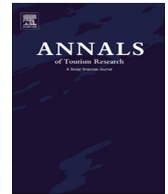




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## Cross country relations in European tourist arrivals

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## ABSTRACT

This paper introduces an optimized Multivariate Singular Spectrum Analysis (MSS) algorithm for identifying leading indicators. Exploiting European tourist arrivals data, we analyse cross country relations for European tourism demand. Cross country relations have the potential to aid in planning and resource allocations for future tourism demand by taking into consideration the variation in tourist arrivals across other countries in Europe. Our findings indicate with statistically significant evidence that there exists cross country relations between European tourist arrivals which can help in improving the predictive accuracy of tourism demand. We also find that MSSA has the capability of not only identifying leading indicators, but also forecasting tourism demand with far better accuracy in comparison to its univariate counterpart, Singular Spectrum Analysis.

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## Introduction

Europe is considered as the world's most visited tourism destination (UNWTO, 2016) with five European Union (EU) member states and one of its candidate countries being listed among the world's top 10 destinations for holiday makers (European Commission, 2016). In 2015, whilst generating an income of US\$ 451 billion, the EU accounted for 51% of the global tourist arrivals which in absolute terms was a 27 million increase in relation to 2014 (UNWTO, 2016). As the EU has placed considerable emphasis on the tourism sector as a source of economic prosperity for its members countries (Lee & Brahmašre, 2013), and given that Europe has suffered dramatically from the global financial crisis and the ongoing European debt crisis, the need for accurate forecasts of tourism demand is of paramount importance for tourism planning, entrepreneurs, investors, policy makers, tour operators and others alike.

There exists numerous studies which consider both univariate and multivariate forecasting applications of tourist arrivals. However, the aim of this paper goes beyond obtaining a forecast alone. In particular, our interest lies in answering the question as to whether one country's tourist arrivals can act as an indicator for the behaviour of tourism demand in another. The use of leading indicators for forecasting tourist arrivals is popular (Zhang & Kulendran, 2016), and the use of indicators for improving tourism demand forecasts have been discussed over many years. Yet, most of the focus has been on determining whether macroeconomic variables function as drivers of tourism demand, see for example Eugenio-Martin and Campos-Soria (2014), Smeral (2012) and Seetaram, Forsyth, and Dwyer (2016). Recently, there has been interest

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in exploring factors beyond the macroeconomic sphere (Dragouni, Filis, Gavriilidis, & Santamaria, 2016) and our work intends on contributing further to this line of research.

In order to achieve the aim of this paper, we consider modelling and finding cross country relations for selected European tourist arrivals in Austria, Cyprus, Germany, Greece, Netherlands, Portugal, Spain, Italy, Sweden and the United Kingdom. The choice of countries is mainly based on data availability. However, a closer look at these countries indicate the continuing and growing importance of tourism within each destination, and thereby justifies the selections. For example, Spain, Italy, Germany and UK are ranked amongst the top 10 destinations for international tourist arrivals (UNWTO, 2016). In addition, destinations such as Portugal, Greece and Cyprus are recognized as established destinations based on increasing tourist arrivals in 2015, whilst the Netherlands and Austria too have recorded solid increases, with Sweden boasting double digit growth (UNWTO, 2016). Table 1 below highlights some key statistics relating tourism to economic growth, employment and degree of seasonality in the selected countries.

The main advantage in identifying a cross country indicator for tourist arrivals is that it enables one to study the tourism policy decisions and investments in a neighbouring country, and alter its current policies and investments in the tourism sector accordingly. Moreover, the identification of such indicators has the potential to help improve forecast accuracy. As such, there is scope to benefit from efficient and improved decision making, planning and resource allocations particularly in relation to staffing and crucial investments in accommodation, aircrafts and infrastructure.

Historically, econometric models have been the most widely used for forecasting tourist arrivals (Rosselló, 2001). However, in this paper we consider a nonparametric, time series analysis technique known as Multivariate Singular Spectrum Analysis (MSSA) for modelling and finding leading cross country indicators for European tourism demand. We use the univariate counterpart of MSSA, Singular Spectrum Analysis (SSA) as the benchmark model, instead of relying on other popular univariate models such as ARIMA, ETS and Neural Networks because in Hassani, Webster, Silva, and Heravi (2015) it was shown via an application into U.S. tourism demand forecasting that SSA has the capability of outperforming these methods. More recently, Hassani, Silva, Antonakakis, Filis, and Gupta (forthcoming) evaluated the use of several parametric and non-parametric univariate forecasting techniques for predicting tourism demand in the same European countries and found SSA outperforming the competing models. In addition, the use of basic univariate SSA as a benchmark provides a further advantage as it enables to clearly show the accuracy gains attainable via the MSSA approach proposed in this paper.

Fig. 1 below plots the time series for European tourist arrivals. As Chen, Bloomfield, and Cubbage (2008) note, if stationary, a series will have a constant sample mean, variance and autocorrelation function over time. However, the series in Fig. 1 clearly shows both growth and declines which are signs of structural breaks in some series, and such breaks are infamous for making a time series non-stationary (Hassani, Mahmoudvand, Omer, & Silva, 2014). The nature of these time series indicate that forecasting techniques which are model free, and thus not bound by the restrictive parametric assumptions of normality and stationarity could provide comparatively better modelling for such data. In addition, the importance of filtering capabilities within such time series methods are apparent as there is a potential to benefit from extracting the seasonal fluctuations which are clearly visible. The proposed MSSA model is not only nonparametric and therefore not bound by the parametric assumptions, but is also a popular filtering and signal extraction technique.

As can be seen from Fig. 1, the movements of all the tourist arrivals series are dominated by seasonality. These strong seasonal patterns are underlined by the seasonal  $R^2$  presented in the last column of Table 1. This is computed as the conventional coefficient of determination in a regression model of the first difference series against twelve monthly dummy variables. Monthly dummy variables account for over 90% of the variation in most of these series, with the smallest seasonality reported for the UK as 81%. The similar characteristics of tourist arrivals in these countries is mainly because all the countries selected are in Europe and geographically close to each other, have similar climate conditions and macro-economic factors. In fact, tourists may visit several European countries in one occasion and thus visiting one country may well contribute to tourism revenues of other selected countries with freedom of movement facilitating tourist travelling, except the UK which is an island and has tighter boarder controls. Therefore, we would expect that the multivariate framework (MSSA) would produce better and more accurate forecasts, taking advantage of the similar behaviour of these series.

It is noteworthy that the aim of this study and its findings can be of great importance to the EU tourism sector as the recovery of many European economies in the year 2015 has fuelled intra-regional tourism (UNWTO, 2016). As a research study focussed on identifying leading cross country relations for European tourist arrivals, this paper has several key contributions. Firstly, it marks the introduction of MSSA for tourism demand modelling and forecasting. The use of an optimized MSSA algorithm as a method of seeking out indicators across countries is novel. This algorithm is extremely useful as it is coded in R to enable users who are not conversant with the theory underlying MSSA to use this method for selecting the optimized MSSA parameters for obtaining the best possible MSSA forecast. The accuracy of forecasts, efficiency, and ease of use are all important attributes when choosing a forecasting technique, and time series methods often yield more accurate forecasting results than causal quantitative approaches (Chen et al., 2008). Thirdly, as noted in Yap and Allen (2011), majority of the tourism demand research focuses on income and price variables as demand determinants for travel. In contrast to historical studies, this application considers uncovering cross country relations in tourist arrivals, and introduces a methodology which can be applied universally for seeking out leading indicators in any format for the entire tourism sector. Finally, the study considers short, medium and long run forecasts when determining the leading cross country relations in European tourist arrivals.

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