-7) and the true value, predicted, and error values are seen in the optimization model provided between the D1 variable and the GDP growth (I1) variable (Figure 8). With the estimation model, it is shown that after the 1999 Earthquake, the number of tourists remained below the required amount, depending on the GDP Growth (I1) variable (Figure 8). The sector seems to be unable to reach its real potential, and tourism demand remained below the planned level due to the post-earthquake economic slowdown and the decline in GDP growth that negatively affected tourism investments, which suggests that the tourism industry performed on average 8% below its projected capacity.

The number of tourist arrivals and independent variables [GDP (USD) (I1), GDP per capita growth

Table 7. Multiple Linear Regression Model (MLR_D1Diff) Estimation Results

Parameter	Value	Standard Error	t Statistic	P-Value
Intercept	933,612.1003	655,093.1604	1.4252	0.17033
Beta{I1Diff}	8,617,886.3157	1,0819,728.8614	0.7965	0.43558
Beta{I2Diff}	-16,970.8266	53,519.8099	-0.31709	0.75463
Beta{I3Diff}	-6,297,005.3517	11,065,650.5361	-0.56906	0.57598
Beta{I4Diff}	-2,174,201.7903	1,505,758.3157	-1.4439	0.16505
Beta{I5Diff}	28,929.558	64,168.2792	0.45084	0.65721

Table 8. Goodness of Fit Results

AIC	825.3877
BIC	832.701

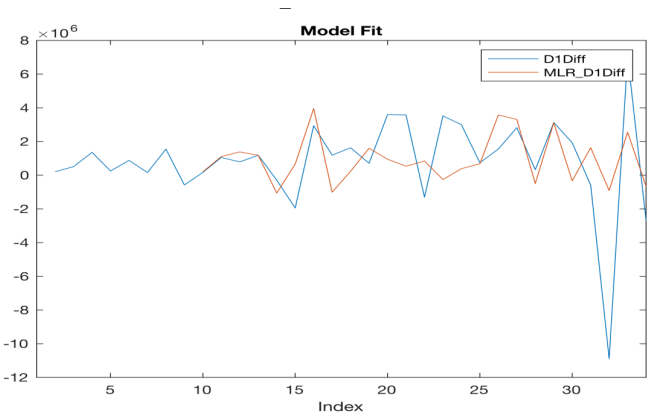


Figure 6. Plot the fit of model MLR_D1Diff time series D1Diff

(USD) (I3), GNI (USD) (I4) and exchanged stocks, overall value (USD) (I5)] are positively correlated while they are negatively correlated to the market indicators of domestic companies (Figure 9).

5. Conclusion

The present study employs an instrument commonly used in financial studies, the event research technique, to analyse the impact of a seismic event that occurred in 1999 on Turkish tourist flows. The aim of the study is to highlight the potential application of an event analysis approach to tourism data that could be used to evaluate the effects of earthquakes on tourism. As defined by Çiftci & Yetgin (2016), the crisis is a disruption that undermines basic assumptions about the system they are working on the participants. All the crises disrupt the order of business and cause a panic environment. In case of a crisis, it is necessary to take decisions promptly in order to return a business to its routine operations. The necessity to take prompt decisions may, however, cause to take wrong decisions. Therefore, the unforeseen crises cause psychological pressure on the governments, decrease productivity and are perceived as disasters (Çiftci, 2017).

The Maki Cointegration Test, which was used to check whether a structural break in the co-integration relationship between the number of tourist arrivals

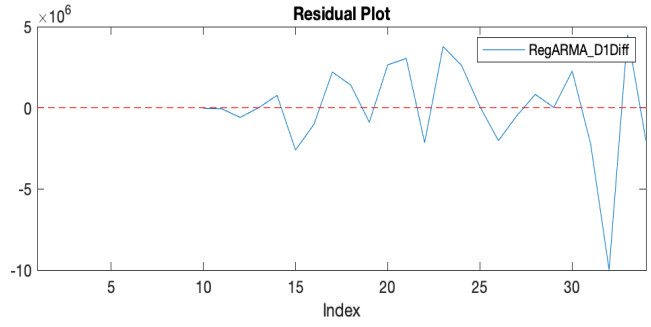
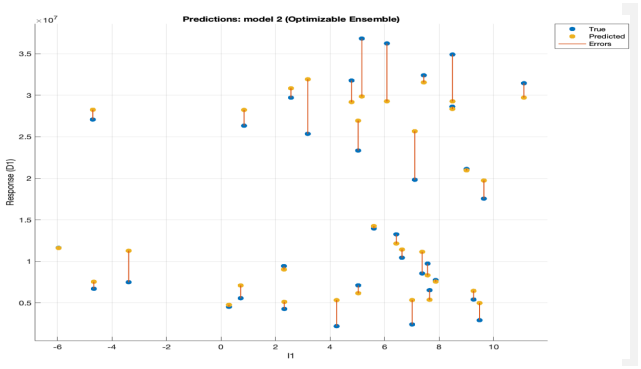


Figure 7. Regression ARMA Residual Plot Graph D1Diff Variable

Figure 8. Optimizable Ensemble Regression Model Between Number of Tourist Arrivals (D1) and GDP Growth (I1)



and other independent variables occurred as a result of the earthquake, verified that there occurred economic break-downs in 1994, 1996, 2010, 2012 and 2014. It points to the split encountered as a result of the 1999 Earthquake among those breakdowns. According to the results of the CUSUM and CUSUMSQ test, recursive residuals of the tourist number variable changed after the earthquake in 2000, which can help to identify structural change patterns when the break date is known. The results show that the number of tourists decreased by about 20% after the earthquake. The results of the CUSUM and CUSUMSQ estimation analysis based on the control variables reveal that the number of future tourists would have been approximately 8 percent higher than the number of incoming tourists if there had been no earthquakes. Multiple Linear Regression Model (MLR D1Diff) Estimation Results indicate that there was no regression relationship between the dependent variable (D1 tourist number) and the independent variables (I1-I5). The dependent variable (D1 number of tourists) is negatively correlated to the Listed Domestic Companies' market capitalization (I2) and positively correlated to all the other independent variables.

The advantages of the event study analysis would be that it makes it easy to measure the reliability of crises in contexts of irrational behaviour. The study of excess residues over time has made it possible to track the trend of the tourism crisis. The

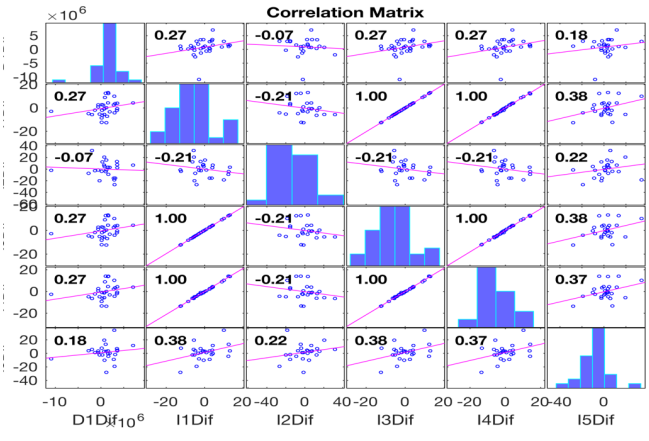


Figure 9. A matrix of plots showing the correlations between variables D1Diff, I1Diff, I2Diff, I3Diff, I4Diff, I5Diff

effect on tourist arrivals seems to have been more conveniently absorbed back even though the initial reduction is readily apparent and valuable. Some of the statistical assemblages of the districts studied have created it difficult to quantify the temporal impact on tourist arrivals in various areas of the country. While many towns encountered the adverse effects of the earthquake, the strongest impact on international tourists had been noticed in Istanbul, which is nearest to the major earthquake hotbeds.

In addition, the tourism industry works in cooperation with many other sectors and offers an integrated service. Therefore, the tourism industry has a multiplier effect on the global and national economy. Thus, if the tourism industry suffers from any economic crisis, it means many other sectors from agriculture to textile will suffer extensively (Çiftçi, Küçükaltan, & Menteş, 2017). For that reason, tourism officials and stakeholders must understand that conflicts and the fight for sustainable development can't be seen as linear processes since we live in non-linear environments where things are unpredictable. In order to gain a better understanding of the crisis, future research might follow the steps of the present study for other destinations and different contexts.

6. Limitations

Although research has some input, it also has some limitations. That the very first limiting factor is that there would be various crises that may impact a destination at one time. That being said, the approach helps determine only the structural breaks in an intracellular case and recognizes their dates; in such situations, it is hard to ascertain if either one of these crises is willing to take responsibility for the structural break in the market for international tourism. Second, provided the former identification of structural breaks, this should be acknowledged that the intentional monitoring of statistics for authentication purpose appears to be viable only under a certain time period.

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