

## BOOK REVIEW

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TOURISM DEMAND MODELLING AND FORECASTING: MODERN  
ECONOMETRIC APPROACHES; Haiyan Song and Stephen F. Witt; Pergamon, 2000;  
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Tourism demand is of central interest to businesses serving travelers away from home, destinations, and those who study them. Reducing the infinite number of futures that this demand might assume is the purpose of forecasting. There are a variety of quantitative and qualitative methods that have been applied to this problem (cf. Frechtling 2001). Quantitative methods include those that rely only past values of the tourism demand series to forecast future values ("extrapolative methods") and those that simulate cause and effect relationships ("causal methods"). The latter are the realm of econometric methods, and the authors propose to present the modern approaches in this book.

The authors provide a clear introduction to determinants of tourism demand, functional forms, hypothesis formulation and testing, data sources, the ordinary least squares method, and what they call "the traditional approach to demand modelling" (Chapter 2). This, briefly, involves defining a dependent demand variable and its time series, and identifying one or two time series of potential explanatory (independent) variables that economic theory suggests could explain the demand series. The one- or two-term equation is estimated by ordinary least squares and the measures of fit, such as such as  $R^2$  and F-statistic, are calculated and the significance of the coefficients of the explanatory variables are examined to discern whether they are statistically significantly different from zero. If the equation is found wanting, then additional variables are substituted and tested until an equation that "fits the researcher's *a priori* beliefs is discovered". (p. 28). The authors criticize this "specific-to-general approach" to modelling as mere "data mining", that is testing all possible relationships and then presenting the equation with the best fit as best representing reality.

The authors present a lucid account of the preferred alternative to this: "general-to-specific modelling". Under this approach, we begin with an equation that "contains as many variables as possible suggested by economic theory" (p. 28), the autoregressive distributed lag model (ADLM). Simply, this model presents for testing the hypothesis that a current value of the demand variable is a function of current and all past values of all possible exogenous variables plus past values of the demand variable itself. Then a number of simpler alternative models (the authors identify 10) are considered and the

optimal one is identified through certain tests of restrictions on regression parameters and diagnostic checking (i.e., checking for autocorrelation and heteroscedasticity of residuals, structural instability, correct functional form, exogenous explanatory variables). The authors make this approach quite clear through a worked example.

But there is another problem with the traditional approach to tourism demand modelling. For most tourism demand series, this approach inevitably leads to spurious regression: one rising series, such as per-capita income, is found to “explain” the rising demand series, say trips generated by a country’s population. Taken to its logical extreme, this approach could find that the rising mean weight of American residents since 1970 “explains” the growth of U.S. trips to overseas destinations.

Clearly we need a more stringent statistical test of explanation. One move in this direction is to insist that each series used be stationary, that is, transformed so that the mean, variance and covariance of each time series remains constant over time. This can be done by taking the first differences of a time series. If the first differenced time series does not comprise a stationary series, then it can be differenced again. The number of these first differences operations it takes to produce a stationary series is called the “order of integration” of the series. Two series are described as “cointegrated” if the error term of their regression never drifts far from zero over the course of the series, i.e., is stationary.

The authors suggest determining the order of integration of a series through testing for unit roots. Several such tests are discussed and an application is clearly presented. A test for cointegration of a demand variable with its explanatory variable, which requires that all be integrated of order one (“most tourism demand variables are likely to be integrated of order one”, [p. 71]), is also presented.

In chapter 5, the authors show how the ADLM can be turned into an error correction model that explicitly shows long-run and short-run behavior of interest. Three estimation methods are presented, and an example estimating models for Korean inbound tourism from the U.S. and the U.K. is discussed. The authors find no way to indicate which model can be expected to produce the most accurate forecasts.

Chapter 6 addresses vector autoregression models. These treat all variables (both dependent and explanatory) as endogenous and are expressed through matrix algebra. The approach avoids the problem inherent in the classic single or multiple equation forecasting models of having to forecast exogenous variables. This approach can, of course, quickly exhaust the degrees of freedom the various time series offer. A procedure is suggested for reducing the lag structure to fit the degrees of freedom. (One potential source of confusion for the reader is that  $\pi$  is used both to represent parameters to be estimated in one equation (p.92) and, two pages later, 3.1416 in another equation.) The authors introduce impulse response analysis for policy

simulations of shocks such as an increase in income in a generating country. This utilizes a vector moving average process where the error terms must be “uncorrelated”, i.e., “orthogonalized”. The resulting impulse response functions measure the impact of shocks over several successive periods, representing the reality most policy makers are interested in.

A second topic covered in chapter 6 is Granger causality, a concept useful in statistics-land that may have little relationship to the frequencies of time series tourism forecasters must deal with. Simply put, a proposed explanatory variable is said to “fail to Granger cause” a dependent variable if the mean square error (MSE) of the equation regressing the dependent variable on its own past values is not significantly different from the MSE of the equation adding the past values of the proposed variable. A test is provided for rejecting the Granger cause failure hypothesis.

The final focus of Chapter 6 is on the Johansen cointegration procedure that permits identifying more than one cointegration relationship among variables, an extension of the Dickey-Fuller test to the VAR framework. Fortunately for readers, the authors provide lucid examples of applying these chapter 6 concepts to tourism demand data.

Chapter 7 addresses the issue of parameter stability. Going beyond customary procedures to determine if the structure of tourism demand generation has undergone a change or not (recursive ordinary least squares, and Chow instability tests), the authors present the time-varying parameter (TVP) regression to model structural change. This could be particularly applicable to countries that have suffered from extreme changes in prices (e.g., from petroleum supply disruptions), or from war in their region, or when their major generating markets are encountering limits such as leisure time available or changing their politico-economic systems (e.g., transition from communist to market economies).

Briefly, the TVP approach is written in the “state space form” including a system equation and a transition equation. These utilize a state vector of parameters to be estimated. The Kalman filter algorithm, a general set of recursive equations used to estimate the state vector, is applied to estimate the parameters of the model. The TVP approach has the advantage of dealing with non-stationary time series without testing for unit roots or applying differencing, and have proved to outperform “a number of econometric models of international tourism demand” for short-run forecasts (p. 131).

Chapter 8 is the least useful for most tourism demand policy modeling purposes, in my opinion. It discusses and demonstrates an approach to ascertaining what social and economic explanatory variables are “important in the determination of international tourism demand” (p. 137). The authors present an example using the international tourism spending by residents of 138 countries over nine years to test whether income,

exchange rates, age structure, gender balance, household size, literacy and proportion urban population are significant explanatory variables across all of these countries. Tests for homogeneity of intercept terms and slope coefficients are provided: such data can be pooled only if the slope coefficients are found to be homogenous.

Aside from the fact that most tourism forecasters are interested in how individual countries are expected to fare in the future as origins or destinations of international tourism, there is the issue of how to interpret these results. The authors find, for example, the income elasticity of these expenditures (0.86) is considerably smaller than found in a host of econometric studies (1.8 to 2.2). But we don't know on which of these estimates to focus in policy simulation studies.

In contrast, chapter 9 is the most valuable contribution the authors make. They provide a summary of selection criteria for the six policy models they have discussed, and then test these models in *ex post* forecasts of demand for tourism to Korea from the U.S. and the U.K. They find that the time-varying parameter (TVP) model provides the most accurate one-year forecasts, suggesting that it is important to take structural stability into account. The vector autoregression model performs the worst on the accuracy test.

Readers of this book would benefit greatly from a glossary, not only for the many technical terms used but also for the myriad acronyms that pop up, sometimes unannounced (e.g., DGP for data generation process [?] on p. 93). The References section is lengthy if idiosyncratic (e.g., only one *Journal of Travel Research* reference is given, a number of incomplete references appear).

The authors are to be congratulated on providing a readable (to the statistically literate) state-of-the-art guide to econometric methods applied to tourism demand policy models. There is no other book that even attempts this. Potential readers, however, should decide whether the often-tedious journey through the jungles of econometrica is necessary. If you want only to generate accurate forecasts, there are a number of time-series and qualitative methods that are considerably cheaper to access, easier to apply, and more obvious in their approaches (Ibid., chapters 4, 5 and 9). There is little point to applying the econometric sledgehammer to these problems. But if you must distinguish the important causal factors shaping the future of tourism demand in quantitative terms, this book is essential.

#### References

Frechtling, Douglas C. (2001). Forecasting Tourism Demand: Methods and Strategies, Oxford, UK: Butterworth Heinemann.

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