European Tourism Patterns During Heat

From the Mediterranean to Sweden

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Degree project/Independent project • 15 credits
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Faculty of Natural Resources and Agricultural Sciences/Department of Economics
Political Science – Sustainable Development
Degree project/SLU, Department of Economics, 1614 • ISSN 1401-4084
Uppsala 2024

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Supervisor: **Jonathan Stråle, SLU, Department of Economics**
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Credits: 15 credits
Level: Bachelor's level, G2E
Course title: Independent project in Economics
Course code: EX0903
Programme/education: Political Science – Sustainable Development
Course coordinating dept: Institutionen för ekonomi
Place of publication: Uppsala
Year of publication: 2024
Title of series: Degree project/SLU, Department of Economics
Part number: 1614
ISSN: 1401-4084

Keywords: Tourism, Heat, Economics

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Faculty of Natural Resources and Agricultural Sciences
Department of Economics

Abstract

This study aims to examine whether people from the Mediterranean travel to Sweden to escape the heat. A panel data model was employed, analyzing flight patterns and tourism behavior using data from multiple sources showing a significant correlation between high temperatures in the Mediterranean and increased travel to cooler northern European countries. Unlike previous research that focused on bed nights, this study uses flight patterns as the dependent variable, providing new insights into the impact of climate on tourism. These findings suggest that rising temperatures may influence travel behavior, highlighting the need for adaptive strategies in the tourism sector.

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Abbreviations

CDD	Cooling Degree days
Med To Swe	Flight passengers from the mediterranean to Sweden
HICP	Harmonized Index of Consumer Prices

1. Introduction

The European Mediterranean countries have long been the preferred tourism destinations in the world (Perry, 2000), but that may change due to continuously rising temperatures. Papers such as those by the Anca Matei et al. (2023) and Bigano et al. (2006) predict that northern European countries with cooler climates will experience an increase in tourism due to climate change. This thesis aims to determine whether this effect is observable. Specifically, it investigates whether there is a trend of people from the European Mediterranean countries vacationing in Sweden to escape the heat. Understanding this trend is crucial for future tourism planning and for ensuring that Sweden can effectively manage a potential increase in tourists.

Answering this research question about the correlation between tourism in Sweden and heat in Mediterranean countries like Greece, Spain, France, Italy, and Portugal can help guide policymakers and key players in the tourism sector. This is crucial for maintaining Sweden’s status as the world's most sustainable tourism destination, according to Bremner (2022). Although Sweden is less popular than the Mediterranean as a tourist destination (Perry, 2000), it could face similar problems, such as overtourism. Choosing Sweden for this study is strategic because it is already recognized for its sustainable practices, making it a model for how to handle increased tourism in an environmentally responsible manner.

Overtourism occurs when an excessive number of tourists overwhelm a destination, leading to negative impacts such as rising living costs and housing prices for locals, and straining water supplies and waste management systems (Dodds and Butler, 2019). The tourism sector has seen significant growth over the past decades, driven by technological advancements and global economic expansion. This trend of cheap and effective travel is expected to continue, with

people seeking new destinations. If tourists from the Mediterranean travel to Sweden to escape the heat, it is time to prepare for the threat of overtourism. According to Milano, Cheer, and Novelli (2018), overtourism can take various forms. In Europe, the international cruise industry significantly contributes to the problem, bringing thousands of passengers daily and causing visible and physical pollution. Local residents often bear the brunt of tourism, facing reduced housing affordability and the displacement of local businesses by tourism-centric enterprises like souvenir shops, clubs, and bars. This leads to overcrowded areas and increased pressure on waste management systems. However, the appeal of a cooler destination is understandable given the effects of warm weather. Addressing these issues in Sweden could provide a blueprint for other destinations facing similar challenges.

Rising temperatures increase the risks of negative health effects for humans, animals, and plants. For humans and animals, extreme heat can cause dehydration and heatstroke, which is especially harmful to children and the elderly (Koppe et al., 2004). High temperatures can also reduce crop yields, which can be detrimental to poor areas (Zhu, Fonseca De Lima, and De Smet, 2021). Rising temperatures particularly affect warm areas. According to Wallemacq and House (2018), average surface temperatures have risen by 0.2 degrees Celsius since 1982. Heatwaves have caused over 166,000 deaths between 1998 and 2017, and 125 million more people were exposed to heatwaves between 2000 and 2016. Yet tourists continue to seek warm destinations each year, raising the question of whether some places can become too hot for tourism. Research by Rutty and Scott (2010) finds that some places in Europe have already exceeded the threshold of comfortable temperatures, while other popular tourism destinations will do so during this century. This indicates that a shift in tourism from the warm climates of the south to the cooler climates of the north, such as Sweden, is feasible.

Previous studies on tourism and climate change have focused heavily on the Mediterranean, with limited research on Sweden. Studies about Sweden typically discuss its winter tourism (Demiroglu et al., 2020). In contrast, the Mediterranean is well-represented in research on climate change and tourism. Papers by Perry

(2000) and Hamilton (2004) highlight the region's appeal and predict shifts in tourist flows due to global warming. Studies by Magnan et al. (2009), Anca Matei et al. (2023) Batista e Silva et al. (2018), and Binago et al. (2005) support these findings, noting significant economic impacts. However, these papers face limitations. This study fills a critical gap by focusing on Sweden's summer tourism potential, offering insights that could diversify its tourism appeal beyond winter sports and activities.

Studies that try to answer similar questions, such as those by the Anca Matei et al. (2023), Bigano et al. (2006), Barrios and Ibanez (2014), and Hamilton (2004), use the dependent variable "bed nights," which measures nights stayed at any tourism accommodation. This variable captures domestic tourism but does not track where the tourists come from. This paper uses a more appropriate approach by analyzing flight records, providing information about flight patterns from the European Mediterranean countries to Sweden. The flight records data, referred to in this paper as "Flight Passengers Mediterranean to Sweden", will serve as the dependent variable. "Cooling Degree Days", indicating days with "uncomfortable heat," will be used as the explanatory variable. The relation between flight records and "uncomfortable" heat will provide insights into tourism patterns during hot weather. Using flight records allows for more precise tracking of international tourist flows, providing clearer insights into the impact of climate change on tourism patterns.

The method used in this paper is a panel data approach, using flight records from the European Mediterranean countries to Sweden as the dependent variable, and Cooling Degree Days as an indicator of uncomfortable outside temperatures. This method provides a more accurate analysis of travel patterns than previous research, offering a unique contribution to understanding the impacts of climate change on Swedish tourism. This information can then be used to proactively maintain a sustainable tourism sector in Sweden. By adopting this methodological approach, the study ensures robust and reliable results, supporting strategic planning and policy-making in Swedish tourism.

This paper is organized as follows: Section 2 provides a more extensive investigation of previous research. Section 3.1 presents the data and descriptive statistics. Section 3.2 explains the method used to answer the research question. Section 4 showcases the results. Section 5 discusses the results and sensitivities. Section 6 concludes.

2. Previous Research

Previous research highlights the importance of tourism in the Mediterranean as a crucial economic factor, while also emphasizing the serious threat posed by climate change. Perry (2000) notes that although the Mediterranean has long been a preferred tourist destination, this trend may not continue due to the impacts of climate change. Similarly, Hamilton (2004) explores preferred tourism destinations for German tourists and finds that the Mediterranean is favored due to its pleasant climate. The author's predictions for a global warming scenario of 2 degrees Celsius suggest that warmer destinations would experience a decline in visitors, whereas cooler destinations would see an increase. This aligns with findings from Magnan et al. (2009), Anca Matei et al. (2023) Batista e Silva et al. (2018), and Bigano et al. (2005).

Research on the economic impacts of tourism, such as that by Bigano et al. (2006), indicates that the economic impact of lost tourism flows due to climate change would be greater than the effect of rising sea levels. This is comparable to conclusions drawn by Du et al. (2018) and Cai et al. (2011), who examined the economic impacts of climate change on Greece, Spain, Turkey, and Tuscany, Italy. Although there is extensive research on the Mediterranean and tourism, the effects of climate change on tourism in Sweden have primarily focused on winter tourism (Demiroglu et al., 2020), leaving the Swedish summer tourism underexplored. If the projections are correct and there is going to be an increase in summer tourism in Sweden then it is important to investigate.

Regarding the research model used in similar studies, this paper differentiates itself in two key ways. First, this paper won't include predictions instead it will focus on the change that has occurred from 2005 until 2018. Predictions are

interesting to read but it is hard to make good predictions especially when dealing with human behavior such as travel patterns. Additionally, there are still uncertainties regarding the extent of climate change effects and it can be worse than anticipated (Watson, 2007). Second, previous research, such as Anca Matei et al. (2023) Batista e Silva et al. (2018) and Barrios and Ibanez (2014), uses bednights as the explaining variable, causing them to miss out on same-day visitors since bednights only include overnights stays. Another effect of using bednight as a dependent variable is that you can not track the tourism pattern since you do not know the country of origin. A third effect is that bednights catch domestic tourism.

3. Data and Method

3.1 Data

3.1.1 Rationale

This study focuses on data collected from Greece, Spain, France, Italy, and Portugal referred to as the European Mediterranean countries as well as Sweden, covering the period from 2005 to 2018. The data is limited to the months from May to September each year, as we are specifically examining the effects of summer tourism, making the winter months irrelevant to this research.

The control variables *Real GDP per Capita*, *Currency* and *Price index Aviation are* included in similar research such as Anca Matei et al. (2023)

Due to limitations in the datasets provided by Eurostat, the study excludes the Balkans and the island nations of Malta and Cyprus, even though they are geographically part of the European Mediterranean. The dataset starts in 2005 because earlier data is not available, and it ends in 2018 to avoid the irregularities in travel patterns caused by the pandemic years.

3.1.2 Mediterranean to Sweden

The first data set is the flight records from the European Mediterranean countries to Sweden. In this data set one can choose one or several countries of origin and a destination country. The dataset then counts up all of the flights bound to the destination country from all of the airports in the selected country or countries of

origin. One does not know who is boarding the plane the only information is about the number of passengers headed to the destination country. This dataset is gathered from Eurostat. The dataset includes records of all the passengers, counting one by one, for each month going from one country to another by plane in the EU. This dataset includes some missing values, however, these missing values are few thus not causing any problems with the research. This dataset is used to create the dependent variable called *Mediterranean to Sweden.*

3.1.3 Cooling Degree days

The second dataset is *Cooling Degree Days* also gathered from Eurostat. This variable serves as the explanatory variable in this research as it measures "uncomfortable heat". *Cooling Degree Days* is a measurement used to quantify the demand for cooling in buildings. This is done by comparing the outside temperature to a base temperature set at 24 degrees. The value of the CDD index is determined by two criteria. The first is that the outside temperature must be above or equal to 24 degrees, once that condition is met, the second part is to subtract the measured outside temperature to 21 degrees. meaning that if the outside temperature is 24 degrees, the first condition is met and the value of CDD is set at 3. If the outside temperature is 23 then CDD is equal to zero. See the equation below for the full formula. The dataset consists of a summation of all days with an outside temperature above 24 degrees Celsius for each month. CDD is a better explanatory variable for measuring heat than average surface temperature because CDD illustrates a summation of "uncomfortable" heat. The average surface temperature does not directly capture the especially warm days but only the average.

$$if\ T_m \geq 24\ Then \left[CDD = \sum_i T_m^i - 21℃ \right] Else\ [CDD = 0]$$

3.1.4 Price Index Aviation

The third dataset is *Price Index Aviation* gathered from Eurostat containing a harmonized index of consumer prices, which is an indicator of how expensive a certain good becomes over time. The collected data is HICP monthly index over passenger transport by air, meaning an indication of how expensive it is to take the plane. The index uses 2005 as the starting measuring point, which is when the data for this research begin. This data was used to create the variable *Price Index Aviation* covering data for the HICP for passenger transport by air for the Mediterranean countries. It was included to control the effect of people traveling because of cheap plane tickets.

3.1.5 Currency and Real GDP Per Capita

The fourth dataset *Currency* is included to examine how the value of the Swedish krona (SEK) against the Euro influences travel incentives to Sweden. This data, collected from Eurostat, shows the exchange rate of one euro in SEK, helping us understand if a weaker krona encourages more tourism from eurozone countries.

The fifth dataset is Real GDP per Capita, also gathered from Eurostat. Although this data is measured yearly, unlike the other datasets, it is included for two reasons. First, it is essential to account for increases in wealth, as people are more likely to travel if they become richer. Second, while Real GDP per Capita doesn't change significantly from month to month, it can vary over the longer period from 2005 to 2018, making it relevant for our study.

3.1.6 Summary Statistics

Tabell 1. Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Mediterranean to Sweden	350	59 108 .79	41 071 .53	4892	222 133
Cooling Degree Days	350	41.44917	41.63161	0	182.49
Real GDP per Capita	350	23 498 .14	5389.239	16 050	32 800
Price Index Aviation	350	125.3016	23.84087	90.3	207.21
Currency	350	9.333911	0.5827823	8.2805	11.1767

The table above summarizes the key statistics for the dependent, main, and control variables, providing an overview of their magnitudes.

At the top of the table is the dependent variable, "Mediterranean to Sweden," which represents the number of passengers flying from Mediterranean countries to Sweden. The number of passengers is substantial but varies widely, indicating that Sweden is a more popular destination for tourists from some countries than others.

The explanatory variable, "Cooling Degree Days," also shows significant variation, ranging from 0 to 183.49. This means that in some months between April and September, certain regions in Italy, Spain, Greece, France, and Portugal had no days with temperatures above 24 degrees Celsius, while other regions had many such days.

"Real GDP Per Capita" ranges from 16,050 to 32,800 euros, reflecting the different average yearly incomes in the countries studied. The lowest GDP per capita is in Portugal, while the highest is in France. This variable changes little

from year to year but is included to account for differences in wealth among the countries.

The "Price Index Aviation" is based on flight prices from 2005. The lowest index value of 90.3 indicates that flight prices were 9.7% lower than in 2005, while the highest value of 207.21 indicates that flight prices were 107.21% higher than in 2005.

The "Currency" variable shows the exchange rate of one euro in Swedish kronor, ranging from 8.2805 to 11.1767.

3.2 Method

To examine whether people from the Mediterranean fly to Sweden in order to escape the heat, a panel data model is employed. A panel data method is prevalent in other similar research such as Magnan et al. (2009), Anca Matei et al. (2023) Batista e Silva et al. (2018) Binago et al. (2005) and Li, Song and Li (2017).

$$Med\ To\ Swe_{cm} = \beta_0 + \beta_1 CDD_{cm} + \boldsymbol{\upsilon X}_{cm} + \gamma_y + \delta_m + \mu_c + \varepsilon_{cm}$$

The equation above uses *Flight Passengers Mediterranean to Sweden (Med To Swe)* as a dependent variable, which is all the passengers flying from the Mediterranean countries Italy, Spain, Greece, France and Portugal. β_0 serves as the intercept given that everything else is held constant. ~~β_1~~CDD_{cm} is the explanatory variable and is measured for each country, month and year. ~~β_2~~$\boldsymbol{X}_{cm}$ is a vector containing all the control variables *Real GDP Per Capita, Currency* and *Price Index Aviation.* γ_y is year fixed effects, δ_m is monthly dummies and μ_c is country fixed effects.

The reason behind including *Real GDP Per Capita* is to control people traveling to Sweden simply because they have more money to do so. The same rationale is behind the inclusion of *Currency* and *Price Index Aviation,* they are included to

control flight ticket prices, if flights are getting more expensive then fewer people would travel to Sweden and fewer Swedes would travel to the Mediterranean. The same motivation is behind *Currency*, if the Swedish Krona gets weaker (resulting in more SEK per EURO) then people from the Mediterranean would have more to spend, whilst Swedish people would have less to spend in the Mediterranean countries.

In addition to the control variables year fixed effects and country fixed effects are included. To control for all unobservable variation between countries and years, respectively. Additionally, monthly dummies are incorporated to control for seasonal variations between months.

4. Results

Tabell 2. Regression results

VARIABLES	(1) Flight Passengers Mediterranean To Sweden	(2) Flight Passengers Mediterranean To Sweden	(3) Flight Passengers Mediterranean To Sweden	(4) Flight Passengers Mediterranean To Sweden
Cooling Degree Days	132.8**	134.2**	127.4***	130.3***
	(34.58)	(35.20)	(25.89)	(25.64)
Real GDP Per Capita		-1.439	-2.066	-6.512**
		(3.399)	(2.665)	(1.625)
Price Index Aviation			-121.5	-63.88
			(215.3)	(145.7)
Currency				-27,152*
				(11,164)
Constant	30,523**	64,826	90,793	445,582**
	(10,698)	(90,216)	(64,108)	(127,717)
Observations	350	350	350	350
R-squared	0.525	0.529	0.534	0.692
Number of countries	5	5	5	5
Country FEs	YES	YES	YES	YES
Year FEs	YES	YES	YES	YES
Monthly Dummies	YES	YES	YES	YES

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The results from the panel data regression reveal the correlation between *Cooling Degree Days* on *Flight Passengers Mediterranean to Sweden*. The table above includes four different model specifications. Each model introduces a new control variable, to see whether the estimations of the main variable of interest change. The estimates of the explanatory variable *Cooling Degree Days* does not change

significantly when introduced to new control variables indicating that the results are fairly reliable.

Model (4) is the initial model planned for this research including all control variables. Since Model (4) yields both a significance level of 1% for the coefficient of interest as well as maintaining a stable *Cooling Degree Days* value. Model (4) is going to be used for interpretation.

Assuming a causal interpretation of *Cooling Degree Days* is that if all other variables are held constant and there is one unit increase in *Cooling Degree Days* would lead to 130,3 more *Flight Passengers Mediterranean to Sweden.* The *Real GDP Per Capita* variable indicates that an increase of one euro in annual income would lead to 6,512 fewer *Flight Passengers Mediterranean to Sweden. Price Index Aviation* yields negative 63,88 and can be interpreted as 63,88 fewer people travel once flight tickets increase by one index unit. Lastly, *Currency* consists of the amount of Swedish Kronor to Euros. Interpreted as, once the Krona is increasing one unit the Euro is more expensive to Swedish people but the Krona is cheaper for the Mediterranean countries. The potential threats to causal interpretations of the estimated model will be discussed in the next section.

5. Discussion

A deeper interpretation of the results from the panel data regression would tell us that since *Cooling Degree Days* range from 0 to 182.49 and each unit of increase yields according to the estimate 130.3 *Flight Passengers Mediterranean to Sweden*, which at first may seem small but since *Cooling Degree Days* are counted through two criteria the estimate is actually rather large. For instance, if it's 24 degrees outside CDD would yield it's lowest value of 3, that times 130 is 390 passengers from the Mediterranean to Sweden. The mean of CDD is rounded to 41.5, according to the estimate that would result in 5407 passengers from the Mediterranean to Sweden. Which is higher than the lowest value of tourists from the Mediterranean to Sweden in the dataset.

Currency yields an estimate of negative 27 152, indicating that once the euro is more expensive for Swedish people then 27 152 fewer persons travel to Sweden from the Mediterranean countries. This result is unexpected because one could think that more people would travel to Sweden if the Swedish *Currency* is weak. One possible explanation is that the *Currency* variable controls the Swedish people who decide not to go to the Mediterranean because their *Currency* is weak and thus not traveling back to Sweden or there could be another macroeconomic force at play. Another unexpected result is *Real GDP Per Capita* Which is also negative, meaning that for every Euro increase in *Real GDP Per Capita*, 6,512 fewer people travel to Sweden. One interpretation could be that the travelers value other tourism destinations above Sweden. Once they are getting richer they choose other places to vacation. Another explanation could be that Mediterranean inhabitants can afford air conditioning thus avoiding the need to travel to a cooler climate.

The results in *Table 2: Regression Results* are to some extent congenial with claims made by Magnan et al. (2009), Anca Matei et al. (2023), Batista e Silva et al. (2018), and Binago et al. (2005) regarding their predictions of tourism during different heating scenarios. If it is warm then people will not vacation in already hot countries, instead, they will seek cooler climates such as those in the northern European countries. However a separator is that this paper shows that there has been a correlation between heat in the Mediterranean and travels to Sweden for at least 14 years, while similar research states that the trend is something to be expected in the future. Furthermore similar research does not isolate a regional travel pattern. The closest is the paper by Hamilton (2006) that investigates the preferred tourism destinations for German tourists. This paper instead focuses on Sweden which has not been explored in the sense of a summer tourism destination before nor explored togheter with the Mediterranean.

The results of this paper add to the knowledge of heat and tourism. Providing information about the tourism patterns between the Mediterranean and Sweden during warm temperatures in the Mediterranean. The positive correlation could be used by the Swedish Tourism Sector as an indicator that heat in the Mediterranean correlates with an increase in travel to Sweden. This information could then be used to work proactively to avoid the outfalls of overtourism and other negative effects of tourism. Investments in sustainable forms of tourism are recommended.

This paper faces challenges in claiming causality due to limitations in the research. The main limitation is that the flight records data does not provide information about who is who. Meaning that people could travel for any other reason than escaping the heat. For example, people may travel primarily because it is summer, fitting with their vacation time or their children's school holidays. Additionally, the data on flight passengers from the Mediterranean to Sweden also include Swedish residents returning from their Mediterranean vacations. This could explain the surprising result of the negative *Currency* variable, indicating

fewer Mediterranean people travel to Sweden when the Swedish Krona is cheap. A part of the effect could also contain the effect of Swedish people deciding not to travel to the Mediterranean since it's too hot there. Another limitation is the inability to determine the intentions of the passengers travels, whether they are traveling to Sweden to escape the heat or if it is for business purposes, or to visit family. However as this paper is trying to inform the Swedish tourism sector, a positive correlation between passengers from the Mediterranean to Sweden during warm periods might suffice, since it indicates that there is an increase in people traveling to Sweden when it is warm in the Mediterranean.

Due to the limitations of this paper, further studies should find a way to isolate people from warm countries traveling to cooler ones and ask them why they are traveling to cooler countries. That would ensure clean data with which one would have a stronger causality claim between heat in one's own country and vacationing in a cooler climate.

6. Conclusion

This thesis explores the impact of rising temperatures in the European Mediterranean countries on tourism patterns, focusing on increased travel to Sweden. Using panel data regression, the study finds a significant relationship between higher temperatures in the Mediterranean and increased travel to Sweden. Each unit increase in Cooling Degree Days (CDD) correlates with an additional 130.3 passengers. For instance, a mean CDD of 41.5 corresponds to approximately 5407 passengers, highlighting the influence of heat on tourism flows.

For the Swedish tourism sector, understanding this correlation is important. It can help policymakers and industry stakeholders address potential challenges, such as overtourism, by investing in sustainable tourism infrastructure to mitigate negative impacts on local resources and services.

Despite its contributions, the study faces limitations. The flight records data does not specify travelers' reasons for travel, complicating the establishment of definitive causality. Factors such as seasonal vacation timing, family visits, and business travel could also influence observed patterns.

Future research should aim to better isolate travelers' motives, possibly through direct surveys, to strengthen the causal link between heat and tourism patterns. This would provide clearer insights and more robust data on climate-driven tourism dynamics.

This thesis highlights the significant impact of rising Mediterranean temperatures on travel to Sweden. These insights can inform proactive measures to sustain and develop Sweden's tourism sector in a changing climate.

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