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Tourism forecasting: accuracy of alternative econometric models

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Abstract

This study evaluates the forecasting accuracy of six alternative econometric models in the context of the demand for international tourism in Denmark. These econometric models are special cases of a general autoregressive distributed lag specification. In addition, the forecasting accuracy of two univariate time series models is evaluated for benchmark comparison purposes. The forecasting competition is based on annual data on inbound tourism to Denmark. Individual models are estimated for each of the six major origin countries over the period 1969–93 and forecasting performance is assessed using data for the period 1994–97. Rankings of these forecasting models over different time horizons are established based on mean absolute percentage error and root mean square percentage error.

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1. Introduction

The last three decades have seen a large increase in the number of published studies on tourism demand modelling and forecasting (Lim, 1997; Witt & Witt, 1995). The growing interest in this area is related to the fast expansion of the international tourism industry in both developed and developing economies. Forecasting tourism demand has not only become an important task for many planners and policy-makers at both national and local levels, but has also stimulated great interest in searching for appropriate tourism demand modelling techniques to improve forecasting accuracy.

Martin and Witt (1989) published the first major study of tourism forecasting accuracy. Their data covered a range of origin country/destination country tourist flows. They obtained more accurate forecasts from several simple time series models, including the random walk (no-change) model, than with the more sophisticated traditional econometric model (least squares regression model). Sheldon (1993), in another major study, obtained similar results.

Witt and Witt (1995, p. 469) suggested that the most likely cause for the forecasting failure of econometric models is that “the considerable advances in econometric methodology during recent years have largely been ignored. It is essential for future econometric studies of tourism demand to take on board these developments, in particular in the areas of diagnostic checking, error correction models and cointegration”. They concluded that “It may well be that econometric forecasts, using the most

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up-to-date methodological developments, would be more accurate” (Witt & Witt, 1995, p. 470).

Articles on tourism demand modelling incorporating up-to-date developments in econometric methodology have started to appear recently in the literature, but have reached conflicting conclusions in terms of the methods that generate the most accurate forecasts. For example, Kulendran and King (1997) and Kulendran and Witt (2001) found that econometric models were still outperformed by simple univariate time series models. By contrast, Kim and Song (1998) and Song, Romilly and Liu (2000) found that the forecasting performance of econometric models was superior to simple time series models.

Conflicting results may arise for three main reasons. First, the performance of econometric models is sensitive to the different methodologies used (Clements & Hendry, 1998). Thus, the Johansen cointegration technique (Johansen, 1988) used by Kulendran and King (1997) and Kulendran and Witt (2001) may well lead to different conclusions than the Engle–Granger two-stage approach (Engle & Granger, 1987) used by Kim and Song (1998) and Song et al. (2000). Second, different data frequencies may lead to different conclusions. For example, Kim and Song (1998) and Song et al. (2000) used annual data, whereas Kulendran and King (1997) and Kulendran and Witt (2001) used quarterly data. It may well be that annual data have fewer unit roots and fewer cointegrating vectors than the same series at quarterly frequency, and different cointegrating relationships usually lead to different error correction models (ECMs). Third, econometric studies of tourism demand generally assume that the structure of the model used for forecasting is constant over time, i.e. the parameters of the model remain unchanged over the sample period. This assumption may be too restrictive, and result in time series models outperforming econometric models. The international tourism market has gradually changed from supply driven to demand driven since the 1970s. The attitudes of tourists and tourism suppliers have also changed accordingly. The choice of holiday destinations for tourists was initially restricted by limited supply, and tourism demand was generally inelastic with respect to the price and quality of tourism products. The subsequent massive growth in the

tourism industry and increasing competition in the international tourism market have provided a wide range of choices of holiday destinations for consumers, and these changes may well have caused tourism demand elasticities to vary over time. Also, in some countries foreign holidays to certain destinations are now regarded as less of a luxury than previously, and may even have become necessities, due to changes in consumers’ tastes and improving economic conditions in the generating countries.

Econometric models of tourism demand have to date been based largely on the search for structural stability and a belief that the future will be similar to the past. Such assumptions, however, may not be tenable in the light of the above discussion, in which case forecasts generated using fixed parameter tourism demand models are likely to be poor. The time varying parameter (TVP) approach allows for structural instability, and is therefore expected to improve forecasting accuracy when structural instability is present in tourism demand models. The TVP approach has been successfully used in modelling and forecasting other economic activities (Brown, Song, & McGillivray, 1997; Riddington, 1993; Song, Liu, & Romilly, 1996, 1997; Song, Romilly, & Liu, 1998; Stock & Watson, 1996; Swamy, Conway, & LeBlanc, 1989). However, the application of the TVP method to tourism has been rare (but see Riddington, 1999 and Song & Witt, 2000).

The purpose of this paper is to examine the forecasting accuracy of a range of alternative modern econometric modelling approaches in the context of the demand for international tourism. The six models evaluated in this paper are special cases of a general autoregressive distributed lag model (ADLM) and they comprise a long-run static cointegration regression; two error correction models, one based on the Wickens and Breusch (1988) (WB) approach and the other on the Johansen (1988) maximum-likelihood (JML) approach; a reduced ADLM; an unrestricted vector autoregressive (VAR) model; and a TVP model. In addition, the forecasting accuracy of two univariate time series models is evaluated for benchmark comparison purposes; these models are an ARIMA model and the no-change model (the latter is included as it has consistently generated more accurate forecasts of international tourism demand than least squares regression). The forecasting ac-

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