A Correlational Analysis of Global Climate Risk Indices and Tourism Industry Indicators Using Fractal Statistics

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Abstract

In this study, we demonstrate the use of techniques associated to a newly-developed fractal statistics in the analysis of data roughness of climate risk indices across the country as these induce a consequent ruggedness in the tourism industry indicators. Fractal dimensions and roughness correlation are used to show relationship while Pearson r correlation analysis to show association of the variables, climate risk index (as X variable), travel and tourism competitiveness, tourist arrival, tourism income and GDP per country(as Y variable). It is found out that climate risk condition is a cause of the decreases of the tourism activity and income of the country. The result lends proof that the weather patterns of a country, specifically climate risk condition, has considerable effects on tourism industry. Changing climate and weather patterns at tourist destinations and tourist generating countries can significantly affect the tourists' comfort and their travel decisions. Influx in international tourist arrivals in response to climate risk affects all countries across the globe. However, developing countries are more vulnerable as they have less resources and mechanisms to mitigate the impacts.

Keywords: Climate Risk, Tourism Industry, Fractal Statistics, Correlation Analysis

1.0 Introduction

Tourism industry is recognized as one of the key economic contributors in a nation's gross domestic product. According to Travel & Tourism Report (2013) tourism continues to be one of the world's leading industries. The year 2011 was one of the most challenging years ever experienced by the global tourism industry. In spite of political disturbance and natural disasters, the industry's direct contribution to world Gross Domestic Product (GDP) grew by nearly 3% to US$2 trillion and directly generated 1.2 million new jobs. This is supported by a 3% increase in visitor exports to US$1.2 trillion, with almost 3% growth in capital investment, which rose to over US$0.7 trillion. It is expected that on the next ten years, tourism industry is expected to grow by an average of 4% annually, taking it to 10% of global GDP, or some US$10 trillion. By 2022, it is anticipated that it will account for 328 million jobs or 1 in every 10 jobs across the globe. So that it is important to understand the dynamics of tourist influx in countries across the globe. For this reason, governments strive to attract tourists through various strategies aimed at establishing an image of a desirable tourist destination for the country. It is well-established that an abundance of tourist sites and efficient services alone are not sufficient to guarantee a robust tourism industry.

Other more important considerations such as

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the peace situations and the climate risks condition of the locality are paramount in a foreigner's list of preferred vacation places. Influx in international tourist arrivals in response to climate risk affects all countries across the globe. However, less developed countries are generally more affected than industrialized countries because they are more vulnerable as they have scarce resources and fewer mechanisms to mitigate the impacts. This study tries to find out the possible effect of climate risk on tourism industry across the globe.

Disasters have always been, and will always occur. The patterns of modern lifestyles today are exposing more countries to danger than ever before. Tourist areas will be more and more exposed to rising sea levels, and weather related disasters due to climate change. Disaster risk reduction linked with efforts to climate change adaptation and improvement of living conditions are undoubtedly the major international challenges nowadays. Catastrophes unavoidably bring about crises. It is the level to which the communities are prepared for disaster that determines how vulnerable or resilient their countries are (UNEP, 2007).

According to UNEP (2008) tourism is one of the booming industry today, it presents destinations with numerous unique challenges ranging from the management and control of industry growth and development, to preserve and maintain the quality of our natural tourist destinations. Reducing losses of life and livelihood during a natural disaster is generally a gauge of the tourist destination's capacity to adequately prepare for and effectively manage disaster incidents. For the tourism industry, there is a need for cooperation between local disaster management agencies and industry stakeholders. For many countries, this remains a challenge yet an imperative for creating a resilient industry, with a sound reputation to manage disasters.

Gössling and others (2012) describe that the increasing global awareness about the fast pace of climate change taking place on our globe, together with the impacts that such changes are having on the natural environment, on humans and their economic activities have become evident. For tourism industry, climate change is not an isolated event, but an occurrence that already affects the industry and certain destinations in particular, mountain and beach destinations among others.

The issue of climate change has become known as one of given importance by the tourism industry in terms of both the potential effects of climate change on tourism industry and the contribution of tourism industry to climate change (UNWTO & UNEP, 2008).

This paper explores the effects of climate risk indices to the tourism industry across the globe with the use of automated algorithm frak.out and Padua's (2012) statistical equation that would solve variations of two variables. This study also looks into how the fluctuations in the climate risk conditions in various countries influence the corresponding variability of the tourism industry indicators across the globe.

2.0 Methodology

In this paper, fractal dimensions and roughness correlation are used to show relationship of the climate risk to tourism industry indicators across the globe and Pearson r correlation analysis to show association of the variables.

Using the raw data of the Global Climate Risk Index 2013, The Travel & Tourism Competitiveness Report 2013, World Tourism Organization (UNWTO, 2013), and Gross Domestic Product per capita; the fractal dimensions of these data were determined.

The researchers used fractal observations in this study to describe the roughness of the data. This is achieved by the fractal dimension. The fractal dimensions of the variables, climate risk index (as X variable), travel and tourism competitiveness, tourist arrival, tourism income and GDP per country (as Y variable) were obtained by transforming the data sets into graphs. The one-dimensional representation of the variables in question tells how a straight line segment is fragmentized by the random variable in question. The degree of fragmentation or roughness is summarized in an index called the fractal dimension (λ). The fractal dimension is calculated through the box-counting method which is automated through the freeware frak.out.

The result of two-dimensional configuration (x,y) will tell a fractal figure. The fractal dimension of this two-dimensional configuration is likewise obtained by the box-counting algorithm using the frak.out software.

Fractal statistics is used in this study to complement the traditional normal-based statistics in describing the data behavior. This paper investigates how the fractal dimension of the two (2) variables correlate with each other (x,y). Then, the plot (x,y) of variables were simultaneously analyzed for roughness correlation. The results will look into how the roughness (variability) of the climate risk situation in various countries influences the corresponding variability or roughness of tourism industry indicators.The formula is as follows:

$$R_\lambda = 1 - (\lambda\text{-}1)^{(\lambda x \lambda y)1/2}$$

Where :

Λ = fractal dimension of the (x,y) plot
Λ_x = fractal dimension of x
Λ_y = fractal dimension of y
R^λ = roughness correlation

Pearson r correlation analysis on the other hand is also used to show the association between the two (2) variables, climate risk indices and tourism industry indicators. Correlation is a statistical method which enables the researcher to find out whether two variables are related and to what extent they are related. Correlation is considered as the sensitive movement of two or more variables. It is observed that when a change in one particular variable is accompanied by changes in other variables as well, and this happens either in the same or opposite direction, then the resultant variables are said to be correlated.

In correlation, when the value of one variable increases with the increase in another variable, it is a positive correlation. On the other hand, when the value of one variable decreases with the increase in another variable, then it would be a negative correlation. There might be a case when there is no change in a variable with any change in another variable. In this case, it is defined as no correlation between the two.

The formula for correlation is as follows:

$$r = \frac{n(\Sigma xy) - (\Sigma x)(\Sigma y)}{\sqrt{[n\Sigma x^2 - (\Sigma x)^2][n\Sigma y^2 - (\Sigma y)^2]}}$$

Where:

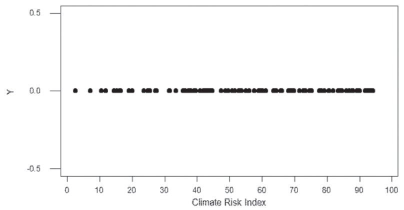
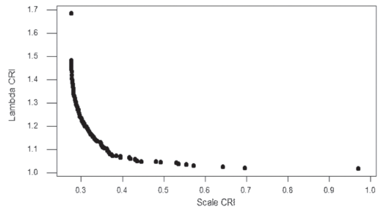
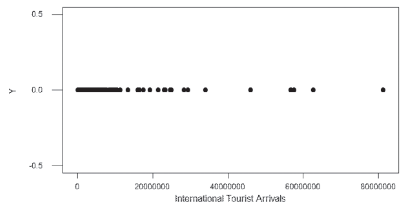
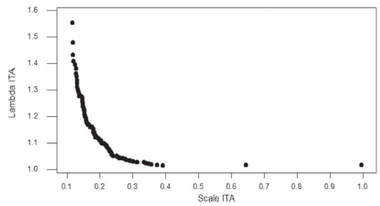
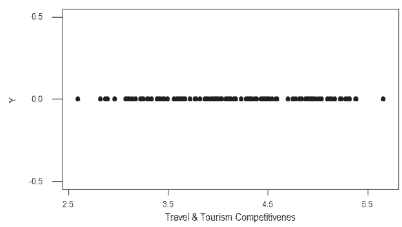
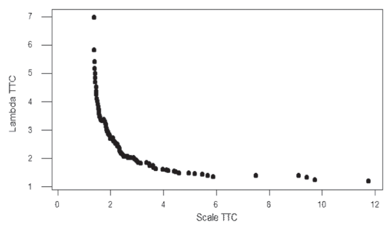
r = Pearson correlation coefficient
x = Values in first set of data
y = Values in second set of data
n = Total number of values

Results

The results present the findings of the study conducted on the impact of climate risk of the countries across the globe on the tourism industry after the gathered data were treated with the appropriate statistical tools suited in the proper interpretation and analysis.

The results of the procedures explicated in the next preceding subsection are presented below.

Table 1: Fractal Dimension and Spectrum of the Variables of the Study

Fractal Dimension	Spectrum
A. Global Climate Risk Index  Figure 1: Fragmentation or fractality induced by GCRI on nations across the globe, $\Lambda_{y=}1.5569$	 Figure 2: Fractal Spectrum of the Global Climate Risk Index (GCRI)
B. International Tourist Arrival  Figure 3: Fragmentation or fractality induced international tourist arrivals on nations across the globe, $\Lambda_{y=}1.5711$	 Figure 4: Fractal Spectrum of the International Tourists Arrival
C. Travel and Tourism Competitiveness  Figure 5: Fragmentation or fractality induced by travel and tourism competitiveness on nations across the globe, $\Lambda_{y=}1.6163$	 Figure 6: Fractal Spectrum of the Travel & Tourism Competitiveness

D. Tourism Income

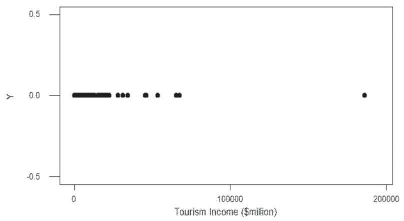


Figure 7: Fragmentation or fractality induced by tourism income on nations across the globe, Λ_y = 1.5620.

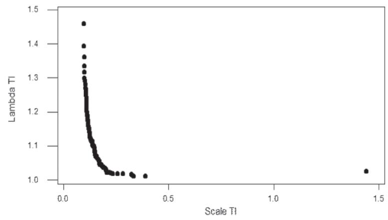


Figure 8: Fractal Spectrum of the Tourism Income

E. GDP per capita

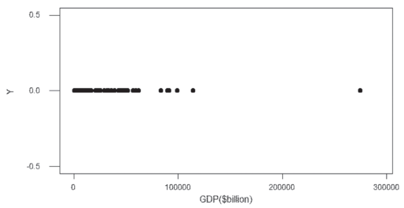


Figure 9: Fragmentation or fractality induced by GDP per capita on nations across the globe, Λ_y = 1.5983

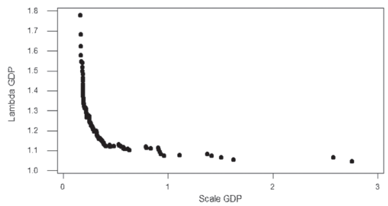


Figure 10: Fractal Spectrum of the GDP per capita

As seen on the variables in Table 1, the Travel and Tourism Competitiveness Index (TTCI) is more fragmented than the rest of the data sets with fractal dimension of 1.6163. The fragmentations of travel and tourism competitiveness indicate that the TTCI scores across the different countries in the world are rough and irregular followed by GDP per capita, international tourist arrival and tourism income with fractal dimensions of 1.5983, 1.5711 and 1.5620 respectively. Fragmentations of travel and tourism competitiveness data are revealed on both ends. This means that variations of travel and tourism competitiveness are found among countries with the lowest and highest variation. They either increase or decrease. The countries that have higher increase in travel and tourism competitiveness are Singapore, Sweden, Canada, France, United States, Spain, United Kingdom, Austria, Germany and Switzerland. While countries that have higher decrease in travel and tourism competitiveness are Nigeria, Mali, Benin, Algeria, Yemen, Lesotho, Guinea, Sierra Leone, Burundi and Haiti. The fractal dimension of travel and tourism competitiveness Λy is equal to 1.6163. This supports the initial observation on the graph that the data set shows fractality; that is, the data are far more rugged than a straight line.

The data set with lowest fractal dimension is the climate risk index amounted to 1.5569. The implication is that there is a wide range of variability in the climate risk condition of the countries across the globe considered in the study with greater uniformity for the most risky country and higher variability across countries as the least risky. In other words, the researchers observed greater variability in the climate risk indices for countries with higher Global Climate Risk Index (GCRI) scores, i.e. Suriname, Sierra Leone, Seychelles, Senegal, Qatar, Mozambique, Mongolia, Moldova, Macedonia, Luxembourg, Yemen, Lesotho, Latvia, Jordan, Israel, Iceland, Egypt, Cyprus, Cape Verde, Barbados and Bahrain, which are not generally risky (not exposed to extreme weather events) and are more irregular in terms of the GCRI. In contrast, most risky (exposed to extreme weather events) countries are relatively more homogeneous in terms of this index since their fractal dimensions are lower. Countries that have lower GCRI scores are Thailand, Cambodia, Pakistan, El Salvador, Philippines, Brazil, United States, Guatemala, Sri Lanka and Honduras.

The spectrum shows the fractal observations of the variables used in the study. For countries belonging to the smaller scale, high fractal dimensions are noted while for countries belonging to the larger scale, low fractal dimensions are observed. In other words, the researchers observe greater variability for countries that belong to the lower scale that have higher fractal dimension. On the contrary, countries that belong to higher scale are relatively more homogeneous in terms of this index since their fractal dimensions are lower.

Table 2: Fractal Dimension of X,Y Variables and Correlation Analysis

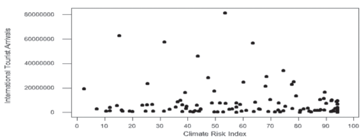
<table>
<tr><th rowspan="2">Variables</th><th colspan="2">Roughness Correlation</th><th colspan="2">Pearson R Correlation</th></tr>
<tr><th>R^{λ}</th><th>%</th><th>R</th><th>Interpretation</th></tr>
<tr><td>A. International Tourist Arrival (Y) vs Climate Risk Index (X)


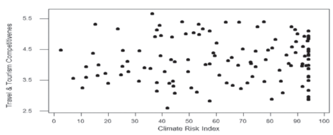
Figure 11: Plot of climate risk versus international tourist arrival, $\Lambda_{xy} = 1.1915$</td><td>0.9246</td><td>92.46%</td><td>-0.16915</td><td>Denotes negligible correlation</td></tr>
<tr><td>B. Travel &Tourism Competitiveness Index (Y) vs Climate Risk Index (X)


Figure 12: Plot of climate risk versus travel & tourism competitiveness, $\Lambda_{xy} = 1.1582$</td><td>0.9463</td><td>94.63%</td><td>0.037913</td><td>Denotes negligible correlation</td></tr>
</table>

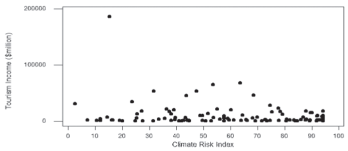
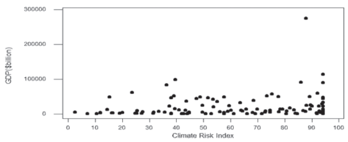
C. Tourism Income (Y) vs Climate Risk Index (X)  Figure 13: Plot of climate risk versus tourism income, $\Lambda_{xy} = 1.2266$	0.9012	90.12%	-0.22363	Means low or slight correlation
D. GDP (Y) vs Climate Risk Index (X)  Figure 14: Plot of climate risk versus GDP per capita, $\Lambda_{xy} = 1.2368$	0.8969	89.69%	0.129863	Denotes negligible correlation

Table 2 shows thet as for roughness (x,y) the one with highest correlation is the travel and tourism competitiveness. The result is Rλ = 0.9463. That is, around 94.63% of the variability in the travel and tourism competitiveness in the countries accounted for their global climate risk ratings. It appears that large values of GCRI correspondingly make a reduction in the roughness of travel and tourism competitiveness. This means that travel and tourism competitiveness data set has high roughness correlation with the climate risk index across the globe compared with the international tourist arrivals, tourism income and GDP per capita with roughness correlation of 0. 9246, 0.9012 and 0.8969, respectively. Thus, it follows that the climate risk induces a considerable roughness in the travel and tourism competitiveness. Specifically, the countries that are not risky (not exposed) have higher travel and tourism competitiveness scores than the countries which are generally risky (exposed).

As to the Pearson r correlation analysis, when climate risk indices and tourism industry indicators were simultaneously analyzed (x,y), the one with low or slight relationship is the tourism income of the country. The result is r = -0.22363, that means that climate risk indices have a low/slight relationship with the tourism income data sets compared with the international tourist arrivals (r = -0.16915), travel and tourism competitiveness (r = 0.037913) and GDP per capita (r = 0.129863) that denotes negligible correlations. Therefore, climate risk indices slightly affect the tourism income of certain countries and so, less risky nations have higher tourism income than the more risky ones.

However, the researchers offer some caveats on improving climate risk measures. It should be noted that the tourism industry has a vital role to play in dealing with the impacts of climate change. With its close links of tourism industry and climate itself, tourism is considered to be a highly climate-sensitive economic segment. Certainly, climate change is not an isolated future event for tourism, as the varied impacts of a changing climate are even now becoming evident in different tourist destinations around the world.Climate change is already influencing policy makers and tourism stakeholders in making decisions for the tourism industry. It is very important that there are adaptation and mitigation strategies because they are very vital for the tourism industry of the different countries across the globe. With the formulation of mitigation and adaptation strategies and the appropriate policies to be prepared, the tourism sector can play a key role in dealing with climate change and encouraging sustainable growth in the tourism industry.

In sum, climate risk is a cause of the decreases in tourism activity and income of the country. The result provides proof that the weather pattern of a country, specifically climate risk condition, has considerable effects on tourism industry. Influx in international tourist arrivals in response to climate risk affects all countries across the globe. And the analysis reconfirms that less developed countries are generally more affected than industrialized countries.

3.0 Discussion

This paper presents an analysis of fractal dimensions, roughness correlation and Pearson r correlation analysis of the climate risk to the tourism industry.

Travel and Tourism Competitiveness, in general, are far more rugged than the international tourist arrivals, tourism income, and GDP per capita. For travel and tourism competitiveness, very high fractal dimensions are noted. The high scores in these data sets are distinctly very variable.

When the plot (x,y) was simultaneously analyzed for roughness correlation, the result was a fractal dimension of 1.1582 for data sets climate risk versus travel and tourism competitiveness. The roughness correlation measure is therefore $R\lambda = 0.9463$. It is, around 94.63% of the variability in travel and tourism competitiveness of the countries based on their global climate risk ratings. It appears that large values of GCRI correspondingly make a reduction in the roughness of travel and tourism competitiveness. Specifically, the countries that are not risky (not exposed) have higher TTCI scores than the countries which are generally risky (exposed). Indeed, more risky nations cause the decrease of the tourism activity and income of countries worldwide.

For Pearson r correlation analysis, when climate risk indices and tourism industry indicators were simultaneously analyzed (x,y) the one with low or slight relationship is the tourism income of the country. The result is $r = -0.22363$, that means that climate risk indices have a low/slight relationship with the tourism income data sets compared to the international tourist arrivals ($r = -0.16915$), travel and tourism competitiveness ($r = 0.037913$) and GDP per capita ($r = 0.129863$) that denote negligible correlations. Therefore, climate risk indices slightly affect the tourism income of certain countries and so, less risky nations have higher tourism income than those that are more risky .

By examining the high and low rating of the countries across the globe,the researchers found that Climate Risk Index, the lowest are Yemen, Luxembourg, Macedonia, Moldova and Mongolia. The highest ranking countries are Philippines, Thailand, Cambodia, Pakistan, El Salvador, Guatemala, Brazil, United States and Sri Lanka as the more risky nations. In Intenational tourist arrivals, the lowest are Moldova, Guinea, Sierra Leone, Burundi and Mali. While the highest are France, USA, China, Spain and Italy as preferred tourist destinations of the international tourists. For Travel and Tourism Competitiveness, the lowest are Haiti, Burundi, Sierra Leone, Guinea and Lesotho. The highest are Switzerland, Germany, Austria, United Kingdom and Spain as countries with more competitiveness for travel and tourism. For Tourism Income, the lowest are Guinea, Burundi, Lesotho, Tajikistan and Malawi. The highest are USA, Spain, France, Germany and China have more income from international tourist arrivals. Further, in GDP per capita, the lowest are Burundi, Ethiopia, Malawi, Guinea and Uganda. Those with highest GDP per capita are Singapore, Luxembourg, Norway, Slovak Republic and Qatar that belong to developed countries.

The researchers found out that International Tourist Arrival, Travel & Tourism Competitiveness, Tourism Income and GDP per capita data sets reveal that most of those in the lowest ranking are the developing countries and most of these countries are from the African region that have low human development in 2011. In 2011 international tourist arrivals in Africa increased only a little (1%), as the gain of two million international tourist arrivals for Sub-Saharan destinations (+7%) which was almost fully compensated by the losses in North Africa (-9%). All in all, arrivals in the region increased by half a million, maintaining the total at 50 million. Tourism receipts only increased by 2% in real terms to US$ 33 billion (UNWTO, 2013).

The top countries for International Tourist Arrival, Travel & Tourism Competitiveness, Tourism Income and GDP per capita data sets most of the countries are from developed nations that belong to the Europe, Asia and the Pacific. In 2011, Europe surpassed expectations with 6% growth in international tourist arrivals, making it the fastest-growing region together with Asia and the Pacific. In spite of persistent economic doubt, international tourist arrivals to Europe reached 504 million in 2011, accounting for 29 million of the 43 million additional international arrivals recorded worldwide. Results were boosted by Central and Eastern Europe, and Southern and Mediterranean Europe (both +8%). In terms of earnings, Europe holds the largest share of international tourism receipts (45%), reaching US$ 463 billion in 2011, and representing a 5% increase in real terms (UNWTO, 2012).

Except for the Climate Risk Index, that most of those on the highest ranking, are countries that are mostly affected by severe weather events in 2011 and these countries are always prone to typhoon and floodings. The lowest ranking and seldom to have catastrophic events are countries that belong to the Sub-Sharan and Middle East countries.

Harmeling & Eckstein (2012) explained that the increase of extraordinary of very severe natural catastrophes makes 2011 one of the highest-ever loss years on record. The extremely devastating floods in Thailand account for the countries' rise to the top of this year's Climate Risk Index. The tough monsoon season in Southeast Asia also caused substantial damage in Thailand neighbors. In Cambodia, the extreme rainfalls resulted in the worst flooding in decades killing people, destroying houses and ruining rice crops. The United States, Pakistan and Philippines have been featured several times. In year 2011, the Philippines endured a severe typhoon season and were severely hit by tropical storm Washi or Sendong in local name in the Philippines which claimed over 1,600 flood victims, topping the list for most human casualties of the year 2011. Pakistan, which experienced the worst flooding in the country's history the other year, was again struck by a rough monsoon season killing over 500 people. United States also suffered a combination of exceptional and severe weather events including a series of devastating tornadoes, record-breaking high temperatures and an intense hurricane season. Guatemala and El Salvador have come out frequently among the most affected countries due to the high exposure to the Atlantic hurricane season. Where extensive floods and landslides as a result of hurricanes caused damages to the amount of over US$ 1 billion in El Salvador, and more than 500 million in Guatemala in 2011. Stranger in 2011 in the appearance of the countries mentioned before is the presence of Sri Lanka and Brazil. In the case of Brazil, the reason for this year's emergence is the worst floods and landslides the country has ever experienced, causing almost US$ 5 billion of direct losses. Likewise, as for Sri Lanka, heavy flooding were accountable for the damages suffered in which 21 % of the country's rice crops were destroyed.

With its close links of tourism industry and climate itself, tourism is considered to be a highly climate-sensitive economic segment. Certainly, climate change is not an isolated future event for tourism, as the varied impacts of a changing climate are even now becoming evident at different tourist destinations around the world and climate change is already influencing policy makers and tourism stakeholders in making decision for the tourism industry.

4.0 Conclusion

There are relationships between climate change and tourist industry indicators. Climate is a vital resource for tourism, and especially for the mountain, beach and winter sport tourism industry. Unstable climate and weather patterns at tourist destinations and tourist generating countries can considerably affect the tourists comfort and their travel decisions. Changing demand patterns and tourist flows will have an impact on tourism industry and economic activity of the country.

In this paper, it also offers evidence on the effects of climate risk to tourism industry. The researchers found out that the variations or roughness in climate risk induces the roughness in the tourism industry. The recent evidence shows that the climate risk situation of a country has considerable effects on the tourism industry.

In sum, climate risk is a cause of the decreases of the tourism activity and income of the country. The result lends proof that weather patterns of a country, specifically climate risk condition has considerable effects on tourism industry. Influx in international tourist arrivals in response to climate risk affects all countries across the globe. However, less developed countries are generally more affected than industrialized countries because they are more vulnerable as they have fewer resources and mechanisms to mitigate the impacts.

References

Blanke, J., & Chiesa, T. (2013). The Travel & Tourism Competitiveness Report 2013. In The World Economic Forum.

GDP per capita (current US$). (http://data. worldbank. org/ indicator/NY.GDP.PCAP.CD). Retrieved 2nd April, 2014.

Gössling, S., Scott, D., Hall, C. M., Ceron, J. P., & Dubois, G. (2012). Consumer behaviour and demand response of tourists to climate change. Annals of Tourism Research, 39(1), 36-58.

Harmeling, S. and Eckstein, D.(2012) Global Climate Risk Index 2013. Who Suffers Most from Extreme Weather Events? Weather-Related Loss Events in 2011 and 1992 to 2011.(https://germanwatch. org/en/download/7170.pdf) Retrieved 14th November 2013.

"Interim Update".UNWTO World Tourism Barometer (2013).(http://mkt.unwto .org /en/publication/ unwto-tourism-highlights-2013-edition). Retrieved 05th January 2014.

Most, W. S., & Weather, E. (2012). Global Climate Risk Index 2013.

Padua, R. (2013). On Fractal Probability Distributions: Results on Fractal Spectrum. (SSDSU

Multidisciplinary Journal, Vol. 1, 87 – 92, CHED – JAS B).

The Travel & Tourism Competitiveness Report 2013. Retrieved 3rd April, 2014. UNEP, 2008. Disaster Risk Management for Coastal Tourism Destination Responding to Climate Change. A Practical Guide for Decision-makers. 15, rue de Milan, 75441 Paris CEDEX 09, France.

UNEP, 2008. Disaster Risk Reduction. A toolkit for Tourism Destinations. Practical examples from Coastal Settlements in Asia. 15, rue de Milan, 75441 Paris CEDEX 09, France.

UNEP, 2007. Disaster Risk Reduction in Tourism Destinations. Disaster Reduction through Awareness, Preparedness and Prevention Mechanisms in Coastal Settlements in Asia-Demonstration in Tourism Destinations. 15, rue de Milan, 75441 Paris CEDEX 09, France.

United Nations World Tourism Organization & United Nations Environment Programme (UNWTO & UNEP) (2008). Climate change and tourism: Responding to global challenges, Madrid: UNWTO & UNEP.(http://www.unep.org/greeneconomy/Portals/88/documents/ger/ger_final_dec_2011/Tourism%20in%20the%20green_economy%20unwto_unep.pdf). Retrieved 3rd March, 2014.

UNWTO. (2013). UNWTO Tourism Highlights, 2013 Edition Tourism. United Nations World Tourism Organizations. (http://mkt.unwto.org/en/publication/unwto-tourism-highlights-2013-edition.pdf). Retrieved 3rd March 2014.

UNWTO, UNEP. "WMO (2008): Climate Change and Tourism–Responding to Global Challenges." Advanced Summary, October (2007).

World Bank Group (Ed.). (2012). World Development Indicators 2012. World Bank Publications.

"World's top destinations by international tourism receipts". World Tourism Barometer.UNWTO. (http://dtxtq4w60wqpw.cloudfront.net/sites/all/files/pdf.Worlds_top_destinations_pr_27.pdf). Retrieved 11th March 2014.

APPENDIX

List of Countries and Data Sets of all Variables used in the Study

	Country	Climate Risk Index	International Tourist Arrivals	Travel & Tourism Competitiveness	Tourism Income ($million)	GDP ($billion)
1.	Albania	93.33	2,932,000.00	3.97	1,833.00	4,109.00
2.	Algeria	44.67	2,395,000.00	3.07	302.00	5,258.00
3.	Argentina	43.33	5,705,000.00	4.17	6,059.00	10,952.00
4.	Armenia	91.83	758,000.00	3.96	485.00	3,420.00
5.	Australia	23.50	5,875,000.00	5.17	34,168.00	62,003.00
6.	Austria	77.67	23,012,000.00	5.39	22,432.00	49,581.00
7.	Azerbaijan	87.83	1,562,000.00	3.97	1,500.00	7,190.00
8.	Bahrain	94.17	6,732,000.00	4.30	1,766.00	22,467.00
9.	Bangladesh	50.83	303,000.00	3.24	97.00	732.00
10.	Barbados	94.17	568,000.00	4.88	6,830.00	4,368.00
11.	Belgium	51.67	7,494,000.00	5.04	13,028.00	46,513.00
12.	Benin	84.67	209,000.00	3.09	188.00	746.00
13.	Bolivia	31.33	807,000.00	3.46	499.00	2,320.00
14.	Bosnia and Herzegovina	49.67	392,000.00	3.78	719.00	4,751.00
15.	Brazil	14.33	5,433,000.00	4.37	6,830.00	12,576.00
16.	Bulgaria	59.00	6,328,000.00	4.38	4,554.00	7,287.00
17.	Burundi	57.67	142,000.00	2.82	4.00	247.00
18.	Cambodia	7.00	2,882,000.00	3.56	1,790.00	878.00
19.	Canada	39.00	16,014,000.00	5.28	19,901.00	51,554.00
20.	Cape Verde	94.17	428,000.00	3.87	438.00	3,875.00
21.	Chile	39.33	3,070,000.00	4.29	2,706.00	14,501.00
22.	China	31.50	57,581,000.00	4.45	53,313.00	5,442.00
23.	Colombia	33.50	2,385,000.00	3.90	3,083.00	7,144.00
24.	Croatia	92.17	9,927,000.00	4.59	9,614.00	61,789.00
25.	Cyprus	94.17	2,392,000.00	4.84	2,724.00	24,992.00
26.	Czech Republic	93.83	8,775,000.00	4.78	8,462.00	29,372.00
27.	Denmark	53.67	7,363,000.00	4.98	5,993.00	20,580.00
28.	Dominican Republic	35.67	4,306,000.00	3.88	4,353.00	5,486.00
29.	Ecuador	74.67	1,141,000.00	3.93	843.00	5,035.00

30.	Egypt	94.17	9,497,000.00	3.88	9,333.00	2,972.00
31.	El Salvador	11.83	1,184,000.00	3.59	729.00	3,699.00
32.	Estonia	82.00	2,665,000.00	4.82	1,683.00	16,534.00
33.	Ethiopia	92.00	523,000.00	3.29	1,998.00	355.00
34.	Finland	57.67	4,192,000.00	5.10	5,591.00	48,843.00
35.	France	53.50	81,411,000.00	5.31	65,172.00	42,522.00
36.	Georgia	44.67	2,822,000.00	4.10	1,059.00	3,220.00
37.	Germany	47.33	28,374,000.00	5.39	53,411.00	44,021.00
38.	Ghana	44.17	931,000.00	3.30	797.00	1,594.00
39.	Greece	89.67	16,427,000.00	4.75	14,984.00	25,631.00
40.	Guatemala	16.17	1,823,000.00	3.65	1,350.00	3,243.00
41.	Guinea	80.67	30,000.00	2.88	2.00	457.00
42.	Haiti	42.00	349,000.00	2.59	162.00	732.00
43.	Honduras	19.00	871,000.00	3.72	704.00	2,277.00
44.	Hungary	69.83	10,250,000.00	4.51	6,928.00	13,909.00
45.	Iceland	94.17	566,000.00	5.10	750.00	44,120.00
46.	India	27.17	6,309,000.00	4.11	17,518.00	1,534.00
47.	Indonesia	57.67	7,650,000.00	4.03	8,994.00	3,472.00
48.	Ireland	48.83	7,630,000.00	5.01	9,629.00	48,249.00
49.	Israel	94.17	2,820,000.00	4.34	5,598.00	33,250.00
50.	Italy	43.67	46,119,000.00	4.90	45,368.00	36,104.00
51.	Jamaica	72.83	1,952,000.00	4.08	2,060.00	5,330.00
52.	Japan	38.00	6,219,000.00	5.13	12,534.00	46,135.00
53.	Jordan	94.17	3,975,000.00	4.18	3,859.00	4,666.00
54.	Kazakhstan	83.50	3,393,000.00	3.82	1,524.00	11,259.00
55.	Kenya	61.17	1,470,000.00	3.66	1,844.00	817.00
56.	Korea, Republic	37.33	9,795,000.00	4.91	17,246.00	22,388.00
57.	Kuwait	73.50	269,000.00	3.61	525.00	51,497.00
58.	Kyrgyz Republic	77.83	3,114,000.00	3.45	689.00	6,197.00
59.	Latvia	94.17	1,493,000.00	4.43	1,098.00	13,807.00
60.	Lebanon	86.83	1,655,000.00	4.04	7,070.00	9,148.00
61.	Lesotho	94.17	397,000.00	2.89	26.00	1,244.00
62.	Lithuania	89.50	1,775,000.00	4.39	1,417.00	14,155.00
63.	Luxembourg	94.17	871,000.00	4.93	4,807.00	114,211.00
64.	Macedonia	94.17	327,000.00	3.98	250.00	4,941.00
65.	Malawi	69.17	767,000.00	3.22	43.00	364.00
66.	Malaysia	60.17	24,714,000.00	4.70	19,593.00	10,012.00
67.	Mali	52.83	160,000.00	3.11	274.00	739.00
68.	Malta	92.67	1,412,000.00	4.92	1,480.00	21,964.00
69.	Mauritius	92.83	965,000.00	4.28	1,813.00	8,741.00
70.	Mexico	25.50	23,403,000.00	4.46	12,270.00	9,699.00

71.	Moldova	94.17	11,000.00	3.60	262.00	1,970.00
72.	Mongolia	94.17	457,000.00	3.63	258.00	3,181.00
73.	Morocco	92.00	9,342,000.00	4.03	9,101.00	3,044.00
74.	Mozambique	94.17	1,718,000.00	3.17	270.00	511.00
75.	Namibia	27.50	984,000.00	3.77	293.00	5,692.00
76.	Nepal	38.00	736,000.00	3.42	645.00	699.00
77.	Netherlands	89.33	11,300,000.00	5.14	415.00	50,085.00
78.	New Zealand	55.00	2,572,000.00	5.17	20,970.00	36,080.00
79.	Nicaragua	24.83	1,060,000.00	3.67	377.00	1,632.00
80.	Nigeria	38.00	715,000.00	3.14	688.00	1,486.00
81.	Norway	39.50	4,963,000.00	4.95	6,399.00	99,143.00
82.	Oman	59.50	1,048,000.00	4.29	1,612.00	23,133.00
83.	Pakistan	10.50	907,000.00	3.25	1,123.00	1,196.00
84.	Panama	80.83	1,473,000.00	4.54	2,925.00	8,373.00
85.	Paraguay	20.00	524,000.00	3.39	281.00	3,957.00
86.	Peru	56.17	2,598,000.00	4.00	2,912.00	5,970.00
87.	Philippines	11.83	3,917,000.00	3.93	3,796.00	2,358.00
88.	Poland	79.17	13,350,000.00	4.47	11,598.00	13,382.00
89.	Portugal	90.17	7,264,000.00	5.01	14,882.00	22,504.00
90.	Qatar	94.17	2,527,000.00	4.49	4,463.00	89,736.00
91.	Romania	73.00	7,611,000.00	4.04	2,084.00	8,539.00
92.	Russia	78.33	24,932,000.00	4.16	17,031.00	13,284.00
93.	Saudi Arabia	49.67	17,498,000.00	4.17	9,336.00	24,116.00
94.	Senegal	94.17	1,001,000.00	3.49	1,150.00	5,964.00
95.	Serbia	41.00	764,000.00	3.78	378.00	12,118.00
96.	Seychelles	94.17	194,000.00	4.51	44.00	501.00
97.	Sierra Leone	94.17	52,000.00	2.87	17,990.00	47,268.00
98.	Singapore	88.00	10,390,000.00	5.23	17,990.00	245,024.00
99.	Slovak Republic	86.00	1,460,000.00	4.32	2,514.00	96,034.00
100.	Slovenia	88.17	2,037,000.00	4.58	2,920.00	24,478.00
101.	South Africa	64.50	8,339,000.00	4.13	10,707.00	7,943.00
102.	Spain	63.50	56,694,000.00	5.38	67,538.00	31,985.00
103.	Sri Lanka	16.50	856,000.00	3.99	1,421.00	2,836.00
104.	Suriname	94.17	220,000.00	3.63	69.00	8,125.00
105.	Sweden	75.33	5,006,000.00	5.24	16,331.00	57,071.00
106.	Switzerland	36.33	8,534,000.00	5.66	21,061.00	83,326.00
107.	Tajikistan	71.50	183,000.00	3.41	40.00	872.00
108.	Tanzania	44.00	795,000.00	3.46	1,487.00	609.00
109.	Thailand	2.50	19,230,000.00	4.47	30,926.00	5,480.00
110.	Turkey	74.67	34,038,000.00	4.44	28,059.00	10,605.00
111.	Uganda	42.67	1,151,000.00	3.39	974.00	479.00

112.	Ukraine	68.17	21,415,000.00	3.98	5,406.00	3,576.00
113.	United Kingdom	68.50	29,306,000.00	5.38	45,940.00	38,961.00
114.	United States	15.17	62,711,000.00	5.32	185,886.00	48,113.00
115.	Uruguay	65.83	2,857,000.00	4.23	2,375.00	13,724.00
116.	Venezuela	64.00	595,000.00	3.41	843.00	10,728.00
117.	Vietnam	25.33	6,014,000.00	3.95	5,620.00	1,408.00
118.	Yemen	94.17	1,025,000.00	2.96	913.00	1,361.00
119.	Zambia	84.00	815,000.00	3.46	146.00	1,409.00
120.	Zimbabwe	66.17	2,423,000.00	3.33	664.00	723.00