Climate Change

# The impact of climate change on tourism demand in Türkiye

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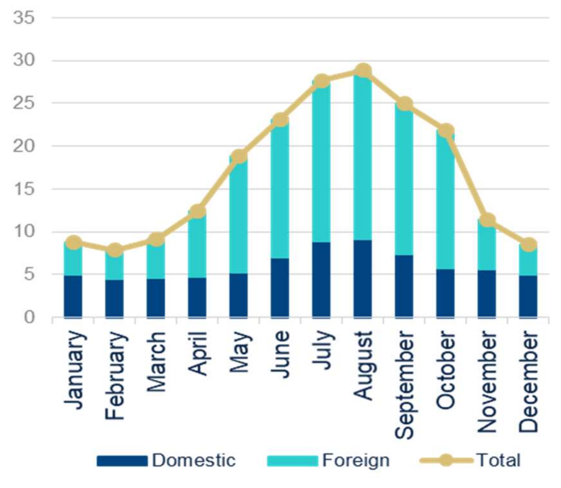
**November 12, 2024**

Climate change may negatively impact climate comfort, affecting tourism demand and destination attractiveness. Türkiye, with its Mediterranean, Aegean, and Black Sea coasts, ski resorts, highland villages, and outdoor cultural sites, is vulnerable to these effects. Our upcoming analysis explores the current and future impact of climate conditions on tourism demand in Türkiye, using alternative scenarios at the provincial level, highlighting the varied effects on different types of tourism.

**Tourism, a crucial sector for the Turkish economy, is vulnerable to climate change effects.** In order to assess the extent of such vulnerability, we conduct a panel-data analysis employing the methodology presented in Matei et. al. (2023) and Barrutiabengoa et. al. (2024) to gauge the impact of the climatic conditions on tourism demand in Turkish provinces, differentiated by types of tourism.

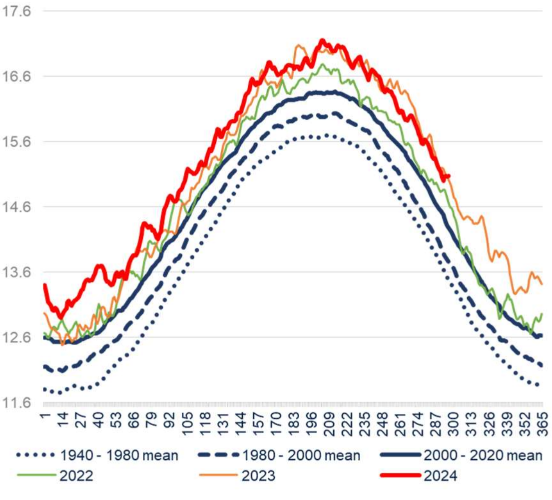
The tourism sector in Türkiye plays a significant role in both economic activity and employment, with accommodation and food services contributing 2.9% to GDP and 5.1% to employment in 2022. Furthermore, tourism demand presents a marked seasonality in Türkiye, with a peak in summer and high concentration in foreign tourism seeking sun and beach (see **Figures 1 and 2**).

Figure 1. **BEDNIGHTS PER MONTH IN TÜRKIYE** (2023, MILLIONS)




Source: Ministry of Tourism, BBVA Research

Figure 2. **DAILY WORLD TEMPERATURE** (1940-PRESENT, ºC)




Source: BBVA Research from Daily 2-meter Air Temperature.

The study examines both the impact of historical climate data (2004-2021) as well as the potential future impact of climate change on tourism demand up to 2100, holding other factors constant (ceteris paribus), across different climate scenarios. Therefore, the study provides insights into the **potential long-term impacts** of climate change on Türkiye's tourism sector, while serving as a reference for defining the necessary strategies to improve the resilience of the sector. For more details on the methodology see **Box 1.**

**The analysis is conducted at a granular provincial-level, providing projections of Türkiye's tourism flows** by differentiating across destination type (beach, mountain and urban), tourist origin (domestic and foreign) and climate comfort indices. First, **the provinces are classified by 4 types of tourism**: Coastal South (the provinces with a sea shore on the Mediterranean and Aegean Sea), Coastal North (the provinces with a sea shore on the Black Sea), Mountain & Nature (the provinces that report higher shares of bed nights on average during winter months) and finally Urban Mix (the remainder of the 81 provinces). As an indicator of tourism demand, we use the number of overnight stays in hotel accommodations certified by the Ministry of Tourism. Both total and foreign demand are estimated separately, as foreign tourists may have different preferences when selecting tourism destinations. Two different climate indices are included in the analysis -namely, the Tourism Climate Index (TCI) and the Holiday Climate Index (HCI)- to check the robustness of the model.

**Climate conditions affect the tourism demand significantly.** The model points to a statistically significant historical relationship between the tourism demand indicator and the climate comfort indicators. Accordingly, higher climate comfort has been associated with an increase in monthly tourism flow in Southern Coast and Northern Coasts, whereas the tourism flows in regions characterized with Mountains and Nature or Urban Mix tourism report lower tourism demand with the increasing climate comfort. The highest sensitivity to the climate conditions is reported in the Southern Coast of Türkiye, where a 1% increase (or decrease) in the TCI corresponds to a positive (or negative) 0.46% change in bed nights. Meanwhile, mountain tourism reports lower tourism demand with increasing climate comfort, due to the fact that warmer weather conditions deteriorates the suitability for ski tourism. The urban areas are the most inelastic in absolute value at -0.01, possibly due to a substitution effect between coastal and urban destinations.

**Regarding the economic factors, GDP and inflation of the destination province significantly impact bed nights, both reporting a positive effect on the tourism demand**[1]. The relative foreign real GDP per capita positively affects tourism demand, reflecting the higher purchasing power of foreign tourists. On the other hand, the relative foreign CPI reports negative coefficient indicating that the foreign tourists demand declines as the price index of the tourists' origin country increases relative to the price index of the destination. The decline in foreign tourists' purchasing power may outweigh the boost from relatively cheaper prices, negatively impacting tourism demand. CPI-related indicators are counterintuitive and likely distorted by the bidirectional relationship with demand.

**Looking ahead, climate change will become a major driving factor in the seasonal and geographical distribution of tourism demand.** Our results point towards a loss in tourism demand in the Southern Coast of Türkiye, characterized by beach tourism and in mountainous areas characterized by winter tourism. Increasing temperatures coupled with higher moisture decrease the climate comfort thereby decreasing the attractiveness of destinations located on the Mediterranean coast. Meanwhile, increasing temperatures deteriorate the conditions suitable for winter tourism, particularly the ski season, thereby resulting in a decline in tourism demand in cities with ski facilities. The net effect on Turkish tourism demand could be negative, though it depends on the climate index and the warming scenario considered. For instance, under the TCI specification, tourism demand may experience mild impacts which are almost zero, under low and moderate temperature increases (RCP 2.6 and RCP 4.5)[2] by the end of the century, but could see a significant 5.1% decrease in tourism demand under a scenario of high temperature

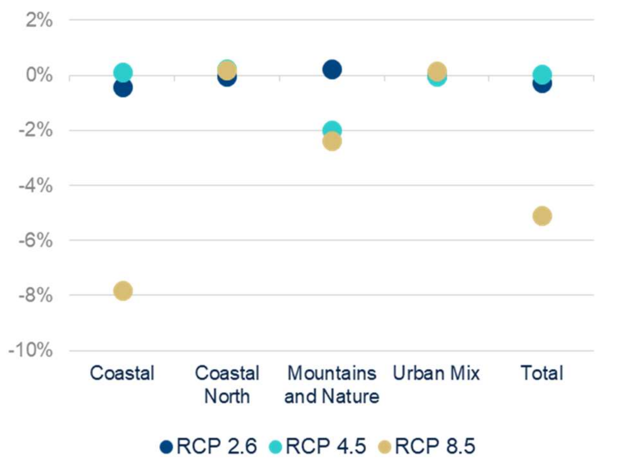
[1] The positive effect of CPI on tourism demand seems counter-intuitive as also discussed in the Matei et. al (2023), indicating that the tourism demand is increasing when the price level in the tourism destination increases. Two reasons could explain the positive coefficient of the CPI: First, the inflationary period in Türkiye coincides with the depreciation of the currency, making Türkiye a relatively cheaper tourism destination for foreigners. Turkish tourism is dependent on foreign tourism with foreign tourists accounting for nearly 65% of total bed nights in 2023, depreciating currency may have had an upward effect on tourism demand. Secondly, the relationship could happen in reverse with higher demand resulting in higher prices: Tourism attractions receiving high demand could experience increasing price levels, hence CPI inflation.

[2] Three different scenarios based on Representative Concentration Pathways (RCPs), formally adopted by the IPCC, that quantify future GHG concentrations. For more details see Box 1.

(RCP 8.5) increases by 2100 (see **Figures 3**)[3]. Hence, it is important to note that changes in tourism demand are generally non-linear in relation to warming levels. Under current policies, the most likely temperature rise scenario is RCP 4.5, with a 2.8°C increase over pre-industrial levels. The RCP 8.5 scenario is highly unlikely today and would require a significant reversal in climate efforts, which is improbable even with rising geopolitical tensions, as many green technologies, particularly in energy, are cost-competitive and here to stay.

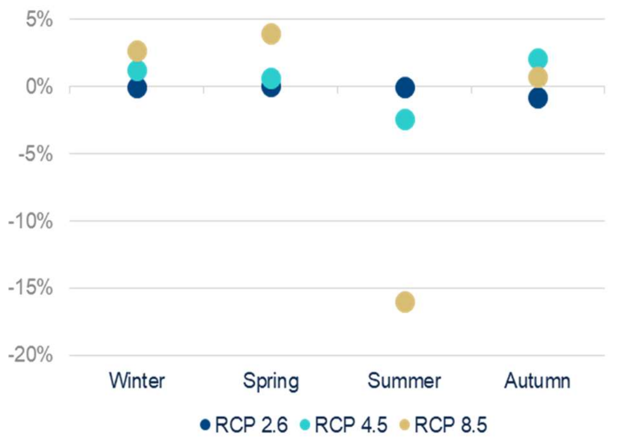
**The expected effects point to the possibility of changing seasonality[4] in tourism.** The study highlights the potential for deseasonalization of tourism, with autumn and spring becoming a particularly favorable season for travel. This trend is observed even under the RCP 4.5 scenario[5]. As extreme summer heat discourages travel to traditional destinations, spring could become a more popular season for tourists. Moreover, this shift could help alleviate the strain on summer tourism, provided that it is supported by necessary policy measures and investment in infrastructure.

Figure 3. **NET EFFECT ON TOURISM DEMAND BY 2100 BY TYPE OF TOURISM UNDER DIFFERENT SCENARIOS (%)**




Source: BBVA Research
Average variation (%) of decade 2091-2100 with respect to base 2024-2030

Figure 4. **NET EFFECT ON TOURISM DEMAND BY 2100 BY SEASON UNDER DIFFERENT SCENARIOS (%)**




Source: BBVA Research
Average variation (%) of decade 2091-2100 with respect to base 2024-2030.

**The choice of the index to quantify the climate comfort changes the projections considerably, even though the model results show minor changes in statistical terms.** While both TCI and HCI climate indices are designed to assess the suitability of a destination's climate for tourism, they have different weighting and ranking systems for climatic factors, leading to variations in the magnitude of projected impacts. For instance, under the most severe warming scenario, the HCI forecasts a national net effect on tourism demand of around −0.4%[6] (compared to −5.1% indicated by the TCI). As a consequence, the overall net effect on tourism demand using the HCI is comparatively

[3] Projection results compare tourism demand for the 2090s decade, defined as the period 2091–2100, against a baseline from 2024–2030. The reasons are (i) ease of interpretation, (ii) reduces the variability and uncertainty of future years, (iii) avoid biases of the Covid period.

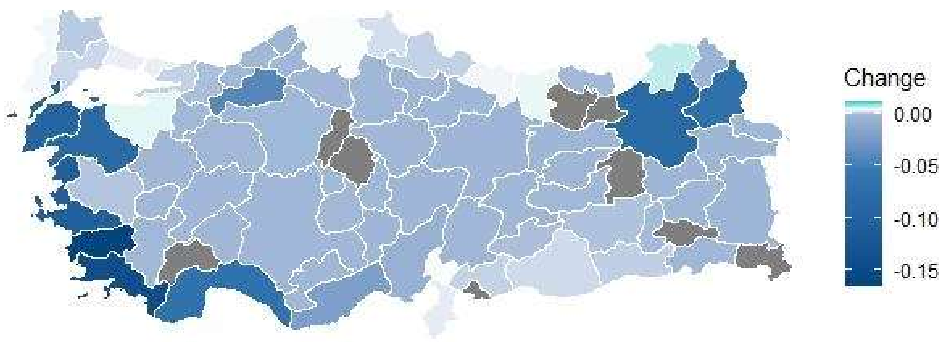
[4] We introduced the seasonal dummy variables to check for the seasonal tourism patterns and a COVID dummy (from March 2020 to March 2021). As expected, summer months (June, July, August) period reports the highest bed nights, whereas winter season reports the lowest. Additionally, the COVID period dummy reports a negative coefficient due to the disruptive impact of COVID restrictions on tourism demand.

[5] The RCP 4.5 scenario is the most likely among the three considered in this exercise with current climate policies.

[6] This happens particularly because the HCI method takes the maximum temperatures into account instead of average temperature, a considerable part of the maximum temperatures recorded in Türkiye are ranked into low or even zero values. Therefore, the HCI fails to penalize the temperature increases as much as TCI, in the case that the maximum temperatures reach very high levels.

lower than the TCI model, with a less pronounced difference across provinces. It is crucial to emphasize that the differences between the HCI and TCI results primarily stem from how the reference climate scenarios (RCPs) are translated into the respective proxy -whether TCI or HCI- over the forecasted period. The key difference does not lie in the model coefficients themselves, but rather in the future scenarios. The HCI applies a different ranking system, particularly regarding thermal comfort, where a considerable part of the maximum temperatures in Türkiye are already in the upper end of the distribution, translating into low or even zero values (see Figure 7 and Figure 8 in the Box). This reflects a limitation in the HCI's ability to adequately penalize temperature increases, once maximum temperatures reach very high levels, as already seen in many Turkish provinces. As a consequence, there is a reduced overall effect and a less pronounced north-south differentiation.

Figure 5. **TÜRKIYE. NET EFFECT ON TOURISM DEMAND UNDER AN ADVERSE CLIMATE SCENARIO. 2091-2100** (%, USING AS BASE 2024-2030)




Source:BBVA Research
Notes: Conditional forecast based on TCI projections under RCP8.5, comparing the average effect of the decade 2091-2100 with respect to the base period 2024-2030. The provinces colored in gray are excluded from the projections due to lack of sufficient monthly bed nights data.

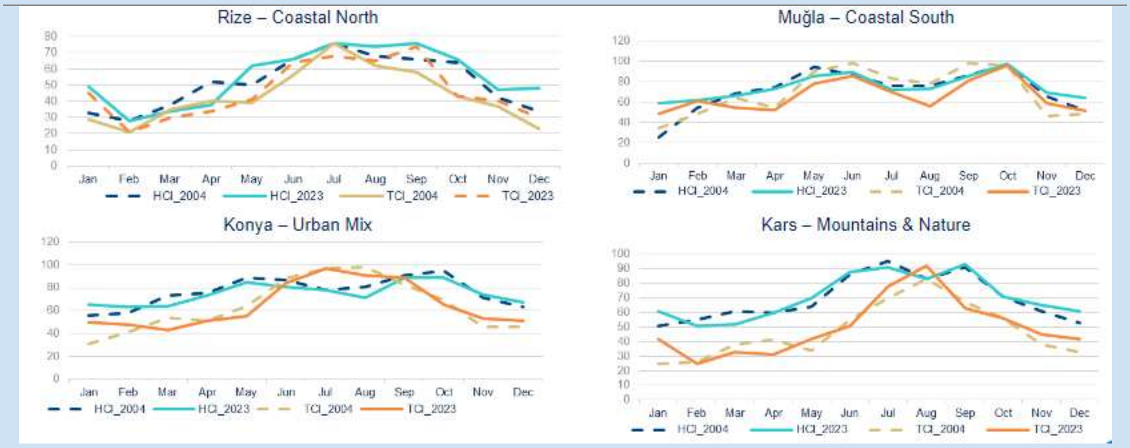
**In summary, the BBVA Research's study highlights the challenges posed by climate change to Türkiye's tourism sector, particularly for traditional summer beach tourism areas in the Southern Coast, as well as for ski tourism areas in the mountainous terrain. Under the most severe emissions scenario, the future national impact is expected to be negative. On the other hand, the potential for deseasonalization and regional diversification offers opportunities for economic growth. To mitigate the adverse effects, the tourist industry must adapt by promoting off-peak travel, developing sustainable infrastructure, and diversifying tourist attractions beyond beach tourism to ensure the long-term resilience of Türkiye's tourism sector.**

## Box 1. Measuring climate comfort and analyzing its impact on tourism demand against a background of climate change

### A. Climate Comfort Indexes

In order to measure the impact of climate change on tourism demand, the analysis is based on two key climate indices: the **Tourism Climate Index (TCI)** and the **Holiday Climate Index (HCI)**, as these indices capture a range of factors including temperature, humidity, and precipitation to assess the climatic suitability of regions for tourism activities.[7] To do so, all the climate variables are ranked according to different thresholds - with an additive methodology, in which the weights of each sub-index indicate the relative impact of each climatic component. The difference in both indices relies on the different thresholds and weights assigned to each variable. While the TCI is the most widely used measure, the HCI was designed to be specified for major tourism segments and destination types: beach and urban tourism.

Figure 6. **TCI and HCI in selected provinces(*)**

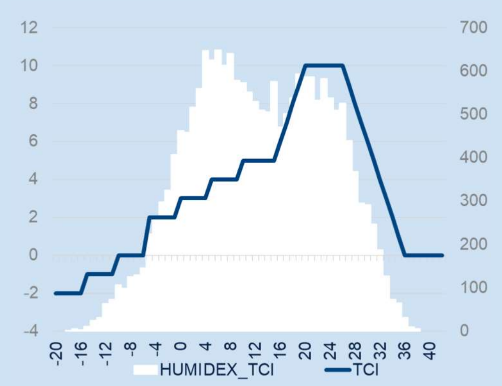



Source: BBVA Research
(*) Each of the provinces in the figure are representative of a type of tourism (Rize for Coastal North, Muğla for Coastal South, Kars for Mountains and Nature, and Konya for Urban mix). HCI beach was employed for both coastal types of tourism, while HCI Urban for the remaining provinces.

**Figure 6** displays the TCI and HCI of four selected provinces in Türkiye to illustrate their historical evolution. Climate comfort has decreased in provinces that already had higher temperatures back in 1980, for example Southern Coast. Since the southern Coast provinces report higher temperatures compared to the rest of the provinces in the summer months, the climate comfort seems to decline during summer months for these provinces, while it improves for provinces in the mountainous or urban areas. The differences in HCI and TCI becomes apparent especially for the beach tourism areas: The HCI Beach index displays a more defined bell shape compared to the TCI, as it assigns higher values in the months in which tourists value going to the beach, while the HCI Urban displays more stable values since city sightseeing is less sensitive to climate conditions.

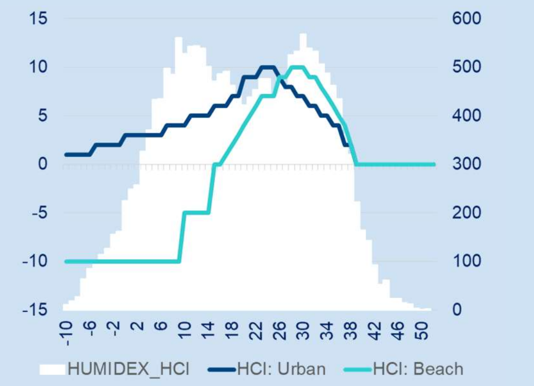
7 The literature has long explored the effect of temperature as it offers a direct measure of climate impact (Bigano and Tol, 2005; Cai and Leung, 2010; Taylor and Ortiz, 2009; Barrios and Ibañez, 2015, Priego et al., 2015). The use of climate indexes, however, provides a more complete understanding on the effect of climate on tourism demand (Mieczkowsi, 1985; Amelung & Moreno, 2012; Daniel Scott and Göosling, 2016; Rutty et al. 2020; Ogur and Baycan, 2023; Matei et al., 2023). In addition, some works quantify the effect of natural disasters and extreme events driven by climate change (Roselló et al. 2020, Cevik and Ghazanchyan, 2021).

Figure 7. **HUMIDEX Historical Distribution 1980-2023 (Right-axis) and Rating (Left-axis)**




Source: BBVA Research
Notes: Calculated using monthly average mean temp.

Figure 8. **HUMIDEX Historical Distribution 1980-2023 (Right-axis) and Rating (Left-axis)**




Source: BBVA Research
Notes: Calculated using monthly average mean temp.

## B. Methodology

The analysis has been developed in two phases:

1. **Historical Panel Estimation**: A panel regression model estimates how climatic factors (namely, TCI and HCI) influenced tourism demand (bednights) over the past two decades. The model controls economic factors such as GDP, prices (CPI), the ratio of foreign GDP per capita with respect to the GDP per capita at destination, the ratio of foreign CPI with respect to CPI index of the tourism destination, as well as type of tourism (Tclass), seasonal dummy variables (M) and a COVID-19 dummy, and applies fixed effects to account for province-specific characteristics[8]. The equation is as follows:

$$ln(BN_{it}) = \gamma + \alpha_i + \beta_1 \, ln(TCI_{it} \times Tclass_i) + \beta_2 \, ln(GDP_{it}) + \beta_3 \, ln(CPI_{it}) +$$

$$+ \beta_4 \, ln(GDPpcfor_{it}) + \beta_5 \, ln(CPIfor_{it}) + d_s \, M_S + d_c Covid + \epsilon_{it}$$

2. **Conditional Forecasting**: The second phase projects future tourism demand under three different climate change scenarios based on Representative Concentration Pathways (RCPs), formally adopted by the IPCC, that quantify future greenhouse gas concentrations and radiance forcing due to increased pollution. These forecasts provide an outlook on how tourism demand may shift by 2100 under varying degrees of global warming[9]. Namely, there are three scenarios:

- Net zero scenario (RCP 2.6): low future emissions trend, declining by 2020 and reaching net zero by 2100, with an increase of 1.8ºC by 2100 compared to pre-industrial levels.
- Intermedium scenario (RCP 4.5): low to moderate future emissions, with an increase of 2.8ºC by 2100 compared to pre-industrial levels.

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[8] More precisely, the model was estimated using Feasible Generalized Least Squares with AR(1) autocorrelation in the residuals as well as cross-sectional correlation across panels.

[9] The model assumes that the influence of climatic variables on tourism demand (the elasticity) remains stable throughout the projection period (2024–2100), with economic variables held constant at 2023 levels. The model does not account for adaptation and non-linearities to changes in climate patterns.

- Adverse scenario (RCP 8.5): very high future emissions tripling current levels by the end of the century, with an increase of 4.8ºC by 2100 compared to pre-industrial levels.

Creating Opportunities

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