

Econometric analysis of earthquake impacts on tourism mobility in Türkiye Depremin Türkiye'deki turizm hareketliliğine etkilerinin ekonometrik analizi

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ABSTRACT: Unlike other sectors, the tourism sector can be easily affected by negative events due to its nature. Earthquake, one of the risks brought about by its geography in Türkiye, has affected the tourism sector in the past and may affect it in the future. Based on the 2023 earthquakes centered in Kahramanmaraş, this study aims to understand the impact of earthquakes on tourism demand. To provide a comprehensive view, the research analyzes data from earthquakes in Elazığ, İzmir, and Kahramanmaraş over the last three years. The research utilizes accommodation facility data by Türkiye Republic Ministry of Culture and Tourism. Using an econometric model, the change in the number of overnight stays as a result of earthquakes is analyzed. This study contributes by being among the first to quantitatively assess the impact of earthquake-related events on tourism demand in Türkiye. Based on the research findings, it has been determined that the impact of earthquakes on tourism activity is less significant compared to the pandemic. The earthquakes that occurred affected the participation of foreign visitors in tourism activities more than domestic visitors. The uniqueness of the research is that it is among the first studies to try to measure the change in tourism demand as a result of negative events based on earthquakes in Türkiye.

Keywords: Tourism, Earthquake, Türkiye, Econometric analysis

ÖZ: Turizm sektörü, diğer sektörlerden farklı olarak doğası gereği olumsuz olaylardan kolaylıkla etkilenebilmektedir. Türkiye'de bulunduğu coğrafyanın getirdiği risklerden biri olan deprem, turizm sektörünü geçmişte etkilemiş ve gelecekte de etkileyebilecektir. Bu çalışma, Kahramanmaraş merkezli 2023 depremlerinden yola çıkarak, depremlerin turizm talebi üzerindeki etkisini anlamayı amaçlamaktadır. Araştırma, Elâzığ, İzmir ve Kahramanmaraş'ta son 3 yılda meydana gelen depremler analiz edilerek gerçekleştirilmiştir. Araştırmanın özgünlüğü, Türkiye'de depreme dayalı olumsuz olaylar sonucunda turizm talebindeki değişimi ölçmeye çalışan ilk araştırmalardan biri olmasıdır. Araştırmada Türkiye Cumhuriyeti Kültür ve Turizm Bakanlığı'nın konaklama tesisi verileri kullanılmıştır. Ekonometrik bir model kullanılarak, depremler sonucunda geceleme sayısındaki değişim analiz edilmiştir. Araştırma bulgularına dayanarak, depremlerin turizm faaliyeti üzerindeki etkisinin pandemiye kıyasla daha az olduğu tespit edilmiştir. Meydana gelen depremler, yabancı ziyaretçilerin turizm faaliyetlerine katılımını yerli ziyaretçilere göre daha fazla etkilemiştir. **Anahtar Kelimeler:** Turizm, Deprem, Türkiye, Ekonometrik analiz

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GENİŞLETİLMİŞ ÖZET

Literatür taraması

Doğal afetler, özellikle depremler, küresel ölçekte ciddi sosyoekonomik etkiler doğurmakta olup, günümüz teknolojik imkânları bu tür afetler üzerinde tam denetim sağlamaktan hâlen uzaktır. Depremler, gelişmekte olan ülkelerde hem insan kaybına hem de ciddi ekonomik zararlara neden olmakta, özellikle turizm gibi hassas sektörlerde belirgin olumsuzluklar yaratmaktadır. Türkiye örneğinde, 1999 Gölcük ve 2023 Kahramanmaraş depremleri gibi yıkıcı olaylar, on binlerce can kaybının yanı sıra, milyarlarca dolarlık doğrudan ekonomik kayıplarla sonuçlanmıştır. Turizm sektöründe ise hem iç hem de dış turist sayısında azalma, döviz girdisinde düşüş ve cari açıkta artış gibi yansımalar gözlenmektedir. Alan yazında Japonya, Nepal ve Türkiye gibi yüksek riskli ülkelerde afetlerin turizm üzerindeki etkileri incelenmiş; ülkelerin altyapı dayanıklılığı ve afet sonrası müdahale kapasiteleri arasında önemli farklılıklar tespit edilmiştir. Ancak Türkiye özelinde, depremlerin turizm üzerindeki etkilerin kir yaklaşımla ele alan bütüncül çalışmalar oldukça sınırlıdır. Bu bağlamda, Elazığ, İzmir ve Kahramanmaraş depremleri üzerine gerçekleştirilen bu araştırma, söz konusu afetlerin turizm hareketliliği üzerindeki etkilerini COVID-19 dönemiyle ayrıştırarak değerlendirmeyi amaçlamakta ve politika geliştiricilere yönelik anlamlı bulgular sunmaktadır.

Yöntem

Araştırma, Ocak 2019-Eylül 2023 dönemi arasında Türkiye'de meydana gelen depremlerin turizm faaliyetleri üzerindeki etkilerini ampirik olarak incelemektedir. Araştırmanın temel sorusu, depremlerin gerçekleştiği dönemlerde ve sonrasındaki kısa vadeli süreçte turizm hareketliliğinin ne ölçüde etkilendiğini belirlemektir. Turizm hareketliliği, tesislerde yapılan yerli ve yabancı konaklama sayıları ile temsil edilmiştir. Ampirik analiz iki yaklaşım üzerine inşa edilmiştir: İlki, Türkiye geneline ilişkin toplam ziyaretçi verilerinin değerlendirilmesidir; ikincisi ise depremlerden etkilenen ve etkilenmeyen illerin karşılaştırmalı analizidir. İzmir, Elazığ ve Kahramanmaraş depremleri ile ilişkilendirilen 12 il, özel olarak ele alınmıştır. Pandemi etkisinin eş zamanlı gözlemlendiği Elazığ ve İzmir depremleri kapsamında, model COVID-19 etkisini de içerecek şekilde yapılandırılmıştır. Araştırmada oluşturulan ekonometrik modelde, deprem ve pandemi etkileri kukla değişkenler aracılığıyla ayrıştırılmıştır. Veriler, Kültür ve Turizm Bakanlığı'nın konaklama tesis verilerine dayanmakta olup, 80 aylık bir dönemi kapsamaktadır. Seriler, mevsimsellikten arındırılarak logaritmik dönüşüm ve fark alma yöntemiyle durağanlaştırılmış ve yüzdesel değişim analizi yapılmıştır. Bulgular, afetlerin turizm üzerindeki etkilerini sayısal olarak değerlendirme açısından önemli katkılar sunmaktadır.

Bulgular ve tartışma

Araştırma, Türkiye genelinde 2019-2023 döneminde yaşanan depremlerin turizm faaliyetleri üzerindeki etkisini ampirik olarak analiz etmektedir. Regresyon analizine göre, pandemi döneminde yabancı ziyaretçilerde %98.6, yerli ziyaretçilerde ise %28.6 oranında anlamlı düşüş gözlemlenmiştir (p<0.01). Depremlerin etkisi genel olarak istatistiksel olarak anlamlı bulunmazken, yerli ziyaretçilerde %7.2 oranındaki azalma %10 anlamlılık düzeyindedir. Toplam ziyaretçi sayısında pandeminin etkisi, depremlerin etkisinin yaklaşık 9 katı olarak hesaplanmıştır. İl bazında analizlerde Elazığ, İzmir ve 11 ili etkileyen Kahramanmaraş merkezli depremlerin etkileri karşılaştırılmış, ancak etkiler istatistiksel olarak anlamlı bulunmamıştır. Grafik analizler, Elazığ'da deprem sonrası artış, İzmir ve Kahramanmaraş'ta ise belirgin azalma olduğunu göstermektedir. Detaylı olarak değinildiğinde, depremlerin yaşandığı kentlerde depremlerden sonraki dönemde turist sayısındaki değişim, Elazığ %10, İzmir, %7, Kahramanmaraş %3 oranında bir azalma olduğu yönündedir. Elazığ depreminden sonra Türkiye geneli turizm hareketliliğinde yabancı turistler için %7, yerli turistler için %11 oranında artış olmuştur. İzmir depremi sonrasında ise yabancı turistlerde %33, yerli turistlerde ise %13 oranında düşüş yaşanmıştır. Kahramanmaraş merkezli depremin ardından yabancı turistlerde %0,6, yerli turistlerde ise %26'lık bir düşüş yaşanmıştır. Genel olarak bulgular, yerli turistlerin depremlerden yabancı turistlere kıyasla daha fazla etkilendiğini ve turizm faaliyetlerinin krizlere karşı yüksek duyarlılık gösterdiğini ortaya koymaktadır.



Sonuç ve öneriler

Arastırmada analiz edilen veriler, depremler gibi olağanüstü olayların turizm talebi üzerindeki belirgin etkilerini ortaya koymaktadır. Özellikle, pandemi ve 2020'de Elazığ-Sivrice, 2020'de İzmir ve 2023'te Kahramanmaraş merkezli depremlerin turizm sektöründe hem fiziksel altyapıya hem de turistlerin güven algısına ciddi zararlar verdiği tespit edilmiştir. Bu etkiler, yabancı turistlerde yerli turistlere kıyasla daha belirgin olmakla birlikte, pandemi kaynaklı düşüşlerin depremlerden çok daha ağır olduğu vurgulanmıştır. Ekonometrik analizler, pandemi sürecinin yabancı turist sayısında depremlerden yaklaşık 20 kat, yerli turist sayısında ise 4 kat daha fazla olumsuz etkisi olduğunu göstermiştir. Depremler sonrası turizm talebindeki azalışın, şehirlerin turizm potansiyeli ve altyapısal dayanıklılığı ile doğrudan ilişkili olduğu; örneğin İzmir'deki büyük düşüş, kentin yüksek turizm kapasitesiyle açıklanabilir. Ayrıca bölgesel güvenlik algısını etkileyen uluslararası ve ulusal gelişmelerin de turizm hareketliliğine yansıdığı görülmüştür. Araştırma, turizm sektöründe kriz yönetimi, risk azaltma ve afetlere karşı hazırlıklı olmanın önemine dikkat çekmekte; afet sonrası toparlanmayı hızlandırmak için acil durum fonları ve dayanıklı altyapı önerilmektedir. Ayrıca, afet sonrası uluslararası algıyı iyileştirmek üzere hedefe yönelik pazarlama stratejileri ve kriz iletişimi önerilmiştir. Araştırmanın sınırlılıkları arasında, deprem sonrası kullanılan kamu tesislerinin sayısal analizde etkisi, sadece resmi veri kullanımı ve pandemi ile depremlerin eşzamanlı etkilerinin ayrıştırılmasının zorluğu yer almaktadır. Gelecekte, uzun vadeli ekonomik etkiler, turist davranışlarındaki kalıcı değişimler ve bölgesel politikaların etkisi gibi konuların derinlemesine incelenmesi önerilmektedir. Araştırma, depremlerin turizm talebine etkisini pandemi etkilerinden bağımsız olarak inceleyen nadir araştırmalardan biri olarak literatüre katkı sağlamaktadır.



Introduction

Natural disasters are usually unpredictable and uncontrollable (Chan et al., 2020). They can cause structural destruction, economic, social losses, and most importantly, death and tragedy (Güncü & Güneş, 2017). Considering that tourism is a people-based sector, the impacts of the earthquake are felt more than in other sectors (Gök, 2023). And, by its nature, tourism feeds on the perception of prosperity, happiness, and security. Tourism has a reciprocal relationship with natural disasters, and they are perceptually opposite concepts. When natural disasters occur, the growth and development of the tourism sector can be affected. There can be major destruction of tourist attractions and even entire destinations (Tourismembassy, 2014). Consumer behavior can change due to the perception of risk and safety concerns in disasters. Human beings develop a sense of fear and anxiety as a natural reaction to the disaster area. According to the literature, disasters have a widespread psychological and emotional impact on human behavior (Eser & Marangoz-Yavuzalp, 2024). Briefly, tourists can change their travel intentions and the number of people visiting the region decreases (Göçen et al., 2011; Murat et al., 2013).

Also, earthquake, a type of disaster, and tourism are perceptually opposite concepts. Located in an earthquake zone, Türkiye, generates a significant portion of its foreign exchange inflow through tourism (TÜİK, 2024). Due to its special geographical environment, it has experienced major earthquakes and been subjected to massive destruction throughout history (Aktürk & Albeni, 2002). As a matter of fact, since the late 1990s, when tourism gained momentum in the country, there have been 8 earthquakes above 6.5 magnitude. And according to official figures, more than 70,000 citizens lost their lives in these earthquakes. The previous year's earthquake in Kahramanmaraş, which was the biggest earthquake since the 1939 Erzincan earthquake (TRT News, 2021), once again brought to the fore the risk that this natural disaster poses to the country. In Türkiye, where earthquakes are examined in different aspects, the relationship between earthquakes and tourism has not been sufficiently and directly studied. However, the fact that the country is located in an earthquake zone makes this issue significant for the nation. Understanding the impact of earthquakes in the field of tourism is crucial, especially for economies like Türkiye that are highly dependent on tourism, as earthquakes can affect foreign exchange inflow. This makes the research on this topic particularly important. Although there are various studies on the effects of natural disasters on tourism (Biardeau & Sahli, 2024; Liu et al., 2024; Zhang, Lv & Sarker, 2024), research specifically analyzing the economic impact of earthquakes on tourism demand in Türkiye remains limited. This study fills this gap by conducting an econometric analysis of multiple earthquakes (Elazığ, İzmir, and Kahramanmaraş) and distinguishing their effects from those caused by the COVID-19 pandemic.

in this research, which was conducted to examine the impact of earthquakes on tourism, the changes in the number of visitors following the earthquakes that occurred in the last 3 years were examined. The study investigated whether there were changes in visitor numbers in regions affected by the three major recent earthquakes. The relationship between the changes in visitor numbers and the magnitude and destructiveness of the earthquakes was analyzed. The presence of pandemic conditions during the period of these earthquakes allowed for a comparison of the effects of the earthquakes and the pandemic. The 2020 Elazığ earthquake (magnitude 6.8), the 2020 İzmir earthquake (magnitude 6.6), and the 2023 Kahramanmaraş earthquake (magnitude 7.6) were analyzed within the scope of the research, and the number of visitors before and after the earthquakes was compared using an econometric method.

Literature review

Natural disasters, it is widely acknowledged, wield significant and far-reaching destructive power on a global level (Holzer & Savage, 2013). In parallel, it is an inevitable reality with today's technology that full control over most natural phenomena remains elusive. Earthquakes serve as a prime example of this. Apart from reinforcing the buildings with the least impact and raising public awareness, we have limited options in dealing with this type of disaster (Otani, 2004; Shaw et al., 2009). Such events particularly pose significant challenges for developing countries and regions prone to frequent geographical occurrences, as they render their economies vulnerable (Benson & Clay, 2003). When considering a country like Türkiye, it is believed that looking into the past is sufficient. Earthquakes such as the 1992 Erzincan (magnitude 6.8, 653 deaths); 1999 Gölcük (magnitude 7.4, 17,480 deaths); 2011 Van (magnitude 7.2, 601 deaths); 2020 Elazığ-Sivrice (magnitude 6.8, 41 deaths); 2020 İzmir (magnitude



7.0, 116 deaths); February 6, 2023, earthquake centered in Kahramanmaraş (magnitude 7.7, 53,537 deaths) highlight this reality (TRT News, 2021; Sözcü, 2024). These natural disasters inflict significant damage on the Turkish economy. JPMorgan estimated that the direct financial cost of the earthquakes centered in Kahramanmaraş in Türkiye (2023), stemming from the destruction of physical structures, would amount to 25 billion dollars (Euronews, 2023). Within these losses, tourism also plays a significant role, as declines are observed not only in outbound tourism but also in inbound tourism. These factors contribute to the stagnation of economies dependent on tourism, a reduction in foreign currency inflow, and an increase in current account deficits. Consequently, a review of the literature indicates that numerous studies focus on this issue.

The initial studies on tourism were conducted by Mazzocchi and Montini in 2001, where they developed an approach to assess the economic impact of the earthquake that struck the Umbria region in Central Italy on September 26, 1997, on tourist flows. Subsequently, their research extensively analyzed the effects of the earthquake on the tourism sector in Umbria and contributed to the development of a new approach for measuring economic losses. Following this study, similar research has been conducted in many countries worldwide, including Taiwan, the United Kingdom, Japan, Chile, New Zealand, Nepal, China, Türkiye, and Indonesia (Huang et al., 2020; Huang & Min, 2002; Mendoza, et al., 2012; Orchiston et al., 2014; Wu & Hayashi, 2014; Prayag, et al., 2019; Min et al., 2020; Bayram & Çiftçi, 2021; Zhang et al., 2021; Habibi et al., 2022).

Considering studies conducted in the aforementioned countries, it is possible to observe numerous similarities and differences. Some examples such as the significant earthquakes in Japan in 2011 (Wu & Hayashi, 2014), Türkiye in 1999 (Bayram & Çiftçi, 2021), and Nepal in 2015 (Min et al., 2020), there are observable declines in tourist numbers, which have resulted in economic challenges, damage to infrastructure and superstructures, and constraints on national resources. These earthquakes extensively damaged tourism infrastructure, reducing tourist arrivals and causing significant economic impacts. The disasters not only affected tourist flows but also challenged the sector's recovery. Differences in the economic fallout and recovery degree were influenced by each country's infrastructure resilience and disaster response strategies. Japan's advanced systems likely facilitated quicker recovery, unlike in Nepal and Türkiye, where ongoing infrastructural issues posed longer-term challenges.

In this context, while numerous studies have examined the impact of earthquakes on tourism in highrisk countries, recent research (Biardeau & Sahli, 2024; Liu et al.,2024; Zhang, Lv & Sarker, 2024) has generally analyzed earthquakes alongside other natural disasters. However, there is no comprehensive econometric study specifically examining the impact of earthquakes on tourism in Türkiye. Despite being a country with high seismic risk and significant dependence on tourism, empirical studies in this field remain scarce. This research analyzes the Elazığ, İzmir, and Kahramanmaraş earthquakes to assess their effects on domestic and international tourist flows within an econometric framework while distinguishing these effects from those caused by the COVID-19 pandemic. The findings provide important insights for policymakers, tourism sector stakeholders, and disaster management strategies.

Methodology

In this paper, we empirically investigate the expected relationship between earthquakes and tourism activity in Türkiye between January 2019 and September 2023. The main research question is, to what extent was tourism activity affected during the earthquake and in the immediate periods following the earthquake? Here, the number of visits to the facility is evaluated within the scope of domestic and foreign visitors to represent tourism mobility.

The empirical research is designed using two approaches. The first is the use of total visitor data for Türkiye as a whole, which allows inferences to be made for domestic and foreign visitors. The second approach is to examine earthquake provinces and non-earthquake provinces. In the second approach, 12 provinces affected by the İzmir, Elazığ, and Kahramanmaraş earthquakes are analyzed. While examining the impact of the October-2020 İzmir earthquake, the pandemic impact was also added to the econometric model due to the presence of pandemic restrictions.



Model of the research

COVID-19 measures started in February following the Elazığ earthquake, and some important restrictions started shortly afterwards. The İzmir earthquake, on the other hand, occurred a few months after the Covid-19 restrictions were lifted, and this was the period when educational activities continued online. For these reasons, although the main purpose of this article is to determine the relationship between earthquakes and tourism activity, it is also necessary to consider the impact of the global pandemic. With this approach, it becomes possible to separate the impacts of the pandemic and earthquakes. The most appropriate method to determine this relationship is to create an econometric model with dummy variables.

$Y_t = \alpha_0 + \alpha_1 Earthquake + \alpha_2 Pandemic + \varepsilon_t$

Here, Y represents the number of arrivals to the facility, α_i (i = 0,1,2) parameters and the stochastic error term with the $\varepsilon \sim (0,1)$ process, respectively. *Earthquake* and *Pandemic* are defined as dummy variables. The *Earthquake* variable is a dummy variable that takes the value 1 in the periods of earthquakes and the following periods when the negative impact of earthquakes persists and 0 in the other periods. It takes the value 1 for 3 periods for Elazığ and İzmir earthquakes and 6 periods for Kahramanmaraş earthquake. Similarly, the *Pandemic* variable takes the value 1 in the February-May 2020 period and 0 in other periods.

Data of the research

The data source is accommodation facility data by Türkiye Republic Ministry of Culture and Tourism, and the sample period covers 80 months of data from January 2019 to September 2023. Tourism data are seasonally adjusted with Tramo-Seats and logarithmically transformed by taking the first difference. This transformation process not only ensures the stationarity of the series, but also allows the percentage changes to be obtained, so that tourism mobility of different magnitudes in different provinces can be interpreted and compared in terms of percentage change rather than quantity, independent of the scale effect. Descriptive statistics of the variables used in econometric analyzes are summarized in Tables 1 and Table 2.

Ta	abl	e 1	1:	D	escrip	otive	stat	istic	cs
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	Domestic Visitors (a)	Foreign Visitors (b)	Total (a+b)
Mean	3323115	2624830	5947945
Median	3133619	2092395	5214184
Maximum	5850662	6985859	12836521
Minimum	623627	64139	719430
Std. Deviation	1044947	1760387	2678105
Skewness	0.218439	0.625442	0.483146
Kurtosis	3.184046	2.260570	2.449753
Jarque-Bera Normality	0.7584	7.1262	4.1731
Probability	0.6843	0.0283	0.1241
Observations	81	81	81

Tab	le	2:	D	escri	ptiv	/e	stat	tis	tic	S
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	Elazığ	İzmir	11 Cities Affected by Kahramanmaraş	Total of Other Provinces not Affected by Kahramanmaraş
			Earthquake	Earthquake
Mean	18854.22	246622.7	375281.4	5346821
Median	19042	195187	363110	4727970
Maximum	31050	584624	612619	12377496
Minimum	4814	21839	77618	376536
Std. Deviation	4386.46	129728.9	99088.17	2633946
Skewness	-0.3952	0.6499	-0.0345	0.5745
Kurtosis	4.4793	2.5187	3.6664	2.7650
Jarque-Bera	9.4957	6.4849	1.5152	4.6430
Normality				
Probability	0.0086	0.03906	0.4687	0.0981
Observations	81	81	81	81



Findings and discussion

		5 5				
	Number of Arrivals to the Facility					
	Foreign Visitors Domestic Visitors Total					
	-		(Foreign + Domestic)			
$\hat{\alpha}_0$	6.6518	3.3177	3.9386			
	(1.6046)	(1.2719)	(1.6185)			
	[0.1125]	[0.2072]	[0.1095]			
Earthquake	-4.8834	-7.1855	-5.8562			
	(-0.5584)	(-1.8712)	(-1.1407)			
	[0.5781]	[0.0905]	[0.2574]			
Pandemic	-98.6748	-28.6287	-45.1180			
	(-5.6506)	(-2.6698)	(-4.4011)			
	[0.0000]	[0.0093]	[0.0000]			
R^2	0.3136	0.1309	0.22392			
F	18.2771	5.7986	12.5825			
	[0.0000]	[0.0045]	[0.0000]			
DW	1.9813	2.0242	2.1521			

The least squares estimate of the model (1) is summarized in Table 3.

Table 3: Türkiye totally

Note 1: t-statistics are provided in parentheses and p-values of t-statistics are provided in square brackets. **Note 2:** The earthquake dummy includes three earthquakes in the sample period.

The second column of Table 3 presents the impact of earthquakes and the pandemic on the number of arrivals in terms of foreign visitors. The econometric findings indicate that the number of foreign visitor arrivals decreases by 4.883% during earthquake periods and 98.674% during pandemic periods (when the impact of the earthquake is fixed). The negative impact of the earthquake does not have sufficient statistical significance, but the impact of the pandemic has strong significance (p<0.01). Since the model does not include quantitative explanatory variables, the explanatory power of the model cannot be interpreted, but the F test for the overall significance of the model remains important. The overall significance of the model for foreign, domestic, and total is adequate, and the margin of error for the F test is below 1%. The Durbin-Watson test for the residuals of the three models indicates that there is no autocorrelation.

Similarly, it was estimated that the number of local visitors to the facility decreased by 7.185% during the earthquake period and 28.628% during the pandemic period. The negative effect of the earthquake can be considered statistically significant (p<0.10). The impact of the pandemic is also statistically significant (p<0.01). When the total number of foreign and domestic visitors is evaluated, it is seen that the number of foreign and domestic visitors decreased by 5.856% during the earthquake period and by 45.118% during the pandemic period. The negative impact of the earthquake does not have sufficient statistical significance, but the effect of the pandemic has strong statistical significance (p<0.01). When the findings of Table 3 are evaluated as a whole, in summary, the negative response of domestic visitors to earthquakes is approximately 1.5 times that of foreign visitors. In terms of total visitors, the negative impact of the pandemic is about 9 times larger than the impact of earthquakes.



—	Number of Arrivals to the Facility (Foreign + Domestic)					
_	Elazığ	İzmir	11 Cities Affected by Kahramanmaraş Earthquake	Total of Other Provinces not Affected by Kahramanmaraş Earthquake		
Constant	0.2411	3.6546	0.5891	1.5193		
	(0.0985)	(91.8232)	(0.2150)	(0.2746)		
	[0.9218]	[0.3618]	[0.8303]	[0.7843]		
Earthquake	-10,5952	-7.3548	-3.0903	-4,2423		
-	(-0.8219)	(-39.3980)	(-0,5199)	(-0.4036)		
	[0.41036]	[0.6948]	[0.6046]	[0.6875]		
Pandemic	-	-48.1216 (-2.9542) [0.0043]	-	-		
R^2	0.1513	0.1159	0.0034	0.0020		
F	0,6756	4.3926	0.2703	0.1629		
	[0.4136]	[0.0161]	[0.6045]	[0.6875]		
DW	2.1912	2.2806	2.0270	2.3328		

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Note 1: t-statistics are provided in parentheses and p-values of t-statistics are provided in square brackets.

Note 2: İzmir earthquake is analyzed together with the pandemic effect.

Note 3: The earthquake dummy differs according to earthquake regions. For example, only the Elazığ earthquake is considered as a dummy variable in the Elazığ model and only the İzmir earthquake is considered as a dummy variable in the İzmir model. **Note 4:** In the model of provinces not affected by the Kahramanmaraş earthquake, the earthquake dummy includes all earthquakes.

In Table 4, the impacts of the earthquake and pandemic are analyzed according to the provinces with earthquakes. The number of visits to the facility decreased by 10.595% in Elazığ province due to the Elazığ earthquake, 7.354% in İzmir province due to the İzmir earthquake, 3.090% in 11 provinces affected by the Kahramanmaraş earthquake, and 4.242% in other provinces not affected by the Kahramanmaraş earthquake. The statistical significance of these effects was not found to be sufficient. Durbin-Watson test findings indicate that there is no autocorrelation in the models.

The findings were analyzed and interpreted using four figures. The effects of the 2020 Elazığ earthquake are shown in Figure 1, and the effects of the 2020 İzmir earthquake are shown in Figure 2. Figure 3 illustrates the impacts on 11 provinces affected by the 2023 Kahramanmaraş-centered earthquake, and Figure 4 presents data for Türkiye as a whole. The data used in the figure cover the period from January 2019 to November 2023 to track the trends in the number of arrivals to accommodation facilities over time. The series in the Figure are seasonally adjusted and normalized. The first arrow in the figures indicates the onset of the pandemic, while the second arrow marks the beginning of the Kahramanmaraş-centered earthquakes. The discussion of the tables is provided in the conclusion section.



Figure 1: Elazığ⁵



* The blue line in the figures includes the number of arrivals to the facility (foreigners), and the orange line includes the number of arrivals to the facility (domestic).

Figure 1 above shows the normalized values of the changes in the number of domestic and foreign tourists in Elazığ from 2019 to 2023. As can be seen, there was a sharp decline from February to May 2020. The decline continued from October 2022 to October 2023. When comparing the number of visitors in the month of the earthquake to the same month in the previous year, it is observed that the number of foreign tourists visiting the city increased by 62%, while the number of domestic tourists increased by 22%. The overall impact of the earthquake in Türkiye showed an increase of 7% in foreign tourists and 11% in domestic tourists.



Figure 2: İzmir

⁵ In Figure 1, 2, 3 and 4 the series were normalized to eliminate scale differences by province.



* The blue line in the figure includes the number of arrivals to the facility (foreigners), and the orange line includes the number of arrivals to the facility (domestic).

Figure 2 above shows the normalized values of the changes in the number of domestic and foreign tourists in İzmir from 2019 to 2023. A significant decline was observed over an eight-month period from February 2020 to September 2020. Comparing the number of visitors in the month of the earthquake to the same month in the previous year, the number of foreign tourists visiting the city decreased by 67%, and the number of domestic tourists decreased by 15%. In contrast, during the same period, one year before the earthquake in 2020, an upward trend in both domestic and foreign tourist numbers was observed. The overall impact of the earthquake in Türkiye showed a decrease of 33% in foreign tourists and 13% in domestic tourists. During the period affected by the pandemic, it took 8 months for the number of visitors to the city to return to pre-earthquake levels for both domestic and foreign tourists.



* The blue line in the figures includes the number of arrivals to the facility (foreigners), and the orange line includes the number of arrivals to the facility (domestic).

Figure 3 examines the number of foreign and domestic tourists in Kahramanmaraş, Hatay, Adıyaman, Osmaniye, Gaziantep, Şanlıurfa, Malatya, Diyarbakır, Adana, Kilis, and Elazığ, which were affected by the earthquakes centered in Kahramanmaraş on February 6, 2023. Sharp declines are observed from January 2020, June 2022, and February 2023. Comparing the number of visitors in the month of the earthquake to the same month in the previous year, the number of foreign tourists visiting the city decreased by 29%, and the number of domestic tourists decreased by 35%. The overall impact of the earthquake in Türkiye showed a decrease of 0.6% in foreign tourists and 26% in domestic tourists. It took 7 months for the number of internal visitors and 8 months for the number of foreign visitors to return to pre-earthquake levels.

Province	Hotel
Adıyaman	Arsames Hotel, Bozdoğan Hotel, Grand İsias Hotel, Grand İskender Hotel, Ünal Hotel, Yolaç Hotel
Gaziantep	Nurdağı Hotel
Hatay	Alice Hotel, Arsuz Hotel, Divan Hotel, Güney Hotel, Özhan Hotel, Savon Hotel
Kahramanmaraş	Arıkan Hotel, Burcu Hotel, Kazancı Hotel, Saffron Hotel
Malatya	Avşar Hotel, Büyük Hotel, Kırçuval Hotel, Özlem Hotel, Palancı, Trend Garden Residence
	Source: (Sezgin & Karagöz, 2023)

 Table 5: Some hotels destroyed after the Kahramanmaraş earthquake

Additionally, the list of hotels that were destroyed in the 11 provinces can be seen in Table 5. As can be observed, 23 hotels were destroyed, resulting in numerous injuries and fatalities. This situation starkly highlights the harsh reality of earthquakes once again.

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Figure 4: Türkiye



* The blue line in the figure includes the number of arrivals to the facility (foreigners), and the orange line includes the number of arrivals to the facility (domestic).

Figure 4 above shows the normalized values of the changes in the number of domestic and foreign tourists in Türkiye from 2019 to 2023. As can be seen, there was a decline from February 2020 to May 2021. Additionally, another decline was observed from November 2022 to March 2023, followed by an increase until June 2023. To understand the changes during the periods of the earthquakes, the tourism data for the month of the earthquake and the same month in the previous year were analyzed. After the Elazığ earthquake, there was an increase in overall tourism activity in Türkiye by 7% for foreign tourists and 11% for domestic tourists. Following the İzmir earthquake, there was a decrease of 33% for foreign tourists and 13% for domestic tourists. After the Kahramanmaraş-centered earthquake, there was a decrease of 0.6% in foreign tourists and a 26% decrease in domestic tourism activity.

Results and recommendations

In this paper, which investigates the empirical relationship between earthquakes and tourism mobility in Türkiye between January 2019 and September 2023, four analyzed figures clearly demonstrate the impact of extraordinary events such as pandemics and earthquakes on tourism demand. The results provide an in-depth understanding of how tourism demand is shaped during crisis periods. It is believed that this understanding offers valuable insights for policymakers and industry leaders to take preventive measures in the face of similar future situations. This information is expected to contribute significantly to enhancing the sector's resilience and protecting the national economy, enabling the development of strategic and effective policies.

On January 24, 2020, at 20:55, a 6.8 magnitude earthquake occurred with its epicenter in Sivrice (Elazığ) at a depth of approximately 8.06 km. This earthquake was followed by 995 aftershocks ranging in magnitude from 0.8 to 5.1 until January 27, 2020, at 12:25 (AFAD, 2020). Significant changes were observed in the tourism sector during the period impacted by both this earthquake and the COVID-19 pandemic (Figure 1). As can be seen, the number of foreign visitors increased by 62% and the number of domestic visitors increased by 22% following these adverse events. The limited number of accommodation facilities in the city and the minimal damage these facilities sustained in the earthquake ensured their continued availability. The increase in visitor numbers can be attributed to these facilities being used to accommodate individuals involved in post-earthquake relief activities.

On the other hand, considering the numbers from May to September 2022, there were increases observed over this five-month period. However, the sharp decline in tourist numbers from February to August 2023 can be directly attributed to the earthquakes centered in Kahramanmaraş. According to reports by





Elazığ Hakimiyet, Cumhuriyet, and Şen (2023), the 7.7 magnitude earthquake centered in Kahramanmaraş on February 6, 2023, resulted in the deaths of five people and injuries to 379 people in Elazığ. Additionally, following a 7.5 Mw magnitude aftershock, a damaged building collapsed. Elazığ was ranked 11th among the affected provinces and was declared a disaster area. A total of 10,694 buildings in the city were severely damaged.

In İzmir, a significant decline in the number of foreign tourists from January 2020, when the pandemic conditions were intensely felt and curfews were implemented, and in the number of domestic tourists from February 2020, was observed. In the second half of the year, there was a noticeable drop in the number of visitors to İzmir (Figure 2). In October 2020, during the period when the impacts of the pandemic were still being discerned, a 6.6 magnitude earthquake resulted in the deaths of 117 people, serious injuries to 1,035 people, and damage to 1,329 buildings (TRT News, 2023). As a result of the earthquake, there was a 67% decrease in the number of foreign visitors and a 15% decrease in the number of domestic visitors. This indicates that the earthquake negatively altered tourists' perceptions of safety (Bayram & Çiftçi, 2021). The number of foreign visitors experienced a relatively smaller decline due to the closure of border crossings.

In Figure 3, which evaluates the 11 provinces, the decline in tourism observed from May 2022 to January 2023 can be explained by various dynamics that emerged following the pandemic period. Restrictions imposed due to the COVID-19 pandemic limited people's freedom to travel; however, the easing of these restrictions led to a significant increase in tourism activities during the summer season of 2022. This increase was followed by a decline that continued until November. It is known that the tourism season in the Southeastern and Eastern Anatolia regions lasts until the end of October and November. Another factor could be Türkiye Pençe-Kilit Operations in Northern Iraq (Özcan, 2022). For example, the news of a Turkish soldier being martyred on June 28, 2022 (Kaçar, 2022), impacted the perception of security in the region, causing concern, especially among foreign tourists. This situation was observed to have a more significant effect on the reactions of foreign tourists compared to domestic tourists. Additionally, international conflict environments, such as the Russia-Ukraine war, are significant factors affecting tourism flow to the region (Voa, 2022). International conflicts can create security concerns that significantly alter tourists' travel preferences.

When examining Figure 4, which includes the number of domestic and foreign tourist accommodations in Türkiye between 2019 and 2023, it is econometrically estimated that the negative impact of the pandemic on the number of arrivals is approximately 20 times higher for foreign visitors and 4 times higher for domestic visitors than the negative impact of earthquakes. This value is approximately 8 times higher for the total number of arrivals. Leaving the pandemic effect constant, when only the relationship between earthquakes and the number of visits to the facility is analyzed, it is seen that the number of visits to the facility decreased by 4.883% for domestic visitors, 7.185% for foreign visitors, and 5.856% in total. A sharp decline in tourism activity was observed starting from March 11, 2020, when the first COVID-19 case was reported in the country (T.R. Ministry of Health, 2021). The recovery process in the tourism sector continued until the first quarter of 2022, at which point the number of visitors returned to pre-pandemic levels. Up until the last quarter of 2020, fluctuations in the number of domestic and foreign visitors were observed, with a significant drop occurring again following the October 30, 2020, İzmir earthquake. This situation is evident in Figure 2. The more noticeable decline following the İzmir earthquake, compared to the other two earthquakes, can be attributed to İzmir being the third most populous city in Türkiye and one of the top five cities attracting the most tourists (İzmir Provincial Directorate of Culture and Tourism, 2020; TÜİK, 2024). By February 2023, following the Kahramanmaraş earthquakes, referred to as "Disaster of the Century," which affected 11 provinces, number of visitors had declined to levels close to the end of 2021. However, the decline experienced was less pronounced compared to the İzmir earthquake. This is partly due to İzmir's significant position in Türkiye and the dominant pandemic conditions during the time the earthquake occurred.

The COVID-19 pandemic and the earthquakes that occurred in Türkiye, particularly the disasters centered in Elazığ and İzmir in 2020 and subsequently in Kahramanmaraş, have had profound and



multifaceted impacts on the tourism sector. As is known, the impact of the pandemic may have created vulnerabilities in tourist flows. As can be anticipated, different countries' policies and health concerns can alter people's travel habits (Uğur & Akbıyık, 2020; Seyfi et al., 2023).

As initially announced on January 5 (Medyascope, 2020), and only six days later marked by the first death, the World Tourism Organization (UNWTO) predicted significant economic impacts due to the COVID-19 pandemic. For the year 2020, the UNWTO estimated that tourism revenues could suffer a loss of nearly \$1.2 billion, and the global GDP could see a reduction of up to 2.8% due to diminished contributions from tourism. It is thought that the pandemic, in addition to the Elazığ and İzmir earthquakes and the Kahramanmaraş earthquakes, has caused serious damage to the physical infrastructure of the destinations as well as to the perception of tourism activity in these regions. "This situation can be explained as follows: tourists' safety concerns may have increased, interest in the affected region may have declined, and potential visitors may have postponed or canceled their travel plans due to the damage caused by the earthquake and subsequent aftershocks. These factors are believed to have contributed to the decline in the number of domestic tourists. However, this decline appears to be more closely related to the level of tourism development and opportunities in the affected cities rather than the magnitude of the earthquakes themselves. For instance, the more substantial decrease in tourism following the İzmir earthquake compared to the Kahramanmaraş earthquake, as well as the unexpected increase in tourism after the Elazığ earthquake, supports this interpretation. In addition, the effects of the earthquakes examined in the research are not as important as the COVID-19 pandemic. It has been observed that the impact of the epidemic on tourism activities across Türkiye is 9 times greater than that of the earthquake. The only exception to this was the Izmir earthquake, where the change in the number of foreign tourists was more pronounced than that of domestic tourists. This shows that earthquakes in tourism cities affect foreign tourist visits more than domestic tourist visits.

Theoretical implications

Based on the findings of the study, it has been determined that in tourist cities, the number of foreign tourists visiting after an earthquake decreased more significantly compared to domestic tourists. This situation is believed to be due to misinformation disseminated through communication channels. It can be noted that foreign tourists have more safety concerns compared to domestic tourists. On the other hand, even if the destructiveness of the earthquake is high in tourist cities, the decrease in the number of visitors post-earthquake is relatively lower in cities with low tourism potential. This can be attributed to the fact that some of the domestic and foreign visitors to these cities are there for hometown and family visits. Most importantly, the pandemic had a more significant negative impact on the number of visitors than the three earthquakes discussed in previous sections.

This study is one of the few that independently examines the impact of earthquakes on tourism demand using an econometric model, distinguishing these effects from those of other crises such as the COVID-19 pandemic. While studies have generally analyzed natural disasters as a whole, our research focuses solely on earthquakes, offering a more precise understanding of their economic consequences on tourism mobility. Additionally, this study aligns with theories on risk perception and post-crisis destination choices, as it highlights how tourists—particularly international visitors—react to uncertainty following a disaster. By providing empirical evidence on these behavioral patterns, our findings contribute to the broader discussion of crisis-induced fluctuations in tourism demand and destination resilience strategies.

Practical implications

This study explains the impacts of earthquakes on tourism in Türkiye and offers suggestions to policymakers, managers, and other stakeholders in the tourism sector. It is recommended that managers and policymakers need to be more careful about risk-crisis management, intervention procedures, and emergency studies, and coordination units should be established in advance. Additionally, emergency funds should be allocated specifically for tourism businesses affected by earthquakes to ensure a faster recovery process (Tuna, 2020). In this way, it is envisaged to minimize the damage of future accidents and reduce potential losses.



In the field of tourism, especially in provinces such as the Aegean and Mediterranean, where tourism is developed, these studies need to be managed more meticulously, and precautions must be taken. For instance, establishing earthquake-resistant tourism infrastructure, developing rapid response plans for hotels and tourism businesses, and providing crisis communication training to sector representatives can help mitigate the negative effects of such disasters. In addition, although the focus of this study is earthquakes, it is evident that the problems caused by epidemic diseases are even greater. Therefore, policymakers should prioritize the development of disaster-resilient tourism strategies that address multiple crises simultaneously.

The greater decrease in the number of foreign visitors after earthquakes in tourism cities may be influenced by negative perceptions abroad. Therefore, it is crucial to develop accurate, reliable policies that can counteract negative perceptions post-earthquake. This includes launching targeted international marketing campaigns, collaborating with global travel agencies to restore confidence, and leveraging social media to showcase real-time recovery efforts.

Limitations and future research directions

As with all research, this study has its limitations. Firstly, it is essential to consider the measures taken during the 2023 Kahramanmaraş earthquakes in Türkiye. State officials decided to allocate hotels and dormitories for families who lost their homes and earthquake victims (Yıldırım, 2023). As can be seen from the figures, this led to significant spikes in the number of arrivals at these facilities post-earthquake. This situation makes it difficult to quantitatively distinguish the loss caused by the earthquake on tourism mobility and preventive measures. The second limitation is that only official observed data sets were used in the data analysis, and survey-based data measuring the perspective of local people and/or openended data obtained from interviews with policy makers were not used. Thirdly, since the pandemic and Elazığ-İzmir earthquakes occurred in the same period, it makes it difficult to understand the impact of the earthquakes alone. Both the earthquakes and the negative conditions of the pandemic affect the tourism data observed during this period. The observed declines are due to both earthquakes and pandemic conditions. In addition, the long-term economic impacts of earthquakes and pandemics on tourism have been addressed in a limited way due to the lack of sufficient observed data. Long-term issues, such as the macroeconomic effects of declines in tourism revenues, could be critically important for future policy decisions. In-depth examination of these effects could help better understand recovery processes following economic crises and natural disasters. Also, data can also be collected through interviews or surveys to assess the impact of behavioral and perceptual factors on post-earthquake tourism mobility. For future research, additional variables such as tourism marketing activities, regional security perceptions, local government policies, infrastructure quality, and regional economic indicators can be employed in the research model as long as data are available. Moreover, this study does not examine how earthquakes affect long-term shifts in tourist behavior, such as destination loyalty and changes in travel risk perception over time. Future research could explore these aspects to better understand the prolonged effects of disasters on tourism demand.

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Ethical approval

This study is among the studies that do not require ethics committee approval due to used binary data published by the Ministry of Culture and Tourism of the Republic of Türkiye.

Contribution rate of researchers

The authors contributed equally to the study.

Conflict of interest

There is no potential conflict of interest in this study.