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Research Article

Interrelationships between Tourist Arrivals, Exchange Rate, Inflation, and Economic Growth: Empirical Evidence for Türkiye[a]

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Touristic activities have become essential for sustainable development associated with countries' prosperity and mobility opportunities. These activities may be affected by the exchange rate, economic growth, and general price movements, and these variables may also be affected by tourism activities. This study analyzes the relationships between tourist arrivals, economic growth, inflation, and exchange rate for Türkiye taking the country's geopolitical risk as exogenous, using monthly data over 2008-2020 and a Vector Error Correction modelling approach. The results indicate favorable short-run and long-run impacts of tourist arrivals on economic growth and confirm the validity of the tourism-led growth hypothesis for Türkiye. Toda Yamamoto causality tests show unidirectional causality from economic growth to inflation and exchange rate fluctuations and from the exchange rate to inflation. Therefore, results do not show evidence of tourism's Dutch disease effect. Improving the quality of tourism-related services and marketing is vital for revenue increase and, thus, economic growth.

JEL codes: Z32, C32, F31

Keywords: Tourist arrivals, Tourism-led growth, Inflation, Exchange rate, Geopolitical risk

1 Introduction

There has been considerable growth in the tourism sector of economies until the emergence of the COVID-19 pandemic. The pandemic has affected the sector deeply because of travel restrictions and lockdown measures, as it is not tradable as opposed to other export-oriented industries. However, more income can be spent on tourism and travel as countries become more prosperous and mobility opportunities increase (Şen & Şit, 2015). Tourism contributes to the socioeconomic development of countries due to its direct, indirect, and

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induced impacts[1] on economic growth and cultural exchange, among many others.

Türkiye has experienced rapid development in its tourism sector since the early years of the Republic of Türkiye through the establishment of many institutions and associations, such as the Turkish Traveler Society, Turkish Aeroplane League, and Hoteliers and Innkeepers Association and this sector's development dates back to the period of Ottoman Empire in the 19^{th} century (Karadağ & Bağcı, 2019; Kerim, 2020; Kozak et al., 2017). Starting in the 1980s, Türkiye has followed an export-led growth strategy, and the tourism sector has become much more critical for economic growth and decreasing the current account deficit (Akdağ & Seçilmiş, 2018). Tourism Incentive Law (No. 2634) was enacted to develop the sector in 1982. Since 1992, there has been a rapid increase in the number and capacity of tourism facilities and companies (Polat, 2019). Country ranking of UNWTO (2021) based on tourist arrivals shows that Türkiye (6^{th} in the world) is in the top ten most visited countries. On the other hand, Türkiye ranked 14^{th} and 15^{th} in 2018 and 2019, considering the tourism receipt-based country ranking.

Figure 1 demonstrates the number of international tourist arrivals in thousands, international tourism receipts in current million USD, and international tourism receipts as a percentage of total exports. The number of international tourist arrivals (international tourism receipts) increased from 21.1 million (20.8 billion USD) to 41.1 million (35.6 billion USD) between 2005 and 2015. After its decline in 2016 to 30.9 million (26.5 billion USD), both figures surged from 38 million (32 billion USD) in 2017 to 51.7 million (41.4 billion USD) in 2019. However, in 2020, because of the COVID-19 pandemic, the number of tourists (receipts) decreased to 16 million (13.8 billion USD). Up to 2020, the share

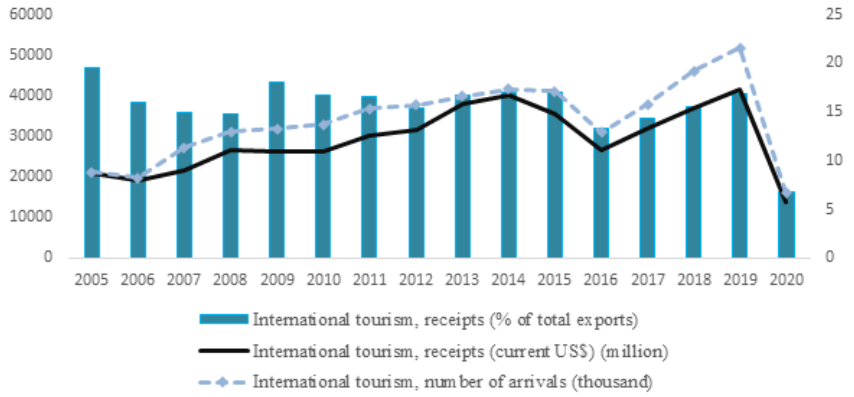

Figure 1: Tourism-related indicators for Türkiye (2005-2020)
Source: Own elaboration using data obtained from World Bank, 2022.

of tourism receipts in total exports was between 13.3% and 19.5%. However, this share declined to 6.8% in 2020, lower than the previous period's average. According to WTTC (2021), the share of the tourism and travel sector in GDP declined from 10.4% in 2019 to

[1] According to WTTC (2021), as a result of tourism and travel activities, economic output/income can be generated directly by accommodation facilities, travel agencies, transportation services, direct spending of tourists, government expenditures on the tourism sector, indirectly by investments related to tourism services and domestic good and service purchases by this sector through supply chains, and in an induced manner with a multiplier effect resulted from the spending of income generated by this sector.

5.5% in 2020 due to the COVID-19 pandemic. Over 2014-2019, 25% of net new jobs were reported to be the outcome of this sector. While the percentage of this sector's employment in total employment was 9.3% in 2019, this share decreased to 8.1% in 2020.

Because of the high dependency of Türkiye on imported energy sources, raw materials, and intermediate goods, exchange rate fluctuations may lead to inflation, which may cause further nominal depreciation. However, inflation may lead to domestic currency appreciation if there is a strong expectation for an interest rate increase, as discussed by Krugman et al. (2015). On the other hand, as tourism provides foreign exchange revenues, this sector is vital in financing imported goods and services (Xia et al., 2022). For Türkiye, because of dependency on imported raw materials and capital goods in domestic production, tourism contributes to economic growth through this channel also, besides efficiency increase, economies of scale, wealth distribution and multiplier effect (Xia et al., 2022). However, it may also cause undesirable outcomes, such as inflation and environmental damage.

On the other hand, tourists may prefer safer destinations with some economic development, low cost of living, and depreciated exchange rate, compared to other destinations with similar quality. Economic growth, inflation, tourism, and exchange rate may be highly interrelated. There may be feedback relationships among them. In addition, geopolitical risk is considered an additional factor because tourist arrivals may decline due to safety-related concerns (Zhang et al., 2022).

Based on this argument, by taking the country's geopolitical risk as exogenous, the main aim of this study is to analyze the interrelationships between tourist arrivals, economic growth, inflation, and exchange rate for Türkiye, employing the Vector Autoregression (VAR) and Vector Error Correction (VECM) modelling approaches based on the stationarity of time series and monthly data covering the years between 2008 and 2020. After the COVID-19 pandemic, the tourism sector has been in the recovery process; therefore, the analysis was made for the period before the COVID-19 pandemic.

In the literature, Dutch disease effect of tourism (Bulut & Şahan, 2020), tourism-led growth hypothesis (e.g., Turgut et al., 2021; Xia et al., 2022), and growth-led tourism hypothesis (Balıkçıoğlu & Oktay, 2015) were tested by many studies. Starting with the first paper published in 2002, the number of studies testing the tourism-led growth hypothesis increased tremendously (Perles-Ribes et al., 2017). Recently, Xia et al. (2022) showed the validity of the tourism-led growth hypothesis for 34 European countries between 1995 and 2015.[2] For Türkiye, in addition to various studies, Turgut et al. (2021), Manga & Ballı (2019), and Altıner (2019) found that tourism contributes to economic growth. Some studies showed that this relationship is from growth to tourism. For example, Balıkçıoğlu & Oktay (2015) and Kanca (2015) found that the growth-led tourism hypothesis was valid for Türkiye over 2003-2014 and 1980-2013, respectively. There are also studies showing a bidirectional relationship (e.g., Turan Koyuncu, 2015; Samırkaş& Samırkaş, 2014), while other studies cannot find any relationship between tourism and growth (e.g., Çil Yavuz, 2006; Tuğcu, 2014; Topallı, 2015; Öztürk & Acaravcı, 2009; Katırcıoğlu, 2009).

Moreover, studies analyzed various relationships between tourism, inflation, and exchange rate and the effect of geopolitical risk on tourism (e.g., Kerim, 2020; Doğru et al., 2019; Shaari et al., 2018; Zhang et al., 2022). For Türkiye, based on the Autoregressive Dis-

[2] Please refer to Ahmad et al. (2020) for a systematic literature review of studies analyzing the relationship between tourism and economic growth. Appendix C shows the studies performed for Türkiye.

tributed Lag (ARDL) model, Kerim (2020) showed adverse significant short-run effects of geopolitical risks and inflation, whereas favorable short-run effects of oil prices and currency depreciation. The author also showed the undesirable effect of currency depreciation in the long run. Bingöl et al. (2020) showed a long-run relationship between economic growth, employment, tourism receipts, inflation, and real exchange rate for Türkiye between 1986 and 2019, employing the Fourier ADL cointegration test. However, the studies did not reach a consensus on all these relationships.

By employing data before the COVID-19 pandemic, following the VECM approach and considering the geopolitical risk of Türkiye as an exogenous factor, this study aims to contribute to the existing literature by focusing on three research questions; *(i)* is there any Dutch disease effect of tourism in Türkiye?, *(ii)* are tourism-induced growth and inflation hypotheses valid for Türkiye?, and *(iii)* does a country's geopolitical risk affect tourism?

After the introduction, methodological issues are discussed in Section 2. Section 3 gives information on data and presents empirical results. The study concludes with recommendations for future studies and policy.

2 Methodology

This study employs the VAR model in equation system (1). LARRIVAL, LCPI, LEXCR, LIPI, and GPRC represent the number of tourist arrivals, economic output, nominal exchange rate, consumer price index, and the country's geopolitical risk, respectively. All variables are in natural logarithms except GPRC to obtain elasticities.

$$y_t \;=\; \alpha \;+\; t\;\delta_1 \;+\; GPRC_t\;\delta_2 \;+\; \textstyle\sum_{i=1}^{p} A_i\; y_{t-i} \;+\; \epsilon_t \tag{1}$$

where

$$y_t = \begin{bmatrix} LARRIVAL_t \\ LCPI_t \\ LEXCR_t \\ LIPI_t \end{bmatrix}, \alpha = \begin{bmatrix} \alpha_{1,0} \\ \alpha_{2,0} \\ \alpha_{3,0} \\ \alpha_{4,0} \end{bmatrix}, \delta_1 = \begin{bmatrix} \delta_{1,1} \\ \delta_{1,2} \\ \delta_{1,3} \\ \delta_{1,4} \end{bmatrix}, \delta_2 = \begin{bmatrix} \delta_{2,1} \\ \delta_{2,2} \\ \delta_{2,3} \\ \delta_{2,4} \end{bmatrix}$$

$$A_i = \begin{bmatrix} \alpha_{1,i} & \beta_{1,i} & \gamma_{1,i} & \theta_{1,i} \\ \alpha_{2,i} & \beta_{2,i} & \gamma_{2,i} & \theta_{2,i} \\ \alpha_{3,i} & \beta_{3,i} & \gamma_{3,i} & \theta_{3,i} \\ \alpha_{4,i} & \beta_{4,i} & \gamma_{4,i} & \theta_{4,i} \end{bmatrix}, \epsilon_t = \begin{bmatrix} \epsilon_{2,t} \\ \epsilon_{2,t} \\ \epsilon_{3,t} \\ \epsilon_{4,t} \end{bmatrix}$$

Economic growth may be influenced by touristic activities based on the tourism-led growth hypothesis. On the other hand, tourists may prefer developed countries much more because of better infrastructure and tourist facilities. This is called as growth-led tourism hypothesis. As the depreciation of domestic currency increases the price competitiveness of the destination relative to alternatives, more tourist arrivals can be expected. Like the Marshall-Lerner condition, tourist arrivals should be sufficiently elastic to exchange rates. Also, as tourist arrivals increase, an increase in the supply of foreign currency may lead to an appreciation of the domestic currency. The appreciation of currency leads to an increase in imports and a decrease in exports and tourist arrivals, therefore causing deindustrialization, which also can be related to resource allocation among different sectors. In that case, so-called Dutch disease may occur. Therefore, bidirectional relationships can be expected between exchange rates and tourism.

Similarly, low inflation showing a low cost of living may attract more tourists because of its competitive advantage. However, higher tourist arrivals may increase the general price level due to the demand-pull and cost-push effects (İçöz, 1991). The inflationary effect of tourism may be due to an increase in aggregate demand caused by the decline in unemployment due to tourism-led economic growth (Shaari et al., 2018). As the country's geopolitical risk increases, one may expect a decline in tourist arrivals due to safety concerns. However, for some tourists, this may not affect their travel decisions.

After discussing the relationships among these variables, the methodological approach can be explained as follows. First, the integration order of variables was determined. Based on the results, a cointegration test was performed. If there is evidence of a long-run relationship between the variables, one can estimate a VECM to capture short- and long-run relationships and to consider endogeneity among the variables. Due to the weak exogeneity of variables in VECM, the equations corresponding to these variables can be omitted from the system. If all variables except one are weakly exogenous, VECM reduces to the ARDL model. ARDL model is a single equation model as opposed to a VAR and VECM. Moreover, the ARDL model allows for both stationary and nonstationary time series, therefore, mixed of I(0) and I(1) variables. Cointegration can be tested using the ARDL approach. However, in case of the absence of a significant cointegrating relationship, the series was made stationary by taking the first difference. In addition, the Toda Yamamoto causality test, which does not require a pretest and estimation of the cointegration relationship, was performed, and one can test causal relationships between series with different integration orders. The test was performed using the equation system shown in equation (2), where p and d are the optimum lag length and maximum integration order, respectively. The Wald test was performed by considering only the first p lags to test for causality.

$$y_t \;=\; \alpha \;+\; t\;\delta_1 \;+\; GPRC_t\;\delta_2 \;+\; \textstyle\sum_{i=1}^{p+d} A_i\; y_{t-i} \;+\; \epsilon_t \tag{2}$$

3 Data and Empirical Results

For the analysis, monthly data were employed, covering the period from 2008:01 to 2020:03. The industrial production index is used as a proxy for economic output due to the unavailability of monthly data on GDP. Data on the total number of foreign visitors (ARRIVALS), the consumer price index (CPI, 2003=100), US dollar/TRY exchange rate (selling) (EXCR), and industrial production index (IPI, 2015=100) were obtained from the Electronic Data Delivery Service of the Central Bank, Republic of Türkiye (EDDS-CBRT). Country geopolitical risk index (GPRC) is from EPU (2022).

According to the descriptive statistics in Table 1, monthly average tourist arrivals were 2.6 million from 2008 to 2020. The maximum level was achieved in 2019:08, whereas the minimum level occurred in 2009:02. The nominal USD/TRY exchange rate fluctuates with an upward trend between 1.176 and 6.38, with a mean value of 2.725. Next, data were transformed by taking the logarithm of each time series. For seasonal adjustment, the Census X-13 method was used. There are statistically significant positive pairwise correlations between LARRIVALS, LCPI, LEXCR, LIPI, and GPRC, as shown in Appendix A.

Table 1: Descriptive statistics for raw data

	ARRIVALS	CPI	EXCR	IPI	GPRC
Mean	2,693,010.00	253.51	2.73	91.18	0.30
Median	2,334,127.00	234.54	2.12	91.67	0.26
Maximum	7,018,257.00	450.58	6.38	130.17	1.18
Minimum	857,114.00	146.94	1.18	50.45	0.04
Std. Dev.	1,415,528.00	83.41	1.45	19.46	0.19
Skewness	0.59	0.81	1.13	-0.03	1.52
Kurtosis	2.42	2.65	3.07	2.02	6.92
Jarque-Bera	10.64	16.68	31.09	5.97	150.95
p **value**	0.01	0.00	0.00	0.05	0.00
Observation	147	147	147	147	147

Source: Own calculations.

Figure 2 illustrates the time series between 2008 and 2020. In tourist arrivals, sharp declines occurred in 2016 and 2020 due to the 15^{th} July coup attempt and the COVID-19 pandemic. According to the GPRC index, the country's geopolitical risk increased rapidly at the end of 2015 because of terrorist attacks and the fighter jet crisis between Türkiye and Russia; however, it declined after this period. Another peak in GPRC occurred in 2019:10, possibly related to the long-lasting Syrian civil war.

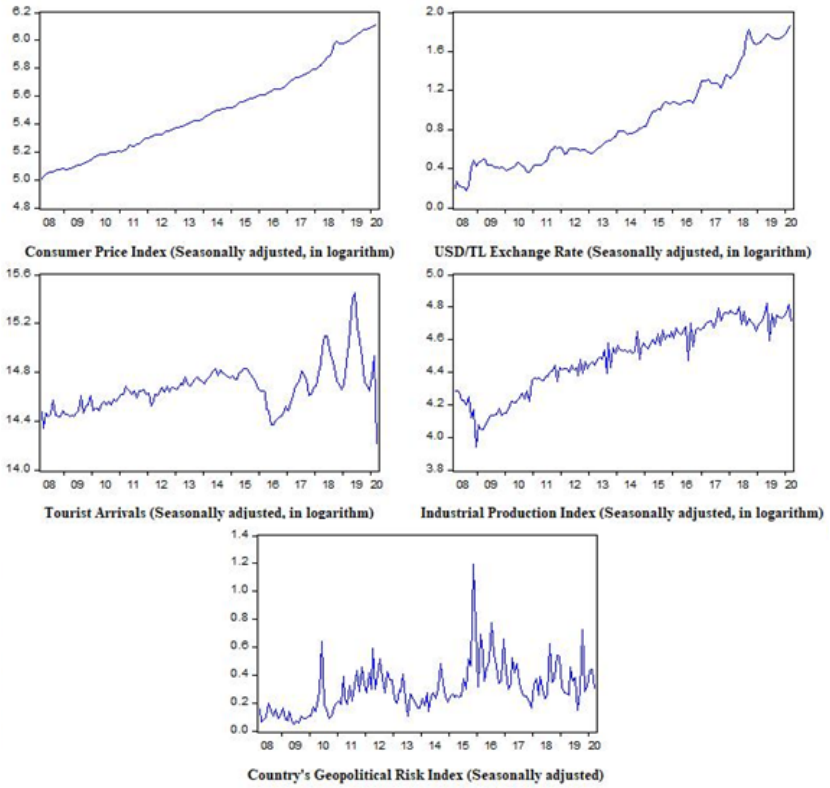

Figure 2: Seasonally adjusted monthly data in natural logarithm (2008-2020)
Source: Own elaboration using data obtained from EPU and EDDS-CBRT.

As shown in Table 2, all series contain unit roots; therefore, they are I(1) except GPRC. Thus, the cointegration test was performed.[3]

Table 2: Unit root tests

	Phillips-Perron			Augmented Dickey-Fuller			KPSS	
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)
LARRIVALS	-2.7*	-2.5	-0.3	-2.6*	-2.5	-0.3	0.8***	0.08
LCPI	2.0	-0.3	10.8	2.2	-0.3	6.7	1.4***	0.3***
LEXCR	0.5	-1.7	3.3	0.6	-2.2	3.1	1.4***	0.3***
LIPI	-1.1	-7.5***	0.9	-0.3	-3.0	1.6	1.3***	0.2**
GPRC	-6.9***	-8.2***	-2.4***	-3.2**	-7.6***	-1.1	0.8***	0.1*
ΔLARRIVALS	-8.4***	-8.3***	-8.4***	-8.4***	-8.4***	-8.5***	0.12	0.06
ΔLCPI	-8.3***	-8.4***	-5.1***	-8.4***	-8.8***	-3.1***	0.52**	0.09
ΔLEXCR	-8.4***	-8.4***	-8.2***	-8.7***	-9.1***	-8.1***	0.14	0.04
ΔLIPI	-30***	-30***	-31***	-13***	-13***	-13***	0.09	0.09

Source: Own calculations.
Note: *, **, *** indicate statistical significance at 10%, 5%, 1%, respectively. The author used the one-sided p-values of MacKinnon (1996) and critical values given in Kwiatkowski et al. (1992, Table 1). The lag lengths were determined by BIC. Unit root test equations include (1) constant, (2) constant and trend, and (3) no deterministic term.

According to the Johansen cointegration test results, there are statistically significant long-run relationships between these variables, Table 3. This result is robust to the specification of trend assumption. Therefore, analysis was performed by estimating the VECM, as shown in equation (3).

Table 3: Johansen cointegration test

Number of Cointegrating Equations	Eigenvalue	Trace Statistic	0.05 Critical Value	Max-Eigen Statistic	0.05 Critical Value
None	0.22	76.99***	63.88	36.37***	32.12
At most 1	0.15	40.63*	42.92	23.60*	25.82
At most 2	0.07	17.02	25.87	10.78	19.39
At most 3	0.04	6.25	12.52	6.25	12.52

Source: Own calculations.
Note: *, **, *** indicate statistical significance at 10%, 5%, 1%, respectively. Critical values of MacKinnon et al. (1999) are shown.

$$LEXCR_t = 8.78 - \underset{(0.65)}{0.11}\, LARRIVAL_t - \underset{(-6.44)***}{2.71}\, LIPI_t + \underset{(0.25)}{0.17}\, LCPI_t + \underset{(3.84)***}{0.02}\, trend_t + \hat{\epsilon}_t \quad (3)$$

Estimation results of VECM for only error correction terms are given in Table 4. A set of dummy variables were also included in the model to consider the effects of important global and national socioeconomic events, including the Global Financial Crisis of 2008, 15^{th} July 2016, the exchange rate shock in 2018, and earlier effects of the COVID-19 pandemic.[4]

As Table 4 shows that the error correction term is only statistically significant in the economic growth equation, other variables, which were weakly exogenous, did not have any

[3] Detailed explanations are available in Appendix B.
[4] To save space, coefficient estimates of the dummy and other variables were not presented. Results are available upon request.

Table 4: Estimation result of the VECM for error correction terms

	$\Delta LARRIVALS_t$	$\Delta LCPI_t$	$\Delta LEXCR_t$	$\Delta LIPI_t$
ECT_{t-1}	0.01	0.004	-0.016	-0.128***
t statistics	[0.17]	[1.24]	[-0.98]	[-5.82]

Source: Own calculations.

adjustment process to ensure the restoration of the equilibrium relationship in the long run. Tourist arrivals, exchange rate and consumer price index were omitted from the VECM; thus, VECM is reduced to an ARDL model. The estimation results for this reduced-form unrestricted model are shown in Table 5. The coefficient on lagged $LIPI$ was estimated, and the corresponding t value was calculated to test for cointegration.

Table 5: Estimation result of the unrestricted ARDL model

ΔLIPI	**Coefficient**	**t-Statistic**	**p-value**
LARRIVALS$_{t-1}$	0.034*	[1.684]	(0.095)
LCPI$_{t-1}$	-0.158	[-1.577]	(0.117)
LEXCR$_{t-1}$	-0.041	[-0.962]	(0.338)
LIPI$_{t-1}$	-0.295***	[-5.853]	(0.000)
ΔLARRIVALS$_t$	0.097***	[4.190]	(0.000)
ΔLCPI$_t$	-0.303	[-0.496]	(0.621)
ΔLEXCR$_t$	0.183	[1.532]	(-0.128)
ΔLIPI$_{t-1}$	-0.658***	[-7.758]	(0.000)
ΔLIPI$_{t-2}$	-0.188***	[-2.863]	(0.005)
GPRC	0.004	[0.241]	(0.810)
Trend	0.003***	[4.612]	(0.000)
Constant	1.525***	[2.666]	(0.009)
DUMMY2008M10	-0.109***	[-4.348]	(0.000)
DUMMY2008M12	-0.201***	[-14.079]	(0.000)
DUMMY2009M2	-0.011	[-0.498]	(0.619)
DUMMY2016M4	-0.015**	[-2.238]	(0.027)
DUMMY2016M6	0.044***	[6.173]	(0.000)
DUMMY2016M7	-0.183***	[-19.826]	(0.000)
DUMMY2017M10	-0.007	[-0.719]	(0.474)
DUMMY2018M6	-0.084***	[-6.316]	(0.000)
DUMMY2018M8	-0.084***	[-4.269]	(0.000)
DUMMY2018M9	-0.006	[-0.223]	(0.824)
DUMMY2019M6	-0.183***	[-9.548]	(0.000)
DUMMY2019M12	-0.014	[-1.548]	(0.124)
R-squared	0.799	Akaike criterion	-3.801
Adjusted R-squared	0.761	Schwarz criterion	-3.306
Log-likelihood	297.696	Hannan-Quinn criterion	-3.6
F-statistic	20.767***	(0.000)	

Source: Own calculations.

Note: t values were calculated using heteroscedasticity and autocorrelation robust (HAC) standard errors obtained employing Bartlett kernel with Newey-West fixed bandwidth set at 5. p values are shown in parentheses. After reparameterization, long-run relation can be obtained as follows:

$$\begin{aligned} LIPI_t = & \underset{(2.66)***}{5.17} - \underset{(1.68)*}{0.11}\, LARRIVAL_t - \underset{(-1.58)}{0.14}\, LIPI_t \\ & + \underset{(-0.96)}{-0.14}\, LCPI_t + \underset{(4.61)***}{0.01}\, trend_t + \hat{u}_t \end{aligned} \tag{4}$$

As the coefficient of $LIPI_{t-1}$ is negative (-0.295), its t value (-5.853) is smaller than the critical values obtained from Enders (2010, Table F)[5], which were calculated based on Ericsson & MacKinnon (2002), the null hypothesis of no error correction can be rejected. Therefore, results show evidence of cointegration among the variables.

The findings suggest that the long-term rate adjusts by -0.295 units in response to a one-unit deviation from the long-run equilibrium. The country's geopolitical risk may not affect economic growth. Adverse long-run effects of exchange rate depreciation and inflation were statistically insignificant. The results indicate favorable short- and long-run impacts of tourist arrivals on economic growth and validate the tourism-led growth hypothesis for Türkiye. A 1% increase in tourist arrivals increases economic output by 0.097% and 0.11% in the short- and long-run, respectively. This result is in line with the findings of several studies (e.g., Akdağ & Seçilmiş, 2018; Aykaç Alp, 2010; Turgut et al., 2021).

Moreover, the Toda-Yamamoto causality test results in Table 6 indicate unidirectional causality from $LIPI$ to $LEXCR$ and $LCPI$ and causality running from $LEXCR$ to $LCPI$, which is in line with the findings of Civcir & Akçağlayan (2010) and Gayaker et al. (2021). Many studies have investigated the exchange rate pass-through effect on inflation and its determinants (Cuitiño et al., 2022) because of the importance of the exchange rate in the transmission of macroeconomic shocks globally (An et al., 2021). This effect can occur directly through raw material and commodity prices and indirectly through wages, profits and import prices (Ha et al., 2020). Gayaker et al. (2021) employing the Phillips curve model and threshold regression method over 2002-2020 showed that exchange rate pass-through increased in Türkiye. Civcir & Akçağlayan (2010) showed the importance of exchange rate shock in the monetary policy reaction function over 1987-2009 and also found substantial exchange rate pass-through on inflation weakened by inflation targeting.

Table 6: Toda-Yamamoto causality test

Dependent/ Explanatory	**LARRIVALS**	**LCPI**	**LEXCR**	**LIPI**	**ALL**
LARRIVALS		0.227 (0.893)	1.35 (0.509)	0.038 (0.981)	1.708 (0.945)
LCPI	3.752 (0.153)		5.766* (0.056)	5.498* (0.064)	16.116** (0.013)
LEXCR	1.143 (0.565)	4.386 -0.112		4.780* (0.092)	11.407* (0.077)
LIPI	1.402 (0.496)	0.97 (0.616)	1.653 (0.438)		3.294 (0.771)

Source: Own calculations.
Note: p values are shown in parentheses.

In summary, findings indicate the absence of tourist arrivals' Dutch disease effect because of the favorable short- and long-run impacts on economic growth and the absence of any causal relationships between exchange rate and tourist arrivals. This finding contradicts the finding of Kerim (2020), Şen & Şit (2015), Aykaç Alp (2010), and Bingöl et al. (2020), whereas it is supported by Aktaş (2005), Bulut & Şahan (2020), Akar & Özcan (2021), and Akboz& Canatan (2021).

[5] The critical values are -4.831, -4.182, and -3.846 for 1%, 5%, and 10% significance levels, respectively, by taking k=4 and T=100.

4 Conclusion

This study analyzes the interrelations between economic growth, tourist arrivals, inflation, and exchange rate by taking the country's geopolitical risk as exogenous. Results indicate the validity of the tourism-led growth hypothesis, the presence of exchange rate pass-through on inflation and the absence of any causal relationships between exchange rate and tourist arrivals. In addition, the favorable short- and long-run impacts of tourism were shown on economic growth. Therefore, the tourism sector should be supported by various mechanisms, such as public infrastructure investments and incentives, due to its impact on economic growth, as also discussed by Turan Koyuncu (2015).

Although the results do not indicate any effect of geopolitical risks, risk and crisis management are essential issues calling for attention, as Kerim (2020) suggested. Kerim (2020) highlighted that source market diversification, expenditures for tourism advertisement and marketing, quality improvement in tourism services, and development of long-term strategies and policies are all essential for the improvement of the sector. In the long term, it is essential to support the sector to ensure its adaptation to low carbon, inclusive and digital economy in the context of the United Nation's Sustainable Development Goals. Sector-specific taxes should finance this transition, the negative externalities, investments for infrastructure and capacity building. Different types of tourism, such as health, rural, cultural and congress, their associated benefits, costs, and needs should be considered while designing long-term strategies and policies. As the sector is susceptible to health and safety-related issues, it should consider these extreme events and take necessary steps to minimize losses.

The study cannot show any relationship between the exchange rate and tourism. For further analysis, the effects of appreciations and depreciation should be analyzed separately by employing nonlinear models and considering other measures of tourism development. In addition, the analysis should be extended considering the effect of the COVID-19 pandemic.

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Appendices

Appendix A: Pairwise correlations

Table A.1: Pairwise correlations

	LARRIVALS	**LCPI**	**LEXCR**	**LIPI**	**GPRC**
LARRIVALS	1				
LCPI	0.60***	1			
[t-Statistic]	[9.12]				
LEXCR	0.57***	0.98***	1		
[t-Statistic]	[8.44]	[68.51]			
LIPI	0.57***	0.91***	0.86***	1	
[t-Statistic]	[8.46]	[26.41]	[20.61]		
GPRC	0.18**	0.47***	0.45***	0.51***	1
[t-Statistic]	[2.15]	[6.44]	[6.11]	[7.11]	

Source: Own calculations.
Note: LARRIVALS, LCPI, LEXCR, and LIPI, are ARRIVALS, CPI, EXCR, and IPI series in the natural logarithm. *** indicates statistical significance at 1%.

Appendix B: Estimation of the VAR Model

In the VAR modelling taking GPRC as exogenous and adding trend term to the VAR equation system, lag length was selected based on two information criteria, Table B.1. The VAR model was estimated, and all roots were found to be inside the unit circle; therefore, the stability of the VAR system was satisfied, Figure B.1. The diagnostic tests show that there is not any evidence of autocorrelation, ARCH effects[6] and heteroscedasticity in the residuals, Table B.2. Correlograms of residuals also do not show strong autocorrelation, Figure B.2.

Table B.1: Selection of lag length

Lag	Log-Likelihood	Sequential Modified LR Test	Final prediction error	Akaike information criterion	Schwarz information criterion	Hannan-Quinn information criterion
0	763.612	NA	4.73×10^{-10}	-10.124	-8.857	-9.609
1	1,260.78	858.42	4.67×10^{-13}	-17.047	-15.443	-16.395
2	1,321.092	100.665*	2.48×10^{-13}*	-17.685*	-15.743*	-16.896*
3	1,334.819	22.122	2.59×10^{-13}	-17.652	-15.372	-16.726
4	1,341.488	10.363	2.99×10^{-13}	-17.518	-14.900	-16.454
5	1,356.838	22.969	3.06×10^{-13}	-17.509	-14.553	-16.307
6	1,365.025	11.779	3.48×10^{-13}	-17.396	-14.103	-16.058
7	1,374.165	12.626	3.93×10^{-13}	-17.297	-13.666	-15.822
8	1,382.011	10.386	4.54×10^{-13}	-17.18	-13.211	-15.567

Source: Own calculations.

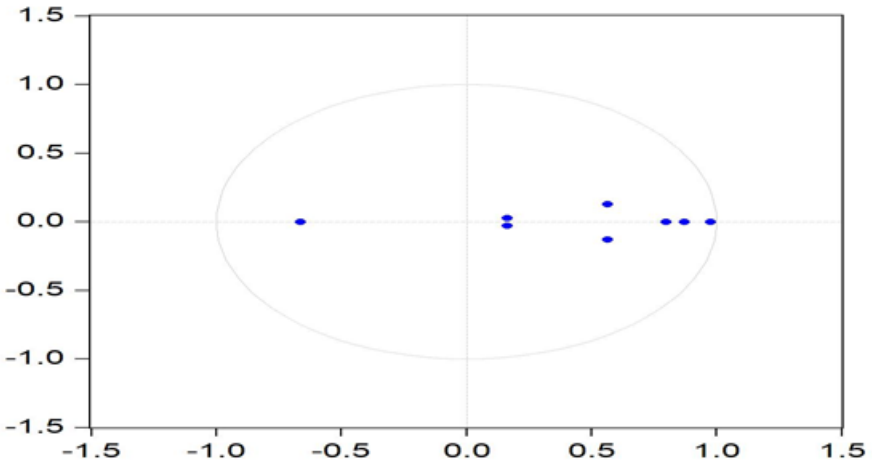

Figure B.1: Inverse Roots of AR Characteristic Polynomial
Source: Own elaboration.

[6] Although for equation (3) (equation for LIPI), Q statistics for squared residuals show evidence of ARCH effects, after the first lag graphs of autocorrelation and partial autocorrelation functions do not show any evidence of ARCH effects.

Table B.2: Autocorrelation, ARCH and heteroscedasticity tests

Lags	VAR Residual Autocorrelation Test				ARCH Effect Tests for Each Equation (Q-Stat^2)			
	Portmanteau		LM					
	Q-Stat	Adj Q-Stat	LRE* stat	Rao F-stat	LARRIVALS	LCPI	LEXCR	LIPI
3	23.520	23.785	4.429	0.273	0.954	5.554	4.241	15.429
	(0.101)	(0.094)	(0.998)	(0.998)	(0.812)	(0.135)	(0.237)	(0.001)
6	58.581	60.133	16.001	1.003	1.096	6.938	7.473	20.284
	(0.668)	(0.614)	(0.453)	(0.453)	(0.982)	(0.327)	(0.279)	(0.002)
9	105.041	109.353	20.038	1.263	1.149	7.195	10.497	23.092
	(0.667)	(0.553)	(0.219)	(0.219)	(0.999)	(0.617)	(0.312)	(0.006)
12	148.892	156.916	27.306	1.739	7.683	8.956	12.530	26.250
	(0.725)	(0.554)	(0.038)	(0.038)	(0.809)	(0.707)	(0.404)	(0.01)
15	190.493	203.010	18.446	1.160	8.072	9.802	13.523	34.068
	(0.803)	(0.585)	(0.299)	(0.299)	(0.921)	(0.832)	(0.562)	(0.003)
18	222.557	239.287	15.193	0.951	8.097	9.918	14.985	39.44
	(0.936)	(0.766)	(0.511)	(0.511)	(0.977)	(0.935)	(0.663)	(0.002)
VAR Residual Heteroskedasticity Joint Tests (Levels and Squares)								
χ^2_{320}	333.012	(0.297)						

Source: Own calculations.
Note: p values are shown in parentheses.

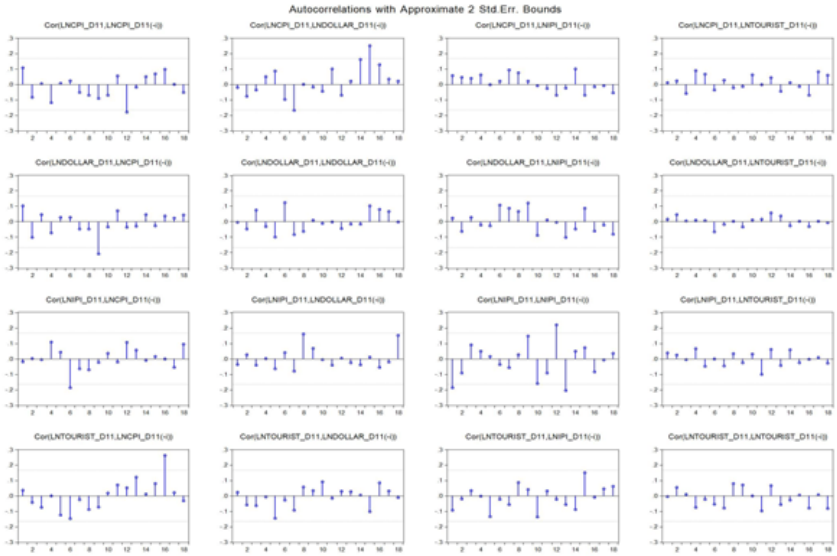

Figure B.2: Correlogram for residuals
Source: Own elaboration.

Appendix C: Literature Review of Studies for Türkiye

In the literature, various studies are related to the relationship between tourism indicators (tourist arrivals, tourism receipts, and tourism expenditures) and macroeconomic variables, such as international trade and economic growth, as discussed by Şen & Şit (2015). This study focused on the studies analyzing relationships between tourism, growth, exchange rate, and inflation for Türkiye only as there is a tremendous number of studies investigating these relationships, especially the relationship between growth and tourism. Table C1 shows the results of the studies.

Relationships between tourism and exchange rate			
Author(s)	**Period**	**Method**	**Findings**
Timur & Mert (2021)	2003:Q1-2020:Q1	Nonlinear ARDL model	-Asymmetric long-run effect of the real effective exchange rate on tourism receipts
Keşap (2021)	2006:Q1-2020:Q1	Fourier ADL cointegration test, FMOLS, DOLS, and CCR	-Cointegrating relation between the USD/TRY exchange rate and tourist expenditures per capita -Adverse long-run effect of domestic currency depreciation on tourism expenditures
Karadağ & Bağcı (2019)	2010-2018	Descriptive analysis	-The number of tourist arrivals increased due to domestic currency depreciation
Kara et al. (2012)	1992-2011	VAR model	-Unidirectional causality from exchange rate to tourism revenues -A shock to the exchange rate causes a permanent increase in tourism revenue
Aktaş et al. (2014)	2003:01-2011:12	Error Correction Model	-Adverse effect of domestic currency appreciation and the positive effect of exchange rate volatility on tourism incomes
Albayrak (2017)	2010:1-2017:6	Granger causality test, Cointegration test	-The adverse long-run effect of currency appreciation on tourism revenues -One-way causal relationship from exchange rate to tourism receipts
Bahar (2007)	1980-2005	Multiple regression analysis	-Favorable effect of exchange rate depreciation and devaluation on tourist arrivals and tourism revenues
İçöz et al. (1998)	1982-1993	Multiple regression analysis	-Favorable effect of exchange rate depreciation and devaluation on tourist arrivals and tourism revenues
Demirel et al. (2013)	1994:1-2006:4	Granger causality test, Error correction model	-Adverse effect of exchange rate appreciation and volatility on tourist arrivals
Ergen&Yavuz (2017)	2003:Q1-2016:Q1	ARDL modelling approach	-Long-run relationship between tourist arrivals, relative prices, exchange rate volatility, and GDP -Short-run adverse effect of exchange rate volatility on tourist arrivals
Sarı & Oğuz (2018)	2002-2015	Multivariate cointegration analysis, Granger causality test	-Long-run relationship between real exchange rate and tourist arrivals -One-way causality from real exchange rate to tourism demand

Zortuk (2009)	1990:Q1-2008:Q3	Vector error correction model, Granger causality test	-Evidence of a cointegrating relationship between tourist arrivals, real effective exchange rate and real GDP -Unidirectional causal relationships from the real effective exchange rate to tourist arrivals and from the real effective exchange rate to economic growth
Öncel et al. (2016)	2003:1-2015:4	Toda-Yamamoto causality test, FMOLS and DOLS estimation methods	-Long-run relationship between the real exchange rate and tourism revenues -Increase in real exchange rate increases tourism receipts -Causality runs from tourism receipts to exchange rate
Bozkurt & Pekmezci (2015)	1996-2012	Granger causality test	-One-way causal relationship from tourist arrival volatility to exchange rate volatility -Negative long-run relationship between them
Turan Koyuncu (2015)	1980-2014	Granger causality test	-One-way causal relationship from tourism revenues to the real exchange rate
Pekmezci & Bozkurt (2016)	2005-2015	Cointegration test, Granger causality test	-Long-run relationship between tourism revenue and Euro/TRY exchange rate -Unidirectional causality running from tourism revenues to Euro/TRY exchange rate -Absence of any long-run and causal relationships between tourism revenue and the Dollar/TRY exchange rate
Şen & Şit (2015)	2000-2012	Frequency domain causality test	-Bidirectional relationship between the monthly real exchange rate and tourism receipts, in the long run -Unidirectional relationship from tourism receipts to the real exchange rate in the medium-term and short run
Arslan & Çetiner (2020)	2008-2019	VAR modelling analysis	-Significant relationships between tourism receipts and economic growth -Currency depreciation increases tourism receipts, leading to currency appreciation.
Aslan (2008)	1992:1-2007:2	Multivariate cointegration test, Granger causality test	-Bidirectional causal relationship between exchange rate and tourism receipts

Kılıç & Bayar (2014)	1994:01-2013:08	Multivariate cointegration test, Granger causality test	-Positive long-run relationship between real effective exchange rate volatility, tourism receipts and expenditures
Aktaş (2005)	1980-2000	Multiple linear regression method	-Absence of any relationship between exchange rate and tourism -Favorable and statistically significant effects of the number of tourist arrivals and the number of travel agencies on receipts
Akboz& Canatan (2021)	2012-2019	ARDL bounds test, Toda-Yamamoto causality test	-Absence of any cointegrating and causal relationships between tourism revenues and exchange rate
Bulut & Şahan (2020)	2004-2014	Descriptive analysis	-Absence of any Dutch disease effect of tourist arrivals
Uğuz & Topbaş (2011)	1990-2010	Cointegration analysis	-Long-run relationship between the exchange rate, its volatility, and tourist arrivals -Insignificant effect of exchange rate -Significant effect of exchange rate volatility on tourist arrivals
Akar & Özcan (2021)	2012:01-2019:12	VAR analysis with structural breaks	-Absence of any relationship exchange rate and tourism
Erkan et al. (2013)	2005:01–2012:12	VAR model, Granger causality test	-Absence of any relationship exchange rate and tourism
Relationships between tourism and inflation			
Kılıç & Kurt (2018)	2002:01-2015:12	ARDL modelling approach	-Adverse effect of inflation on tourist arrivals along with a negative effect of political stability controlling for the impacts of real effective exchange rate and economic stability
Ilgaz Yıldırım et al. (2017)	2005-2015	Johansen cointegration test, Vector Error Correction model	-Negative long-run impact of inflation on tourism revenues. -In the short run, there is not any relationship between inflation and tourism revenues

Relationships between tourism, exchange rate, and inflation			
Atay Kayış & Aygün (2016)	2003-2011	VAR analysis	-There is not any causal relationship between inflation and tourism receipts
Bingöl et al. (2020)	1986-2019	Fourier ADL cointegration test, Toda-Yamamoto causality test	-Long-run relationship between economic growth, employment, tourism receipts, inflation, and real exchange rate -Unidirectional causality from the exchange rate and inflation to tourism receipts and from tourism receipts to employment
Kerim (2020)	1990:01-2018:05	ARDL model	-Adverse significant short-run effects of geopolitical risks and inflation, whereas favourable short-run effects of oil prices and currency depreciation -Undesirable effect of currency depreciation in the long run
Relationship between tourism and economic growth			
Turgut et al. (2021)	1998:Q1-2019:Q4	ARDL modelling and bounds testing approach, Granger causality test	-Validity of the tourism-led growth hypothesis -Long-run relationship between economic growth, number of tourist arrivals, and tourism receipts -Bidirectional causal relationship between the number of tourist arrivals and tourism receipts
Manga & Ballı (2019)	1963-2016	ARDL bounds testing, VAR modelling	-Short-run and long-run economic growth increases with financial development, trade openness and tourist arrivals
Altıner (2019)	1969-2018	ARDL modelling method	-Long-run and short-run growth effects of tourism revenues controlling for inflation, real effective exchange rate, and population
Akdağ & Seçilmiş (2018)	2000-2016	Dynamic panel data model, panel GMM estimation method, panel data Granger causality test	-Positive and significant effect of tourism receipts on economic growth -Causal relationship running from tourism receipts to economic growth for 30 OECD countries, including Turkiye
Gövdeli (2018)	1963-2015	Cointegration test, bootstrap causality test	-Long-run relationship between export, tourism receipts and growth -Favorable long-run growth effects of exports and tourism on growth -Causal relationships run from exports to tourism receipts and growth -No causal relationship between tourism revenues and growth

Akın (2018)	1990-2017	Descriptive analysis	-Favorable effect of tourism revenues on the economic growth
Karaçor & Konya (2017)	1963-2014	Cointegration analysis, Granger causality test	-Long-run relationship between GDP and tourism receipts -One-way causal relationship from tourism revenues to the economic growth
Şahin (2017)	2000-2015	Dynamic panel data model, panel GMM estimation method	-Favorable impact of international tourism revenues on economic growth for a panel of 20 Mediterranean countries, including Türkiye, controlling for variables related to government expenditure, education, capital formation, and labour force participation
Özcan (2015)	1963-2010	Symmetric, asymmetric, linear, and nonlinear causality tests	-Unidirectional causality from tourism revenues to economic growth
Yamak et al. (2012)	1960-2006	Cointegration analysis, Granger causality test	-Short-run effect of real tourism revenues on Türkiye's industry and service sector
Özdemir & Öksüzler (2006)	1963-2003	VECM modelling	-Long-run relationship between real GNP, real exchange rate, and real tourism revenues -One-way causality from tourism to economic growth
Bahar (2006)	1963–2004	Johansen co-integration test, Causality test	-Evidence of cointegrating relation between tourism receipts and GNP -Validity of the tourism-led growth hypothesis
Değer (2006)	1980-2005	Johansen cointegration test	-Validity of the tourism-led growth hypothesis in the long run
Aslan (2008)	1992:1-2007:2	Johansen Cointegration test, VECM-based Granger causality test	-Evidence of a cointegrating relationship between real GNP, international tourism receipts and real effective exchange rate -Validity of the tourism-led growth hypothesis
Çetintaş & Bektaş (2008)	1964-2006	ARDL modelling	-Validity of the tourism-led growth hypothesis only in the long run
Akan & Işık (2009)	1970–2007	Cointegration test, Granger Causality test	-Causal relation from international tourist spending to economic growth -Validity of the tourism-led growth hypothesis
Bahar & Bozkurt (2010)	1998–2005	Dynamic panel data model	-Validity of the tourism-led growth hypothesis for 21 countries, including Türkiye

Arslantürk et al. (2011)	1963–2006	Time-varying Vector Error Correction Model (VECM) based Granger causality test	-Validity of the tourism-led growth hypothesis
Aktaş et al. (2013)	1995-2011	Panel unit root tests, panel cointegration tests, pooled mean group estimation	-Long-run relationship between GNP and tourism revenues -Validity of the tourism-led growth hypothesis for a panel of Mediterranean countries (Spain, France, Italy, Greece and Türkiye) in the long run
Aslan (2014)	1995–2010	Granger causality test	-Validity of the tourism-led growth hypothesis
Kızılkaya et al. (2016)	1980-2014	ARDL modelling approach	-Validity of the tourism-led growth hypothesis in the short run and the long run
Dereli & Akiş (2019)	1970-2016	Granger causality test based on VECM	-Long-run relationship between economic growth and tourism revenues -Validity of the tourism-led growth hypothesis
Durgun Kaygısız (2015)	2003:Q1-2013:Q4	Granger causality test	-Validity of the tourism-led growth hypothesis
Esen & Özata (2017)	2003:Q1-2015:Q4	ARDL model, Toda-Yamamoto causality test	-Validity of the tourism-led growth hypothesis -Favorable long-run and short-run effects of tourism
Gökovalı & Bahar (2006)	1987-2002	Panel data methods	-Validity of the tourism-led growth hypothesis for Mediterranean countries, including Türkiye
Gökdemir & Durdu (2007)	1980-2005	Linear regression model	-Validity of the tourism-led growth hypothesis
Gündüz & Hatemi-J (2005)	1963-2002	Toda and Yamamoto's (1995) causality test	-Validity of the tourism-led growth hypothesis
Husein & Kara (2011)	1964–2006	Multivariate cointegration test, Granger causality test based on VECM	-Long-run relationship between real GDP, tourism receipts and real exchange rate -Validity of the tourism-led growth hypothesis
Kasman & Kasman (2004)	1963-2002	Johansen multivariate and Pesaran et al. (2001) bounds test for cointegration, Granger causality tests	-Long-run relationship between tourism revenues and economic growth -Validity of the tourism-led growth hypothesis

Topallı (2015)	1963-2011	Granger causality test based on VECM	-Validity of the tourism-led growth hypothesis in the long run
Yıldırım & Öcal (2004)	1962-2002	Granger causality test based on VECM	-Validity of the tourism-led growth hypothesis in the long run
Zortuk (2009)	1990:Q1-2008:Q3	Vector error correction model, Granger causality test	-Validity of the tourism-led growth hypothesis
Kara et al. (2012)	1992-2011	Granger causality test, VAR analysis, Impulse-response analysis	-Unidirectional causality from economic growth to tourism revenues -Positive and statistically significant permanent impact of growth shock on tourism revenues
Kanca (2015)	1980-2013	Granger causality test, Simple linear regression analysis	-One-way causal relationship from economic growth to tourism income -Positive impact of tourism income on economic growth
Balıkçıoğlu & Oktay (2015)	2003:Q1–2014:Q2	Granger causality test	-Long-run relationship between tourism and economic output -One-way causal relationship from economic growth to tourism receipts
Kızılgöl & Erbaykal (2008)	1992:01–2006:02	Toda-Yamamoto causality test	-Validity of growth-led tourism hypothesis
Selim et al. (2015)	1980-2012	Cointegration test, VAR model, block Granger causality test	-Cointegrating relationship between tourism revenues, real effective exchange rates, GDP and tourist arrivals -Growth-led tourism hypothesis
Dücan et al. (2016)	2005-2015	Panel Granger causality test	-Two-way causal relationship between tourism revenues and economic growth for a panel of France, Greece, Italy, Portugal, Spain, and Türkiye
Turan Koyuncu (2015)	1980-2014	Granger causality test	-Bidirectional causal relationship between tourism revenues and economic growth
Samırkaş& Samırkaş (2014)	2003Q1-2013Q3	Granger causality test	-Bidirectional relationship between tourism receipts and economic growth
Bozkurt & Topçuoğlu (2013)	1970–2011	Cointegration test, VECM	-Long-run and short-run bidirectional relationships between economic growth and the share of tourism revenues in the export revenues

Kamacı & Oğan (2014)	1995-2011	Panel cointegration and causality tests	-Long-run relationship between GDP and tourism revenues using panel data on six countries (Azerbaijan, Kazakhstan, Kyrgyzstan, Uzbekistan, Macedonia, and Türkiye) -Bidirectional causal relationship between economic growth and tourism revenues
Aykaç Alp (2010)	1998:01 – 2009:12	Threshold VAR model	-Positive relationship between receipts and economic growth -If the tourism receipts increases over the 30% threshold level, there will be a positive relationship between tourism demand and economic growth -Effect of economic growth on tourism was shown to dominate the effect of tourism on economic growth. -Favorable effect of domestic currency depreciation on receipts
Bozgeyik & Yoloğlu (2015)	2002-2014	OLS estimation method, Granger causality test	-Two-way relationship between tourism receipts and economic growth
Coşkun & Özer (2014)	1992:Q1-2014:Q1	VECM-based Granger causality test controlling for the growth and tourism volatilities obtained from GARCH models.	-Bidirectional relationships between economic growth and tourism receipts in the long run and the short run
Çağlayan et al. (2013)	1995–2008	Granger causality analysis	-Bidirectional relationships between tourism revenue and GDP for Europe, including Türkiye
Çoban & Özcan (2013)	1963-2010	VECM-based Granger causality test	-No any short-run relationship between tourism and economic growth -The long-run bidirectional relationship between per capita GDP and tourism revenues
Ongan & Demiröz (2005)	1980:Q1-2004:Q2	VECM-based Granger causality test	-Bidirectional relationships between international tourism receipts and GDP in the long run and the short run
Uysal et al. (2004)	1992-2003	Granger causality test, Linear regression analysis	-Bidirectional relationships -Positive effect of tourism revenues on economic growth

Kutlar & Sarıkaya (2012)	1964-2007	Cointegration test, VECM estimation	-Long-run relationship between GNP and tourism receipt, the numbers of inbound and outbound tourists
Çil Yavuz (2006)	1992:Q1-2004:Q4	Granger causality test, Toda-Yamamoto causality test	-Absence of a relationship between tourism receipts and economic growth
Tuğcu (2014)	1998-2011	Granger causality test	-Absence of a relationship between international tourism receipts and economic growth -One-way causality from international tourism expenditures to economic growth
Topallı (2015)	1963-2011	Toda-Yamamoto causality test	-Absence of a relationship between international tourism arrivals and economic growth
Öztürk & Acaravcı (2009)	1987-2007	ARDL bounds test	-Absence of cointegration between real GDP and international tourism
Katırcıoğlu (2009)	1960-2006	Cointegration tests	-Absence of a relationship between tourist arrivals and economic growth controlling for the effect of the real exchange rate