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FORECASTING INBOUND TOURISM FLOW TO TÜRKİYE: BVAR APPROACH[1]

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Abstract

The tourism sector is a significant revenue and growth source for Türkiye's economy due to its foreign exchange provision and employment creation capacity and its connections with other sectors. Because of its increasing share and the potential it promises, it is expected that the sector will gain further importance in the following years. However, the growth potential depends on many factors, which are internal and external, as well as economic and social. Recognizing these factors as given, it is important to obtain realistic tourism demand forecasts for both the intra-sector players and political decision-makers. In this study, such a forecasting practice has been attempted. To this end, by using the Bayesian VAR method, forecasts obtained for the 2016–2023 period for the five most tourist sending countries to Türkiye and evaluation of the forecast success has been made depending on various criteria. Forecasts reveal that it is difficult to reach the government's target of 60 million tourists in 2023. However, it is important not to ignore the impact of the COVID-19 pandemic, whose devastating impact has not yet been fully compensated, and the loss of purchasing power experienced all over the world.

Keywords: Inbound Tourism, forecasting, Türkiye, Bayesian VAR.

TÜRKİYE'YE YÖNELİK TURİZM AKIMININ ÖNTAHMİNİ: BVAR YAKLAŞIMI

Öz

Turizm sektörü, sağladığı döviz geliri, yarattığı istihdam ve diğer sektörlerle olan bağlantıları ile Türkiye ekonomisi için önemli bir gelir ve büyüme kaynağıdır. Zaman içinde artan payı ve vaat ettiği potansiyel ile sektörün öneminin gelecek yıllarda daha da artması beklenmektedir. Ancak bu büyüme potansiyeli içsel ve dışsal, ekonomik ve sosyal birçok faktörle bağlantılıdır. Bu faktörleri veri kabul ederek geleceğe dönük gerçekçi turizm talep tahminlerinin elde edilmesi hem sektör içindeki oyuncular hem de politik karar alıcılar açısından önem arz etmektedir. Bu çalışmada, bu tür bir öntahmin denemesine girişilmektedir. Bu doğrultuda, Bayesyen VAR yöntemiyle Türkiye'ye en fazla turist gönderen beş ülke için 2023 dönemine ilişkin öntahminler elde edilmiş ve öntahmin başarısı için farklı ölçütlere dayalı değerlendirmeler yapılmıştır. Öntahminler, hükümetin 2023 yılında

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60 milyon turist hedefine ulaşmanın zor olduğunu ortaya koymaktadır. Bununla birlikte henüz yıkıcı etkisi tam olarak telafi edilemeyen COVID-19 pandemisinin ve tüm dünyada yaşanan satınalma gücü kaybının etkisini göz ardı etmemek gerekmektedir.

Anahtar Kelimeler: Turizm, öntahmin, Türkiye, Bayesyen VAR.

1. Introduction

The tourism sector has been growing steadily around the world since the mid-20th century, in parallel with global living standards and developments in the transportation-communication sector. According to the World Tourism Barometer published by the United Nations World Tourism Organization (UNWTO), global tourism flows reached 1.18 billion in 2015, increasing by 4.4% compared to the previous year. Revenues from international tourism exceeded 1 trillion US dollars in the same period. UNWTO estimates that global tourism flows will reach 1.8 billion in 2030, with an annual increase of 3.3% between 2010 and 2030 (UNWTO, 2015).

The importance of the sector stems from its capacity to create employment, its contribution to economic growth, and its being a significant source of foreign exchange and income for the government. The tourism sector has the potential to impact almost the entire economy due to its strong forward and backward linkages. Tourism can be considered an invisible export item that has significant effects on the balance of payments. As in most other service branches, the employment/investment ratio is generally high in the sector, which has very low automation and mechanization capabilities. Tourism indirectly causes increases in production, employment and income in many other sectors due to the stimulating effects it creates. The micro and macro externalities and growth potential of the tourism sector led many countries to compete fiercely to get a larger share of this cake. (Karagöz, 2016).

Many empirical studies have been carried out recently on the determination of factors affecting tourism demand and demand forecasting. However, despite being one of the leading tourism destinations, it is noteworthy that empirical studies on tourism demand in Türkiye are quite inadequate. This deficiency can be easily noticed when major international academic journals for the tourism sector are examined. In this study, an attempt is made to forecast the tourism demand for Türkiye, which is an important tourist route. For this purpose, using the Bayesian VAR model, which is a different version of VAR models, the number of tourists from the top five countries sending the most tourists to Türkiye was estimated for the period 2016 - 2023.

2. Tourism Sector in Türkiye: Development and State of Art

The roots of the tourism sector in Türkiye can be stretched back to the Ottoman Empire period. The conversion of the Hagia Irene Church into a museum in 1846 and the arrival of thousands of people from within and outside the country to Istanbul due to the international fair opened in Istanbul under the name of *Sergi-i Umum-i Osmanî* created a serious touristic activity. On the other hand, Regulation No. 190, issued in 1890 for tourist guiding, can be seen as the first legal regulation regarding the sector. (İTO, 2007; 39).

With the developments in transportation facilities, especially railways, significant increases were observed in tourist flows from Europe to Türkiye in the early 20th century. As a result of this development, the construction of large and luxury hotels started in Istanbul and other big cities (ITO, 2007; 40). The tourist flow from Europe to Anatolia, which was interrupted during the World Wars, showed a steady development in the post-war period. It is seen that the tourism sector was also taken into consideration and encouraged as an important factor in the planned development studies that started in the 1960s (Çımat and Bahar, 2003).

In parallel with the development in world tourism flows, remarkable developments have been observed in the number of tourist arrivals to Türkiye and tourism revenues in recent years. The Turkish tourism sector has shown great development due to both state-supported supply-side initiatives and demand-side developments resulting from the expansion in domestic and foreign tourism flows. Although domestic tourism for holy places, health and summer holidays has a long history in Türkiye, the country's opening to the international tourism market dates back to the late 1980s (Yıldırım and Öcal, 2004). It can be said that the investment incentives and financial support provided to the sector by the Tourism Incentive Law of 1982 have a very important impact on the development of tourism (Bahar, 2006;138). With the opening up and liberalization policies that started in the early 1980s, tourism became one of the important issues, as well as international trade in goods and services, and investments in this direction were supported by the state.

Today, the tourism sector is the most important source of foreign currency and employment after the manufacturing industry. On the other hand, tourism is considered as a suitable tool in terms of growth, employment and productivity increase. There are empirical findings that the tourism sector has a positive impact on Türkiye's economic growth in the long term (Bahar, 2006; Gündüz and Hatemi-J, 2005; Yıldırım and Öcal, 2004). Input–output analyses reveal that the tourism sector in Türkiye has a significant forward and backward impact on other sectors (Çakır and Bostan, 2000; Dilber, 2007; Canlı and Kaya, 2012). Tourism

revenues are one of the most important sources in closing the balance of payments deficit (Kar et al., 2004).

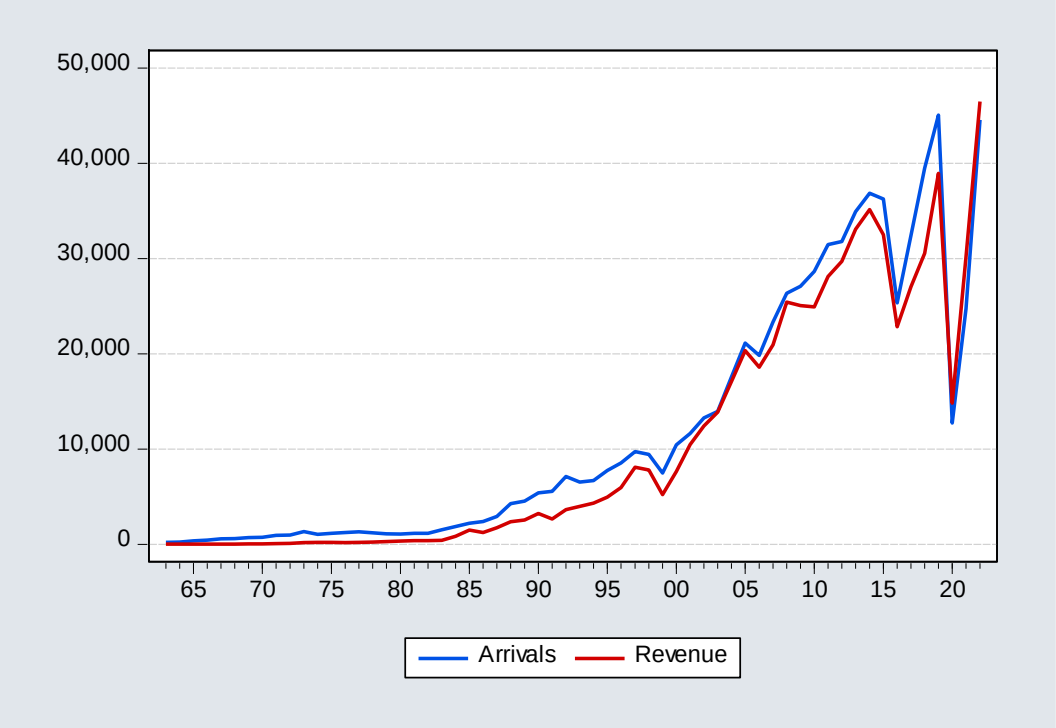

Figure 1. Tourist arrivals and revenue in Türkiye (1963-2022) (Source: TURKSTAT)

However, while the number of incoming tourists has increased in recent years, there has been a relative decline in tourism revenues due to the decrease in the amount of expenditure per tourist (Ünlüönen and Kılıçlar, 2004). According to 2020 World Tourism Organization data, while Türkiye ranks 6th in the World tourism market in terms of the number of tourist arrivals, unfortunately it cannot enter the top-10 in terms of tourism revenue (see Table 1). According to UNWTO data, as of 2006, Türkiye's tourism revenues are 13.5% of its GDP. With an income of $16.9 billion from tourism in 2006, Türkiye is among the top ten countries that generate the most income from tourism in the world (ranked 9th). However, it cannot be said that Türkiye has fully utilized its tourism potential arising from its geographical and historical riches. The income of Spain, a Mediterranean country like Türkiye, from tourism in 2015 was 56.5 billion $, and Italy's was 39.4 billion $ (UNWTO, 2015).

The above-mentioned benefits of the tourism sector increase the importance of the sector. For this reason, examining the characteristics of the tourist flow is as important as determining measures and policies for the development of the sector. Excessive and permanent volatility in the tourist flow to a country in the face of shocks will increase uncertainty about

the future and will result in the expected benefit from the sector not being fully achieved. The analysis implemented by Karagöz (2016) based on ARCH and GARCH models shows that the volatility in the number of tourist arrivals to Türkiye prevailed in the short-term. The findings reveal that the tourism sector quickly recovered from the effects of shocks, and that the volatility in the number of arrivals is asymmetrical; that is, positive shocks are relatively more effective on volatility than negative shocks.

Table 1. Leading countries in terms of number of tourists and tourism revenues.

Tourist arrivals (million person)					Tourism revenue (million USD)				
Rank	Country	2018	2019	% Dif.	Rank	Country	2018	2019	% Dif.
1	France	89,4	88,9	-0.6	1	USA	214.7	214.3	-0,2
2	Spain	82.8	83.5	0.8	2	Spain	81.7	79.7	-2.5
3	USA	79.7	79.3	-0.5	3	France	66.0	63.8	-3.4
4	China	62.9	65.7	4.3	4	Thailand	56.4	60.5	6.8
5	Italy	61.6	64.5	4.5	5	UK	50.1	52.7	4.9
6	*Türkiye*	*45.8*	*51.2*	*10.5*	6	Italy	49.3	49.6	0.6
7	Mexico	41.3	45.0	8.2	7	Japan	42.1	46.1	8.7
8	Thailand	38.2	39.8	4.0	8	Australia	45.0	45.7	1.5
9	Germany	38.9	39.6	1.8	9	Germany	43.0	41.6	-3.4
10	UK	38.7	39.4	1.8	10	Macao	40.7	39.5	-3.0

Source: (UNWTO, 2020)

The fact that the tourism sector in Türkiye is resistant to shocks and that the sector has shown significant development over time does not mean that the sector is risk-free. The country's sensitive structure due to its geopolitical location makes it vulnerable both economically and politically, as well as touristically. The political tension between Türkiye and Russia that emerged following the downing of a Russian fighter jet in southern Anatolia in early 2016 and the coup attempt in the mid-summer led to a dramatic decline in tourist arrivals that year.

The novel Covid-19 pandemic, which has affected the whole world and has shaken the entire economic structure, especially tourism, has also deeply hit Türkiye, one of the world's leading tourist destinations. According to the analysis performed by Karagöz and Ergün (2023), the direct loss caused by the pandemic in revenues reached 25 billion dollars in total, and the loss in the number of tourist arrivals reaches 55.7 million from February 2020 to June 2021 time interval. However, it should be emphasized that these values show direct losses. Since the

tourism sector is related to many sectors from transportation to agriculture, shopping to entertainment, it can easily be said that the financial loss due to the pandemic would be much higher. However, contrary to the hasty conclusions of Yücel et al. (2022), the Turkish tourism sector recovered from the impact of the crisis faster than its competitors and recovered in a short time, almost reaching the level of 2019 in 2022 (UNWTO, 2023).

3. Related Empirical Literature

In today's ever-shifting tourism landscape, accurate forecasts are more valuable than ever. Recognizing this, researchers have undertaken a massive effort, with over 600 studies in the past few decades dedicated to modeling and predicting tourism demand. While the majority focused on building and testing different models, a handful ventured into groundbreaking hybrid approaches, weaving together diverse methods to tackle this complex puzzle. The expansion observed in tourism movements on a global scale in recent years has also increased academic interest in the analysis of tourism movements. This interest, which started in the 1960s with the pioneering studies of Guthrie (1961), Gerakis (1965) and Gray (1966) on tourism demand forecasting, has increased its methodological diversity over time in parallel with the developments in econometric modeling and forecasting theory. Song and Hyndman (2011) mention three reasons for this increase in interest.

Firstly, the volume of international tourism flows increased from 69.3 million in 1960 to 934 million in 2010, with an average annual increase rate of 5.3%. This tremendous growth has attracted the attention of researchers who are curious about the factors contributing to the increase in tourism flows and future trends. Secondly, forecasting constitutes an important component of tourism business plans, and accurate forecasts of the future level of tourism demand will have a direct impact on growth strategies in the sector. Third, considering the multifaceted effects of the tourism sector on the economy, accurate demand forecasts will help governments in destination countries determine appropriate strategies and policies.

When the empirical literature on tourism is examined, it is seen that studies have increased and diversified in parallel with the development of econometric methodology. In estimating inbound tourism demand equations for Türkiye, factors affecting tourism demand have been investigated, and in some studies, predictions have been made, using samples consisting of different country groups and time series of different frequencies.

In an earlier study, Baldemir and Bahar (2003) estimated the international tourism demand for Türkiye from five countries using the artificial neural network (ANN) method with

annual data for the period 1984-1999 and concluded that the feedback neural network model performed better than alternative forecasting methods. Karahan (2015) also used the artificial neural network method and obtained monthly forecasts for the period between January 2014 and June 2014 (6 months). Gerçek (2017) forecasted the number of tourists on a monthly basis for 2017, using the 2012-2016 period monthly data and again using the ANN method.

The ANFIS (Adaptive Neural Fuzzy Inference Systems) method, which is a synthesis of ANN and fuzzy logic, is used in the analysis of time series and cross-section data. Dinç et al. (2017) forecasted tourism revenues, tourist numbers and occupancy rates for the 2016-2018 period with the ANFIS method. They also made predictions at the regional level. Cankurt and Subaşı (2015) used artificial neural networks and support vector regression methods to obtain tourist number forecasts.

Çuhadar (2006), Çuhadar et al. (2014), and Çuhadar (2014) estimated the international tourism demand for Antalya, Izmir and Istanbul on a monthly basis using various forecasting methods. Kaya (2009) also estimated tourism demand for 2009 using different growth models.

Univariate time series analysis models, which have good performance in prediction, have also been used to make predictions in various studies. Baran (2010) and Bozkurt et al (2022) estimated international tourism demand for Türkiye using the seasonal Box-Jenkins (SARIMA) time series analysis method. Önder and Hasgül (2008) made tourism demand forecasts for the 2008-2010 period using Box-Jenkins, Winters' exponential smoothing and artificial neural network methods. Again, Soysal and Ömürgönülşen (2010) used different smoothing methods for this purpose.

Using seasonal ARIMA (SARIMA) and structural time series model (STM) Yılmaz (2015) obtained in-sample forecasts of tourist arrivals in Türkiye and found out that the SARIMA model outperforms than STM in terms of MAE and MAPE criteria. As Li et al (2005) stated that empirical literature on tourism demand studies shows that there is no method that performs best in all cases. Departing from this idea, Akın (2015) incorporated three distinct methods to forecast inbound tourism demand for Türkiye. She employed SARIMA, support vector regression (SVR), and neural networks approaches and found out that the SVR model dominates the forecasting performances. Finally, she proposes a hybrid approach to determine the selection criteria for the best model.

When the existing literature is examined, it can be seen that the Bayesian VAR method has not been used so far in tourism demand forecasts for Türkiye. In the related international

literature, there are very few studies on tourism prediction using the BVAR method. In only two studies, Wong et al. (2006) made predictions for Hong Kong, and Zhu and Yan (2007) made predictions for China.

4. Econometric Analysis

4.1. Method and Model

There are many different methods used in the econometric literature for forecasting. Quantitative approaches to tourism demand forecasting can be divided into three main types: time-series models, econometric models, and artificial intelligence (AI)-based models (Song and Wu, 2023). In addition to univariate ARIMA time series methods, various multivariate regression models and artificial neural networks, time-varying coefficient (TVP) model, vector autoregression (VAR) methods are also increasingly used in tourism demand forecasting (Song and Guo; 2008). Another strand of the methods incorporates subjective judgement in forecasting procedures such as Delphi method (Sheldon and Var, 1985) and Bayesian regression. In the rich empirical literature using these methods, there is no consensus on the absolute superiority of a particular method (for a review of the empirical literature on tourism demand forecasting see Witt and Witt, 1995; Li et al, 2005; Li and Song, 2007; 2008; Goh and Law, 2011; Jiao and Chen, 2019). Furthermore, for evaluation of the performance of different methods see Martin and Witt, 1989; Song et al, 2008; Song et al, 2013).

The Bayesian VAR model used in this study consists of applying the Bayesian inference approach in the single equation regression model to the VAR structure. The main feature of the Bayesian approach is that it allows obtaining more effective and realistic estimates by combining a priori information about the parameters with sample information. Thus, by restricting the lag structure in the model, the difficulty of estimating a large number of parameters (overparameterization), which is frequently encountered in VAR models, is eliminated to some extent.

Typical VAR model for n dimension column vector variable $\boldsymbol{y}_t$ VAR can be wrote as follows (Karagöz and Keskin, 2016):

$$\boldsymbol{y}_t' = \boldsymbol{c} + \sum_{p=1}^{L} \boldsymbol{y}_{t-p}' \boldsymbol{b}_i + \boldsymbol{D}\boldsymbol{z}_t + \boldsymbol{\varepsilon}_t' \quad (1)$$

where $\boldsymbol{y}_t$ is $n \times 1$ vector of indigenous variables; $\boldsymbol{D}$ is $n \times d$ matrix of parameters; $\boldsymbol{z}_t$, $d \times 1$ vector of exogenous variables, and $\boldsymbol{\varepsilon}_t'$ is $n \times 1$ vector of independently, identically and normally

distributed error term. Covariance matrix of the error term is $\boldsymbol{\Sigma}$, accordingly $\boldsymbol{\varepsilon}_t' \sim iid(\mathbf{0}, \boldsymbol{\Sigma})$. $(\boldsymbol{c}', \ \boldsymbol{b}_1', \dots, \boldsymbol{b}_L') = \boldsymbol{\beta}'$ is $n \times n$ coefficient matrix of the VAR model.

Asymptotic theory is often used to make inferences about $\boldsymbol{\beta}$ and $\boldsymbol{\Sigma}$. However, in practice, asymptotic theory cannot often be applied because a typical VAR model used in macroeconomic research contains a large number of parameters and the sample size is not large enough compared to the size of the VAR model. An alternative to the asymptotic theory is the Bayesian VAR (BVAR) approach, which combines sample information with a priori information.

Equation (1) can be written in a compact way as below:

$$\boldsymbol{y}_t = \boldsymbol{X}_t\boldsymbol{\beta} + \boldsymbol{\varepsilon}_t \tag{2}$$

where $\boldsymbol{X}_t = (\boldsymbol{I}_n \otimes \boldsymbol{W}_{t-1})$ has $n \times nk$ dimension, $\boldsymbol{W}_{t-1} = (\boldsymbol{y}_{t-1}', \boldsymbol{y}_{t-2}', \dots, \boldsymbol{y}_{t-p}', \boldsymbol{z}_t')$ has $k \times 1$ dimension, and $\boldsymbol{\beta} = vec(\boldsymbol{b}_1, \boldsymbol{b}_2, \dots, \boldsymbol{b}_p, \boldsymbol{D})$ is of $nk \times 1$ dimension. The unknown components of the model are $\boldsymbol{\beta}$ and $\boldsymbol{\Sigma}$.

The estimation process of Equation (2) with the Bayesian method consists of combining the sample information which is expressed as the following p.d.f. in the form of a conditional likelihood function on the model parameters and the *a priori* joint distribution of the parameters with the *Bayes Rule*.

$$L(\boldsymbol{y}|\boldsymbol{\beta}, \boldsymbol{\Sigma}) \propto |\boldsymbol{\Sigma}|^{-\frac{T}{2}} exp\left\{-\frac{1}{2}\sum_t (\boldsymbol{y}_t - \boldsymbol{X}_t\boldsymbol{\beta})' \boldsymbol{\Sigma}^{-1}(\boldsymbol{y}_t - \boldsymbol{X}_t\boldsymbol{\beta})\right\}$$

Thus, the *a posteriori* distribution of the parameters is obtained as follows[2].

$$p(\boldsymbol{\beta}, \boldsymbol{\Sigma}|\boldsymbol{y}) = \frac{p(\boldsymbol{\beta}, \boldsymbol{\Sigma})L(\boldsymbol{y}|\boldsymbol{\beta}, \boldsymbol{\Sigma})}{p(\boldsymbol{y})}$$

$$\propto p(\boldsymbol{\beta}, \boldsymbol{\Sigma})L(\boldsymbol{y}|\boldsymbol{\beta}, \boldsymbol{\Sigma})$$

The selection of the appropriate prior distribution is generally the most important step in Bayesian modeling. A common practice is to use a multivariate normal prior for the VAR coefficient matrix $\boldsymbol{\beta}$ and an independent inverse *Wishart prior* for the covariance matrix $\boldsymbol{\Sigma}$. In this case, the posterior distribution will be in Normal–Wishart form. Another widely used prior distribution is the prior distribution proposed by Litterman (1980), known as the *Minnesota prior*. This prior turns the VAR model into a random walk process for each variable. Giannone, Lenza and Primiceri (2012) (GLP) proposed another approach for construction of the prior, and

[2] Here $\propto$ means "proportional".

its hyperparameters, in a different manner. GLP begin with a normal-Wishart prior where the specification of the coefficient covariance is akin to a modified Litterman approach.

4.2. Findings

According to economic theory, demand for a product is mainly affected by the income level, price of the product, and price of other products those complementary and substitute. As a luxury item, it is expected that tourism demand would be sensitive to the income level of tourist and the relative cost of living in their own country. In this regard modelling strategy of Song and Wong (2003), Song et al. (2006), Song and Witt (2006) has been followed. Accordingly, the model used in this study is as follows:

$$TOUR_{it} = f(PCGDP_{it}, P_{it}, P_{st}, D_t)$$

where, $TOUR_{it}$ is the number of visitors from country *i* in period *t*, $PCGDP_{it}$ is the per capita income level of country *i* in period *t*, P_{it} the ratio of the cost of living in Türkiye to the cost of living of country *i*, $P_{st}$is Türkiye 's regional position in international tourism. It is a replacement price variable consisting of the average living costs of Spain, Italy and Greece, which are considered its competitors. P_{it} and P_{st} are calculated as follows:

$$P_{it} = \left[\frac{(CPI_T/FX_T)}{(CPI_i/FX_i)}\right] \qquad P_{st} = \sum_{j=1}^{3}(CPI_j/FX_j)$$

The variables included in the empirical models are:

$TOUR_{it}$: Number of visitors from Germany, France, UK, Russia and Iran

$PCGDP_{it}$: Per capita GDP of Germany, France, UK, Russia and Iran

P_{it} : Cost of living ratio between Türkiye and Germany, France, UK, Russia and Iran

P_{st} : Average cost of living in Spain, Italy and Greece

D_t : Dummy variable which represents the impact of the 2008 economic crisis (1 for 2008, 2009) and of the COVID19 pandemic (1 for 2020, 2021)

The number of inbound tourist arrivals by country has been compiled from the statistics published by the Ministry of Culture and Tourism of the Republic of Türkiye, and the per capita GDP and the number of tourist arrivals into Spain, Greece, and Italy have been gathered from the World Bank's WDI database. Consumer price index and exchange rate data, which are the basis for calculating living costs, have been compiled from IMF - IFS. Annual data for the period 1994-2022 was used in the analysis. Tourist numbers and per capita GDP figures have been transformed into logarithmic values.

The dependent variable is the number of tourists coming from the top five countries that send the most tourists to Türkiye (Germany, UK, Russia, Iran, France)[3]; Bayesian VAR estimation of the model was made, in which the income levels of these countries, Türkiye 's relative cost of living, and the relative cost of living of alternative tourism destinations to Türkiye (Greece, Italy and Spain) were taken as independent variables. The Bayesian VAR model used in this study consists of applying the Bayesian inference approach in the single equation regression model to the VAR structure.

The first results obtained from the estimation using the Minnesota prior as the prior distribution were compared with the results of the standard VAR model. Forecasts was carried out using annual data for the period 1994-2019, and in-sample (or pseudo out-of-sample) forecast performance was evaluated for following three years that is 2020-2022. Accordingly, based on the estimated models, out-of-sample forecasts were obtained for 2023. According to the findings, it is estimated that approximately 20 million tourists will come to Türkiye from the top five countries that send the most tourists within 2023.

Since the VAR model requires the series to be stationary, the stationarity properties of the series were investigated with the Augmented Dickey-Fuller (ADF) test before estimating the models. According to the ADF test, some series were found to be stationary in terms of level values, that is [I(0)]. Since traditional methods such as the ADF test tend not to reject the null hypothesis in case of structural breaks, the Lee-Strazicich test, which takes structural breaks into account, was applied for non-stationary series and it was determined that the unit-root hypothesis is not valid for the other series. Therefore, it was concluded that all series are I(0)[4].

Five different VAR models were estimated with data from the period 1994 to 2022. The first of these is the unconstrained VAR model, and the others are Bayesian VAR models using different prior distributions. Minnesota (BVAR1), Normal-Wishart (BVAR2), Sims-Zha (Normal-Wishart – BVAR3) and Giannone-Lenza-Primiceri (BVAR4) priors were used in Bayesian models, respectively. Using the estimated models, in-sample predictions were made for the years 2020 – 2022 and the performances of the models were determined. RMSE, MAPE and Theil-U metrics were calculated to evaluate the prediction performances.

[3] Visitors from Germany, France, UK, Russia, and Iran constitute nearly 40-45% of the total foreign tourist volume in the period 1994-2022.

[4] The results of the ADF and Lee-Strazicich unit-root tests are not reported here due to space constraints but can be provided from the author upon request.

Table 2. Evaluation of the forecasts in terms of RMSE.

Country	VAR	BVAR1	BVAR2	BVAR3	BVAR4
Germany – Mean	10,825	10,826	10,821	**10,817**	10,818
1 year ahead	10,802	10,806	10,801	**10,798**	10,799
2 years ahead	10,823	10,824	10,818	**10,815**	10,816
3 years ahead	10,851	10,849	10,843	**10,839**	10,840
France – Mean	9,237	9,239	**9,226**	9,235	9,236
1 year ahead	9,226	9,227	**9,213**	9,225	9,225
2 years ahead	9,217	9,219	**9,206**	9,215	9,216
3 years ahead	9,269	9,271	**9,258**	9,266	9,267
UK – Mean	10,098	10,092	10,091	**10,086**	**10,086**
1 year ahead	10,092	10,088	10,084	**10,084**	**10,084**
2 years ahead	10,105	10,100	10,099	**10,094**	**10,094**
3 years ahead	10,096	10,088	10,089	**10,080**	10,081
Russia – Mean	9,438	9,435	9,454	**9,425**	9,429
1 year ahead	9,453	9,451	9,467	9,448	**9,447**
2 years ahead	9,443	9,440	9,459	**9,435**	**9,435**
3 years ahead	9,417	9,413	9,435	**9,391**	9,406
Iran – Mean	9,458	9,429	**9,343**	9,415	9,444
1 year ahead	9,339	9,348	9,321	**9,315**	9,335
2 years ahead	9,483	9,487	9,462	**9,439**	9,469
3 years ahead	9,551	9,551	9,520	**9,491**	9,529

Table 3. Evaluation of the forecasts in terms of MAFE.

Country	VAR	BVAR1	BVAR2	BVAR3	BVAR4
Germany – Mean	233,796	233,854	233,442	233,545	**233,303**
1 year ahead	233,237	233,520	233,149	233,964	**233,054**
2 years ahead	233,754	233,806	233,403	**233,161**	233,251
3 years ahead	234,397	234,237	233,775	**233,509**	233,605
France – Mean	199,109	199,209	**198,353**	198,995	199,027
1 year ahead	199,095	199,140	**198,209**	198,999	199,014
2 years ahead	198,649	198,773	**197,962**	198,561	198,594
3 years ahead	199,583	199,713	**198,889**	199,425	199,478
UK – Mean	217,239	216,864	216,780	**216,480**	216,484

1 year ahead	217,307	217,060	216,779	216,821	**216,791**
2 years ahead	217,410	217,028	216,991	**216,642**	216,643
3 years ahead	217,001	216,505	216,570	**215,978**	216,018
Russia – Mean	203,380	203,145	204,416	**202,677**	202,809
1 year ahead	204,003	203,830	204,896	203,648	**203,598**
2 years ahead	203,494	203,257	204,534	202,958	**202,922**
3 years ahead	202,643	202,347	203,819	**201,425**	201,906
Iran – Mean	203,096	203,372	201,600	**200,360**	202,224
1 year ahead	200,583	201,128	199,437	**199,013**	200,287
2 years ahead	203,668	203,936	202,303	**200,865**	202,747
3 years ahead	205,036	205,052	203,061	**201,203**	203,637

Table 4. Evaluation of the forecasts in terms of Theil – *U*.

Country	VAR	BVAR1	BVAR2	BVAR3	BVAR4
Germany – Mean	0,539	0,539	0,539	0,538	0,538
1 year ahead	0,538	0,539	0,538	0,538	0,538
2 years ahead	0,539	0,539	0,539	0,538	0,538
3 years ahead	0,540	0,539	0,539	0,539	0,539
France – Mean	0,499	0,499	0,498	0,499	0,499
1 year ahead	0,499	0,499	0,498	0,499	0,499
2 years ahead	0,498	0,498	0,497	0,498	0,498
3 years ahead	0,499	0,500	0,499	0,499	0,499
UK – Mean	0,521	0,520	0,520	0,520	0,520
1 year ahead	0,521	0,520	0,520	0,520	0,520
2 years ahead	0,521	0,520	0,520	0,520	0,520
3 years ahead	0,520	0,520	0,520	0,519	0,519
Russia – Mean	0,504	0,504	0,506	0,504	0,504
1 year ahead	0,505	0,505	0,506	0,505	0,504
2 years ahead	0,504	0,504	0,506	0,504	0,504
3 years ahead	0,503	0,503	0,505	0,502	0,502
Iran – Mean	0,504	0,504	0,503	0,501	0,503
1 year ahead	0,501	0,501	0,499	0,499	0,500
2 years ahead	0,505	0,505	0,503	0,501	0,503
3 years ahead	0,506	0,506	0,504	0,502	0,505

These findings reveal that (in terms of MAFE and RMSFE) the Bayesian VAR models give lower erroneous predictions than the standard VAR model. According to the forecast performance evaluation criteria, the most successful model is the BVAR3 model using the Sims – Zha (Normal – Wishart) prior. Using these five models, forecasts of the number of tourists for 2023 were made for the five countries that send the most tourists to Türkiye, and the results are given in the table below.

Table 5. Forecasts for 2023 by country using VAR models (thousand).

Model	Germany	France	UK	Russia	Iran	Total
VAR	4,833.1	542.0	10,719.8	3,391.2	2,463.3	21,949.1
BVAR1	6,006.1	966.1	3,807.2	5,347.5	2,445.6	18,572.5
BVAR2	2,678.6	689.0	3,241.4	5,305.2	3,849.3	15,763.5
BVAR3	7,224.6	967.0	3,800.7	5,341.9	2,444.9	19,779.1
BVAR4	6,034.5	1,019.7	3,974.9	4,238.4	2,543.6	17,811.1

5. Conclusion

Türkiye, whose historical, cultural and natural beauties promise a great tourism potential, also has a very fragile structure due to its sociopolitical and geopolitical location. For this reason, the tourism sector, which is expected to contribute greatly to economic growth and development, needs to be developed with appropriate policies and rescued from its fragile structure. For this reason, it is important to analyze the structure of the sector well and determine the development and growth trend with realistic methods.

This study aimed to determine a reliable forecasting model regarding the tourism demand in Türkiye and to obtain a one-year ahead prediction. In the study using the Bayesian VAR method, which is gaining increasing attention in the literature, it was determined that this method showed better prediction performance than the standard VAR. Although prediction values and success vary depending on the prior distribution used, Bayesian models generally produce more realistic predictions. This shows that, unlike the standard VAR model, the use of prior information in the Bayesian approach improves the prediction process. On the other hand, based on the estimated values obtained for five countries by Sims-Zha prior (BVAR3 model), it can be said that Türkiye will host 50 million tourists in 2023 (assuming that they have a share of roughly 40 percent). Accordingly, it seems impossible for Türkiye to reach the target of 63 million tourists in 2023, which was set out in MoCT (2007). Considering the impact of the

COVID-19 pandemic, which was effective in 2020-2021 and brought life all over the world to a halt, this deviation from the targeted level can be considered as being expected.

As it is well known tourism is quite sensitive to political affairs not only to economic stance. Due to its geographical location, Türkiye is an important but fragile country not only politically but also in terms of tourism. Political tensions experienced with certain countries from time to time are largely and rapidly reflected in tourism flows (for instance, the political tension between Türkiye and Russia in early 2016, which is clearly seen in Figure 1). For this reason, the government must take measures to strengthen the tourism infrastructure and increase investments as well as act with political caution. Therefore, taking measures by the government to strengthen the tourism infrastructure and increase investments is not enough on its own. Such political, economic and natural shocks negatively affect the success and effectiveness of forecasts for tourism.

The ethical aspect of the research

In this study, all rules specified within the scope of the "Higher Education Institutions Scientific Research and Publication Ethics Directive" were followed. None of the actions mentioned under the title of "Actions Contrary to Scientific Research and Publication Ethics", which is the second part of the directive, have been carried out.

I declare that this research is one of the studies that does not require the ethics committee's permission.

Conflict of interest declaration

I declare that there is no material or other material conflict of interest in this study that could affect the results or interpretations.

Author contribution rate

All stages of the study were designed and prepared by the author.

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