

## **The Potential Economic Impact of Climate Change on the Greek Tourism Sector**

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### **Abstract**

*In this paper we assess the potential economic impact of climate change on the Greek tourism sector. Firstly, we attempt a bibliographical survey of studies concerning the significance of climate change to tourism sector. Moreover, we present the impacts of climate change on tourism on a global basis. As well, we analyze the forecast impact of climate change in Greece. The contribution of the tourism sector to the Greek economy and society in general appears to be particularly large; it accounted for 15.2% of Gross Domestic Product in Greece in 2009 while the total employment in the tourism sector (774,200 jobs) accounted for 18,5% of all employees in Greece (SETE, 2011). Compared to its international competitors the Greek tourism sector appears to have a satisfactory level of competitive performance, being in 16<sup>th</sup> place in the number of international arrivals and 12<sup>th</sup> place in terms of gross income from such activities again for the year 2008. The potential negative effects of climate change will worsen the figures of Greek economy. Finally, we analyze the conclusions of our study.*

**JEL Codes: L83, Q54**

**Key words:** Climate Change, tourism sector, economic impacts, Greece

### **1. Introduction**

Climate change is expected to have a range of direct and indirect repercussions on almost every sector of human activity both from a social and economic viewpoint (Viner and Agnew, 1999). The globally robust tourism sector is no exception from this conclusion. To have an idea of the scale of activities in this sector at global level, note that in 2008 the sector's turnover was \$ 3.6 billion and it employed more than 200 million workers, which accounts for around 10% of the global supply of work. As far as the geographical allocation of tourism destinations is concerned, Europe is considered to be the most popular destination, accounting for 53.5% of tourists in 2006, in other words around 846 million visitors worldwide (UNWTO, 2008a). Examining the data in more detail it should be noted that the Mediterranean Basin is the final tourism destination for around 30% of tourists worldwide, making it the world's most attractive and famous destination. Moreover, according to World Tourism Organisation data, the Mediterranean includes 5 of the world's most popular destinations for 2006, accounting for 20% of preferences among global tourism traffic (UNWTO, 2008a).

Although the above data clearly presents the dynamic of the region, the ongoing climate changes could potentially affect its enviable position creating new circumstances both for those destinations and tourist flows internationally.

The aim of the article is the study of the potential economic impact of climate change on the Greek tourism sector. In order to foster our analysis we present firstly the results of a bibliographical survey on the phenomenon of climate changes. Parallel, we study the impacts of climate change on tourism globally. Moreover, we consider the potential economic impacts for Greece from changes to tourism flows that could be brought about by climate change. Closing our analysis, we present the conclusions of our study and we discuss the prospects of the Greek tourism industry.

## **2. Bibliographical Survey**

In the first part of our paper we present the results of a bibliographical survey concerning the impacts of climate change to tourism sector. The tourism industry is a sector which bases its existence primarily on the natural environment. Recent research papers have explored in detail the precise importance of the natural environment on any tourist activity and development and the impacts of the latter on the former (Green et al., 1990, Goessling, 2002). Despite that, climate conditions used to be taken as a fixed property at any destination and long-term changes in those conditions were not considered as affecting tourist flows (Abegg et al., 1997) or any changes were recognised but in the final analysis their impacts were ignored as negligible (Smith et al. 2001, Scott et al. 2004). However, in recent years a major effort has been made to examine precisely which impacts climate change could have on the tourism industry. Other studies examine impacts at local level (Smith et al., 2001, Hamilton & Tol 2007, Moreno & Amelung, 2009) or at national level (Elsasser & Bürki, 2002, Hein et al. 2009). Certain studies examine the impacts on specific types of tourism destinations, such as seaside or hinterland areas, ski centres, etc. (OECD, 2007, Jones & Scott, 2006) or provide a general examination of changes at global level (Nicholls, 2004, Hamilton et al. 2005).

The vast majority of the articles referred to above made use of econometric techniques to examine the behaviour of both supply and demand for tourism services. Demand was examined to see how sensitive it was to climate conditions (Syriopoulos & Sinclair, 1993, Witt & Witt, 1995, Wietze & Tol, 2002). All the articles cited above concluded that climate conditions are a key factor in selecting a destination and that a gradual rise in global temperatures will lead to changes in either destinations selected by tourists, or the time at which they opt to go on holidays. Hamilton (2005) went so far as to develop a simulation econometric model which is known as the Hamburg Tourism Model (HTM). Using this model, researchers reached the conclusion that climate change does in fact affect tourism traffic at a destination but the consequences of this phenomenon are small compared to other exogenous or endogenous factors. Another later study once again used the HTM and concluded that popular tourist destinations will gradually tend to shift closer to the poles and mountainous areas (Hamilton et al., 2005). One of the exceptionally interesting conclusions drawn by Hamilton's research team is the finding that the ostensible rise in temperature due to climate change will affect demand at international tourism centres because it will create an ever more powerful trend among residents of warm and temperate regions to spend their holidays within the boundaries of their homelands (Hamilton & Tol, 2007).

The impacts of climate change on the spatial aspect of popular tourist destinations is yet another field of research (Scott et al., 2004) where the allocation of available tourism resources in North America in spatial terms over time was examined, among other things. Using the climate index from the Mieczkowski model, the conclusion was drawn that the forthcoming climate changes will affect the tourism capacity of certain areas necessarily leading to a reduction in their market share (Mieczkowski, 1985). H. Muller and F. Weber (Muller & Weber, 2008) examined the impacts of climate change at local level, focusing their attention on the Bernese Oberland region. Using modelling techniques, based on a scenario they concluded that climate change will not only affect the tourism product of the area but also considered it extremely likely that it would lead to the total annihilation of the tourism industry in the region. Similar results were reached by Hans Elsasser and Rolf Bürki (Elsasser & Bürki, 2002) who concluded that climate change would cause major losses for tourism across all of Switzerland. Hein, Metzger and Moreno (Hein et al. 2009) analysed the spatial changes caused by climate change and created logical links between physical and social phenomena but used a different approach which confirmed the conclusions reached by Hamilton's team. They concluded that climate change will affect both tourism destinations and the countries from which tourists come.

Perhaps the most important studies in the sector were conducted by the United Nations World Tourism Organisation (UNWTO, 2008b) and the United Nations Environment Programme (UNEP) entitled 'Climate Change and Tourism—Responding to Global Challenges' (Scott et al., 2008) and 'Climate Change Adaptation and Mitigation in the Tourism Sector: Frameworks, Tools and Practices' (Simpson et al., 2008). Both those studies focus on the main interactions between climate change and the tourism sector, and attempt to guide professionals in the sector to adopt strategies and practices for sustainable development of their activities.

The presentation of our bibliographical survey brought out the high level of correlation between climate change and tourism sector. It consists necessity to draw attention to potential negative effects of climate change to world economy. For this reason, we will now proceed with the impacts of climate change on tourism.

### ***3. Brief presentation of the impacts of climate change on tourism***

In this section of our article, we present the impacts of climate change on tourism at a global level. Climate change is not just a new threat for the traditional tourism industry but also has features the like of which the sector has not had to deal with in the past. Traditional threats such as violent natural phenomena, terrorist attacks and threats, political instability, etc. have certain features in common: the fact that they appear suddenly and impressively, but their limited duration and the fact that they are rapidly forgotten. Climate change and its expected impacts have precisely the opposite characteristics. These changes occur gradually, future impacts are taken into account and weighed up but when they actually occur they will relate to permanent, irreversible realities as a rule. Traditionally popular tourist destinations are obliged to adapt to these forthcoming changes by taking changes in the tourism habits of the market and changes in the dominant tourist flows.

The rise in the average temperature of the planet entailed by global warming has already shown the first signs of what it can do with the reduction in the level of ice coverage across large sections of the planet (UNWTO, 2008 a). The expected continuation of this phenomenon coupled with the rise of the oceans is expected, thanks to the use of modern geographical and spectrographic imaging and analysis systems, to result in a rise in sea levels by around 50 cm over the next 50 years (Bigano, Jacqueline and Tol, 2006b). At first sight that figure may not appear to be so destructive given the corresponding changes in sea level which have occurred in the recent geological past. However, there are some factors which make the current situation different. The first factor has to do with the estimate that the climate change occurring today is due in large part, or even completely, to human activity. The second relates to the fact that during previous large global climate shifts man's activity was not as widespread across the planet as it is today, and any impacts related just to humanity like they did to other biological organisms. The third factor relates to the dramatic impacts which such a rise in sea level will have for coastal areas or more so for areas below sea level (Simpson et al., 2008). It is precisely in these areas where human presence and activity are particularly visible, if not dominant, both in terms of day-to-day life and in terms of infrastructure.

In December 2004 tsunami waves created by the destructive earthquake in the wider maritime area of Indonesia reached as far as the Maldives, among other places. Under no circumstances was their rage as powerful and destructive as in other areas but their impacts were clear even just in terms of a temporary rise in sea levels in coastal areas or those with a very low altitude. The damage caused to infrastructure and economic activity in general on those islands indicate the scale of economic loss which could be caused on a larger scale in coastal areas due to climate change and the rise in sea levels it entails. Of course, it should be noted here that in the case of islands or areas with a low altitude close to the seashore, such as the Maldives, the rise in sea levels by 50 cm will not just impact on their economic activity but will result in their disappearance from the world map (Bigano, Jacqueline and Tol, 2006b).

Before the final rise in sea levels occurs, a series of related phenomena can be expected to make their presence intensely felt and with them a series of losses and barriers to human activities and infrastructure. For example, one can mention the estimate that a rise in average temperature on the planet by 4 degrees will cause massive tides in coastal and riparian areas. These estimations have caused concerns for countries like Italy about the threatened flooding in their regions. One famous and economically, culturally and semantically valuable city is Venice. The Italian state cannot accept both the social and economic cost of losing tourism income from the fact that in 50 years from now Venice could be under water. For that reason, that country has put in place expensive plans worth at least € 5 billion to rescue the historical city centre (Bigano, Jacqueline and Tol, 2006a).

Of course, in addition to the urban coastal environment, one cannot ignore the impact of climate change on coastal areas overall. It is easy to realise the importance of the loss of immense areas of land both from an environmental viewpoint and from an economic viewpoint and in terms of feeding populations. In an era when the human population is increasing at rapid rates, the loss of large cultivatable areas of land will further worsen existing problems and incite social reactions and conflicts. Focusing now on the impacts on the tourism sector, it is clear that there will be problems and unfortunate repercussions for thousands of coastal tourism destinations. In short, we can mention more frequent flooding, the consequent erosion of land, the visual destruction of the environment, damage to infrastructure, the pressure on and/or destruction of maritime and coastal ecosystems and the inundation of famous beaches and islands.

Another phenomenon which is expected to cause the global rise in temperature is the rise in average air temperature and the change in climate conditions in general. These changes are expected in turn to cause a corresponding rise in the temperature of the oceans and the seas of this planet. Although that rise is clearly expected to be less than that of the air because of the greater thermal capacity of the first, and the volume of the oceans, the climate impacts will certainly be far from negligible. In addition to the oceans expanding, referred to above, the rising temperature of water bodies is expected to kick-start the emergence of a series of weather phenomena which to date were rare or even unknown in many areas of the planet. It is considered that cyclones or even typhoons will make their appearance in areas which today there is a temperate climate which does not permit them to develop. The rise in water temperatures in areas such as the Mediterranean coupled with contact with cold air masses from northern Europe is expected in the future to lead to the appearance of harsh storms or cyclones in the region. Although the possible appearance of such phenomena is not expected to coincide with the tourist season, it is easy for one to realise the extent of destruction which could be caused to infrastructure given that such infrastructure has not been designed to withstand those conditions. Hurricane Katrina which affected the New Orleans region in 2005, and the terrible destruction it wrought both in terms of human life and infrastructure gave us a picture of the impacts which increasingly more destructive tropical storms can have, a phenomenon which is primarily attributed to climate change (Scott et al, 2008).

All the above phenomena mentioned are expected to have a particular impact on sea life and its equilibrium. The consequences are expected to be particularly negative for areas which are particularly sensitive, such as reefs. More robust ecosystems with greater tolerance levels would already appear to be facing problems. An indicative example is the increasing phenomena of fish migrations from the Red Sea to the Mediterranean, as occurred recently with the appearance of the *Lagocephalus* species in Greek waters. That fact indicates that the waters in the Mediterranean temperate zone are beginning to become tolerable for fish that live in the subtropical waters of the Red Sea and that the phenomenon of the rise in water temperatures has begun (Roson 2003).

In the case of the Mediterranean basin, the region is promoted as a pole of attraction which offers both sea and sun coupled with its primarily mild weather conditions. This combination can mainly be found on the southern European coastlines which of course include Greece. In addition to the clear benefits for national economies, one must not overlook the benefits for the European Union overall due to a large part of international tourism being attracted here. For the European economy and social structure, the current reality of the climate and tourism has one further important benefit. It has to do with the major flow of tourists from northern and central areas of Europe which as a rule are more robust economies, to the southern regions and countries which as a rule are economically weaker. In this way wealth is somehow transferred from the 'wealthy' north to the 'poorer' south.

In light of this, the ostensible rise in the average temperature in the region can be expected to cause a series of politico-economic changes. The scenario of today's mild weather conditions for most of the year changing is particularly likely, especially during the summer months and in particular in the more southern regions of Europe, where they will have to face exceptionally high temperatures and dangerous levels of sunshine. In addition, it is very likely that there will be a drop in the already limited level of rainfall especially in areas which are as a rule short of water, which includes a significant number of the particularly popular tourist islands. The drop in potable water reserves coupled with the deterioration, erosion and possible desertification of the soil in those areas would render them incapable of / unsuitable for hosting the large number of visitors they support today. This is likely to make the more southern regions of the European Union unsuitable for more sensitive visitors from northern Europe such as children and the elderly (World Tourism Organization, 2008).

Of course, we cannot ignore questions (depending on the seriousness of the phenomena) which relate to the ability of such soils to maintain even the local population in the future. Governments and local bodies have already begun to plan and implement measures and actions to protect underground and ground fresh water supplies, to protect soils from desertification and to ensure potable water by making use of fixed or mobile desalination plants. Of course, all these measures raise major questions about the end benefits and their repercussions on the local environmental equilibrium. In light of the foregoing points, it is particularly likely that the tourism flows described will change or drop off. Difficult weather conditions in the more southern European regions and along African and Asian coastlines will transfer the northern Mediterranean destinations into more attractive places to go on holiday. However, the major change will occur in central and northern areas of Europe where the relatively warm summers will encourage residents to go on holidays in neighbouring areas and not in the hot south (World Tourism Organization, 2008).

From the above analysis it can be seen that the climate change affects the world tourist map. Countries with high level of contribution of tourism sector to their economies may be affected negatively as a result of climate change at the near future. It is time for countries to change the model of tourist development that have adopted. For this reason, we are going to analyze the forecast impact of climate change and the new reality of tourist sector in Greece.

#### ***4. Forecast impact of climate change in Greece***

At this part of our analysis we will present the main scenarios about the forecast impacts of climate change in Greece. Greece's geography can be characterised as a classic Mediterranean landscape with the main geographical body of the country being surrounded by around 2,000 large and small islands. Those islands are highly diverse in terms of both their geographical and physical characteristics, but also have rich, diverse vegetation and are almost completely dry but do have many available springs and surplus drinking water and do face difficulties in retaining even a few local residents. If one also takes into account the fact that the country's overall coastline is around 16,000 km and that 70% of the population lives close to it, it is clear that the ties between the people of this country and the sea are strong (Greek Ministry of Environment, Energy and Climate Change 2007). The climate change phenomenon had not become visible in Greece before 1975. Meteorological data show that until that year the average temperature had been dropping but since that year the trend has clearly been upwards. That trend, just like in other areas and countries, is accompanied by a range of extreme phenomena. In meteorological terms, the gradual drop in rainfall is an unfavourable phenomenon which reached its peak with the drought in the winter of 1989-1990. 2007 was recorded as the hottest year since the start of the 20<sup>th</sup> century with the highest temperature being 44.8°C and the average summer temperature being 34.9°C. The immediate result of these changes has led to marginal levels of fresh water for several years coupled with a gradual rise in the sea level by 1 to 2 cm each year (Bigano, Jacqueline and Tol, 2006a).

In the decades to come, climate conditions in Greece are expected to follow the trends we can see at global level. One can expect an increase in the length of the summer period and a simultaneous increase in the maximum temperatures recorded. Another major cause for concern is the issue of rainfall. Although the figures have not dropped significantly, the expected change in the quality of rainfall with sparse but violent downpours will limit the benefits of rainfall and will increase damage both to the natural environment and environmental equilibrium, and will cause destruction to infrastructure and people's property in general. Drawing inferences from the foregoing points, it is clear that the upset cycle of annual rainfall and the increased level of rainfall will lead to ever greater pressures on fresh water reserves and a significant deterioration in both geological and pedological features. Erosion and desertification of soils are particularly unfavourable consequences, but are becoming a strong possibility for a large part of the Greek territory.

The phenomena of drought and desertification are expected to be particularly intense in a large part of the insular area of Greece, which just happens to be the geographical area of the country where the tourism industry is most intense. Given that coastal and island areas cannot prevent these changes in weather conditions, they have no choice but to take significant measures to protect, conserve and preserve the existing stocks of water and to protect infrastructure against extreme situations. The survival of the tourism sector which is so important for the economic survival and prosperity of residents depends in large part on the precautionary measures which will be taken today to preserve the sustainability, if not the friendliness, of the environment.

However, at the same time it is essential to put in place a plan to address what appears to the unavoidable change in weather conditions that is coming. The plan implemented must weigh up the deterrent aspect of difficult weather conditions –heat and strong solar radiation- so that tourism can continue to be a robust source of income for the country (Perry, 2000).

Over recent years, the international bibliography has been enriched with several studies which examined the possible impacts of climate change on specific geographical areas. Lohmann & Kaim (1999) used field research to evaluate the factors which affect the behaviour of German tourists in choosing their tourism destination, and reached the conclusions that the relationship between weather and climate is one of the key factors, but not the most important factor for tourists. This was followed by other studies which were also based on behavioural studies, which sought to record the factors which affect the competitiveness of certain tourist areas. In their study, Hu & Ritchie (1993) examined Canadian tourists who ranked climate as the second most important factor while Gomezelja & Tanja Mihalic (2008) examined the competitiveness of Slovenian tourism, and evaluated climate as one of the most important factors in the competitiveness of the tourism sector.

In order to better forecast the impact of climate change, other studies developed forecasting models using alternative scenarios about the rise in temperature and its impacts of tourist demand. Agnew & Palutikof (2001) used an econometric model and concluded that a 1°C rise in temperature in the summer months would lead to a 1-5% reduction in domestic tourist demand in the UK, while Maddison (2001) used a parametric shift model for climate change and reached the conclusion that a 2°C rise in the Mediterranean basin by 2030 would result in a reduction in British tourists' preferences for Greece by 1.3% and would increase preferences for Spain by 2.2%. The most important effort to explore the possible relationship between climate change and fluctuations in tourism level in a country was, as mentioned above, carried out by Hamilton, Maddison, & Richard Tol, (2005, 2007) with subsequent contributions by Bigano & Mayor (2007, 2008) who developed the Hamburg Tourism Model which is a model for simulating tourism flows for 207 countries using alternative scenarios affecting the potential climate changes. The possible scenarios for Greece which result from use of this model are a 2% drop in arrivals from a 1°C rise which is permanent (Hamilton et al, 2005). This assumption was supplemented in terms of arrivals by extending the model to 2100 which was done by Bigano, Hamilton & Tol in 2005, 2006 and 2008 who verified the forecasts made by the original model and used different statistical and econometric analyses and reached the conclusion that as the temperature rises on the planet today's 'cold' destinations will become more popular, while also affecting domestic tourism. For example, the British and German will now chose domestic destinations (Hamilton & Tol, 2007). On the contrary, today's popular summer destinations, like Greece, will lose a significant part of their competitiveness and a major part of their revenues (Bigano et al. 2008).

If one takes into account those studies, the conclusion reached is that a country such as Greece will be gravely affected by any potential verification of such studies. From table 1 we notice that Greek economy is highly depended on tourism sector. Especially, at the current situation that Greece has adopted a programme of economic adjustment as a result of its high public debt. The potential negative consequences of climate change to tourism sector will affect intensely the ability of Greek economy to overcome the expansion of public debt (Ministry of Finance, 2010).

**Table 1. Percentage of tourism sector to GDP and employment of Greece**

<b>Years</b>	<b>GDP</b>	<b>Employment</b>
2000	15,93%	19,9%
2001	16,20%	19,9%
2002	15,81%	20,1%
2003	15,67%	20,0%
2004	16,3%	19,6%
2005	16,9%	20,5%
2006	17,1%	20,8%
2007	17,2%	20,8%
2008	16,2%	19,6%
2009	15,2%	18,5%
2010	15,3%	17,9%

Source: (SETE, 2011)

As we can consider from table 2 the percentage of foreign tourists visiting Greece at the hottest months of the year is around 50 percent for all the previous decade. The climate change and the augmentation of the temperature at Greece may affect seriously the tourist industry of country as the foreign tourists will choose other tourist destinations with lower temperature at summer months.

**Table 2. Percentage of arrivals of foreign tourists at July-August-September**

Years	Percentage
2000	51,2%
2001	51,3%
2002	50,3%
2003	50,6%
2004	49,1%
2005	49,5%
2006	49%
2007	47,7%
2008	50%
2009	52%
2010	55%

Source: (SETE, 2011)

Closing our analysis, we can assume that the climate change will affect the environment and as a result the Greek tourism sector. It is time, for the policy makers to invest at policies that will strengthen sustainability in order to create Greece a competitive advantage relatively to its competitors at the international tourist market.

### **5. Conclusions – Proposals about the future of the tourism industry**

Climate change, whether caused by man or not, is not something that concerns the future but is a reality now, the first repercussions of which have begun to make themselves felt. As scientists have stressed, the phenomenon has not reached its maximum intensity yet, but the negative impacts will affect our lifestyle as we know it today and our current economic and social fabric in various and diverse ways. Tourism, a sector which primarily matured during the last century, precisely matches the degree of prosperity of human societies. The impacts from changes in climate conditions on the prosperity of societies will have similar repercussions on the prosperity of this sector. However, the greatest threat which the tourism industry faces today relates to a change in climatological, pedological and hydrological conditions in tourist areas which are popular today, resulting in current investments and present-day infrastructure being rendered obsolete, without of course ignoring the economic decline which residents of their areas will suffer.

The tourism industry, especially in Greece, will suffer direct impacts if the scenarios which include a drop in arrivals are verified. Given a rise in temperature, the parties involved in the tourism sector will have no choice but to adapt to the current and emerging changes. A first step towards achieving that objective is to provide detailed information to professionals in the sector about the extent of the problem and future developments. In this way, not only will they be in a position to take proper business decisions in their view, but they will also be able to shoulder their share of responsibility both as individuals and as businesses. The first, and perhaps most important change which must be made by parties involved in the tourism sector, relates to them becoming the most environmentally aware professional group. When they understand the threat they are facing, they are obliged to protect both the natural and man-made environment as an investment in their survival of the medium-term. Their contribution to the global issue of addressing climate change and its impacts can be maximised if they are partners in a rationale of real sustainable development. They have day-to-day contact with a range of people who as a rule come from all over the world, at times when they are most open to receiving messages, since they have left behind the pressing problems of their day-to-day even if only for a few short days.

Interventions and changes to tourist infrastructure and practices so that they become more environmentally friendly and contribute as least as possible to heating the planet are considered to be the first step, and a *sine qua non*. However, at the same time given that this phenomenon is already a global reality which the threatened tourist areas cannot prevent on their own, they are obliged to prepare for these forthcoming changes.

Scenario-based planning will be more effective if it takes place by utilising economies of scale on all levels, starting a global level with the assistance of the UN which has significant know-how already, and then proceeding downwards to local level. Planning for tourism infrastructure and actions must also take into account the forthcoming changes and protect the areas and investments that have already been made. At the same time, since certain new areas will benefit from climate change, when one looks at the tourism sector on its own (not taking into account the shifts in equilibrium in other sectors), planning needs to start to meet needs which are perhaps not such future needs after all. Likewise, the areas which will be harmed by these changes must re-plan their strategy, especially in relation to tourism activities and their development model in general.

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