Annals of Tourism Research 44 (2014) 131–142

Contents lists available at ScienceDirect

Annals of Tourism Research

journal homepage: www.elsevier.com/locate/atoures

Estimating demand elasticities in non-stationary panels: The case of Hawaii tourism

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ARTICLE INFO

Article history:
Received 13 May 2013
Revised 17 August 2013
Accepted 13 September 2013

Keywords:
Panel cointegration
Cross-sectional dependence
Tourism demand
Hawaii

ABSTRACT

It is natural to turn to the richness of panel data to improve the precision of estimated tourism demand elasticities. However, the likely presence of common shocks shared across the underlying macroeconomic variables and across regions in the panel has so far been neglected in the tourism literature. We deal with the effects of cross-sectional dependence by applying Pesaran's (2006) common correlated effects estimator, which is consistent under a wide range of conditions and is relatively simple to implement. We study the extent to which tourist arrivals from the US Mainland to Hawaii are driven by fundamentals such as real personal income and travel costs, and we demonstrate that ignoring cross-sectional dependence leads to spurious results.

1. Introduction

The past several decades have seen tremendous growth in the literature which seeks to explain and forecast tourist flows (Song, Dwyer, Li, & Cao, 2012; Li, Song, & Witt, 2005). Following a wide variety of empirical methods applied across different countries and time periods, researchers have produced an even wider array of estimates for demand elasticities central to marketing, forecasting and policy work. While the income elasticity of tourism demand is generally expected to lie between one and two, Crouch (1995, 1996) found that nearly 5% of estimates from 80 international studies were negative. Analyzing 30 years of international tourism demand studies, Witt and Witt (1995) found income elasticity estimates ranging from 0.4 to 6.6 with a median value of 2.4.

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http://dx.doi.org/10.1016/j.annals.2013.09.006

Although an "inferior" tourist destination could explain a negative income elasticity, and an elasticity of less than 1 might be explained by some "necessary" short-haul international trips, such as those from the US to Canada, the large variation in estimates calls into question their validity and limits their usefulness to decision-makers. Estimates of price elasticities fare about the same. Witt and Witt (1995) found estimates ranging from −0.05 to −1.5, and Crouch (1995, 1996) found that about 29% of the estimates were positive. Finally, these studies found transportation price elasticity estimates ranging from 0.11 to −4.3. Crouch (1996) investigated a number of potential causes of such disparate results, and noted that model specification played an important role. We suspect that the wide range of elasticity estimates is due to the limited information and short samples used in time series models, and the use of panel estimation techniques that do not adequately deal with important characteristics of panel data.

There is a rich literature making use of a variety of approaches to explain and forecast tourist flows. Conventional approaches range from exponential smoothing to vector autoregressive and error correction models using time series data for a single origin-destination pair (Witt & Witt, 1995; Li et al., 2005). Recently some alternative quantitative tools, such as artificial neural networks, fuzzy time series, and genetic algorithms, have been showing up in the literature. (For a comprehensive survey of recent developments in tourism demand modeling, see Song & Li (2008).) Unfortunately, the entire literature on tourism demand is at the mercy of short time series samples. And the limited data available for estimation has likely contributed to imprecise estimates of demand elasticities. For example, Bonham, Gangnes, and Zhou (2009, p. 541), report an income elasticity for Hawaii tourism demand from the US that is "implausibly large and estimated quite imprecisely". Fortunately, it may be possible to obtain better estimates of the parameters of interest by taking advantage of the variation in both the temporal and cross-sectional dimensions of panel data sets. This point has not been lost on the tourism literature, and as econometric tools have advanced, a trend to exploit the richness of panel data has emerged (Song & Li, 2008; Seetaram & Petit, 2012). In their review article, Song et al. (2012, p. 1657) suggest that "future studies should pay more attention to the dynamic version of panel data analysis and to more advanced estimation methods… ".

While early panel studies ignored problems arising from nonstationarity and potential cointegration, the tourism literature has now begun to address such issues. Among others, Seetanah, Durbarry, and Ragodoo (2010) estimated a static model of demand for South African tourism using Fully Modified Ordinary Least Squares (FMOLS) developed by Pedroni (2001). Using the same technique, Lee and Chang (2008) investigated the long-run co-movements and causal relationships between tourism development and economic growth. Falk (2010) applied the dynamic heterogeneous panel technique of Pesaran, Shin, and Smith (1999) to estimate the effects of snow fall on winter tourism in Austria.

One common thread running through this nascent literature is reliance on the assumption of cross-sectional independence, or that each unit contributes entirely new information to the dataset. Yet, cross-sectional units are almost certainly influenced by national or global shocks such as business cycles, technological innovations, terrorism events, oil crises or national fiscal and monetary policies. In fact, a large empirical macro and macro-finance literature (see Stock and Watson, 1989, 1998) and results presented here for Hawaii tourism show that cross-sectional dependence is very common. And, neglecting cross-sectional dependence can lead to substantial bias in conventional panel estimators (Kapetanios, Pesaran, & Yamagata, 2011).

An increasingly common solution to the problem of cross-sectional dependence is to model such dependence using a factor structure. To the best of our knowledge, this approach has not been used in the tourism literature where cross-sectional dependence is usually ignored. But at least one study has included observed proxies for unobserved common factors. Nelson, Dickey, and Smith (2011) used oil prices, indicator variables for the effects of the September 11, 2001 terrorist attacks, and a nonlinear time trend capturing the overall slow-down of tourism demand during recessions. Such proxy variables may be effective in mitigating the effects of cross-sectional dependence, but their choice involves judgement on the part of the researcher, and it is unclear whether they are adequate to capture all sources of common shocks. Alternatively, unobserved dynamic common factors can be approximated using the methods proposed by Bai, Kao, and Ng (2009), Pesaran (2006), or Kapetanios et al. (2011). These approaches have the benefit that they do not require selection of a set of observed proxies.