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The determinants of demand for tourism in Turkey: Does terror-threat matter? A Markov Regime Switching-VAR approach

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ABSTRACT

This paper investigates the impacts of potential determinants of demand for tourism in Turkey through Markov Regime Switching-Vector Auto Regression (MS-VAR) estimations from 1999 to 2017 on monthly data. The determinants are income level, exchange rates and the threat of terror incidences. The terror variable, following the Global Terrorism Index (GTI) 2017 report, is calculated for Turkey by the author. This research has conducted two separate MS-VAR models to observe the relevant parameters' signs of the demand for tourism function. Both MS-VAR models revealed that income level and exchange rates have positive influences on tourism while the terror threat has a negative impact on tourism in Turkey. Terror adversely affects the demand for tourism in the short-term in which terror has occurred in the nearest past (i.e., a month ago). The MS-VAR models also yield that a similar negative impact of terror on tourism activities does not appear over the longer periods.

KEYWORDS

tourism, terror, terrorism index, exchange rates, MS-VAR estimation, Turkey, government policy

JEL CLASSIFICATION INDICES

B23, C22, F52, L83, Z3

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1. INTRODUCTION

Security perceptions lead to fluctuant tourist numbers and tourism income per year. In terms of the overall economy, floating tourism income makes it hard to forecast the current account deficit and future projections for the economy.

Tourism demand can be defined as the number of people who have a desire to travel and who have a sufficient budget to meet that desire (Kaya – Canlı 2013). Determinants for tourism demand can be grouped into three categories: *Economic factors* (prices, disposable income, etc.), *Social factors* (education level, spare time, occupation, etc.), and many *Diverse factors* (health, advertisement and terror, etc.) as depicted in Lim (1997), Kaya – Canlı (2013) and Kozak et al. (2001).

1.1. Global tourism and Turkey

The rise of globalization has enabled people to travel more freely. However, globalization comes with its side effects: it causes less competition chance to the developing countries than the developed ones. Thus, if a country is not prepared for the environment that globalization brings, the cost is severe. In this kind of tough economic conditions, tourism, as an industry, becomes a saviour to the less developed and developing economies (Aktas 2005).

Tourism is an intangible exporting item that stabilizes the balance of payments. In that sense, tourism can be defined as the export of goods and services with domestic prices (Aktas 2005). In addition, the employment/investment rate is high in the tourism industry since it is mostly dependent on human labour. Also, tourism indirectly and positively affects the employment and income level of other industries (Kozak et al. 2008; Aktas 2005).

International tourism demand has risen from 808 million people to 1,326 million in the period of 2005–2017. The largest share of global tourism demand belongs to France with 86.9 million people. Spain comes after with 81.8 million people. However, the U.S. has the largest share of 210.7 billion USD from total international tourism receipts with 1,340 billion USD (UNWTO 2018).

In line with the developments in global tourism, the tourism industry in Turkey has made an important progress over the last 40 years. With the enactment of the 'Tourism Incentive Law' in 1982, the tourism sector has attracted more investments from private investors and more funds from governments (Kaya – Canlı 2013). As a result, the number of tourists that come to Turkey has increased from 1.2 million people to 37.6 million people from 1980 to 2017 (UNWTO 2018; Aktas 2005). Fig. 1 briefly outlines the progress of the tourism industry from 1999 to 2018 in terms of the number of tourists.

The steady rise of the number of tourists has made the tourism industry to become the second-largest national revenue and a major source of foreign exchange (Feridun 2011). In addition, Turkey started to rank among the top 10 most popular tourist destinations (UNWTO 2018). The share of tourism receipts in GDP has increased from 1.5% in 1980 to 2.7 in 2017 (TURSAB 2019).

1.2. Terrorism-threat in Turkey

Several studies documented the detrimental effects of terrorism on the tourism industry (Blomberg et al. 2004; Eckstein – Tsiddon 2004; Yaya 2009). The negative effects of terrorism on

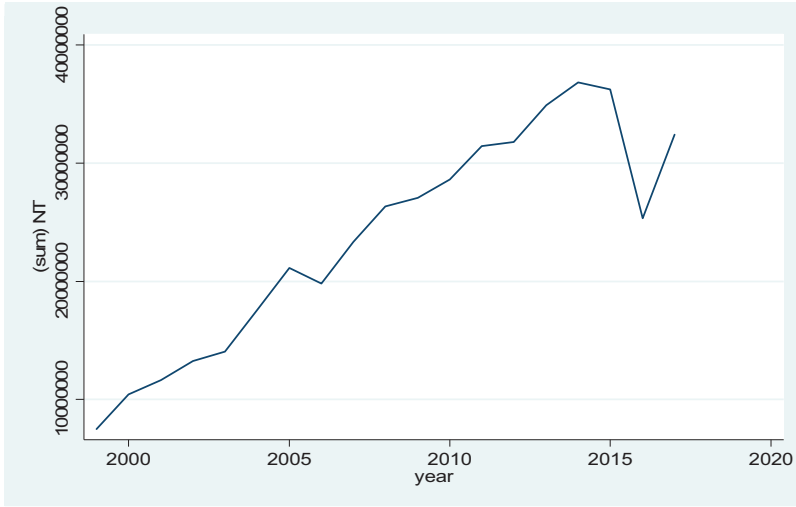

Fig. 1. Number of foreign tourists in Turkey
Source: TURSAB (www.tursab.org.tr).

tourism are most likely to spread out to the overall economy (Feridun 2011). The number of terror attacks has skyrocketed from 206 in 1972–3010 in 1985 worldwide.

Turkey has faced many terror attacks throughout her history because of many reasons (geological location, political conflicts, diversity of ethnic groups, etc.) as explained in Yaya (2009). Among these terror attacks, the longest and the costliest ones came so far from the Kurdish ethnic community living in Turkey itself and a number of neighbouring countries. The Kurdistan Workers' Party (PKK) has been negatively affecting the tourism industry for more than 30 years (Yesiltas et al. 2008). Other than PKK, one might mention some extreme radical Islamic and extreme leftist terrorist groups, as well. As a result of the terror attacks, the number of tourists, for example, from England has decreased by 20% affecting 25% of total tourism receipts (Emsen – Deger 2004). Appendix II displays some recent studies on the impact of terrorism on tourism.

Our study aims to estimate tourism demand expressed in money terms (NT) with the variables of terror (TER), industrial production index (IP), and real broad effective exchange rate (REXR) through Markov Regime Switching VAR (MS-VAR) models for the period of 1999–2017. The contribution of this research is three-fold: First, this study considers two different states within the model estimations. We applied MS-VAR models in which the estimations might change from one state (regime 0) to another state (regime 1). Second, we constructed a new terror index (for Turkey) which is similar to the Global Terrorism Index (GTI). The difference between the terror index of this paper and that of GTI is the time-frequency. GTI delivers *annual* terror index, we follow the *monthly* terror index. Thirdly, most of the studies apply terror variables and/or other variables to estimate tourism in single equation(s) in which the parameter estimations most likely do not change from one state to another. This paper, on the other hand, employs the terror variables and other relevant variables to estimate the demand for tourism in multiple equations simultaneously in which the parameter estimations and variances

can vary from one state to another state. Eventually, due to the original monthly terror index and advanced/superior statistical features of MS-VAR models, this paper is expected to provide potential readers/researchers with more efficient, unbiased, and consistent parameter estimations to explore the influence of terror on tourism in Turkey.

The paper is organized as follows: Section 2 reveals the literature review evidence, Section 3 explains the methodology and data through subsections of (3.1) Markov-Switching Vector Autoregressions (MS-VAR), and (3.2) data and demand functions. Section 4 introduces the MS-VAR Models and estimation outputs, Section 5 yields the conclusion that covers highlights, remarks and suggestions.

2. LITERATURE REVIEW

Table 1 shows some recent studies on the determinants of tourism demand. The downward arrow (upward arrow) indicates a decrease (an increase). For instance, according to Martin et al. (2017), as the local currency appreciates against the other country's currency (↑Exchange rate), the demand for tourism will increase (TD ↑), and a decrease in relative prices (↓Relative Prices) will cause demand for tourism to increase (TD ↑). An increase in the world income level (↑World GDP per capita) will also increase interest in visiting a foreign country (countries). Wang (2009) and Aydin et al. (2015) also explore that there exists a positive causality from exchange rate to demand tourism. Ozcan – Kayhan (2015), on the other hand, do not find the positive impact of exchange rate on tourism. A number of previous studies take terror and other determinants of tourism demand separately. However, we analyze all possible determinants together and try to find out which one is the most important for tourism demand and interaction between one another.

Table 2 reveals several studies on the impact of terrorism on tourism. Regarding the tourism studies considering only the terror variable suggest that terrorism affects tourism but not vice versa as indicated in Sandler – Enders (1991). Arana – Leon (2008) estimated the short-run impacts of the September 11 attacks in New York on tourist preferences for competing destinations in the Mediterranean and the Canary Islands. They found that terrorist attacks had a negative impact on tourists' image attractiveness and caused a significant decrease in tourists' utility for those deciding upon travel plans. Aschauer (2010) constructed a model to estimate the impact of terrorism on the tourism market with the inclusion of crisis-stable factors as the behavioural aspects of travelers. He suggested that the effects of terrorism on the tourism market may differ according to gender or culture. Samitas et al. (2018) analyzed the impact of terrorism on tourism demand in Greece using monthly data from 1977 to 2012. They applied cointegration, long-run causality tests to avoid a multicollinearity problem, and principal component analysis to construct a terror proxy according to the severity of the incident. They found that terrorism has a significant negative impact on tourist arrivals to Greece and that the causality appears only from terrorism to tourism. Corbet et al. (2019) draw a different perspective on the impact of terrorism on tourism by looking at the short-term ad hoc response of the airline industry across Europe. Conducting a seasonally adjusted ARMA-GARCH methodology, the authors conclude that business travel slows because of the duty of care legislation after the attacks and airline fare decreases.

Drakos – Kutan (2003) showed that the location and the severity of terror attacks have a negative impact on tourism, between 1991 and 2001 in Turkey, the attacks decreased tourism

Table 1. A list of studies on the determinants of tourism demand

Author(s)	Region/Country	Sample period	Methodology	Determinants	
				Impact	Output
Crouch (1995)	North Europe, Mediterranean, North America, and Asia		Meta-Analysis	↑Income level	TD↑
				↓Domestic price level	TD↑
				↓Travel costs	TD↑
				↓Marketing cost	TD↑
Garín-Muñoz (2006)	Canary Islands	1992–2002	GMM-DIFF	↓Relative prices	TD↑
				↓Travel costs	TD↑
Garín-Muñoz – Montero-Martin (2007)	Balearic Islands	1991–2003	GMM-DIFF, panel regression	↓Travel costs	
				↑Relative prices	
Wang (2009)	Thailand	1996:Q1–2006:Q2	ARDL	↑Income	TD↑
				↑Price level	TD↓
				↑Oil price	TD↓
				↑Exchange rate	TD↑
Kaya – Canli (2013)	Turkey	1990–2008	Panel Fixed Effect Model	↑Income level	TD↓
				↑Relative prices	TD–
Fuleky et al. (2014)	USA–Hawaii	1993:Q1–2012:Q4	Pesaran's common correlated estimator	↑Real personal income	TD↑
				↓Travel costs	TD↑
Aydin et al. (2015)	Turkey	1996:01 2013:04	Co-integration	↑Transportation cost	TD↓
				↑Inflation	TD↓
				↑Exchange rate	TD↑
Ozcan – Kayhan (2015)	Northern Cyprus Turkish Republic	1977–2013	Markov-Switching Model	↑Exchange rate	TD–
				↑GDP	TD↑
				↑Inflation	TD↓
Martin et al. (2017)	218 Countries	1995–2012	Panel Regression	↑Exchange rate	TD↑
				↓Relative prices	TD↑
				↑World GDP per capita	TD↑

Note: TD: Tourism demand.

Table 2. A list of studies on the impact of terrorism on tourism

Authors	Region/country	Sample period	Methodology	Output
Fleischer – Pizam (2002)	Israel	1991:5–2001:5	Least Squares Regression	The frequency of acts of terrorism causes a larger decline in international tourist arrivals than the severity of these acts.
Drakos – Kutan (2003)	Turkey, Greece and Israel	1991–2000	Enders-Sandler-Parise Method ARIMA	The location and severity of terror attacks have a negative impact on tourism. Between 1991 and 2001 terror attacks decrease tourism market share by 5.21% in Turkey.
Slobada (2003)	USA	1998–2001	Armax	Terrorism has a negative effect on USA tourism.
Ozsoy – Sahin (2006)	Turkey	1999:Q1–2015:Q4	Vector Autoregressive Model	Terrorism reduced both the number of tourists and tourism receipts in Turkey.
Arana – Leon (2008)	The Mediterranean and the Canary Islands	Pre and Post September 2001 (Survey data)	Discrete Choice Model	Terrorist attacks have a negative impact on tourists' image attractiveness and caused a significant decrease in tourists' utility for those deciding upon travel plans for a set of destinations.
Yaya (2009)	Turkey	1985:01–2006:12	Transfer Function Models Granger Causality Test	Terrorist attacks have a negative and small impact on the tourism industry in Turkey. Also, tourism does not Granger-cause a change in total terrorist incidents but total terrorist incidents Granger-cause a change in tourism in Turkey.

(continued)

Table 2. Continued

Authors	Region/country	Sample period	Methodology	Output
Aschauer (2010)	Bali, Indonesia, Sinai, Egypt, Catalonia and Spain	2005 (Survey data)	Linear Multiple Regression	Effects of terrorism on the tourism market may differ according to gender or culture but the overall effect on tourism is negative.
Feridun (2011)	Turkey	1986–2006	ARDL	Terror incidents have a negative causal effect on tourism.
Liu – Pratt (2017)	95 Countries	1990–2018	Panel ARDL	Terrorism does not have an adverse impact on tourism demand in the long-run, as no long-run relationship is found with the panel data model using the data of all 95 destinations. On the other hand, terrorism has a significant effect on tourism in the short-run for all 95 countries but the coefficient is quite small.
Samitas et al. (2018)	Greece	1977:01–2012:12	PCA Cointegration Causality	Terrorism has a significant negative impact on tourist arrivals to Greece and that causality is noted from terrorism to tourism only.
Corbet et al. (2019)	Europe	2011–2017	ARMA-GARCH	Business travel slows and airline fare decreases due to terrorism.

market share by 5.2%. By applying a four-variable vector autoregressive (VAR) model, Ozsoy – Sahin (2006) claimed that terrorism reduced both the number of tourists and tourism receipts in Turkey.

Yaya (2009) examined the impact of terrorism on tourism in Turkey by using a time series method called the 'transfer function'. He indicated that terrorist attacks had a negative impact on the tourism industry in Turkey. Moreover, he found that terrorism caused a reduction in the number of foreign tourists and of tourism revenue in Turkey.

When the researches in Tables 1 and 2 are examined in terms of the method, one may argue that the researchers mainly preferred to follow ARDL (Wang 2009; Liu – Pratt 2017; Feridun 2011), co-integration (Aydin et al. 2015; Samitas et al. 2018), GMM (Garín-Muñoz 2006; Garín-Muñoz, – Montero-Martin 2007) and regression (Martin et al. 2017; Garín-Muñoz, – Montero-Martin 2007; Aschauer 2010; Fleischer – Pizam 2002) techniques.

3. METHODOLOGY AND DATA

3.1. Markov-Switching Vector Autoregressions (MS-VAR)

The Markov regime-switching (MS) model introduced by Hamilton (1989) is a nonlinear econometric technique used to model nonlinear motions of time series. The Markov regime-switching vector autoregressions (MS-VAR) model was formed by adding the Markov Chain feature to the VAR model. The stochastic process generating the unobservable regimes is an ergodic Markov chain with a finite number of states $S_t = 1 \ldots\ldots N$ which is defined by the transition probabilities:

$$\boldsymbol{b_{i\ell}} = \boldsymbol{Br}(S_{t+1} = \ell | S_t = \boldsymbol{i}),$$

$$\sum_{\ell=1}^{N} \boldsymbol{bi}\ell = 1 \forall_{\boldsymbol{i}} \text{ for all } \boldsymbol{i},\ \ell \in \{1,\ \ldots,\ \boldsymbol{N}\} \tag{1}$$

This equation assumed that S_t follows an ergodic N state Markov process with an irreducible $(N \times N)$ transition matrix B.

$$\boldsymbol{B} = \begin{bmatrix} \boldsymbol{b}_{11} & \boldsymbol{b}_{12} & \ldots & \boldsymbol{b}_{1N} \\ \boldsymbol{b}_{21} & \boldsymbol{b}_{22} & \ldots & \boldsymbol{b}_{2N} \\ \vdots & \vdots & \ddots & \vdots \\ \boldsymbol{b}_{N1} & \boldsymbol{b}_{N2} & \ldots & \boldsymbol{b}_{NN} \end{bmatrix} \tag{2}$$

In Eq. (2), $bi_N = 1 - bi_1 - \ldots - bi_{,N-1}$ for $i = 1 \ldots N$ (Krolzig, 1996). $B_{i\ell}$ denotes the probability of transition from state i to state ℓ, $b_{i\ell} = Br(S_{t+1} = \ell | S_t = i)$ The elements of each row matrix B sum to one, $\sum_{\ell=1}^{N} b_\ell = 1$.

Transition probabilities also include significant information about the expected duration M_ℓ and show that the system will stay in a certain regime (ℓ) as is given in Chena et al. (2019):

$$\boldsymbol{E}(\boldsymbol{M}_\ell) = \sum_{\ell=1}^{\infty} \ell \boldsymbol{B_r}[\boldsymbol{M} = \ell]$$

$$= 1 \times (1 - \boldsymbol{b}_{i\ell}) + 2 \times \boldsymbol{b}_{i\ell}(1 - \boldsymbol{b}_{i\ell}) + 3 \times \boldsymbol{b}_{i\ell}^2 (1 - \boldsymbol{b}_{i\ell}) + \ldots = (1 - \boldsymbol{b}_{i\ell})^{-1} \tag{3}$$

The impulse response function is accordingly improved for the MS-VAR model. Koop et al. (1996) presented a regime-dependent impulse-response function. Traditional and generalized impulse response functions are different from each other. This difference arises from the fact that generalized impulse response functions are treated as random variables. A generalized impulse response is measured as the difference between the conditional expectations of the model after a shock impact and the conditional expectation of the model without any shock impact (Droumaguet 2012). Formally it can be defined as the difference between the forecasted paths of variables with and without a shock to the variables in period n as below:

$$\boldsymbol{IR}_{\varnothing k}(\boldsymbol{n}) = \boldsymbol{E}\left[\boldsymbol{y}_{\boldsymbol{t+n}}|\mathfrak{W}_{\boldsymbol{t}}, k_{\boldsymbol{t}} + \varnothing_{k};\ \boldsymbol{Y}_{\boldsymbol{t-1}}\right] - \boldsymbol{E}\left[\boldsymbol{y}_{\boldsymbol{t+n}}|\mathfrak{W}_{\boldsymbol{t}}, k_{\boldsymbol{t}};\ \boldsymbol{Y}_{\boldsymbol{t-1}}\right] \tag{4}$$

where $\varnothing_k$ shows the shock at time t. Also, the responses to shocks to the variables, such as in the case of the linear VAR process, can be obtained as follows:

$$\boldsymbol{IR}_{k\,g}(\boldsymbol{n}) = \left(\partial k_{\boldsymbol{gt}}/\partial \boldsymbol{E}\left[\boldsymbol{y}_{\boldsymbol{t+n}}|\mathfrak{W}_{\boldsymbol{t}}, k_{\boldsymbol{t}};\ \boldsymbol{Y}_{\boldsymbol{t-1}}\right]\right)^{-1} \tag{5}$$

The responses to regime shift are described in the generalized impulse-response as below:

$$\boldsymbol{IR}_{\varnothing k}(\boldsymbol{n}) = \boldsymbol{E}\left[\boldsymbol{y}_{\boldsymbol{t+n}}|\mathfrak{W}_{\boldsymbol{t}} + \varnothing\mathfrak{W}, k_{\boldsymbol{t}}; \boldsymbol{Y}_{\boldsymbol{t-1}}\right] - \boldsymbol{E}\left[\boldsymbol{y}_{\boldsymbol{t+n}}|\mathfrak{W}_{\boldsymbol{t}}, k_{\boldsymbol{t}}; \boldsymbol{Y}_{\boldsymbol{t-1}}\right] \tag{6}$$

In Eq. (6), the shift in the regime at time t is represented by $\varnothing$W parameter.

3.2. Data and tourism demand functions

The monthly data spans from 1999: 01 to 2017: 12. The dependent variable is the number of tourists coming to Turkey (NT). The number of tourist's data comes from the Association of Turkish Travel Agencies (TURSAB 2019). NT variable depicts the demand for tourism in Turkey as given in equations (7a), (7b) and (7c).

$$\begin{aligned} NT = f(&\text{Terror Incidents},\ \text{Exchange Rates},\ \text{Foreign Countries' Income},\\ &\text{Seasonal Patterns}, \text{Regime Shifts in Mean Values}) \end{aligned} \tag{7a}$$

In the function, the determinant variables (independent variables) are the scored terror incidents that happened in Turkey (TER), the real broad exchange rate for Turkey (REXR), foreign countries' income, seasonal patterns (Seasonal), and regime shifts that might occur in constant (mean) values [Constant (0), Constant (1)]. The foreign countries' income represents the OECD industrial production index (OECD_IP) within MS-VAR1 Model (Eq. 7b) whereas it denotes the industrial production index of EU 28 Countries (EU28_IP), and weighted average of industrial production for Russia and Japan (RUS_JAP_IP), respectively in MS-VAR2 model (Eq. 7c).

$$\begin{aligned} NT = f\ (&\text{Terror Incidents},\ \text{Exchange Rates},\ \text{OECD Industrial Production Index},\\ &\text{Seasonal Patterns},\ \text{Regime Shifts in Mean Values}) \end{aligned} \tag{7b}$$

$$\begin{aligned} NT = f(&\text{Terror Incidents},\ \text{Exchange Rates},\ \text{Industrial Production Index of EU 28}\\ &\text{Countries},\ \text{Weighted Average of Industrial Production for Russia and Japan},\\ &\text{Seasonal Patterns},\ \text{Regime Shifts in Mean Values}) \end{aligned} \tag{7c}$$

OECD_IP is considered a proxy for foreign countries' income and EU28_IP and RUS_JAP_IP are the proxies for income variables of EU 28 countries and Russia-Japan, respectively. The

Table 3. Indicator weights used in the GTI

Dimension	Weight
Total number of incidents	1.0
Total number of fatalities	3.0
Total number of injuries	0.5

REXR comes from the Central Bank of Republic of Turkey's database (www.evds2.tcmb.gov.tr) (2019). TER variable has been obtained from the Global Terrorism Database (GTD) (2019) (www.start.umd.edu). The data for OECD_IP, EU28_IP and RUS_JAP_IP have been extracted from OECD Data (2019) (https://data.oecd.org/).

Referring to the GTI 2017 report, we construct our terrorism index in three categories. If a terror incident occurs without any fatality and any injury, it has a base weight of 1. In case of any injury in the incident, each injury is multiplied by 0.5 and added to the base weight. If any fatalities happen, then each fatality is multiplied by 3 and added to the base weight. Obviously, in the case of no incident in any month, the index score would be zero. Different than GTI, our terrorism index is organized monthly and not adjusted across weight by month. To normalize our data, we take a natural logarithm on the terror index score. To adjust with the zero score months and natural logarithm, we add 1 to every zero score by following Eckstein – Tsiddon (2004). Table 3 shows the weights of the intensity of terror attacks.

4. THE MS-VAR MODELS AND ESTIMATION OUTPUTS

We follow the MS-VAR models to explore the impacts of independent variables on demand for tourism in Turkey. The MS-VAR models employing regime shifts in constant (mean) term can be exhibited by Eqs. (8) and (9) as explained by Krolzig (1997, 1998).

$$E|y_t|Y_{t-1}, s_t| = m(s_t) + \sum_{k=1}^{n} A_k y_{t-k} \tag{8}$$

$$y_t = m(s_t) + \sum_{k=1}^{n} A_k y_{t-k} + u_t \tag{9}$$

where E, y_t, m, s_t, and y_{t-k} denote expected term, time series vector, mean, regime and lagged variables of time series vector, respectively. The paper launches two separate MS-VAR models. In order to get rid of the potential unit-root issues, the models follow the differenced logarithms (DL) of the variables.

Table 4 shows the estimation outputs of MS-VAR1. The selection of VAR lag length is based on SC (Schwarz information criterion) lag length criteria. MS-VAR lag length is chosen as 4 due to SC among other criteria of LR (Likelihood ratio; sequential modified LR test statistic), PE (Final prediction error), AIC (Akaike information criterion), and HQ (Henan-Quinn information criterion). We have chosen lag length 4 by following SC rather than other criteria to avoid the over-parameterization problem. As SC has determined lag length = 4, other criteria

Table 4. Markov Regime-Switching VAR1 Model: 1999:1–2017:12

	DL_NT Eq. Coefficient	T– Prob	DL_TER Eq. Coefficient	T– Prob
DL_NT_1	–0.26978	0.000	–1.28126	0.222
DL_NT_2	–0.04812	0.478	0.61828	0.555
DL_NT_3	0.01855	0.770	–1.12858	0.270
DL_NT_4	–0.16449	0.010	–0.61123	0.538
DL_TER_1	–0.00859	0.038	–0.50335	0.000
DL_TER_2	–0.00506	0.259	–0.47410	0.000
DL_TER_3	–0.00214	0.606	–0.25720	0.000
DL_TER_4	–0.00425	0.259	–0.02832	0.647
DL_OECD_IP_1	2.05088	0.023	1.12952	0.938
DL_OECD_IP_2	0.60974	0.519	–33.6198	0.028
DL_OECD_IP_3	–1.22942	0.205	6.87858	0.653
DL_OECD_IP_4	–0.18582	0.838	18.0136	0.212
DL_REXR_1	–0.14124	0.303	–3.66214	0.106
DL_REXR_2	–0.10796	0.473	3.10863	0.213
DL_REXR_3	–0.02592	0.870	1.17011	0.657
DL_REXR_4	0.31143	0.035	0.89696	0.712
Seasonal	0.03150	0.500	1.45783	0.046
Seasonal_1	0.39152	0.000	0.02276	0.978
Seasonal_2	0.60372	0.000	1.57995	0.152
Seasonal_3	0.74985	0.000	1.43612	0.242
Seasonal_4	0.84110	0.000	3.16647	0.027
Seasonal_5	0.63975	0.000	2.63598	0.091
Seasonal_6	0.73650	0.000	2.81265	0.051
Seasonal_7	0.43594	0.000	2.82193	0.049
Seasonal_8	0.28270	0.000	1.62018	0.165
Seasonal_9	0.13497	0.016	1.47280	0.095
Seasonal_10	–0.30942	0.000	1.29391	0.072
Constant(0)	–0.36843	0.000	–1.53485	0.071
Constant(1)	–0.36886	0.000	–2.25093	0.011

Table 4a. (continued) Markov Regime-Switching VAR1 Model: 1999:1–2017:12

	DL_OECD_IP Eq. Coefficient	T– Prob	DL_REXR Eq. Coefficient	T– Prob
DL_NT_1	0.01113	0.003	0.03973	0.046
DL_NT_2	–0.00155	0.680	0.02703	0.200
DL_NT_3	0.00148	0.681	–0.01600	0.413
DL_NT_4	–0.00029	0.935	–0.02399	0.214
DL_TER_1	–0.00038	0.110	–0.00093	0.467
DL_TER_2	–0.00056	0.037	0.00051	0.722
DL_TER_3	0.00007	0.777	0.00007	0.958
DL_TER_4	0.00028	0.261	–0.00181	0.180
DL_OECD_IP_1	0.02417	0.681	0.47823	0.131
DL_OECD_IP_2	0.24531	0.000	–0.50788	0.100
DL_OECD_IP_3	0.17185	0.002	–0.13179	0.645
DL_OECD_IP_4	–0.10485	0.040	0.42349	0.120
DL_REXR_1	0.00758	0.479	0.34349	0.000
DL_REXR_2	–0.00158	0.883	–0.15800	0.010
DL_REXR_3	0.02345	0.024	–0.02102	0.721
DL_REXR_4	–0.01823	0.061	0.02247	0.675
Seasonal	–0.00309	0.226	0.01199	0.381
Seasonal_1	–0.00334	0.246	–0.02265	0.149
Seasonal_2	–0.00624	0.105	–0.04944	0.016
Seasonal_3	–0.00808	0.069	–0.02517	0.296
Seasonal_4	–0.00826	0.092	–0.04391	0.107
Seasonal_5	–0.01057	0.056	–0.03794	0.213
Seasonal_6	–0.00637	0.210	–0.02081	0.464
Seasonal_7	–0.00836	0.099	–0.03373	0.226
Seasonal_8	–0.00551	0.181	–0.00301	0.896
Seasonal_9	–0.00483	0.115	0.00971	0.565
Seasonal_10	–0.00241	0.323	0.00236	0.861
Constant(0)	0.00715	0.018	0.02076	0.208
Constant(1)	0.00228	0.500	0.00158	0.935

have determined lag length = 8. Some evidences from Monte Carlo studies reveal that SC dominates all other criteria in the VAR process as is explained in Köse – Uçar (1999).

All MS-VAR estimations are conducted by following two different constant (mean) terms. Constant 0 and constant 1 correspond to relevant regimes (states) which are called 'Regime 0' and 'Regime 1'.

The parameter estimations of DL-NT equation in MS-VAR model are shown in the second column of Table 4. The 3rd column exhibits the probability values of parameter estimations. 2nd column indicates that the number of tourists in Turkey is negatively affected by the first and fourth lagged values of DL_NT. This means that the number of tourists coming to Turkey at the current time, among other possible determinants, is influenced negatively by the number of tourists coming to Turkey in the past (last month and four months before).

In Table 4, the 2nd column exhibits as well that an increase in world income (DL_OECD_IP_1) and exchange rates (DL_REXR_4) have induced tourism in Turkey. The seasonal parameters (1–10) seem to be significant at 1% level. The constant term of DL-NT equation at regimes 0 and 1 are also significant. The constant term at regimes 0 and 1 are negative. The negative value of constant term at regime 0 [Constant (0)] implies that the expected values of DL-NT are less than zero, as all other parameters in the equation are set to zero, during regime 0 which covers 188 months (84.30% of total monthly observations) with the average duration of 13.43 months. The negative value of constant term at regime 1 [Constant (1)] reveals that the expected values of DL-NT are also less than zero, as all other parameters in the equation are set to zero during regime 1 which consists of 35 months (15.70% of total monthly observations) with the average duration of 2.69 months. The smoothed regime means that all available information from sample data is observed to estimate the probabilities of each regime. In this process of smoothed probability estimations, for instance, the probability of staying at Regime 0, as the current regime is Regime 1, is estimated from time t-1 to time *t*. In this respect, the calculations of per smoothed regime consider all past and future information.

The primary issue is to analyze the impact of determinant variables on demand for tourism given in Eqs. (7b) and (7c). Eq. (7b) is employed in the MS-VAR1 model and Eq. (7c) is employed in the MS-VAR2 model. The MS-VAR1 model consists of 4 equations. These are DL_NT eq., DL_TER eq., DL_OECD_IP eq. and DL_REXR eq., respectively. All parameters of four equations are determined endogenously within the MS-VAR1 system. That's why; we need to consider proper interpretation of the given estimations in Table 4 including all relevant parameter estimations of four equations simultaneously in the system.

Therefore, we should explain all estimations in the MS-VAR1 system provided that they are all suitable for the theoretical models. The compliance with the theoretical model is important because, for example, as the dynamics of world income's contribution to Turkish tourism can be meaningful, the contribution of dynamics in Turkish tourism to the world income level may not be very meaningful (in terms of statistical probability).

Thus, for example, the tourism demand equation (DL_NT) in the MS-VAR1 system can be explained by the dynamics of the number of tourists visiting Turkey (DL_Nt_i), the dynamics of terror variable (DL-TER-i), the dynamics of the world income level (DL-OECD_IP_i), and the dynamics of exchange rate (DL_REXR_i). This disclosure may be adapted to the respective microeconomic and/or macroeconomic models. However, on the other hand, the interpretations of world income (DL-OECD_IP) equation's parameters obtained in the MS-VAR1 system simultaneously-endogenously together with Turkish variables of DL_Nt_i,

DL-TER-i and DL_REXR_i (as $i = 1, 2, 3,$ and 4) might be incompatible with the basic micro-macro models.

The 4th and 5th columns of Table 4 yield parameter estimations of terror equation (DL_TER eq.) and relevant probability values, respectively. The immediate outcome appears as follows: Terror tends to decline. Terror index is affected negatively by its 1st, 2nd and 3rd lags. Terror variable is also induced negatively by an increase in the second lag of OECD income (OEC-D_IP_2). The seasonal parameters are all significant except the seasonal 1st -3rd and 8th lags parameters. The mean (constant) terms of the DL-TER equation at regimes 0 and 1 are also negative and significant.

Table 4 (continued in Table 4a), in the 2nd column, the DL_OECD_IP equation depicts the influences of lags of DL_NT, DL_TER, DL_OECD_IP, DL_REXR and mean values (at regimes 0 and 1) on OECD production index (DL_OECD_IP) which is a proxy for OECD countries' income. The control variables of seasonalities have been also employed in the equation. The next column represents the significances of the estimated parameters. The resulting output is that 1st lag of DL_NT (DL_NT_1), 2nd lag of DL_TER (DL_TER_2), 2nd, 3rd and 4th lags of DL_OECD_IP (DL_OECD_IP_2, DL_OECD_IP_3, DL_OECD_IP_4), 3rd and 4th lags of DL_REXR (DL_REXR_3, DL_REXR_4), 3rd, 4th, 5th and 7th seasonal parameters (Seasonal_3, Seasonal_4, Seasonal_5, Seasonal_7) and mean (constant) value at regime 0 have statistically significant effects on DL_OECD_IP at time *t*. The relevant estimations indicate that 1st lag of DL_NT, 2nd and 3rd lags of DL_OECD_IP, and 3rd lag of DL_REXR have positive impacts on DL_OECD_IP, as other significant parameters cause DL_OECD_IP to diminish. The estimates on the income levels of the OECD countries, of course, need to be made carefully. Because it should be noted that, besides the Turkish variables, there exist many other possible variables that might affect the income levels of the OECD countries. The comments here are only made by the fact that OECD income (a) can be affected by their lags in the relevant VAR system, and (b) that the lags of the OECD income variable can affect other variables in the system.

In Table 4a, the 4th and 5th columns denote that, DL_NT_1, DL_REXR_1, DL_REXR_2 and Seasonal_2 parameters affect DL_REXR positively. The parameters of DL_NT_1 and Seasonal_2 are significant at 5% level whereas its lags (DL_REXR_1, DL_REXR_2) are significant at 1% level. Neither the constant term at regime 0 nor the constant term at regime 1 seems to be significant on the real exchange rate.

Overall, from MS-VAR1 analyses, one may claim that the change (fluctuation) in the number of tourists visiting Turkey (DL_NT) can be explained by the fluctuations that emerged in the lagged observations of DL_NT, DL_TER, DL_OECD_IP and DL_REXR together with monthly seasonal changes and the shifts in the mean value of DL_NT equation. The shifts in the mean value of the DL_NT equation capture the structural changes in constant level in DL_NT variable through time by moving from Regime 0 (Regime 1) to Regime 1 (Regime 0).

By considering the dynamics of the variables employed endogenously in the MS-VAR1 system through the shifts in constant value, one can argue that terrorism, together with other variables in the system, does matter in determining the demand for tourism in Turkey. Terrorism can affect the demand for tourism in Turkey negatively. The potential visitors, by considering the terrorism incidents that happened in the nearest past (i.e., a month ago) in Turkey, can change their decision about visit time to Turkey or they can cancel their reservations at all. The MS-VAR1 model, however, indicates that the same negative influence of terrorism on demand for tourism does not appear as time passes (i.e., two or three or four

months after the terror incident). This can be explained by the antiterrorist policies of Turkish administrators taken in the month of the terror event, but whose effects were shown in the following months. Or this might be due to, as time passes and the effects of terror are forgotten, the efficient advertisement campaigns of tourism agencies inside and outside the country by advertising the Turkish natural beauties together with exchange rate advantages of the foreign countries' residents.

The income level is also an important parameter in determining the demand for tourism services. Since Turkey hosts millions of tourists from many countries, the OECD industrial production index, which is a proxy for the changes in the OECD countries' income levels, has been also considered in the MS-VAR1 system, as explained earlier. It is worth noting, however, that the foreign tourists who come to Turkey are mostly from Europe, the Commonwealth of Independent States (CIS), and Asian countries (Table 5). Therefore, the MS-VAR2 model employs alternatively, instead of the OECD income level, the European countries' income level (DL_EU28_IP) and weighted index of the income level of Russia and Japan (DL_RUS_JAP_IP).

Table 6 verifies Table 4 in terms of significance and dynamics of DL_NT, DL_TER and DL_REXR on DL_NT at the current time. Table 6 also confirms Table 4 indicating that the constant terms at Regimes 0 and 1 are significant and have negative signs. The second column of Table 6, DL_NT Eq. reveals that (a) the 1st and 4th lags of DL_NT and 1st lag of DL_TER affect DL_NT at current time negatively, (b) the 4th lag of REXR affects DL_NT at current time positively, (c) the seasonal changes (except 9th seasonal parameter) can help explain the variation in DL_NT, and (d) the significant values of mean of DL_NT in Regimes 0 and 1 can capture the structural changes in the constant level of DL_NT variable through time by moving from State 0 (Regime 1) to State 1 (Regime 0).

Hence, by observing the dynamics of the variables employed endogenously in the MS-VAR2 system through the shifts in constant value, one can argue as well that terrorism, together with other variables in the system, does matter in determining the demand for tourism in Turkey.

The resulting output is that terrorism can affect negatively the demand for tourism in Turkey in a very short-term (in a month), and (b) the 2nd, 3rd and 4th monthly lags of terror variable do not have any significance on terrorism. Table 5 yields differently from Table 4 that the power of change in DL_RUS_JAP_IP_1 appears to be significant on DL_NT at time *t* positively. The dynamics of DL_EU28_IP, from its 1st lag to 4th lag, do not appear to have a significant impact on DL_NT at time *t*. This might be explained by the evidence that, as an increase in the European countries' income levels does not respond much (positively or negatively) to the tourism services available in Turkey, the increase in DL_RUS_JAP_IP causes the number of tourists coming to Turkey to increase.

Table 5. The share of tourists visiting Turkey in 2017 and 2018, %

	2017	2018
European tourists	39	43
CIS countries' tourists	41	40
Asian countries	16	13

Source: Republic of Turkey, Ministry of Culture and Tourism, 2019.

Table 6. Markov Regime-Switching VAR2 Model: 1999–2017

	DL_NT Eq. Coefficient	T– Prob	DL_TER Eq. Coefficient	T– Prob	DL_REXR Eq. Coefficient	T– Prob
DL_NT_1	–0.26135	0.001	–0.61940	0.578	0.05568	0.006
DL_NT_2	–0.02320	0.718	0.69528	0.525	0.02876	0.147
DL_NT_3	0.01383	0.830	–1.86769	0.096	–0.02185	0.233
DL_NT_4	–0.15799	0.016	–0.54210	0.611	–0.00732	0.680
DL_TER_1	–0.00880	0.037	–0.48756	0.000	–0.00026	0.825
DL_TER_2	–0.00531	0.231	–0.44775	0.000	0.00112	0.393
DL_TER_3	–0.00505	0.231	–0.21769	0.006	–0.00048	0.724
DL_TER_4	–0.00440	0.263	–0.04202	0.532	–0.00223	0.113
DL_RUS_JAP_IP_1	0.69871	0.004	–0.05173	0.989	–0.00229	0.978
DL_RUS_JAP_IP_2	0.13345	0.589	–2.44391	0.561	–0.10988	0.177
DL_RUS_JAP_IP_3	–0.04786	0.851	–3.83391	0.382	0.07252	0.357
DL_RUS_JAP_IP_4	0.24923	0.329	–2.07113	0.625	0.09559	0.212
DL_EU28_IP_1	0.89442	0.188	4.85751	0.672	–0.11157	0.595
DL_EU28_IP_2	0.36698	0.566	–13.0592	0.237	–0.16720	0.402
DL_EU28_IP_3	–0.97800	0.116	8.16384	0.435	–0.17274	0.328
DL_EU28_IP_4	–0.74759	0.237	8.61333	0.398	–0.06906	0.690
DL_REXR_1	–0.16954	0.203	–2.71898	0.268	0.27610	0.000
DL_REXR_2	–0.09571	0.517	4.10166	0.133	–0.13966	0.036
DL_REXR_3	–0.08604	0.563	1.42001	0.592	–0.01778	0.765
DL_REXR_4	0.27224	0.063	0.38100	0.881	0.01299	0.834
Seasonal	–0.03309	0.545	1.28.905	0.151	0.00803	0.587
Seasonal_1	0.45142	0.000	–0.48237	0.640	–0.02240	0.224
Seasonal_2	0.57825	0.000	0.75450	0.577	–0.07152	0.004
Seasonal_3	0.63263	0.000	0.26303	0.871	–0.03397	0.247
Seasonal_4	0.88903	0.000	2.59892	0.091	–0.03614	0.158
Seasonal_5	0.63649	0.000	2.25785	0.196	–0.07550	0.016
Seasonal_6	0.63502	0.000	2.25059	0.197	–0.04734	0.131
Seasonal_7	0.40618	0.000	2.39839	0.116	–0.02885	0.264
Seasonal_8	0.28976	0.001	1.60663	0.198	–0.01960	0.351
Seasonal_9	0.06142	0.344	1.36268	0.202	–0.01252	0.497

(continued)

Table 6. Continued

	DL_NT Eq. Coefficient	T– Prob	DL_TER Eq. Coefficient	T– Prob	DL_REXR Eq. Coefficient	T– Prob
Seasonal_10	–0.36352	0.000	0.95543	0.264	–0.00318	0.823
Constant(0)	–0.33858	0.000	–1.20041	0.207	0.03445	0.039
Constant(1)	–0.33938	0.000	–1.39123	0.153	0.01225	0.484

Table 6a. (continued) Markov Regime-Switching VAR2 Model: 1999:1–2017:12

	DL_RUS_JAP_IP Eq. Coefficient	T– Prob	DL_EU28_IP Eq. Coefficient	T– Prob
DL_NT_1	0.01495	0.351	0.01350	0.035
DL_NT_2	–0.00508	0.765	–0.00192	0.758
DL_NT_3	0.00994	0.536	–0.00010	0.986
DL_NT_4	0.01240	0.424	–0.00869	0.148
DL_TER_1	–0.00163	0.117	0.00056	0.988
DL_TER_2	0.00035	0.750	–0.00032	0.455
DL_TER_3	0.00032	0.774	0.00040	0.365
DL_TER_4	0.00021	0.841	0.00074	0.094
DL_RUS_JAP_IP_1	–0.30112	0.000	0.04463	0.082
DL_RUS_JAP_IP_2	–0.05935	0.354	0.07066	0.007
DL_RUS_JAP_IP_3	0.06984	0.291	0.07273	0.006
DL_RUS_JAP_IP_4	–0.10926	0.097	0.01951	0.416
DL_EU28_IP_1	0.20647	0.271	–0.27080	0.001
DL_EU28_IP_2	0.41139	0.020	–0.00675	0.917
DL_EU28_IP_3	0.21162	0.165	0.28224	0.000
DL_EU28_IP_4	–0.37149	0.017	0.00150	0.979
DL_REXR_1	0.04461	0.389	0.01865	0.313
DL_REXR_2	–0.04156	0.376	0.00159	0.931
DL_REXR_3	0.01532	0.740	0.02231	0.209
DL_REXR_4	–0.04190	0.368	–0.03320	0.065
Seasonal	–0.13369	0.000	–0.00714	0.146
Seasonal_1	–0.02770	0.074	0.00094	0.868

(continued)

Table 6a. Continued

	DL_RUS_JAP_IP Eq. Coefficient	T– Prob	DL_EU28_IP Eq. Coefficient	T– Prob
Seasonal_2	0.07620	0.000	–0.00285	0.695
Seasonal_3	–0.07917	0.003	–0.00537	0.561
Seasonal_4	–0.09460	0.000	–0.00859	0.303
Seasonal_5	–0.00572	0.823	–0.00844	0.374
Seasonal_6	0.00003	0.999	0.00300	0.753
Seasonal_7	–0.09094	0.000	–0.00621	0.455
Seasonal_8	–0.00061	0.974	–0.00030	0.963
Seasonal_9	–0.01283	0.411	–0.00277	0.634
Seasonal_10	–0.02345	0.062	0.00208	0.654
Constant(0)	0.03872	0.008	0.00473	0.356
Constant(1)	0.02175	0.121	0.00019	0.971

Table 7 indicates that Eq. (7a) and hence Eqs. (7b) and (7c) are better to be estimated in nonlinear forms instead of their linear forms. The nonlinear convergences are better than the linear convergences in determining the determinants of demand for Turkey. Table 7 indicates that the MS-VAR1 and MS-VAR2 models converge strongly by the SQPF algorithm in a nonlinear solution of the same models. Table 7 gives also the goodness of fit measurements between the MS-VAR1 model and MS-VAR2 model. Since our purpose is to close to zero slope

Table 7. Linearity and nonlinearity tests, convergence, transition probabilities, and goodness of fit test statistics

	MS-VAR1	MS-VAR2
Linearity test (Chi^2)	(10) = 3926.3 [0.0000]	(22) = 5528.6 [0.0000]
Convergence	Strong by SQPF	Strong by SQPF
Log Likelihood	1276.17866	1767.10761
P(0|0)	0.91620	0.87867
P(1|0)	0.083798	0.12133
P(0|1)	0.37669	0.34063
P(1|1)	0.62331	0.65937
AIC	–10.261692	–14.0816826
SC	–8.24489082	–11.019888
Number of obs.	223	223

of the function, the MS-VAR2 model might be preferred due to its lower log-likelihood value of 1767.10761. In terms of log-likelihood, AIC and SC criteria, the MS-VAR2 model seems to be better than the MS-VAR1 model. In the MS-VAR2 model; (a) the probability of staying at Regime 0, as the current regime is 0, is 0.87867, (b) the probability of staying at Regime 1, as the current regime is 1, is 0.65937, (c) shifting from Regime 1 to Regime 0 is 0.34063, and, (d) shifting from Regime 0 to Regime 1 is 0.12133. Thus, one may assert that the cumulative impact of a shock in the MS-VAR2 model to DL_NT Eq. at Regime 0 is more persistent than at Regime 1 whereas DL_NT Eq. responses to the shock(s) less permanently (temporarily) in the system at Regime 1.

5. CONCLUSION

This paper aims at observing the dynamic impacts of exchange rates, terrorism and foreign countries' income on demand for tourism in Turkey by employing the monthly data for the period of 1999–2017. The originality of this study can be considered from two aspects. First, by following the Global Terrorism Index (GTI) 2017 report, this research calculated the monthly terrorism index for Turkey. Other monthly variables have been extracted from OECD and Turkish Central Bank databases. Secondly, the paper has launched Markov Regime-Vector Auto Regression (MS-VAR) models in which the variables (demand for tourism, terrorism, exchange rate and income level) are determined endogenously by (a) lags of each variable, (b) seasonal parameters and (c) mean values at Regimes 0 and 1. The regime changes in mean (or constant term) values are expected to capture the structural changes in the data. Therefore, the MS-VAR models are conducted to estimate the DL_NT equation (differenced logarithmic form of the number of tourists visiting Turkey) by considering (a) the dynamics of simultaneous equations in the VAR system and (b) the possible Markov regime (state) changes in relevant time series data.

By considering the elements of the tourism demand function utilized endogenously in the MS-VAR simulations/estimations through the potential significant Markov regime shifts, one can contend that terror events, as well as income level and exchange rates, do make a difference in deciding the interest in tourism activities in Turkey. The MS-VAR models' predictions reveal that terror can influence the interest for travelling to Turkey adversely and that changes in foreign countries' income levels and exchange rates can increase the interest in visiting Turkey. The potential guests, by considering the fear of terror that occurred in the closest past (for example, a month prior) in Turkey, can change their choice about visit time to Turkey or they can drop their reservations by any means. The MS-VAR models, notwithstanding, indicate that a similar negative impact of fear of terror on interest in tourism activities does not show up over the longer terms (two or three or four months after the dread episode). This can be explained by the antiterrorist strategies of Turkish administrators whose impacts appear in the next months. Or, this might be explained, as time passes and the effects of terrorism diminish, by the productive ads of the tourism industry offices inside and outside Turkey to promote the Turkish cultural and seasonal tourism activities. Also, our results yield that while the world income level and exchange rate positively affect tourism in Turkey, the terror variable has a negative effect. The other alternative MS-VAR model, in which apart from the world income level parameter, the European and Asian income levels are considered separately, confirms the positive signs of

income and exchange rate variables and the negative sign of terror variable on demand for tourism in Turkey.

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