BBVA Research

Creating Opportunities

N.º 24/14

Working Paper

The Impact of Climate Change on Tourism Demand in Türkiye

Joxe M. Barrutiabengoa, Giancarlo Carta, Nara González, Pilar Más, Diego Pérez, and Gül Yücel

November 2024

The Impact of Climate Change on Tourism Demand in Türkiye

Abstract

Tourism sector, an important contributor to Turkish GDP, could be susceptible to changing climatic conditions as a result of climate crisis. Our study investigates the potential effects of climate change on tourism demand across 72 Turkish provinces analyzing monthly hotel bed nights data, using two different indexes to quantify climate comfort, namely, Tourism Climate Index (TCI) and Holiday Climate Index (HCI) under three emission concentration pathways (RCP 2.6, 4.5 and 8.5) corresponding to projected mean temperature increases of 1.8°C, 2.8°C, and 4.8°C by 2100, respectively. Our findings point to the statistically significant relationship between the climatic conditions and tourism demand, with the highest demand loss as a result of worsening weather conditions reported by the provinces located on the Southern Coast. Furthermore, we observe the changing seasonal distribution of tourism demand involving a shift from summer towards spring. Considering the net effect on Turkish tourism, according to TCI specification, we found mild impacts under RCP 2.6 and 4.5 (-0.3% and +0.03% in 2100 vs. 2024-2030), but a significant impact under RCP 8.5 (-5.1%). Finally, our study also highlights that the choice of tourism climate indexes changes the magnitude of tourism loss, hence selecting the most appropriate index to quantify climate conditions is crucial.

Kewywords: Climate Change, Tourism Demand, Türkiye, Tourism Climate Index, Holiday Climate Index, Emission Concentration Pathways, Seasonal Patterns.

JEL classification: L83, Q54.

Introduction

Tourism activities, whether they are beach, mountain, nature or culture tourism, are highly dependent on weather conditions, and hence, vulnerable to the impact of climate change. Variations in temperature, precipitation patterns and the frequency of extreme weather events could affect climate comfort, thereby affecting tourism demand and the attractiveness of destinations. Türkiye is not immune to the disruptive impact of climate change with its seashore by the Mediterranean, Aegean and Black Sea, its ski facilities and touristic highland villages located at the mountainous terrain, and its cultural and historical outdoor attractions. From this perspective, this study investigates the relationship between climate change and tourism demand in Turkish provinces, focusing on the potential alterations in tourism patterns due to future climatic conditions. Following the work of Matei et al. (2023) for European regions and employing the methodology laid out in the study of Barrutiabengoa et. al. (2024) for Spanish provinces, this work provides an extensive analysis of Turkish tourism within the context of climate conditions.

Tourism is a critical sector in the Turkish economy, with the share of accommodation and food services in gross domestic product reaching 3.1% in 2023. Similarly, the share of accommodation and food activities in employment reached 5.7% in 2023. Furthermore, in addition to the direct impact of the tourism sector on economic growth and employment, there are also significant indirect effects of tourism sectors' activity, including induced contributions through expenditures in other goods and services (Lemma, 2014).

Considering the economic importance of tourism, we utilize a combination of the econometric modeling and climate data analysis to estimate the relationship between tourism demand and changes in climatic conditions. Our panel data analysis is conducted on a monthly basis across the 81 provinces of Türkiye, controlling for economic variables such as GDP and prices (both in origin and destination). We estimate the climate influence on tourism demand under two model specifications based on alternative indexes for capturing climate comfort, the Tourism Climate Index (TCI) and the Holiday Climate Index (HCI). Once we estimate the relationship between climate comfort and tourism demand based on historical data, we further forecast tourism demand up to 2100 under different future climate scenarios - referring to differing global warming levels.

Our results point to a major loss in tourism demand in the most severe climate scenario in the Southern Coast of Türkiye, characterized by beach tourism, and in mountainous areas characterized by ski tourism. Increasing temperatures coupled with higher moisture decrease the climate comfort thereby reducing the attractiveness of destinations located on the Mediterranean coast. Meanwhile, hotter temperatures deteriorate the conditions suitable for winter tourism, particularly ski season, thereby resulting in a decline in tourism demand in cities with ski facilities. The net effect of weather conditions 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 under low and moderate temperature increases by the end of the century, but could see a significant 5.1% decrease in tourism demand under a scenario of high temperature increases by 2100.

The structure of this paper is as follows: Section 2 reviews the literature on the determinants of tourism demand, highlighting key findings and identifying research gaps. Section 3 delves into the data and the use of climate indexes, providing information about the sources and specifications used in the modeling. Section 4 outlines the modeling approach. Section 5 and 6 presents the empirical results, discussing the effects of TCI and HCI on tourism demand and providing projections under various climate scenarios. And finally, Section 7 summarizes the main findings of the work.

Literature Review

Literature argues that tourism is sensitive to climate and environmental conditions (Lise, W., and Tol, R. S., 2002). The impact of climate on tourism has physical, psychological and physiological dimensions, like the quality of the experience, convenience, attraction, physical risks and danger (Moore, 2010). This change in tourism demand does not only affect the industry but also the whole economy. Thus, it is imperative to reveal the economic losses due to declining tourism demand when analyzing the consequences of climate change (Burke et. al, 2018).

The relationship between climate change and tourism demand is rather complex: depending on characteristics such as the seasonality, regional qualities, and the dominant type of tourism in that region climate's impact also changes (Gössling, 2012). For instance, Chang et. al (2024) observes that while increasing summer temperatures have a negative effect on tourism demand and revenues, for fall season an increase in temperature affects tourism positively. The change is not only seasonal but also dependent on the geography: Scott and Boyle's (2001) study examines Canada's case and demonstrates how western Canadian cities would experience the lengthening of the tourism season whereas the Eastern Canadian cities' season would be affected negatively. Meanwhile Barrutiabengoa et. al. (2024), in their study of Spanish provinces, point to a clear North-Southeast pattern in coastal tourism demand changes, where northern coastal provinces benefit from climate change and southern and eastern regions experience notable declines in tourism demand, especially under higher warming scenarios. The finding confirms the need for a more granular analysis providing insights for changing seasonality and regional characteristics of tourism demand in the face of climate change.

In order to incorporate the climate impact into the models, the literature primarily studies the temperature as the primary variable, while separately adding other climatic variables as well, such as precipitation and sunshine (Nunes et al., 2013; Agnew & Palutikof, 2006; Taylor & Ortiz, 2009). Although these studies offer insights into the relationship between the impact of individual climate variables on tourism demand, they fail to capture the interdependencies between them. Hence, the literature moves beyond the use of isolated climate metrics and offers different index methodologies to integrate determinants such as humidity, temperature, precipitation, daily duration of sunshine, to analyze climate change in the long run. Tourism Climate Index (TCI), first designed by Mieczkowski (1985) aims to aggregate relevant climate variables that would affect tourism demand. The index consists of daily thermal comfort, precipitation, hours of sunshine and wind speed (Matei, et. al, 2023). Another relevant tool to analyze this relation is the Holiday Climate Index (HCI), which is considered to be an advancement for implying tourists' climatic preferences in its construction. HCI introduces two different versions, HCI Urban and HCI Beach, which use different thresholds in its rating scheme. According to the literature, HCI indexes reveal the relation between climate and tourism demand better in spatial-specific context (Scott et. al, 2016), but they also present problems in the tails of the distribution of climate variables.

In our paper we have used both TCI and HCI to explore how the tourism demand projections change under different scenarios of GHG concentration. Considering the literature on Turkish tourism demand within the context of climate change, Oğur & Baycan (2023) utilizes TCI index for 30 provinces and shows significant losses in tourism demand in Mediterranean and Aegean coasts, especially during summer period. Another study by Bilgin et. al. (2024) deriving the Holiday Climate Index in the Mediterranean coastal region covering 10 provinces reports decline in the optimal duration for vacationing in these destinations, where higher temperatures are likely to impact their attractiveness during summer months. However, it is important to note that these studies do not factor the economic, political and social determinants of tourism demand into their climate models, which could be seen as a shortcoming (Doğru, et.al, 2019). Our study contributes to the already existing literature by including the economic variables in the model to incorporate the impact of income and price levels of both destinations and the origin country of foreign visitors.

Data

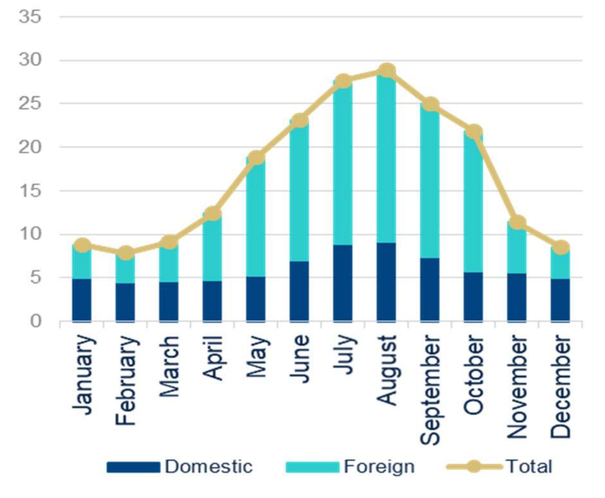
The choice of the variable which represents the tourism demand varies across studies, the most commonly used being tourist arrivals, number of overnight stays or tourism expenditure. In this study, we selected the seasonally unadjusted number of hotel bed nights as reported by the Ministry of Culture and Tourism under the Accommodation Statistics for Facilities Certified by the Ministry. This survey provides the number of hotel bed nights by Turkish provinces at a monthly frequency from 2004 to 2023, distinguishing at the same time between domestic and foreign tourists.

Regarding the determinants of the tourism demand, we considered two economic factors: Income (real GDP) and prices (CPI). First, we computed the monthly real GDP by destination province by combining the annual provincial GDP with the quarterly not seasonally adjusted national GDP. In order to compute the provincial GDP, two assumptions are made: Firstly, we assume that the distribution of GDP across provinces stays the same for each quarter within the year and apply the weights of each province to the not seasonally adjusted quarterly national GDP. Secondly, the quarterly GDP for each province calculated is equally distributed across the three months. Additionally, we calculated the foreign GDP by weighting the GDP per capita of the 35 countries reporting the highest share at the national level in terms of the number of hotel bed nights, for each province.

The CPI is also retrieved from Turkstat by province from 2004 January until 2022 April, which is the last available period for the CPI data at the provincial level. We also computed the relative foreign CPI by dividing the top 35 countries' CPI by each province's CPI and then weighting it with their respective share in each provinces' total bed nights.

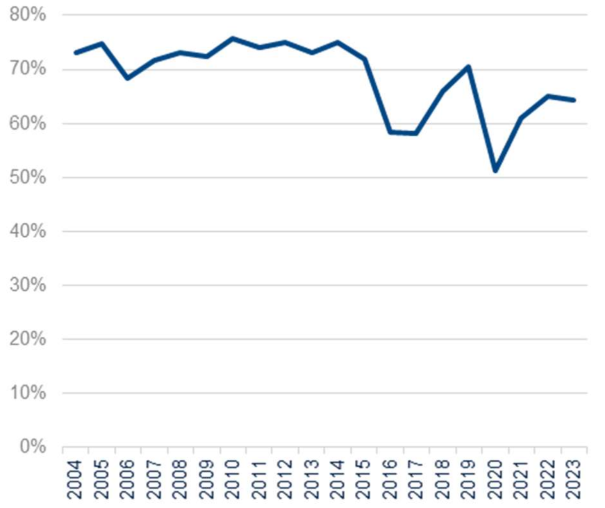
Analyzing the tourism flows at the national level, we see a clear seasonal pattern with a peak in the summer season (Figure 1). Although the foreign tourism exhibits a higher share at the national level (Figure 1 and 2), the distribution of domestic and foreign tourism changes across the destination provinces (Figure 3). In particular, foreign tourism dominates in provinces like Antalya and Istanbul, which together account around 60% of the total tourism, while in most of the provinces 90% of the tourism flows are domestic.

Figure 1. **AVERAGE BED NIGHTS PER MONTH IN TÜRKIYE**



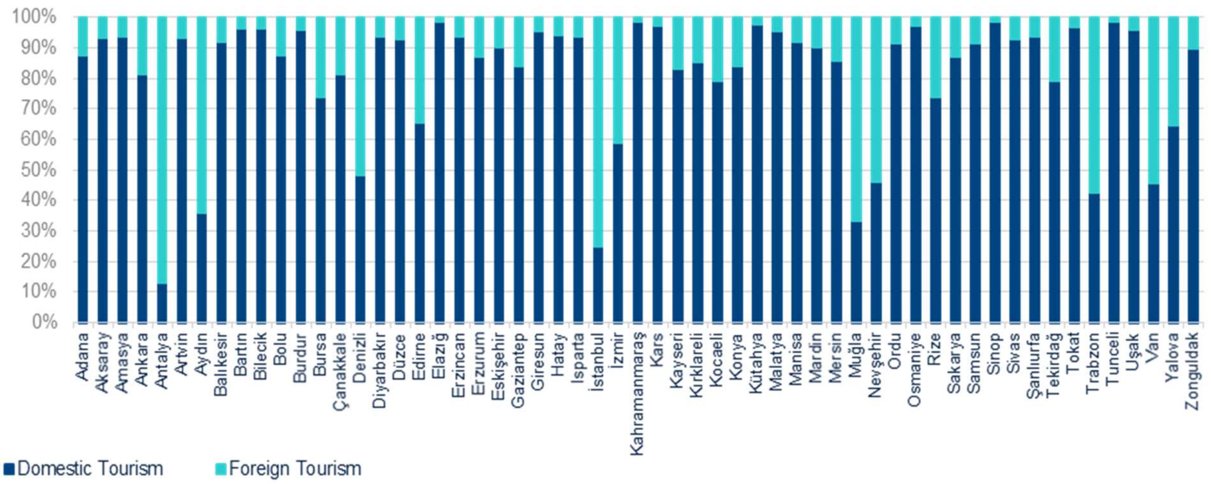
Source: BBVA Research, Ministry of Culture & Tourism

Figure 2. **SHARE OF FOREIGN TOURIST IN TOTAL BEDNIGHTS** (%)



Source: BBVA Research, Ministry of Culture & Tourism

Figure 3. **DISTRIBUTION OF DOMESTIC AND FOREIGN TOURISM BY SELECTED PROVINCES** (2023)



Source: BBVA Research, Ministry of Culture & Tourism

Finally, the tourism types are determined by examining the geographic characteristics and the distribution of bed nights within each province across the year. This type of tourism classification stems from Batista et. al (2021), albeit some modifications, under which we identified 4 distinct categories according to the following definitions (See Figure 4):

- **Coastal South:** The provinces with a sea shore on the Mediterranean and Aegean Sea -Adana, Antalya, Aydın, Balıkesir, Çanakkale, İzmir, Mersin and Muğla- are classified under this category. In terms of tourism flows, they report a higher average share of bed nights in summer.
- **Coastal North:** The provinces with a sea shore on the Black Sea –Artvin, Bartın, Giresun, Kastamonu, Ordu, Rize, Samsun, Sinop, Trabzon and Zonguldak- are classified under this category. The majority of these provinces attract mainly domestic tourism during summer months, not only due to beach tourism, but also highlands tourism in which people travel to upskirts of the mountains, especially in the Eastern Black Sea region, to escape the heat of the summer season. As a result, in terms of tourism flows, these provinces report higher average share of bed nights in the summer months, though the magnitudes are comparatively smaller compared to South Coast.
- **Mountains and Nature:** The provinces with a ski facility and which reports higher shares of bed night on average in the winter times. There are 4 provinces fitting this criteria: Bolu, Bursa, Erzurum and Kars.
- **Urban Mix:** The remaining provinces, which do not conform to the criteria of the 3 other categories presented above, are classified under urban mix. This category stands for the majority of the provinces, ranging from metropolitan cities like İstanbul or Ankara to provinces with relatively less population such as Çankırı or Hakkari. These provinces report an equal distribution of average tourism shares across the year and are mainly known for the cultural & historical sightseeing activities, which are less dependent on the weather conditions.

Figure 4. **TURKISH PROVINCES CLASSIFIED BY TYPE OF TOURISM**

Source: BBVA Research adapted from Batista e Silva et al. (2021)

For climate variables, we extracted the data from ERA5 hourly climate reanalysis database (Hersbach et al., 2023). First we worked with the Tourism Climate Index (TCI) as developed by Mieczkowski (1985), completing the analysis with the Holiday Climate Index (HCI) as an alternative proxy representing the climate conditions affecting tourism demand. The TCI combines the relevant climatic factors, namely temperature, humidity, precipitation, cloud cover and wind speed in one index, giving the highest weight to the Daily Comfort Index, which is a combination of temperature and humidity. The idea behind Daily Comfort Index (or Humidex) is that higher temperatures coupled with higher humidity levels create warmer environments compared to those that are coupled with lower humidity (See Figure A1 in Appendix). The climate factors are first ranked according to Table A1 in Appendix and then combined with the following formula:

$$TCI = 5\,Daily\ Comfort\ Index + 2\,Precipitation + 2\,Cloud\ Cover + Wind$$

The HCI methodology is similar to the TCI in the sense that it also combines the climate variables in one index. However, it separates between beach and urban tourism with the following formulas.

$$HCI\ Beach = 2\,Daily\ Comfort\ Index + 4\,Cloud\ Cover + 3\,Precipitation + Wind$$

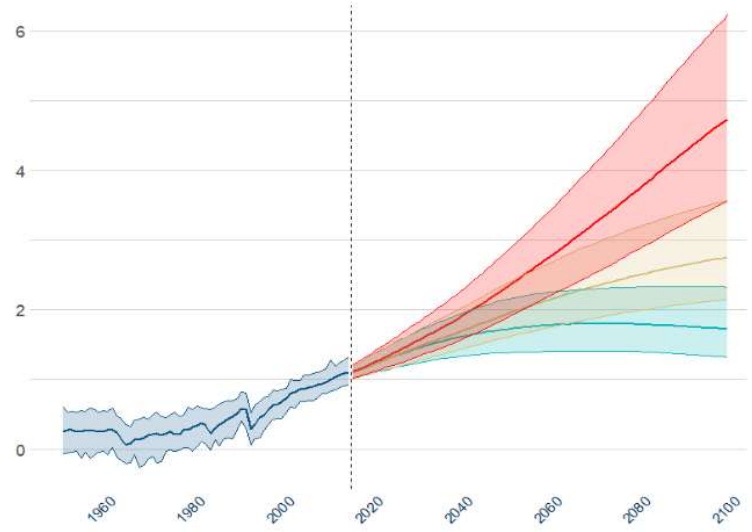
$$HCI\ Urban = 4\,Daily\ Comfort\ Index + 2\,Cloud\ Cover + 3\,Precipitation + Wind$$

Not only the weights for Urban and Beach tourism are different in the formulas above, but also the rankings of the climate variables (see Table A2 and A3 in the Appendix). In addition, there are three main differences between HCI and TCI. The first one is that the two methodologies use different thresholds for rating the climate data (See Appendix A). Secondly, HCI uses maximum daily temperature when computing the Daily Comfort Index instead of average daily temperature. Finally, HCI differentiates between beach and urban tourism attributing the highest weight to cloud cover for regions classified as beach, while giving weight to the Daily Comfort Index for regions classified as urban.

Regarding the future values for TCI and HCI, three different scenarios, based on Representative Concentration Pathways (RCPs) were used in order to quantify future greenhouse gas concentrations:

- RCP 2.6: This scenario corresponds to the case of low future GHG emissions. Under this scenario, the emissions are assumed to start declining by 2020 and reach a net zero target by 2100. Therefore, the temperature increase projected by the end of the century ranges from 0.9 to 2.4ºC degrees above pre-industrial levels, with a mean of 1.8 ºC.
- RCP 4.5: This scenario could be described as low to moderate future GHG emissions. Under this scenario, the temperature mean increase is limited to approximately 3°C by 2100.
- RCP 8.5: This scenario could be defined as the scenario with high future emissions, which will be three times higher than current levels by the end of the century, leading to a mean temperature increase of approximately 4.8ºC.

Figure 5. **GLOBAL SURFACE TEMPERATURE CHANGE (ºC)** (relative to 1850-1900)



Source: BBVA Research from IPCC Sixth Assessment Report
Note: The dark blue line and shaded area represent the historical observed changes. The lights blue, yellow and red solid line and shaded areas represent the estimated point and 95% uncertainty bands for each of the RCP scenarios

Methodology

This study's modeling approach builds on Barrutiabengoa et al. (2024) and Matei et al. (2023) examining the influence of climatic conditions on regional tourist flows. The model offers provincial granularity with the inclusion of the bed nights data by provinces[1] and the incorporation of economic variables such as GDP and CPI on the national and the foreign country dimensions. The model is fit to the sample from January 2004 to December 2021 due to data availability constraints.

1: Due to the considerable lack of data of hotel bed nights on monthly terms, especially for foreign tourism, we decided to exclude the following provinces from the analysis: Burdur, Kilis, Siirt, Bayburt, Bingöl, Gümüşhane, Kırşehir, Hakkari, Kırıkkale.

We work with two climate suitability indices, the Tourism Climate Index (TCI) and the Holiday Climate Index (HCI) in order to check the robustness and gather a more comprehensive understanding compared to the previous studies with this level of regional granularity. The economic determinants at the province level include real GDP in Turkish lira, the consumer price index (CPI) in the destination provinces, the relative real GDP per capita of foreign tourists divided by the real GDP per capita of the province of destination and the relative CPI index of foreign tourists weighted by their respective share. Specifically, we estimate the following fixed effects monthly model for 72 Turkish provinces over the January 2004 - December 2021 period, including a dummy variable for the COVID-19 period:

$$ln(BN_{it}) = \gamma + \alpha_i + \beta_1 ln(TCI_{it} x\, TT_i) + \beta_2 ln(GDP_{it}) + \beta_3 ln(CPI_{it}) + \beta_4 ln(GDPpcforeign_{it}) + \beta_5 ln(CPIforeign_{it}) + d_s M_s + d_c COVID + \epsilon_{it}$$

According to the model above, the $ln\,(BN_{it})$ stands for the dependent variable defined as the natural logarithm of the number of bed nights in province *i* and month *t*. γ is the intercept, whereas α_i represents fixed effects in province *i*. β_i is the corresponding coefficient on each independent variable, namely, Tourism Climate Index interacted by the tourism type of the province *i* ($TCI_{it}\ x\ TT_i$), real GDP in Turkish lira and CPI indices of each province i and month t (GDP_{it} and CPI_{it}), as well as the relative foreign GDP per capita ($GDP\_pc\_foreign_{it}$) and weighted foreign CPI ($CPI\_foreign_{it}$). Finally, we include a dummy variable (M_s) capturing the seasonal characteristic of the tourism demand and the COVID dummy variable capturing the effect of COVID-19 on tourism demand, covering the period from April 2020 to April 2021.

The error term ϵ_{it} for province *i* and month *t* is modeled as an autoregressive process to account for potential autocorrelation in the error terms:

$$\epsilon_{it} = \rho\epsilon_{i,t-1} + \vartheta_{it}$$

where ρ is the autocorrelation coefficient and ϑ_{it} is the white noise error term.

Results with the TCI

Our model points to a significant historical relationship between the tourism demand indicator, namely the bed nights and the Tourism Climate Index, as summarized under Table 1. 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 increasing climate comfort levels. 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. The reason for comparatively higher responsiveness of the Southern Coast could be explained with the dominance of sea and sand tourism in the region. Similarly, the Northern Coast, also characterized by the sea and sand tourism with increasing tourism shares during summer months, demonstrates a positive relationship between tourism demand and the climate conditions, though the elasticity (0.03) is much lower compared to the South Coast. Meanwhile the 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 tourism demand. The relative foreign real GDP per capita positively affects tourism demand, indicating the higher purchasing power of foreign tourists. On the other hand, the relative foreign CPI reports a 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[2].

Finally, 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) report 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.

We further checked whether the results change significantly if we exclude the CPI-related indicators (See Table 2). Accordingly, we found that inclusion of the CPI of the destination result in a statistically significant coefficient for Coastal North and slightly higher impact of climatic conditions on Coastal South, but overall, the significance, direction and magnitude of the coefficients remain robust.

Table 1. **THE REGRESSION RESULTS WITH THE TCI**

	Total Bed Nights
Coastal South x TCI	0.462***
	(21.16)
Coastal North x TCI	0.035**
	(2.37)
Mountains and Nature x TCI	−0.347***
	(-12.39)
Urban Mix x TCI	−0.011
	(− 1.30)
GDP	0.742***
	(15.33)
CPI	0.286***
	(7.46)
Relative Foreign GDP Per Capita	0.081***
	(15.54)
Relative Foreign CPI	−0.044***
	(− 6.65)
Spring	0.052**
	(2.55)
Summer	0.143***
	(7.95)
Winter	−0.094***
	(− 5.15)
COVID	−0.299***
	(− 6.27)

t statistics in parantheses.
$***\rho < 0.01, **\rho < 0.05, *\rho < 0.10,$

Source: BBVA Research calculations

2: The positive effect of CPI on tourism demand seems counter-intuitive as also discussed in Matei et. al (2023), indicating that the tourism demand is increasing when the price level in the tourism destination increases. 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. Thus, a depreciated 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.

Table 2. **THE REGRESSION RESULTS WITH DIFFERENT SET OF INDEPENDENT VARIABLES**

	Base Model	Model 1	Model 2	Model 3
Coastal South x TCI	0.462***	0.455***	0.462***	0.455***
	(21.16)	(21.03)	(21.07)	(20.91)
Coastal North x TCI	0.035**	0.024	0.034**	0.021
	(2.37)	(1.63)	(2.26)	(1.40)
Mountains and Nature x TCI	−0.347***	−0.374***	−0.347***	−0.378***
	(−12.39)	(−13.50)	(−12.39)	(−13.66)
Urban Mix x TCI	−0.011	−0.0254***	−0.011	−0.027***
	(−1.30)	(−2.94)	(−1.28)	(−3.07)
GDP	0.742***	1.064***	0.725***	1.070***
	(15.33)	(28.59)	(14.95)	(28.66)
CPI	0.286***		0.305***	
	(7.46)		(7.96)	
Relative Foreign GDP Per Capita	0.081***	0.0844***	0.0603***	0.055***
	(15.54)	(16.26)	(14.11)	(13.00)
Relative Foreign CPI	−0.044***	−0.0604***		
	(−6.65)	(−9.28)		
Spring	0.052**	0.0606**	0.0511**	0.059***
	(2.55)	(2.98)	(2.49)	(2.89)
Summer	0.143***	0.150***	0.143***	0.151***
	(7.95)	(8.36)	(7.90)	(8.33)
Winter	−0.094***	−0.088***	−0.093***	−0.086***
	(−5.15)	(−4.83)	(−5.09)	(-4.72)
COVID	−0.299***	−0.268***	−0.295***	−0.258***
	(−6.27)	(−5.94)	(−6.16)	(−5.68)

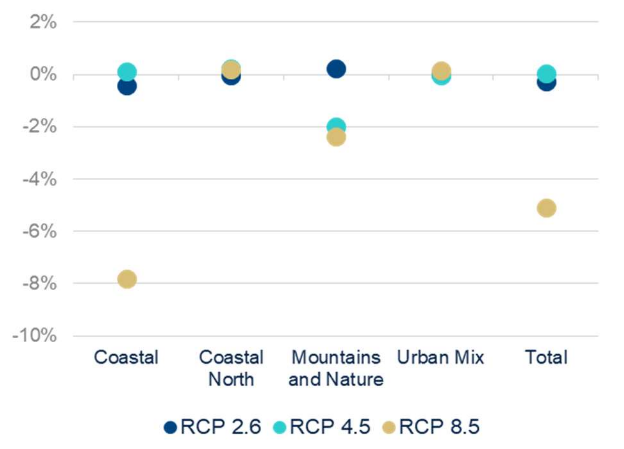
t statistics in parantheses.

$***\rho < 0.01, **\rho < 0.05, *\rho < 0.10,$

Source: BBVA Research calculations

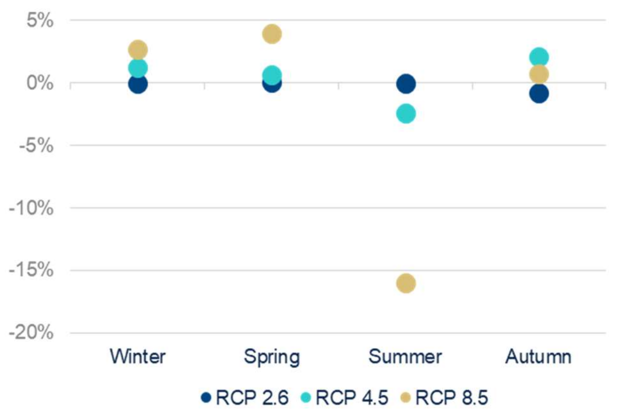
We projected the evolution of the tourism demand with the future values of TCI across the three different Representative Concentration Pathways (RCPs) described in the Data section, namely RCP 2.6, RCP 4.5 and RCP 8.5, which correspond to projected mean global temperature increases of 1.8°C, 2.8°C, and 4.8°C by 2100, respectively. Under the most severe scenario of RCP 8.5, the tourism demand in Türkiye is likely to experience a significant decline of 5.1% in the 2090s compared to the base period of 2024-2030, largely occurring in the southern coast of the country (Figure 6). The loss in tourism demand is observed in the summer period where the increasing temperatures hurt the climate comfort. On the other hand, we observe increasing tourism demand in winter, spring and autumn seasons, which confirms the shifting seasonality of tourism flows (Figure 7). Our findings were in line with Oğur & Baycan (2022) study which shows that the peak season shifts from summer toward winter and spring and that coastal tourism declines considerably.

Figure 6. **NET EFFECT ON TOURISM BY 2100 BY TYPE OF TOURISM UNDER DIFFERENT SCENARIOS***
(%, using as base 2024-2030)



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

Figure 7. **NET EFFECT ON TOURISM BY 2100 BY SEASONS UNDER DIFFERENT SCENARIOS***
(%, using as base 2024-2030)



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

Observing the changes in tourism demand at the provincial level across the different months of the year, the results by tourism types under the RCP 8.5 scenario could be summarized as follows:

- **South Coast provinces** exhibit the largest loss of tourism. The net decline in tourism demand is around 7.9% on average in this group of provinces, for the 2090's with respect to 2024-2030 period. Across provinces, Aydın experiences the largest decline with 16.5% on average in the same period. In terms of summer months, the highest decline in tourism demand is reported by Muğla in August with 35%.
- **The Coastal North provinces**, in general, reflect less favorable tourism conditions during summer, along with an increase in spring and autumn. In this respect, Coastal North demonstrates a similar picture as in Coastal South, though the tourism demand loss is much lower in magnitude. Decreasing tourism demand during summer months is compensated by the rest of the year, leading the mean net impact in Coastal North to be 0.2%, in the 2090's compared to 2024-2030. Albeit being small, this increase in tourism demand could be explained with higher comfort indexes and a substitution effect. Having beaches along the Black Sea, the region could attract some of the tourists preferring not to spend their vacation in Coastal South where the climate comfort declines considerably.
- **Mountain and Nature provinces** exhibit tourism demand loss during winter season. This could happen due to the possibility that climate change deteriorates the winter conditions needed for the ski season. Since the provinces classified under Mountains & Nature are known to receive more tourists during ski season, evident by their higher average tourist shares during winter months, their tourism is hurt by the higher temperatures during summer. For example, tourism demand in Erzurum and Kars decline by 9.3% and 9.6% respectively during winter, whereas the loss in summer period is much less with 5.9% and 6.0% respectively. Overall, the average net effect of climate change on Mountain and Nature provinces will be around -2.4% in the 2090's, compared to the 2024-2030 period.
- **Urban mix tourism cities** report differing impact with Central Anatolia experiencing slight decrease, whereas Southern Anatolia and Northwestern Anatolia (ie. Marmara Region) reporting a slight increase. Urban tourism may

have a substitution effect with beach tourism, making it less sensitive to weather conditions. Additionally, urban tourism typically involves more indoor activities, like the cultural attractions of İstanbul, Diyarbakır or Mardin, further reducing its sensitivity to weather. Still, the slight increase in tourism demand during the summer season is offset by a slight decline in the winter season, limiting the overall net effect to +0.1% in the 2090s.

The net effect under RCP 2.6 and RCP 4.5 scenarios are summarized in Appendix B. Scenario 2.6 reports very limited tourism loss in some of the Urban Mix and North Coast cities, while a couple of the South Coast and Mountain tourism cities gain tourism demand. Overall, the net loss at the national level is -0.3%. On the other hand, scenario 4.5 reports a slight and negligible tourism gain (+0.03% at the national level), caused by temperature increases that do not reach levels that are harmful enough to result in a considerable and widespread tourism loss in most of the provinces and months of the year, but they do improve the climate comfort in specific provinces. That is, under the RCP 4.5 scenario, the temperature rises result in increases in tourism demand (especially in Urban Mix and Southern Coast) which might, at least, compensate, the deterioration in other provinces.

As we discussed previously, given the relevance of foreign tourism flows in Türkiye, we ran the same regression with foreign tourists' bed nights data as the dependent variable. The model with foreign tourists' bed nights as the dependent variable remains robust, with most of the coefficients of the independent variables demonstrating similar values in the model with total bed nights as the dependent variable (see Table 3). Foreign tourists have slightly higher elasticity than the domestic ones to climate in coastal cities, and lower in mountain tourism cities. Meanwhile, the urban mix coefficient is higher for foreign tourists, indicating that foreigners' demand declines for urban tourism as the climate comfort declines, even though the tourism demand loss is not as high as in the Southern coast. This is partly due to the fact that foreign tourists usually prefer the summer season for vacation and tend to do less work-related tourism, which is not really affected by the weather.

Table 3. **THE REGRESSION RESULTS WITH THE TCI AND FOREIGN BED NIGHTS AS THE DEPENDENT VARIABLE**

	Total Bed Nights	Foreign Bed Nights
Coastal South x TCI	0.462***	0.481***
	(21.16)	(13.86)
Coastal North x TCI	0.035**	0.0901**
	(2.37)	(2.38)
Mountains and Nature x TCI	−0.347***	−0.288***
	(−12.39)	(−5.57)
Urban Mix x TCI	−0.011	0.067***
	(− 1.30)	(3.87)
GDP	0.742***	1.367***
	(15.33)	(14.11)
CPI	0.286***	−0.312***
	(7.46)	(−3.67)
Relative Foreign GDP Per Capita	0.081***	0.101***
	(15.54)	(7.47)
Relative Foreign CPI	−0.044***	−0.109***
	(−6.65)	(−6.43)
Spring	0.052**	0.079**
	(2.55)	(2.48)
Summer	0.143***	0.134***
	(7.95)	4.81
Winter	−0.094***	−0.174***
	(− 5.15)	(− 6.12)
COVID	−0.299***	−0.669***
	(− 6.27)	(− 8.30)

t statistics in parantheses.
$***\rho < 0.01, **\rho < 0.05, *\rho < 0.10,$

Source: BBVA Research calculations

Results with the HCI: An Alternative Climate Comfort Index

As described in the Data and Methodology sections, we also estimated the model with Holiday Climate Index (HCI), another widely used index to quantify climate comfort. The model with the HCI remains robust, with most variables showing similar impact as with TCI, except for some minor differences. First, the coefficient for Coastal South tourism has slightly decreased. Hence, compared to the model with the TCI, the impact of the worsening in climate conditions is less pronounced for the Southern coast. Furthermore, the model with HCI points to a higher decline in tourism demand in Mountain & Nature provinces in the case of increasing temperatures. On the other hand, the response of urban tourism is positive for the model with HCI versus a negative coefficient in the TCI specification, reflecting higher tourism demand in the case of a higher climate comfort index.

However, in statistical terms, the coefficients of the model cannot be considered different (see Figure 9), except for the Urban mix and Mountains and Nature coefficients, which turn out to be statistically significantly different. The coefficient for Urban mix differs due to the fact that HCI methodology assigns differing weights to the climate variables for urban and beach cities, in particular, the HCI Urban index gives less importance to temperature and higher to precipitation, and hence, could be better capturing the elasticity.

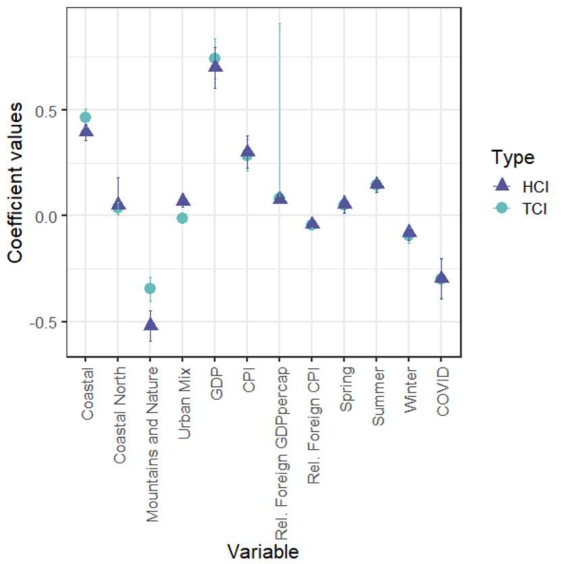
Table 4. **THE MODEL RESULTS WITH THE HCI VS. TCI**

	TCI	HCI
Coastal South x TCI	0.462***	0.395***
	(21.16)	(19.64)
Coastal North x TCI	0.035**	0.052**
	(2.37)	(3.02)
Mountains and Nature x TCI	−0.347***	−0.520***
	(− 12.39)	(− 13.90)
Urban Mix x TCI	−0.011	0.699***
	(− 1.30)	(5.19)
GDP	0.742***	0.701***
	(15.33)	(14.33)
CPI	0.286***	0.301***
	(7.46)	(7.79)
Relative Foreign GDP Per Capita	0.081***	0.784***
	(15.54)	(15.08)
Relative Foreign CPI	−0.044***	−0.414***
	(− 6.65)	(− 6.34)
Spring	0.052**	0.055*
	(2.55)	(2.68)
Summer	0.143***	0.148***
	(7.95)	(8.21)
Winter	−0.094***	−0.0797***
	(−5.15)	(− 4.33)
COVID	−0.299***	−0.297***
	(−6.27)	(− 6.18)

t statistics in parantheses.
***$\rho < 0.01$, $**\rho < 0.05$, $*\rho < 0.10$,

Source: BBVA Research calculations

Figure 9. **THE DIFFERENCE BETWEEN COEFFICIENTS WITH TCI AND HCI MODELS**

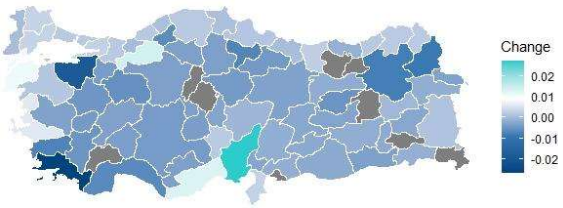


Source: BBVA Research calculations

Overall, the results with HCI proves to be a robustness check for TCI models. Since there does not exist a considerable difference across the two models in terms of statistical significance, the differences in the results are mainly due to how the reference climate scenarios (RCPs) are translated to the respective proxy, TCI or HCI, over the forecasted period (2022-2100). Since TCI and HCI use different classifications for climate variables, the future TCI and HCI values (and thus the demand projections) change accordingly. 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 (see Appendix C). Therefore, the HCI fails to penalize the upcoming temperature increases as much as TCI, in the case that the maximum temperatures reach very high levels. As a consequence, the overall net effect on tourism demand using the HCI is comparatively lower than that of the TCI model, with a less pronounced difference across provinces.

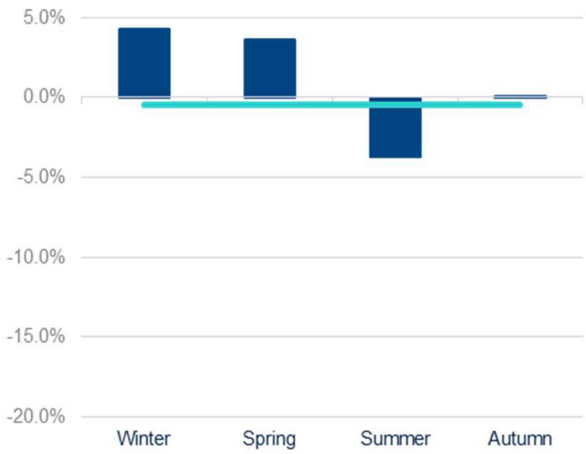
Under the HCI model, even in the scenario of RCP 8.5, the tourism demand in Türkiye is forecasted to experience only a slight decline of -0.4% in 2090s compared to the base period of 2024-2030, with moderate but widespread declines across provinces (Figure 10). Just as in the model with TCI, the loss in tourism demand is observed in the summer period though the magnitude of loss is much lower (Figure . The deseasonalization involves the shift towards winter and spring period, whereas the gain in autumn season is very limited. This limited impact might be happening due to September month showing similar climate patterns that is observed in summer. As a result, possible increases in October or November period are offset by the loss in September.

Figure 10. **NET EFFECT BY PROVINCE WITH HCI IN RCP8.5, 2091-2100*** (%, using as base 2024-2030)



Source: BBVA Research calculations
*Provinces highlighted in gray are excluded from the analysis due to lack of data availability

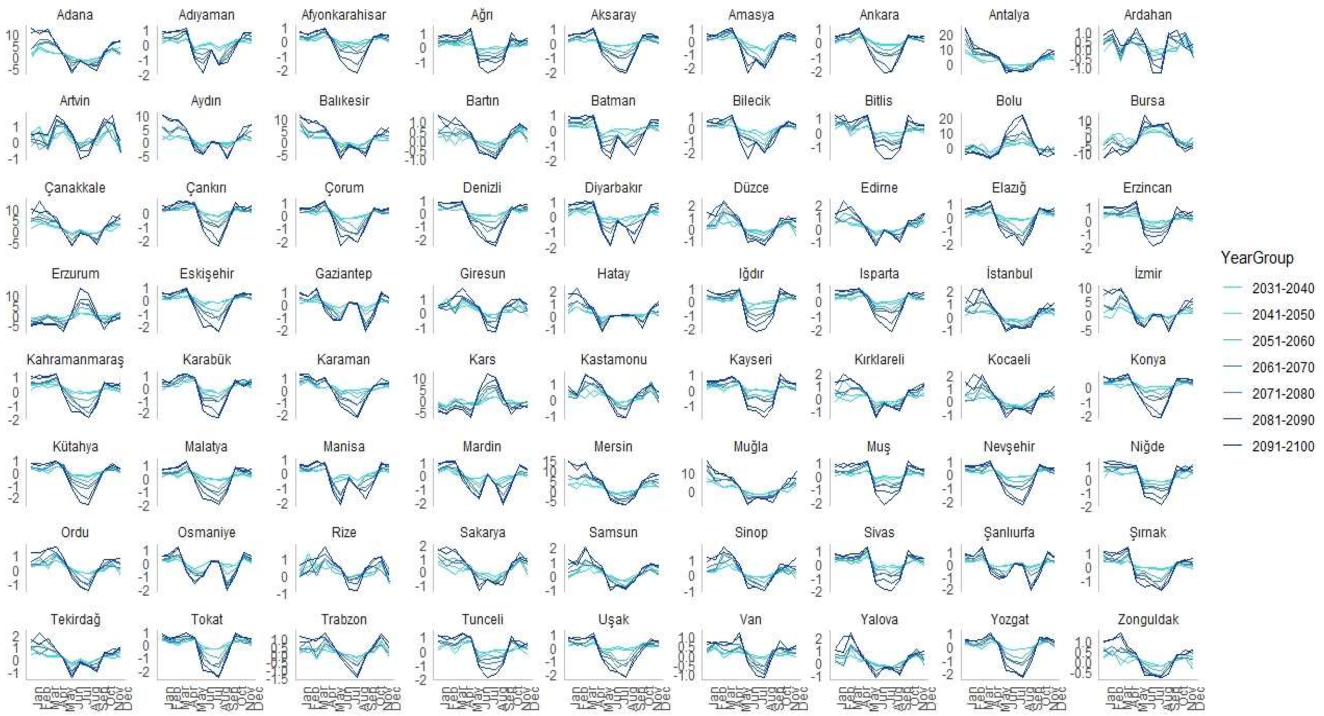
Figure 11. **NET EFFECT BY SEASON WITH HCI IN RCP8.5, 2091-2100** (%, using as base 2024-2030)



Source: BBVA Research calculations

Analyzing the results at the provincial level across the months of the year, the model with the HCI reduces the climate impact on beach tourism while making urban tourism more climate-sensitive. Still, the net effect across provinces is considerably less with the highest tourism loss being recorded in Muğla, with 2.6%, under RCP Scenario 8.5.

Figure 12. **CHANGE IN TOURISM DEMAND WITH HCI (%)** (using as base 2024-2030)



Source: BBVA Research calculations

Conclusion

Our study provides a comprehensive analysis of the present and future impact of climate comfort on the tourism demand in Turkish provinces, by utilizing the Tourism Climate Index (TCI) and the Holiday Climate Index (HCI), two different indicators of climate comfort commonly used in the literature.

Our findings confirm the robust relationship between climate conditions and the tourism demand, while pointing to significant provincial differences depending on the tourism type of each province. Accordingly, a future with rising global temperatures should mainly affect the Mediterranean coastal provinces characterized by sea and sand tourism. In these provinces where the tourism demand peaks during summer months, the tourism demand is projected to experience a decline in their appeal due to increasingly uncomfortable heat levels. Similarly, winter tourism should also be affected negatively by the increasing temperatures, since the conditions suitable for ski tourism also deteriorate.

The redistribution of tourism flows as a result of changing climate conditions could occur both in terms of geography and seasons. The tourism loss in the southern coast of the country could be limitedly compensated by the provinces located in the northern coast and urban areas, though the overall net effect points to a loss in tourism demand at the national level under the warmest scenario of RCP 8.5 (-5.1% in 2091-2100 compared to the base period of 2024-2030). Meanwhile, a clear deseasonalization of tourism demand is also observed in our results. We understand that climate change may extend the tourist season into the spring and autumn, as these periods become more climatically favorable compared to the increasingly extreme summer months. This shift should be studied more extensively by further research since it could have substantial economic implications, potentially reducing the negative net-effect and alleviating the traditional seasonal concentration of tourism demand and leading to more stable revenue streams throughout the year. From this perspective, the adaptation of the tourism-dependent regions to changing tourism seasons and trends is crucial, requiring investment in infrastructure, marketing, and services tailored to off-peak visitors.

Considering the differences in outcomes produced by the TCI and HCI indexes, the choice of the indicator representing the climate conditions is highly important. Differing weights and rankings for climate variables under two different methodologies lead to variations in the magnitude of projected impacts. The treatment of temperature differs between TCI and HCI, which leads to the overall net effect on tourism demand being comparatively lower under the HCI model than the TCI model. The divergence in results necessitates the selection of the appropriate climatic index depending on the specific characteristics of the province under study and the nature of tourism activities being analyzed.

In summary, climate change may have a substantial impact on tourism flows, threatening the conventional tourism destinations and seasons, while presenting opportunities for innovation and adaptation. Pointing to the possible changes in the quantity and quality of tourism flows is highly crucial to mitigate the disruptive impact of rising temperatures on the economy. Our research serves this purpose analyzing this impact within the focus on the tourism sector. However, a more comprehensive approach focusing on the possible strategies for designing economic policies addressing the adaptation and mitigation of climate impact in the tourism sector is needed as a further research avenue.

Appendix A

Figure A1. **HUMIDEX FORMULA**

$$H = T_{\text{air}} + 0.5555\left(6.11 \times \exp\left[5417.7530\left(\frac{1}{273.15} - \frac{1}{273.15 + T_{\text{dew}}}\right)\right] - 10\right)$$

Source: Barrutiabengoa et al. (2024)

Table A1. **TCI RATINGS FOR HUMIDEX, PRECIPITATION, CLOUD COVER AND WIND**

Rating	Humidex (ºC)
0	≥ 36
1	[35.0, 35.9)
2	[34.0, 34.9)
3	[33.0, 33.9)
4	[32.0, 32.9)
5	[31.0, 31.9)
6	[30.0, 30.9)
7	[29.0, 29.9)
8	[28.0, 28.9)
9	[27.0, 27.9)
10	[20.0, 26.9)
9	[19.0, 19.9)
8	[18.0, 18.9)
7	[17.0, 17.9)
6	[16.0, 16.9)
5	[10.0, 15.9)
4	[5.0, 9.9)
3	[0.0, 4.9)
2	(-5.9, -0.1]
0	(-10.9, -6.0]
-1	(-15.9, -11.0]
-2	(-20.9, -16.0]
-6	≤ -21

Rating	Precipitation (mm)
10	[0.0, 0.5)
9	[0.5, 1.0)
8	[1.0, 1.5)
7	[1.5, 2.0)
6	[2.0, 2.5)
5	[2.5, 3.0)
4	[3.0, 3.0)
3	[3.5, 4.0)
2	[4.0, 4.5)
1	[4.5, 5)
0	≥ 5

Rating	CC (%)
10	0.0-16.6
9	16.7-24.9
8	25.0-33.2
7	33.3-41.6
6	41.7-49.9
5	50.0-58.2
4	58.3-66.6
3	66.7-74.9
2	75.0-83.2
1	83.3-91.6
0	≥91.7

Rating ($\leq 23.9^oC$)	Rating ($24 - 32.9C$)	Rating ($\geq 32.9C$)	Wind (km/h)
10	4	4	≤ 2.88
9	5	3	2.89-5.75
8	6	2	5.76-9.03
7	8	1	9.04-12.23
6	10	0	12.24-19.79
5	8	0	19.80-24.29
4	6	0	24.30-28.79
3	4	0	28.80-38.51
0	0	0	≥ 38.52

Source: Barrutiabengoa et. al. (2024)

Table A2. **HCI_BEACH RATINGS FOR HUMIDEX, PRECIPITATION, CLOUD COVER AND WIND**

Rating	Temperature (°C)
-10	<10
-5	10 - 15
0	15 - 17
1	17 - 18
2	18 - 19
3	19 - 20
4	20 - 21
5	21 - 22
6	22 - 23
7	23 - 26
9	26 - 28
10	28 - 31
9	31 - 33
8	33 - 34
7	34 - 35
6	35 - 36
5	36 - 37
4	37 - 38
2	38 - 39
0	≥ 39

Rating	Precipitation (mm)
10	<0.01
9	0.01 - 3
8	3 - 6
6	6 - 9
4	9 - 12
0	12 - 25
-1	≥ 25

Rating	Wind Speed (m/s)
8	<0.6
10	0.6 - 10
9	10 - 20
8	20 - 30
6	30 - 40
3	40 - 50
0	50 - 70
-10	≥ 70

Rating	Cloud Cover (%)
8	<1
9	1 - 15
10	15 - 26
9	26 - 36
8	36 - 46
7	46 - 56
6	56 - 66
5	66 - 76
4	76 - 86
3	86 - 96
2	≥ 96

Source: Barrutiabengoa et. al. (2024)

Table A3. **HCI_URBAN RATINGS FOR HUMIDEX, PRECIPITATION, CLOUD COVER AND WIND**

Rating	Temperature (°C)
0	≥ 39
2	37 - 39
4	35 - 37
5	33 - 35
6	31 - 33
7	29 - 31
8	27 - 29
9	26 - 27
10	23 - 26
9	20 - 23
7	18 - 20
6	15 - 18
5	11 - 15
4	7 - 11
3	0 - 7
2	-6 - 0
1	≤ −6

Rating	Precipitation (mm)
10	<0.01
9	0.01 - 3
8	3 - 6
5	6 - 9
2	9 - 12
0	12 - 25
-1	≥ 25

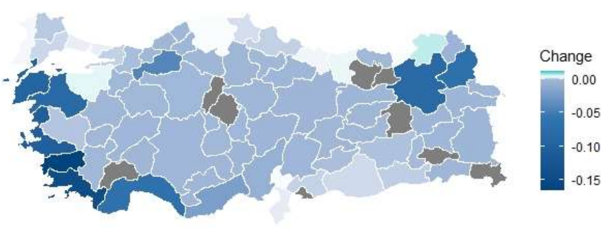
Rating	Wind Speed (m/s)
8	<0.02
10	0.02 - 10
9	10 - 20
8	20 - 30
6	30 - 40
3	40 - 50
0	50 - 70
-10	≥ 70

Rating	Cloud Cover (%)
8	<1
9	1 - 11
10	11 - 21
9	21 - 31
8	31 - 41
7	41 - 51
6	51 - 61
5	61 - 71
4	71 - 81
3	81 - 91
2	91 - 100
1	

Source: Barrutiabengoa et. al. (2024)

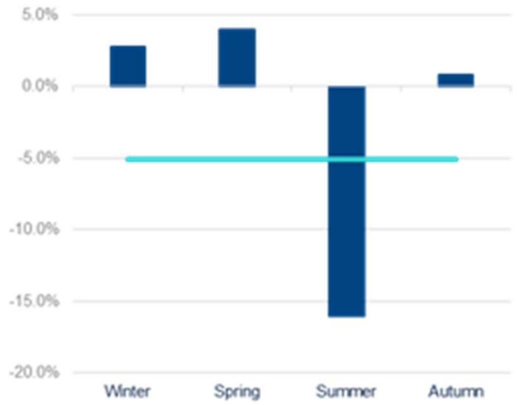
Appendix B

Figure B1. **NET EFFECT BY PROVINCE IN RCP8.5, 2091-2100*** (%, USING AS BASE 2024-2030)



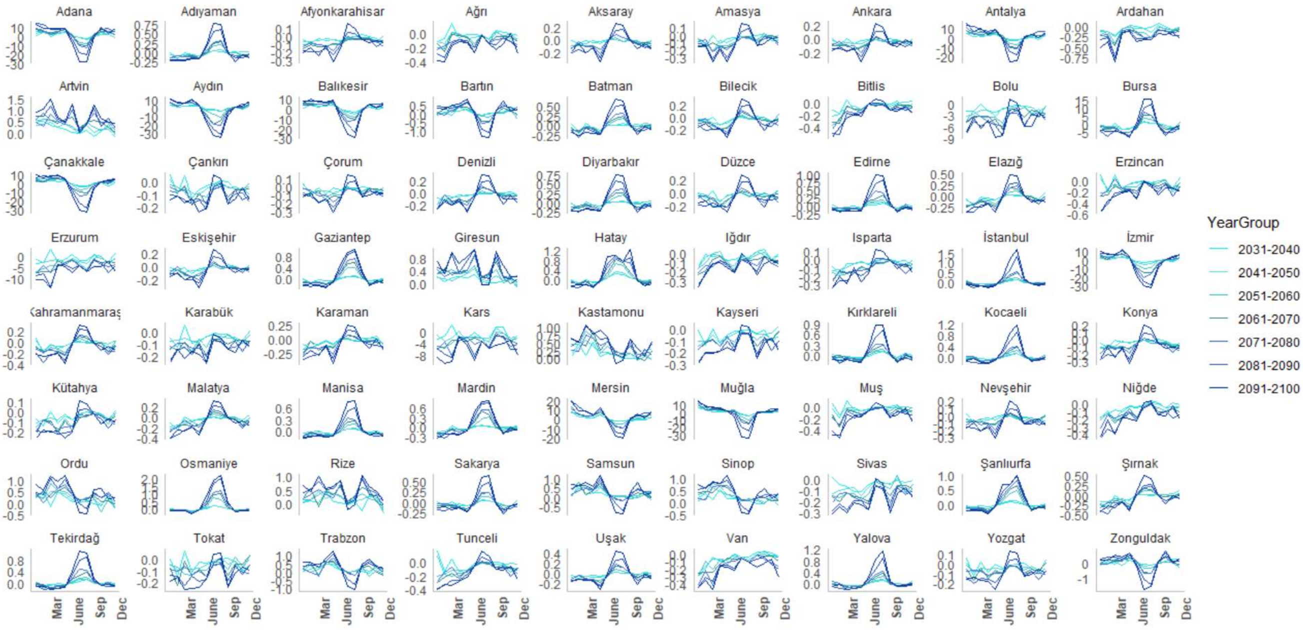
*Provinces highlighted in gray are excluded from the analysis due to lack of data availability
Source: BBVA Research calculations

Figure B2. **NET EFFECT BY SEASON IN RCP8.5, 2091-2100** (%, USING AS BASE 2024-2030)



Source: BBVA Research calculations

Figure B3. **CHANGE IN TOURISM DEMAND WITH TCI** (%,USING AS BASE 2024-2030)

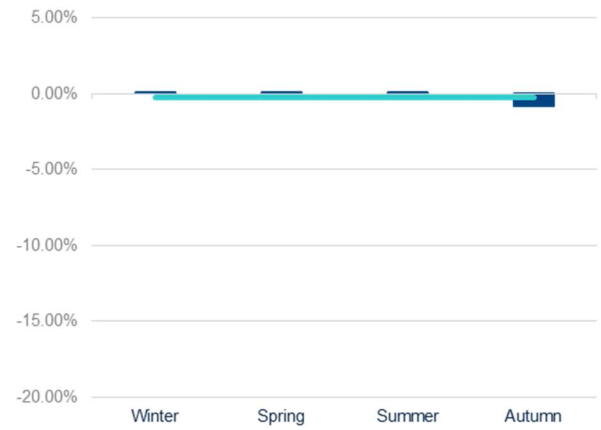


Source: BBVA Research calculations

Figure B4. **NET EFFECT BY PROVINCE IN RCP2.6, 2091-2100*** (%, USING AS BASE 2024-2030)

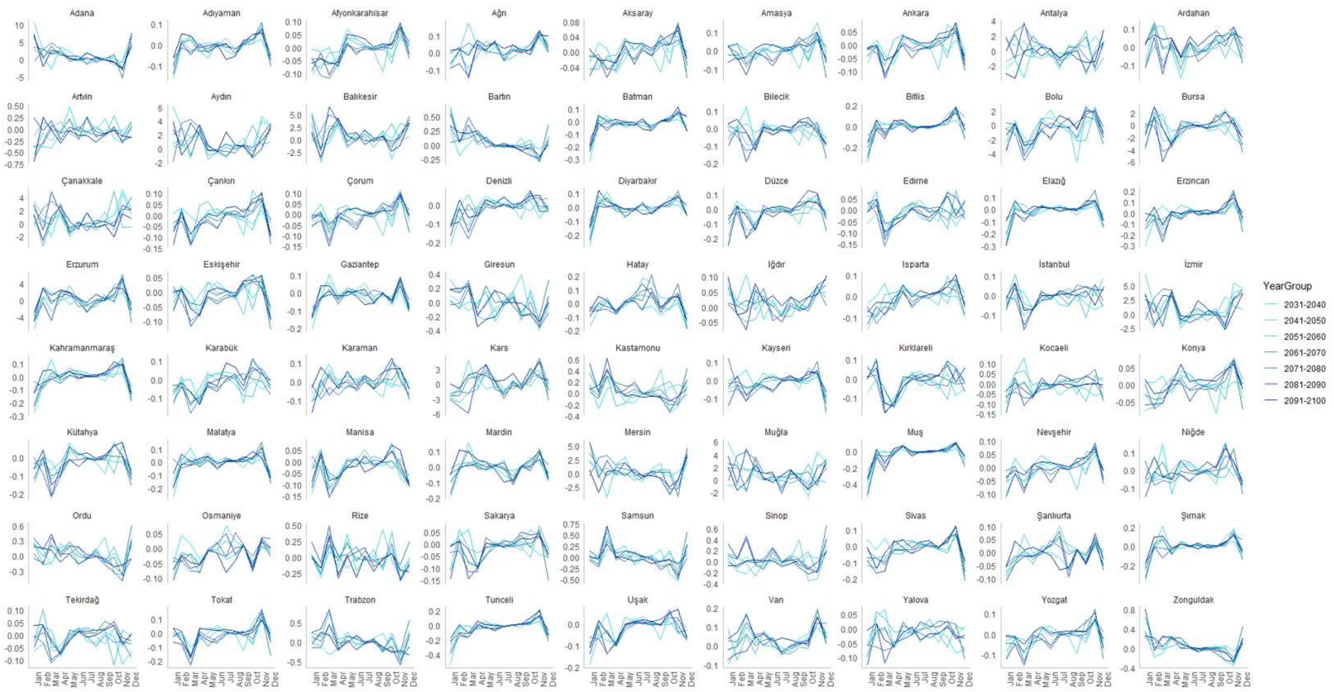
*Provinces highlighted in gray are excluded from the analysis due to lack of data availability
Source: BBVA Research calculations

Figure B5. **NET EFFECT BY SEASON IN RCP2.6, 2091-2100** (%, USING AS BASE 2024-2030)



Source: BBVA Research calculations

Figure B6. **CHANGE IN TOURISM DEMAND THROUGH DECADES IN RCP 2.6** (%, using as base 2024-2030)

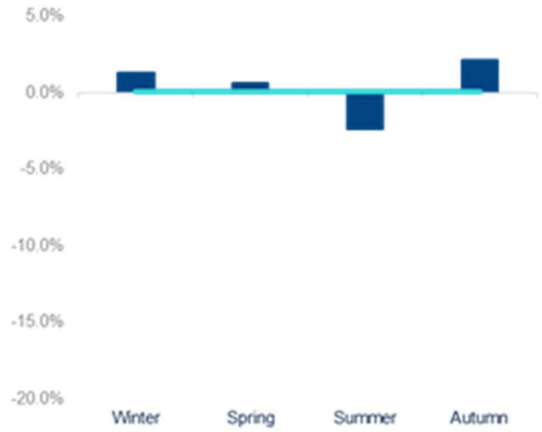


Source: BBVA Research calculations

Figure B7. **NET EFFECT BY PROVINCE IN RCP4.5, 2091-2100*** (%, USING AS BASE 2024-2030)

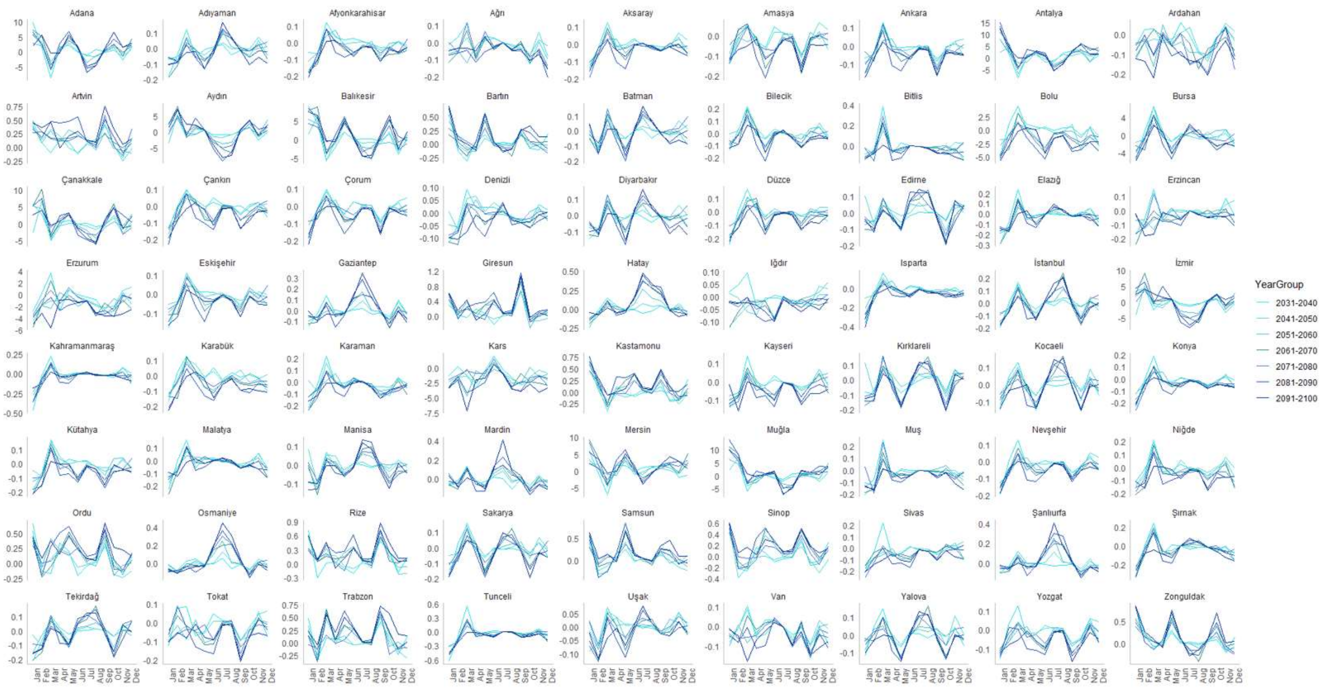
*Provinces highlighted in gray are excluded from the analysis due to lack of data availability
Source: BBVA Research calculations

Figure B8. **NET EFFECT BY SEASON IN RCP4.5, 2091-2100** (%, USING AS BASE 2024-2030)



Source: BBVA Research calculations

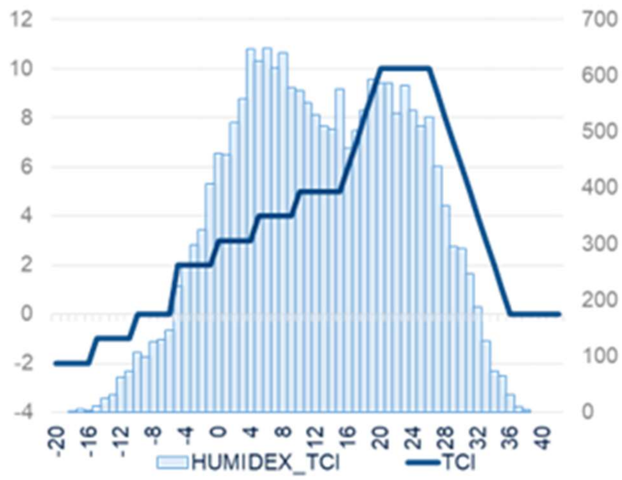
Figure B9. **CHANGE IN TOURISM DEMAND THROUGH DECADES IN RCP 4.5** (%, USING AS BASE 2024-2030)



Source: BBVA Research calculations

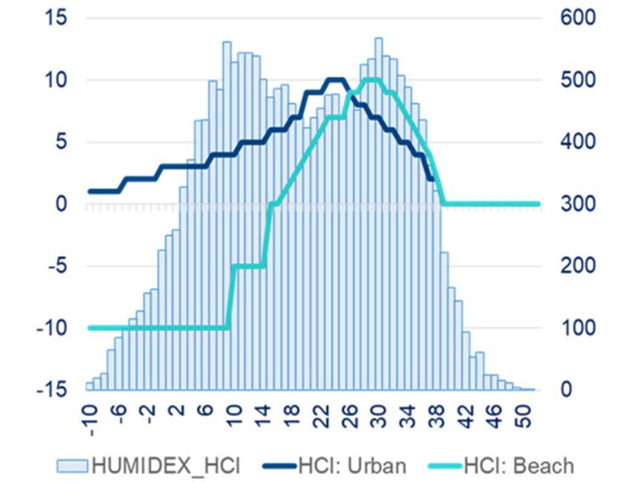
Appendix C

Figure C1. **HUMIDEX HISTORICAL DISTRIBUTION 1980-2023** (RIGHT-AXIS) **AND RATING** (LEFT-AXIS)



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

Figure C2. **HUMIDEX HISTORICAL DISTRIBUTION 1980-2023** (RIGHT-AXIS) **AND RATING** (LEFT-AXIS)



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

References

Agnew, M. D., & Palutikof, J. P. (2006). Impacts of short-term climate variability in the UK on demand for domestic and international tourism. Climate Research, 31(1), 109-120. https://www.int-res.com/abstracts/cr/v31/n1/p109-120/

Batista, F., Barranco, R., Proietti, P., Pigaiani, C., and Lavalle, C. (2021). A new European regional tourism typology based on hotel location patterns and geographical criteria. Annals of Tourism Research, 89:103077.

Bilgin, B., Acar, S., Demiralay, Z. et al. A synthetic approach to the Holiday Climate Index for the Mediterranean Coast of Türkiye. Int J Biometeorol 68, 1773–1787 (2024). https://doi.org/10.1007/s00484-024-02704-7

Burke, Marshall, W. Matthew Davis, and Noah S. Diffenbaugh. "Large potential reduction in economic damages under UN mitigation targets." Nature 557.7706 (2018): 549-553.

Dogru, Tarik, et al. "Climate change: Vulnerability and resilience of tourism and the entire economy." Tourism Management 72 (2019): 292-305.

Dingyi Chang, Naipeng Bu, Ning Zhang, Honggen Xiao, Climate change and tourism demand: Risks for extreme heat?,Heliyon,Volume 10, Issue 17,2024.

Gössling, S., Scott, D., Michael Hall, C., Ceron, J.-P., & Dubois, G. (2012). Consumer behaviour and demand response of tourists to climate change. Annals of Tourism Research, 39(1), 36–58. https://doi.org/10.1016/J.ANNALS.2011.11.002 Pergamon.

Hersbach, H., Bell, B., Berrisford, P., Biavati, G., Horányi, A., Muñoz Sabater, J., Nicolas, J., Peubey, C., Radu, R., Rozum, I., Schepers, D., Simmons, A., Soci, C., Dee, D., and Thépaut, J.-N. (2023). ERA5 hourly data on single levels from 1940 to present. Copernicus Climate Change Service (C3S) Climate Data Store (CDS). Accessed: April 2024.

J.M. Barrutiabengoa, G. Carta, N. González, D. Pérez, P. Más and G. Yücel. (2024). Climate change scenarios and the evolution of Spanish tourism. BBVA Research

Lemma, A. F. (2014). Tourism impacts: Evidence of impacts on employment, gender, income. Overseas Development Institute.

Lise, W., & Tol, R. S. (2002). Impact of climate on tourist demand. Climatic change, 55(4), 429-449.

Lourenço Dias Nunes, Paulo Augusto & Cai, Mattia & Ferrise, Roberto & Moriondo, Marco & Bindi, M.. (2013). An Econometric Analysis of Climate Change Impacts on Tourism Flows: An Empirical Evidence from the Region of Tuscany, Italy. International Journal of Ecological Economics and Statistics. 31. 1-20.

Mieczkowski, Z. (1985). The tourism climatic index: a method of evaluating world climates for tourism. Canadian Geographer/Le Géographe Canadien, 29(3):220–233.

Moore, Winston Ricardo. "The impact of climate change on Caribbean tourism demand." Current Issues in Tourism 13.5 (2010): 495-505.

Oğur, A. A. and Baycan, T. (2023). Assessing climate change impacts on tourism demand in Turkey. Environment, Development and Sustainability: A Multidisciplinary Approach to the Theory and Practice of Sustainable Development, 25(3):2905–2935.

Matei, Nicoleta Anca, et al. Regional impact of climate change on European tourism demand. Luxembourg: Publications Office of the European Union, 2023.

Scott, Daniel, et al. "An inter-comparison of the holiday climate index (HCI) and the tourism climate index (TCI) in Europe." Atmosphere 7.6 (2016): 80.

Scott, D. , & McBoyle, G. . (2001). Using a ‘tourism climate index’ to examine the implications of climate change for climate as a tourism resource. Meteorologischen Institut Universität Freiburg, 69-88.

Taylor, T. and Ortiz, R. A. (2009). Impacts of climate change on domestic tourism demand in the UK. Environmental and Resource Economics, 43:209–224.

Working papers

2024

24/14 **Joxe M. Barrutiabengoa, Giancarlo Carta, Nara González, Pilar Más, Diego Pérez, Gül Yücel:** The Impact of Climate Change on Tourism Demand in Türkiye.

24/13 **Clodomiro Ferreira, José Miguel Leiva, Galo Nuño, Álvaro Ortiz, Tomasa Rodrigo and Sirenia Vazquez:** The heterogeneous impact of inflation on households' balance sheets.

24/12 **Ángel de la Fuente:** La evolución de la financiación de las comunidades autónomas de régimen común, 2002-2022.

24/11 **J.M. Barrutiabengoa, G. Carta, N. González, D. Pérez, P. Más and G. Yücel:** Climate change scenarios and the evolution of Spanish tourism.

24/10 **Federico D. Forte:** Pronóstico de inflación de corto plazo en Argentina con modelos *Random Forest*.

24/09 **Ángel de la Fuente:** La liquidación de 2022 del sistema de financiación de las comunidades autónomas de régimen común.

24/08 **Prachi Mishra, Alvaro Ortiz, Tomasa Rodrigo, Antonio Spilimbergo, and Sirenia Vazquez:** E-commerce during Covid in Spain: One "Click" does not fit All.

24/07 **A. Castelló-Climent and R. Doménech:** Convergence in Human Capital and Income.

24/06 **J. Andrés, J.E. Boscá, R. Doménech and J. Ferri:** TheWelfare Effects of Degrowth as a Decarbonization Strategy.

24/05 **Ángel de la Fuente:** Las finanzas autonómicas en 2023 y entre 2003 y 2023.

24/04 **Ángel de la Fuente y Pep Ruiz:** Series largas de VAB y empleo regional por sectores, 1955-2022. Actualización de RegData-Sect hasta 2022.

24/03 **Ángel de la Fuente:** Series largas de algunos agregados económicos y demográficos regionales: Actualización de RegData hasta 2022.

24/02 **J. Andrés, E. Bandrés, R. Doménecha and M.D. Gadea:** SocialWelfare and Government Size.

24/01 **J. Andrés, J.E. Boscá, R. Doménech and J. Ferri:** Transitioning to net-zero: macroeconomic implications and welfare assessment.

2023

23/08 **Ángel de la Fuente y Rafael Doménech:** Renta per cápita y productividad en la OCDE de 1960 a 2022.

23/07 **Ángel de la Fuente:** La evolución de la financiación de las comunidades autónomas de régimen común, 2002-2021.

23/06 **Ángel de la Fuente:** La liquidación de 2021 del sistema de financiación de las comunidades autónomas de régimen común.

23/05 **Ángel de la Fuente:** Las finanzas autonómicas en 2022 y entre 2003 y 2022.

23/04 **J. Andrés, J.M. Barrutiabengoa, J. Cubero and R. Doménech:** Social Welfare and the Social Cost of Carbon.

23/03 **Ángel de la Fuente y Pep Ruiz Aguirre:** Series largas de VAB y empleo regional por sectores, 1955-2021.Actualización de RegData-Sect hasta 2021.

23/02 **Gergely Buda, Vasco M. Carvalho, Giancarlo Corsetti, João B. Duarte, Stephen Hansen, Afonso S. Moura, Álvaro Ortiz, Tomasa Rodrigo, José V. Rodríguez Mora, Guilherme Alves da Silva:** Short and Variable Lags.

23/01 **Ángel de la Fuente:** Series largas de algunos agregados económicos y demográficos regionales: actualización de RegData hasta 2021.

CLICK HERE TO ACCESS THE WORKING DOCUMENTS PUBLISHED IN

Spanish and English

BBVA Research

Creating Opportunities

DISCLAIMER

The present document does not constitute an “Investment Recommendation”, as defined in Regulation (EU) No 596/2014 of the European Parliament and of the Council of 16 April 2014 on market abuse (“MAR”). In particular, this document does not constitute “Investment Research” nor “Marketing Material”, for the purposes of article 36 of the Regulation (EU) 2017/565 of 25 April 2016 supplementing Directive 2014/65/EU of the European Parliament and of the Council as regards organisational requirements and operating conditions for investment firms and defined terms for the purposes of that Directive (MIFID II).

Readers should be aware that under no circumstances should they base their investment decisions on the information contained in this document. Those persons or entities offering investment products to these potential investors are legally required to provide the information needed for them to take an appropriate investment decision.

This document has been prepared by BBVA Research Department. It is provided for information purposes only and expresses data or opinions regarding the date of issue of the report, prepared by BBVA or obtained from or based on sources we consider to be reliable, and have not been independently verified by BBVA. Therefore, BBVA offers no warranty, either express or implicit, regarding its accuracy, integrity or correctness.

This document and its contents are subject to changes without prior notice depending on variables such as the economic context or market fluctuations. BBVA is not responsible for updating these contents or for giving notice of such changes.

BBVA accepts no liability for any loss, direct or indirect, that may result from the use of this document or its contents.

This document and its contents do not constitute an offer, invitation or solicitation to purchase, divest or enter into any interest in financial assets or instruments. Neither shall this document nor its contents form the basis of any contract, commitment or decision of any kind.

ENQUIRIES TO:
BBVA Research: Azul Street, 4. La Vela Building – 4th and 5th floor. 28050 Madrid (Spain).
Tel. +34 91 374 60 00 y +34 91 537 70 00 / Fax (+34) 91 374 25
www.bbvaresearch.com