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M^a Soledad Otero Giráldez
Marcos Álvarez-Díaz
Manuel González Gómez

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Departamento de Economía Aplicada
Universidade de Vigo
As Lagoas Marcosende S/N, 36310 –Vigo
Tfno: +34 986 812500 - Fax: +34 986 812401
<http://webs.uvigo.es/x06/>
E-mail: depx06@uvigo.es

**DETECTION OF EMPIRICAL RELATIONSHIPS BETWEEN THE NORTH
ATLANTIC OSCILLATION AND INTERNATIONAL TOURISM DEMAND TO
THE BALEARIC ISLANDS**

M^a Soledad Otero Giráldez¹, Marcos Álvarez-Díaz², Manuel González Gómez¹

¹*Department of Applied Economics, University of Vigo, Lagoas-Marcosende s/n, 36310 Vigo, Spain*

²*Department of Economics, University of Vigo, Lagoas-Marcosende s/n, 36310 Vigo, Spain*

ABSTRACT

This paper analyses the relationship between the North Atlantic Oscillation (NAO) and the tourist arrivals to the Balearic Islands from Germany and United Kingdom. The sample period for all time series goes from 1980 to 2008. Using the Granger Causality test and an analysis based on cross-correlation functions, this study discovers the existence of a statistical connection between the variables object of analysis.

Keywords: NAO; Tourism demand, Causality, Balearic Islands

1. INTRODUCTION

It is traditionally assumed that international tourism demand is mainly determined by socio-economic factors such as the population and income level in the origin country, relative prices, currency foreign exchange rate and marketing expenditures on promotional activities in the destination country (Lim, 1997; Law and Au, 1999). These factors have been widely used in the majority of the demand studies (Uysal and El Roubi, 1998). Although the economic factors are unquestionably relevant in explaining tourism flows, other kind of variables could be also important. Tourism is a climate-dependent industry, as a lot of tourist activities heavily rely on specific weather conditions (skiing activities, seaside tourism...). Therefore, it seems also reasonable to consider climate and meteorological factors as significant determinants of tourism demand; however, relatively little systematic research has been carried out. The scarce literature on this topic reveals that the most widely-used meteorological variable in determining tourism is temperature (Madison, 2001). Other variables are also used such as rainfall, wet days, cloud cover, humidity, sunshine and wind speed (Agnew and Viner, 2001; Agnew and Palutikof, 2006).

One potential key variable to explain Tourism could be the climatic phenomenon observed in the North-Atlantic zone and known as the NAO (the North Atlantic Oscillation). The NAO is one of the most prominent and recurrent pattern of atmospheric variability over the North Atlantic Ocean, and plays an important role in the weather conditions in the North Hemisphere (Hurrell *et al.* 2003). It has a significant impact on the meteorological conditions (temperature, storms, precipitations, wind speed, among others) observed predominantly in the Atlantic zone, and also in the Mediterranean region (Greatbatch, 2000). The phenomenon is formally defined as an

anomalous difference in the atmospheric pressure between the subtropical high-pressure belt, around the latitudes of 35°- 40° in the Northern Hemisphere and centered near the Azores, and the subpolar low-pressure belt, centered over Iceland.

The NAO is usually characterized by mean of an index defined as the mean value of the difference between the normalized sea level pressure between Lisbon (Portugal) and Stykkisholmur (Iceland) during the winter months (Hurrel, 1995). The analysis of this index allows distinguishing two different phases of the NAO, one negative and the other positive.

The negative phase indicates a lower-than-normal sea level pressure over the Azores and, simultaneously, a higher-than-normal sea level pressure over the Iceland region. As a result of these anomalies, the Atlantic storm fronts move to the south causing anomalously large amount of precipitations and a higher-than-normal temperature in Europe, in the western Mediterranean and in the southeastern of North America. On the other hand, the Scandinavian countries show a drier and colder-than-normal weather.

Conversely, the positive phase implies a higher-than-normal sea level pressure over the Azores together with a lower-than-normal sea level pressure over the Iceland region. In general, this phase is associated with drier and colder than normal conditions in Europe, in the western Mediterranean and in the southeastern of North America. On the contrary, the Scandinavian wet and warm conditions are observed from Iceland through Scandinavian.

Nowadays, there is an invigorated interest in analyzing empirically the possible relationship of the NAO and a wide range of weather and oceanography variables, and its impacts on specific marine and terrestrial ecosystems (Hurrell *et al.*, 2003).

However, the economic connections have not been deeply explored until now. Through the effects on weather conditions, the NAO has also an indirect influence on certain economic activities. Relatively recently a number of studies have empirically demonstrated the influence of the NAO on the agriculture sector (Gimeno *et al.*, 2002; Kim and McCarl, 2005), the energy sector (Cherry *et al.*, 2005) and marine transport (Woolf *et al.*, 2003). Nevertheless, the influence of the NAO on the tourism sector has not been studied yet, and this gap must be filled in order to understand better how tourism works. For that reason, the main objective here is to empirically analyze if the NAO has a statistical impact on international tourism demand of a concrete tourism-dependent area: The Balearic Islands. Specifically, the study is centered on analyzing the impact on the number of tourist arrivals to the Balearic Islands from Germany and United Kingdom. The tourism industry in this Spanish region is one of the largest employers and generators of economic growth, accounting directly or indirectly for around 60% of its Gross Domestic Product. In consequence, given tourism's obvious importance to the Balearic economy, studies on tourism demand are considered of great relevance by the government and the local industry. The analysis is restricted to visitors from Germany and United Kingdom. This constraint is justified because of the predominance of these two nationalities in the Balearic tourism (almost 80% of the tourist arrivals) and, secondly, because for both cases they are time series with enough entries to apply the statistical methods used in this study.

The rest of the paper is organized as follows. After this introductory section, a description of the data and the methodology is provided. In Section Three, the results

are discussed. Finally, Section Four closes the paper with a summary of the main findings.

2. DATA AND METHODOLOGY

2.1. Data description

As previously noted, we use in our study the index constructed by Hurrell (1995) to describe the temporal evolution of the NAO. This index is defined as the difference of normalized sea level pressure between Lisbon (Portugal) and Stykkisholmur (Iceland) during the standard winter months (December, January, February and March). The winter value is supposed to describe appropriately the whole year beginning that January (Gimeno *et al.*, 2002; Cherry *et al.*, 2005).

The other variable object of analysis is the international tourism demand to the Balearic Islands, which can be adequately approximated by the number of tourist that visit the archipelago from Germany and United Kingdom. There are other approximations such as tourism revenues, overnight stays or tourist expenditure; however, tourist arrival is the most popular measure of tourism demand (Song and Li, 2008).

The data for the NAO index were taken from <http://www.cgd.ucar.edu/cas/jhurrell/indices.html>. Regarding the tourist arrivals to the Balearic Islands from Germany and United Kingdom, the data come from the yearly reports of CITTIB, tourist statistical center belonging to the Balearic government, and available under request at www.inestur.es. Finally, the sample period for all time series

goes from 1980 to 2008; therefore, the final sample comprises a total of 29 observations to carry out the statistical analysis.

2.2. Methodology

Two alternative methods of analysis are employed to statistically study the existence of an impact of the NAO on the tourism arrivals to the Balearic archipelago.

The first one is based on the causality concept developed by Granger (1969). This author presented an approach for testing causality between two variables that has been widely applied in many econometric studies; however, its use is scarce in climate research (Mosedale *et al.* 2006). The procedure starts constructing simple causal models

$$x_t = \alpha_0 + \alpha_1 x_{t-1} + \dots + \alpha_p x_{t-p} + \beta_1 y_{t-1} + \dots + \beta_p y_{t-p} + \varepsilon_t \quad (1)$$

and

$$y_t = \mu_0 + \mu_1 y_{t-1} + \dots + \mu_p y_{t-p} + \delta_1 x_{t-1} + \dots + \delta_p x_{t-p} + u_t \quad (2)$$

where x_t and y_t are the two time series object of analysis and they must be stationary. The residuals of the models ε_t and u_t must be uncorrelated white-noise series. As usual in this kind of analysis, the best order p for the equations is selected by minimising an Information Criterion, for example the Schwarz Criterion (Schwarz, 1978). The first equation means that the variable x_t can be expressed in function of its own past and of the past of y_t . In the same way, the second equation determines that the variable y_t can be determined by its own past and the past of the variable x_t . Therefore, the definition of causality in the sense of Granger implies that y_t is causing x_t if it is proved that some

estimated coefficient β_i is statistically non-zero. Similarly x_t is causing y_t if it is demonstrated that some δ_i is statistically non-zero. Moreover, if both of these events occur, it is said to be a feedback relationship between x_t and y_t . The null hypothesis of the contrast with two restrictions is that y_t does not Granger-cause x_t in the first regression

$$H_0 : \beta_1 = \beta_2 = \dots = \beta_p = 0$$

and that x_t does not Granger-cause y_t in the second regression.

$$H_0 : \delta_1 = \delta_2 = \dots = \delta_p = 0$$

The statistical test used to contrast these hypotheses is the conventional F-test. And as usual, if the p-value of the test is smaller than 0.05, then the null hypothesis is rejected and it can be said that there is a Granger causality relationship between the variables.

The second perspective to analyse the empirical relationship between the NAO and tourist arrivals is based on the cross-correlation function (CCF). This methodology is usually applied in natural science research to detect connections between the atmospheric variability described by the NAO index and different climatic, biological, and oceanographic variables (Hurrell, 1995; Gimeno *et al.*, 2002; Orfila *et al.*, 2005, among others). The sample cross-correlation between two time series y_t and x_t is calculated using the expression

$$\rho_{x,y} = \frac{C_{x,y}(l)}{\sqrt{C_{x,x}(0)} \cdot \sqrt{C_{y,y}(0)}} \quad l = 0, \pm 1, \pm 2, \dots \quad (3)$$

where

$$C_{X,Y}(l) = \begin{cases} \sum_{t=1}^{T-l} (x_t - \bar{x})(y_{t+l} - \bar{y})/T & \text{if } l = 0, 1, 2, \dots \\ \sum_{t=1}^{T+l} (y_t - \bar{y})(x_{t-l} - \bar{x})/T & \text{if } l = 0, -1, -2, \dots \end{cases} \quad (4)$$

Nevertheless, it must be recalled that the analysis using CCFs should be handled with care. If each one of the analyzed series has a very high degree of autocorrelation, then the nonzero values of the cross-correlation function do not necessarily imply a true relationship between the two time series (Katz, 1988). In other words, the presence of autocorrelation can lead to a spurious relationship between the variables and, therefore, the cross-correlation analysis would be completely wrong. For that reason, in order to avoid possible fictitious cross-correlations, it is necessary to remove all of the autocorrelation in each time series and then cross-correlate that which remains. If the identical method of removing autocorrelation is applied to each variable, the true cross-correlation between variables is preserved (DeLurgio, 1998).

The procedure followed here starts assuming that each one of the time series under study follows an autoregressive process with additive Gaussian noise (Orfila *et al.*, 2005). Consequently, the method implies to fit a p-order autoregressive model (AR(p)) for x_t of the form

$$x_t = \alpha_0 + \alpha_1 x_{t-1} + \dots + \alpha_p x_{t-p} + e_t \quad (5)$$

and a q-order autoregressive (AR(q)) for y_t

$$y_t = \mu_0 + \mu_1 y_{t-1} + \dots + \mu_q y_{t-q} + u_t \quad (6)$$

where x_t and y_t are the original time series that show autocorrelation, $\{\alpha_i\}_{i=0}^p$ and $\{\mu_j\}_{j=0}^q$ are the coefficients that must be optimally estimated in order to get non-autocorrelated residuals $\{e_t\}_{t=1}^T$ and $\{u_t\}_{t=1}^T$. The order p and q of the autoregressives will be those that minimize the Akaike Information Criterion (AIC) (Akaike, 1974). Finally, the residuals in (5) and (6) will be the filtered series to be cross-correlated.

3. RESULTS

In order to apply the Granger Causality test, it is necessary to verify that the time series are stationary. For this purpose, the conventional non-parametric Phillips-Perron test (PP) (Phillips and Perron, 1988), and the Augmented Dickey-Fuller test (ADF) (Dickey and Fuller, 1981) are used for testing stationary; in particular, the existence of a unit root in the time series. The results, reported in Table 1 and Table 2, show that the NAO index is stationary. On the other hand, tourist arrivals from Germany and United Kingdom are both non-stationary time series. Specifically, as they are integrated of order one, a common practice to get stationary is to take first differences. Therefore, first-differenced time series were used in the case of German and United Kingdom tourist arrivals.

Given that all series are now stationary, it is feasible to apply the Granger Causality Test. Table 3 shows the null hypothesis to be contrasted, and the values and p-values of the test. As it can be seen, the test has associated a p-value of 0.01 and 0.036 for the German and United Kingdom arrivals, respectively. Therefore, it can be rejected the null hypothesis that the NAO does not have a causal effect on the number of tourist arrivals to the Balearic Islands from Germany and United Kingdom. Moreover, an

analysis of the sensitivity of the results reveals that the choice of the lag length is not a critical issue. That is, the test is robust to different number of lags considered in the analysis. Therefore, the Granger Test verifies statistically that a climatic phenomenon as the NAO has a significant impact on international tourism demand to the Balearic archipelago.

Regarding the use of cross-correlation functions, the first step is to remove the autocorrelation existing in the original series using an AR(p). Figure 1 depicts the choice of the optimal order of the autoregressive for the series object of study. In all cases, the optimum order that minimizes the AIC is $p=1$, and the residuals obtained after filtering the original data did not exhibit significant autocorrelations. Therefore, the residual series can be used in the analysis to detect significant cross-correlations not due to co-temporality. Specifically, the residuals of the NAO index were cross-correlated with each one of the residuals of the international tourist arrivals series.

Figure 2 and Figure 3 show graphically the sample cross-correlation function for the German and British case, respectively. Moreover, these figures also display the intervals of confidence necessary to examine the statistical significance of the cross-correlation coefficients. The intervals are empirically constructed by means of a Montecarlo simulation. To do so, 5000 time series were randomly generated with the same characteristics as a random white variable and with the same standard deviation as the residuals of the NAO index. Then, each one of these artificial variables was cross-correlated with the residual series of tourism arrivals. An empirical distribution of each cross-correlation coefficient for each lag is computed. Using this empirical distribution

a confidence interval with a specific significant level is built, in this case the significance is determined at 95%.

Analyzing Figure 2, it can be observed that the NAO index is positively cross-correlated with the German tourist arrivals at lag $\tau = 4$, negatively at lag $\tau = 7$, and no significant cross-correlations are detected to other lags. These results verify the existence of a statistically significant relationship between the NAO phenomenon and the number of German visitors to the Balearic Islands. On the other hand, the relationship between NAO and tourist arrivals from United Kingdom is not as clear as in the German case. Examining Figure 3, only a slight significance is found for the cross-correlation coefficient at lag $\tau = 2$.

4. CONCLUSION

This study analyses statistically the relationship between the North Atlantic Oscillation, one of the most important pattern of atmospheric variability over the North Atlantic Ocean, and international tourism demand. In particular, using the Granger Causality test and cross-correlation functions, it has been demonstrated that the NAO has a statistical significant connection with the number of tourist arrivals to the Balearic Islands from Germany and United Kingdom.

Certainly, there are many interactions between climate and tourism. However, no published study to our knowledge exists that has examined statistically this interaction and, specifically, the relationship between the NAO and tourism. In this sense, the present paper opens a research avenue that will require further efforts. Once discovered

the association between NAO and tourism arrivals, the next step for future research must be to quantify the impact of the NAO on tourism by means of a model, and discover the causes of this connection

References

Agnew, M., and Palutikof, J. (2006). Impacts of short-term climate variability in the UK on demand for domestic and international tourism, *Climate Research*, 21, 109-120.

Agnew, M., and Viner, D. (2001). Potential impacts of climate change on international tourism, *Tourism and Hospitality Research*, 3, 1, 37-60.

Akaike, H. (1973). Information theory and an extension of the maximum likelihood principle, In B. Petrov & F. Csake (Eds), *Proceedings of the second international symposium on information theory*. Budapest: Akademiai Kiado

Cherry J., Cullen H., Visbeck M., Small A. and Uvo C. (2005). Impacts of the North Atlantic Oscillation on Scandinavian Hydropower Production and Energy Markets, *Water Resources Management*, 19, 673-691.

DeLurgio S. A. (1998). *Forecasting principles and applications*, Irwin/McGraw-Hill, New York.

Dickey, D.A., Fuller, W.A. (1981). Likelihood ratio statistics for autoregressive time series with a unit root, *Econometrica*, 49, 1057–1072.

Gimeno L. , Ribera P., Iglesias R., Torre L., García R., Hernández E. (2002). Identification of Empirical relationships between indices of ENSO and NAO and agricultural yields in Spain, *Climate Research*, 21, 165-172.

Granger, C. W. J. (1969)., Investigating causal relations by econometric models and cross-spectral methods, *Econometrica*, 37, 3, 424-438.

Greatbatch (2000). The North Atlantic Oscillation, *Stochastic Environmental Research and Risk Assessment*, 14, 213-242.

Hurrell J., Kushnir Y., Ottersen G. and Visbeck M. (2003). An Overview of the NAO, *Climatic Significance and Environmental Impact*, Geophysical Monograph 134, 2003, American Geophysical Union.

Hurrell J., (1995). Decadal trends in the North Atlantic Oscillation regional temperatures and precipitation, *Science*, 269, 676-679.

Katz, R. W. (1988). Use of cross correlation in the search for teleconnections, *International Journal of Climatology*, 8, 241-253.

Kim M. and McCarl B. A. (2005). The agriculture value of information on the North Atlantic Oscillation: Yield and Economic Effects, *Climatic Change*, 71, 117-139.

Law, R., and Au, N. (1999). A neural network model to forecast Japanese demand for travel to Hong Kong, *Tourism Management*, 20, 1, pp 89–97.

Lim C. (1999). A Meta-Analytic Review of International Tourism Demand, *Journal of Travel Research*, 37, 3, 273-289.

MacKinnon, J. G. (1996). Numerical distribution function for unit root and cointegration test, *Journal of Applied Econometrics*, 11, 601-618.

Maddison, D. (2001). In search of warmer climates? The impact of climate change on flows of British tourist, *Climatic Change*, 49, pp 193-208.

Mosedale T. J., Stephenson D. B., Collins M., Mills T. C. (2006). Granger Causality of coupled climate processes: Ocean feedback on the North Atlantic Oscillation, *Journal of Climate*, 19, 7, pp 1182-1194.

Orfila A., Álvarez A., Tintoré J., Jordi A., Besterretxea G. (2005). 'Climate teleconnections at monthly time scales in the Ligurian Sea inferred from satellite data', *Progress in Oceanography*, 66, 157-170.

Phillips, P.C.B, and Perron P. (1988). Testing for a Unit Root in Time Series Regressions.', *Biometrika* 75, 335-346.

Schwarz, G, (1978). Estimating the dimension of a model , *Annals of Statistics*, 6, 461-464

Song H., Li G. (2008). Tourism demand modelling and forecasting—A review of recent research, *Tourism Management*, 29, 203–220

Uysal M., and El Roubi M. S. (1999). Artificial Neural Networks Versus Multiple Regression in Tourism Demand Analysis, *Journal of Travel Research*, 38, 111-118.

Wolf D. K., Coll J., Gibb S. and Challenor P. G. (2003). Sensitivity of Ferry services to the Western Isles of Scotland to Changes in Wave Climate, Proceedings of OMAE'04 23rd International Conference on Offshore Mechanics and Arctic Engennering, June 20-25, 2003, Vancouver, Canada.

Table 1. Results of the Phillips - Perron test

Ho: variable has a unit root	t-statistic Models with Constant and Trend	t-statistic Models with Constant
NAO	-4.445173* (3)	-4.423531* (1)
German arrivals	-2.373036 (3)	-0.296345 (6)
British arrivals	-2.618303 (9)	-1.885406 (11)
Δ German arrivals	-4.380040* (1)	-4.471376* (1)
Δ British arrivals	-5.482706* (4)	-5.226123* (3)

Note: Δ is the first difference operator. Values in parenthesis specify the truncation lag for the Newey-West correction length used. * indicates significance at 5% level. Critical values are based on MacKinnon (1996).

Table 2. Results of the Dickey - Fuller test

Ho: variable has a unit root	t-statistic Models with Constant and Trend	t-statistic Models with Constant
NAO	-4.483430* (0)	-4.417141*(0)
German arrivals	-2.177113 (0)	-0.454708 (0)
British arrivals	-3.361824 (1)	-1.933828 (0)
Δ German arrivals	-4.382868* (0)	-4.474004* (0)
Δ British arrivals	-5.053248* (0)	-5.107392* (0)

Note: Δ is the first difference operator Values in parenthesis specify the lag length based on the Schwarz Information. Critical values from Mackinnon (1996). *denotes significance at 5 per cent level.

Table 3. Results of the Granger Causality Test

NULL HYPOTHESIS	Lags	F-Statistic	p-value
NAO does not Granger Cause German arrivals	4	4.88758	0.0100
NAO does not Granger Cause British arrivals	5	3.44631	0.0367

Note: The lag length is based on the Schwarz Information criterion and on the no correlation serial of the residuals.

Figure 1. Choice of the optimum p-order of the autoregressive for the time series

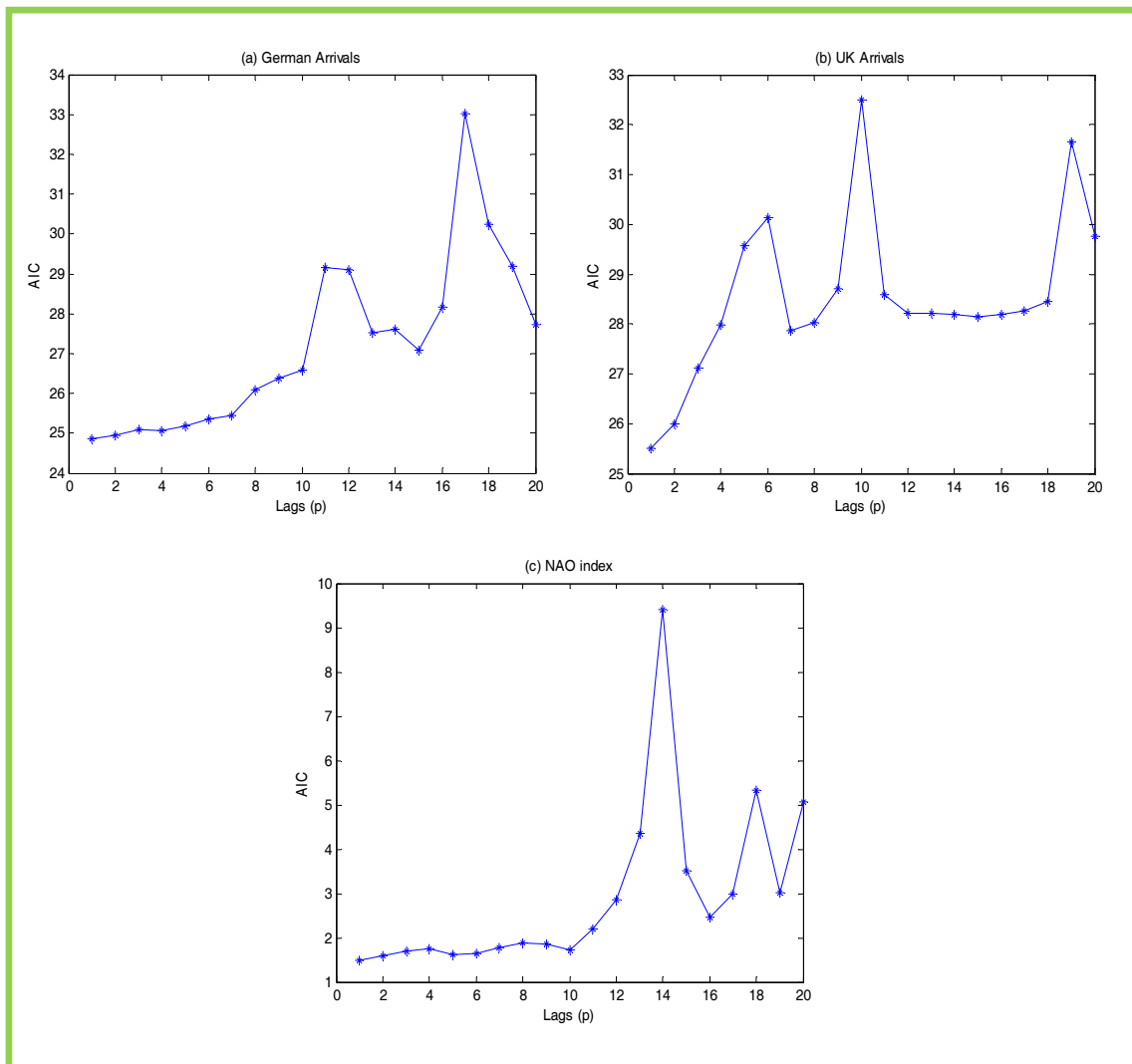


Figure 2. Sample cross-correlation between residuals of the NAO index and the residuals of the tourist arrivals from Germany.

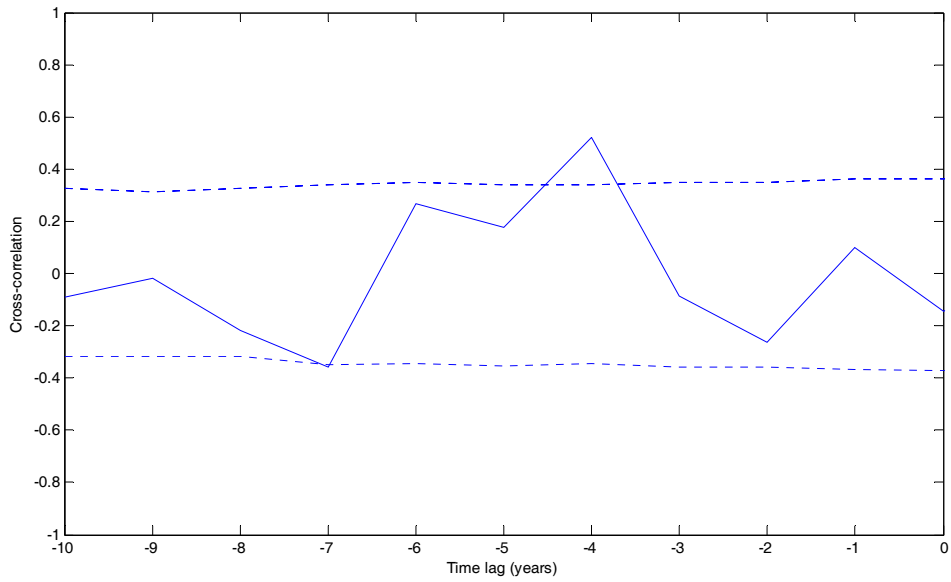
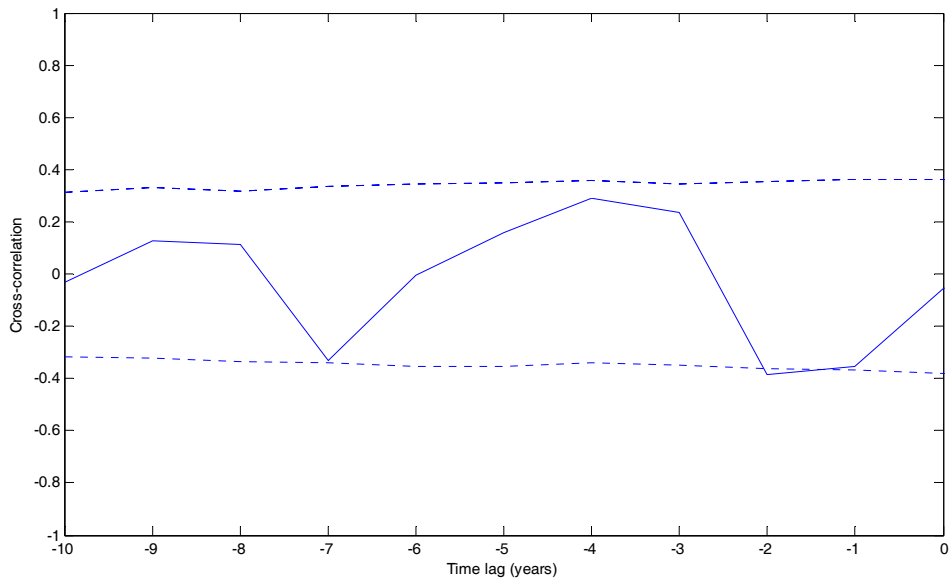


Figure 3. Sample cross-correlation between residuals of the NAO index and the residuals of the tourist arrivals from United Kingdom.



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