Is There Volatility in Tourism Demand?

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Abstract

Modelling tourism demand is essential when tourism policymakers plan tourism activities. The tourism industry is extremely susceptible to specific events' effects, so good models must be found that reflect volatility. This study sought to review systematically the recent literature on this topic, specifically targeting models used to analyse tourism demand. The literature reveals some determinants of volatility in the tourism industry, such as income, gross domestic product and exchange rate, as well as crime, major events, big shocks, epidemics, weather conditions and the absence or existence of direct flights. Moreover, the review showed that modelling volatility is an emergent approach used in the analysis of tourism demand time series. This study's results reveal pathways for the use of volatility models in tourism demand studies, which will allow managers and decision makers to adapt policies to deal with the volatility associated with tourism.

Keywords:
Systematic review; Tourism demand; Forecasting; Volatility; Semantic analysis

Introduction

According to the United Nations World Tourism Organisation (UNWTO) (2017), international tourists numbered 1.2 billion in 2016, generating 10% of the world's gross domestic product (GDP) and creating one out of every 10 jobs worldwide. In 2015, international tourism grew by 5% in Europe, which stayed in first place in terms of international tourist arrivals with about of 608 million visitors (UNWTO, 2016).

A perishable product such as tourism needs to be managed through appropriate planning. This includes forecasting modelling, which allows tourism policymakers to anticipate the future – an essential tool in destination management (Archer, 1987; Witt and Witt, 1995). Research on the relevant economic characteristics of tourism was first carried out by Guthrie (1961), Gerakis (1965) and Gray (1966).

Touristic activities have become extremely important for economies, in particular for regions, representing a strategic sector of economic and social development. In this context, tourism research is indispensable for understanding and analysing underlying phenomena and aspects of regional differentiation that are the basis for the international competitiveness of destinations (i.e. countries, regions or locations). The tourism development of a given territory throughout the various stages of the tourism life cycle (Butler, 1980) needs to be directed and controlled by taking into consideration the particular conditions of this sector's activities and the relevant region's current situation.

Anticipating the future of tourism activities facilitates the development of better plans and appropriate policies. With this in mind, van Doorn (1982) was the first to conduct an analysis that included planning, policymaking and forecasting, as well as measuring the utility of these in terms of the individuals responsible for tourism plans and policies.

More particularly, considering the vast consequences of crises and disasters through evaluations of events' impacts has attracted much interest in tourism demand research (Song and Li, 2008). For these researchers, it is crucial to develop methods that can accommodate unexpected events by

predicting the potential impacts of these on-off events through scenario analysis. Other areas that have still not been extensively researched include tourism cycle analysis and turning point and directional change forecasting. More attention has been paid to predicting the level of tourism demand, while limited research has been conducted on the accuracy of directional change or turning point forecasting. Given the significant policy implications of these forecasts, additional studies still need to be conducted in this field of research.

The present review focused on research published after the last major literature review, in which Song et al (2012) analysed articles published until 2011. Thus, the current analysis reviewed papers published from 2012 to the present. Previous literature reviews have focused primarily on the methods used, so the present analysis sought to complement these reviews by providing a temporal perspective on the use of each method in modelling tourism demand, as well as the variables included. This review also aimed to identify the frequency of existing studies by territories and their geographical distribution. A hybrid methodology was used, including semantic and systematic quantitative analyses, which also distinguishes the present research from most previous literature reviews.

The first general objective of this review was to conduct a systematic literature review of tourism demand modelling methods used in tourism research during the last five years. The second objective was to identify variables and models used in tourism demand modelling, while the third was to understand the rationales for using volatility models when modelling tourism demand. The research questions implicit in this systematic literature review were:

Is volatility modelling in tourism demand research a recent trend in the literature on tourism?

What variables can be used in tourism demand modelling to improve accuracy?

Does modelling of tourism demand on a smaller territorial scale have benefits for tourism policy planning?

This paper includes a second section describing the methodologies used. The third and fourth sections discuss the results of the systematic quantitative analysis and conceptual semantic analysis, respectively.

Methodology

Song et al (2012) argue that the particular characteristics of the tourism industry call for new perspectives and approaches, stating that demand analysis continued to dominate economic studies of tourism in articles published until 2011. Complementing the literature reviews performed by Song and Li (2008), Goh and Law (2011) and Song et al (2012), the present review sought to identify the type of data used (i.e. daily, weekly, monthly, quarterly or annual data). It also focused on the time window, type of destination analysed (i.e. country, region, city or other) and methodology (i.e. studies that model tourist demand or its volatility or that make forecasts). Other aspects concentrated on in this review were variables used in models, journals that publish articles on modelling tourism demand – based on CiteScore[1], SCImago Journal Rank (SJR)[2] and Source Normalised Impact per Paper [SNIP][3]– and the authors that do research on this topic.

This study thus conducted a systematic review, which is a method of identifying and synthesising all evidence of research of sufficiently good quality within a specific topic (Victor, 2008). The present analysis took into account 136 articles published in journals identified in a recent article by Gursoy and Sandstrom (2016), who summarised the top scoring tourism and hospitality journals based on combined scores, as well as articles suggested by articles in the first group of publications. The present search used the keywords 'tourism demand AND volatility' in all fields. We mainly used the following databases: ScienceDirect, Routledge Online, Taylor & Francis Online, Emerald Insight, Ingenta Connect, SAGE and RePEc – Research Papers in Economics.

All articles analysed were compiled on a worksheet in Microsoft Office Excel, including the studies' title, authors, journal, date, abstract, keywords, time window, frequency of data, model applied, variables used and regions considered. This worksheet was analysed using IBM SPSS and Leximancer

[1] This is the ratio between the number of citations a journal receives in one year to documents published in the previous three years and the number of documents indexed in Scopus published in the same three years.

[2] This is a prestige metric based on the idea that 'all citations are not created equal'. The subject field, quality and reputation of cited journals have a direct effect on the value of citations.

[3] SNIP measures contextual citations' impact by weighting citations based on the total number of citations in a subject field.

software.

Leximancer is a data mining software that, through text analysis, visualises texts' concepts and themes and uses a machine learning technique that is useful in literature reviews (Stockwell et al, 2009; Crofts and Bisman, 2010; Stechemesser and Guenther, 2012; Jin and Wang, 2015). In the present study, abstracts were subjected to semantical analysis because these texts are lexically dense and focus on the articles' main topics (Cretchley et al, 2010).

The articles were published from 2012 to 2017, with a tendency toward a greater frequency of studies on tourism demand analysis in tourism research as shown by the number of studies doubling between 2013 and 2014. The distribution of journals with more than one publication on this topic during the years analysed is shown in Table 1, which reveals that the most prominent journals in the area of tourism demand analysis are *Tourism Management*, *Tourism Economics* and *Journal of Travel Research*.

Table 1. Distribution of the number of articles by scientific journals.

Date	Year						Total
	2012	2013	2014	2015	2016	2017[1]	
Annals of Tourism Research	0	3	0	1	4	0	8
Current Issues in Tourism	0	0	0	1	7	0	8
Economic Modelling	0	1	1	1	0	1	4
IMF Working Papers	0	0	2	0	0	0	2
International Journal of Contemporary Hospitality Management	0	0	1	1	0	0	2
International Journal of Tourism Research	1	1	2	3	0	1	8
Journal of Environmental Management and Tourism	0	0	1	1	1	0	3
Journal of Travel and Tourism Marketing	0	0	1	0	1	2	4
Journal of Travel Research	2	1	3	1	5	0	12
Tékhne	0	0	1	0	1	0	2
Tourism Analysis	0	2	0	0	0	0	2
Tourism Economics	1	1	3	9	8	0	22
Tourism Management	4	2	4	8	6	1	25
Tourism Management Perspectives	0	1	1	1	1	0	4
Other Journals	5	3	9	9	3	1	30
Total	13	15	29	36	37	6	136

Note: [1] January and February.

Almost all the articles reviewed (90%) were published in indexed scientific journals, and their distribution, in terms of quartiles, shows that only 9% of these are in quartiles three and four of their respective categories. Regarding SJR, SNIP and CiteScore metrics, we observed that their means are respectively 1.548, 1.584 and 2.50. In general, the journals of the articles analysed have SNIP 2015 values concentrating between 0.6 and 1.2, but a large percentage fall above 2.1 (40%). As for the SJR2015 values, although many journals have a value of 1 in this ranking, 38% are above 2. 42% of the journals of the articles reviewed have a CiteScore above 3 (42%). With respect to CiteScore Rank, 66% of the articles are in journals higher than the thirty-third place of their category.

Results and Discussion

Number of publications by author

The researchers who have been more productive (i.e. more than three research articles published between 2012 and 2017) in terms of articles on tourism demand modelling are as follows. Faruk Balli (Balli et al, 2013; Balli et al, 2015; Balli and Jean Louis, 2015; Balli and Tsui, 2015; Tsui and Balli, 2015; Balli et al, 2016) and Martin Falk (Falk, 2013a, 2013b, 2014; Falk and Hagsten, 2016; Falk and Vieru, 2016a, 2016b) have six published articles. Oscar Claveria (Claveria and Torra, 2014; Claveria et al, 2015a, 2015b, 2015c), Ulrich Gunter (Gunter and Smeral, 2014; Gunter and Önder, 2015, 2016; Gunter et al, 2017), Haiyan Song (Page et al, 2012; Li et al, 2013; Smeral and Song, 2015; Wan et al, 2016) and Salvador Torra (Claveria and Torra, 2014; Claveria et al, 2015a, 2015b, 2015c) have four publications.

Qualitative versus quantitative methods

The two methodological approaches to forecasting in tourism used by authors are qualitative and quantitative analyses (Hyndman and Athanasopoulos, 2013). Qualitative methods are used when no relevant historical data is available that can produce good forecasts or when the patterns found in the historical data are no longer present. Qualitative methods of forecasting produce much more than vague hints as these methods are highly structured methodologies. The qualitative methods used in tourism demand forecasting include jury of executive opinion, subjective probability assessment, the Delphi method and consumer intentions surveys (Frechtling, 2001). The application of qualitative methods in this area can ensure greater accuracy of results because of the existing volatility in tourism demand and this demand's elasticity after events (Croce and Woeber, 2011).

Regarding quantitative methodologies, journal authors have used, among others, time series models (i.e. regression, forecasting, volatility models and regression models with volatility), neural networks models, panel data models and structural models. Quantitative methods used to model and estimate tourism demand are based on the formulation of hypotheses constructed about theory of demand, specifications of tourism demand models and the collection of data considered relevant to the studies in question. Other methods used are models and estimations of tourism demand and tests of the hypotheses considered, as well as making predictions and assessing forecasts' results (Dwyer et al, 2010).

The present systematic literature review revealed that almost all the research on tourism demand modelling published in recent years has used quantitative methods (95%). The qualitative studies analysed, with only one exception, were published in the first and second quartiles of tourism, leisure and hospitality management journals, namely, *Journal of Travel and Tourism Marketing*, *Annals of Tourism Research*, *Journal of Travel Research*, *Tourism Economics* and *International Journal of Commerce and Management*. Among the qualitative methods used, the review revealed the travel constraints model (Cheng et al, 2017), the in-depth interviewing (Czernek, 2013), netnography (Ji et al, 2016), scenario planning (Frost et al, 2014), expert forecasting (Croce et al, 2015) and Delphi methods (Kaynak and Rojas-Méndez, 2014). Only one study combined qualitative and quantitative methodologies (i.e. neural networks) (Ghaderi et al, 2014). Around half of these articles focused only on modelling tourism demand, while the remainder made predictions about tourism demand.

Tourism demand modelling methods

Wong et al (2007), Andrawis et al (2011), Shen et al (2011) and Song et al (2012) found that a combination of different models can significantly improve the quality of predictions. The cited authors compared several combinations of forecasting methods, confirming that this strategy provides better performance than single-method forecasts do.

According to Poon (2005), volatility refers to the range of values that an uncertain variable can take. Volatility is often statistically measured through variance or standard deviation. These statistical results are commonly associated with risk, but, as these are a measure of the uncertainty associated with a variable, this output can be negative or positive. Quantitative methods of tourism demand modelling can be categorised into groups. These include time series models based on means (i.e. regression), time series models based on variance (i.e. volatility), time series models based on means

and variance (i.e. regression and volatility), time series forecasting models, structural models, neural networks, panel data and other quantitative models.

Volatility modelling first appeared in the literature on tourism with Chan et al's (2005) study, in response to the economic, political and financial changes that have required profound modifications of tourism demand models. Overall, the use of the neural networks method to develop tourism demand models has appeared less frequently in research on modelling tourism demand compared with other models (Coshall and Charlesworth, 2011). With respect to the distribution of articles by type of methodology, the present review revealed that the models most used in published studies are time series regression models (44%), followed by panel data models (17%). Neural networks models appear in 12% of the articles analysed. Volatility models are used only in 10% of the studies and volatility with regression models in 2%.

Regarding the objectives of each study, the articles reviewed can be divided into the following classifications: those that sought to (a) model tourism demand, (b) develop a model to meet forecasting objectives and (c) model the volatility of tourism demand.

According to Table 2, the researchers seeking to model tourism demand mainly used time series regression and panel data models. The studies that sought to forecast tourism demand primarily used time series regression and neural networks models. The research focused on modelling the volatility of tourism demand mainly used time series methods (i.e. models in mean and models in variance).

Table 2. Distribution of type of models by type of study.

		Type of Models								
		TS Regression	TS Volatility	TS RegVol	TS Forecasting	Neural Networks	Panel Data	Structural Models	Other Models	Qualitative Models
Type of Study	Modelling	39	8	0	0	2	23	3	9	4
	Forecasting	28	3	1	3	16	2	1	2	3
	Volatility	11	16	4	0	1	3	0	1	0

Note: TS: time series; RegVol: regression and volatility.

Variables in tourism demand modelling

Schwaninger (1984) analysed trends in tourism for 20 years, juxtaposing tourism demand growth with changes in the economy, consumer behaviour and technology. The cited author highlights the need for long-term monitoring the links between these factors and growth trends in tourism. Chew (1987), in turn, concluded that growth trends in tourism may be affected by economic downturns after the cited author analysed factors that can influence tourism, including identifying those with the greatest weight. Song et al (2012) found that the number of arrivals and level of tourist expenditure are the variables most commonly used to measure tourism demand.

When modelling tourism demand, researchers have most often used variables related to tourism arrivals, with 53% of the papers analysed including this variable in their models. In addition, studies have used the number of visitors separated into global, holiday and business travellers (Liu and McKercher, 2016) or museum (Chen and Della Chang, 2016) and temple visitors (Della Chang and Chen, 2013). Still other variables include repeat visitors (McKercher and Tse, 2012), those from different origins (i.e. by country or continent), overnight stays, length of stay (Falk, 2013b; Culiuc, 2014) and international tourist flows.

Variables related to tourism expenditure and receipts are also used in 22% of studies under analysis when modelling tourism demand. These variables include, for example, ski lift revenue (Falk and Vieru, 2016a), vacation rental revenue (Ritchie et al, 2013), observed average spending per day (Divisekera, 2016), hotel room revenue (Ritchie et al, 2013) and air transport and accommodation spending categories (Becken and Lennox, 2012).

Askitas and Zimmermann (2015) compiled the most relevant literature in this field, using Internet data to conduct social sciences research. The cited authors found applications of this type of data, from 2005 onwards, in studies that analysed and predicted unemployment and engaged in nowcasting in terms of health, labour and demographic issues and political processes. Askitas and Zimmermann (2015) predict that this kind of data will soon be applied frequently by researchers.

However, the use of Internet data in tourism demand modelling is still relatively rare (7% of the articles analysed). These studies include data from Google Analytics (Gunter and Önder, 2016), Internet search data, metadata from tagged photos (Onder et al, 2016), website traffic (Pan and Yang, 2016) and click-throughs (Pan, 2015).

More globally, the most commonly used variables are prices (38% of the articles reviewed), namely, substitution, export and import and consumer price indexes. Other variables also common in determining tourism demand are GDP (37%); exchange rates (27%); sociodemographic and territorial variables such as unemployment (7%); income (7%); population (7%) and distance between countries (5%). Availability in the tourist industry in terms of hotels (i.e. beds and rooms) (Balli et al, 2013; Culiuc, 2014; Laframboise et at, 2014; Habibi, 2016) and airlines (i.e. seats, presence of direct flights) (Deluna and Jeon, 2014; Nonthapot and Lean, 2015) are additional variables used in the modelling of tourism demand.

Political factors, such as the openness of economies, political instability, fiscal policies, indexes of political rights and civil liberties and indexes that measure civil liberties across countries are also considered in the studies analysed (Saha and Yap, 2014; Su and Lin, 2014; Balli and Louis, 2015; Pavlic et al, 2015; Habibi, 2016). The use of dummy variables is extremely commonly used in this type of research to control language issues (Balli et al, 2013; De Vita, 2014; Deluna and Jeon, 2014; Balli et al, 2016; Saayman, 2016) and political factors (i.e. 'free' countries, colonial relationships and free trade agreements) (Balli et al, 2013; De Vita, 2014; Balli et al, 2016). Other dummy variables address the effects of crises (i.e. economic downturns, epidemics, calamities, terrorism and wars) (Otero-Giráldez et al, 2012; Yap, 2013; Deluna and Jeon, 2014; Nonthapot and Lean, 2015; Smeral and Song, 2015; Liu and Pratt, 2017) and events (i.e. the Olympics and championships) (Herrmann and Herrmann, 2014; Smeral and Song, 2015). Models can use up to 14 variables of this type (Smeral and Song, 2015).

Climate-related variables are included as determinants of tourism demand. These can be precipitation, weather information, temperature, snow depth, rainfall, meteorological conditions and cloud coverage (Falk, 2013a, 2014; Ridderstaat, Oduber et al, 2014; Alvarez-Díaz et al, 2015; Chen et al, 2015; Falk and Hagsten, 2016; Falk and Vieru, 2016a; Pan and Yang, 2016; Agiomirgianakis et al, 2017).

Data frequency

In tourism modelling, literature distinguish between three different time horizons according to the reasons for planning and developing policies: short-time modelling covers a year or less and allows managers to make decisions about current operations, modelling can also include intermediate periods that allow forecasting trends in the next two to five years and it is used in expansions and changes in products or services and long-range forecasting is used in tourism planning and policies development, including studies analysing periods of five or more years (Dwyer et al, 2010).

In the studies reviewed, the time window varied from one to 56 years, and more than 50% of them covered between 10 and 20 years when modelling tourism demand. The variables used were measured for different time frequencies. The most common was a monthly (46%) or annual (29%) frequency. The least used time frequency was daily data (3%) (Chang et al, 2013; Ellero and Pellegrini, 2014; Herrmann and Herrmann, 2014; Chen et al, 2015).

Tourism demand modelling in the world

Research on tourism demand modelling varies greatly with respect to type of territory. The present review found that some studies were done in all countries simultaneously, such as research conducted by Gunter and Smeral (2014) and Croce (2016). Other studies covered continents, including Smeral and Song (2015) in Europe and Frost et al (2014) in Asia-Pacific. Single country research

made up 70% of the articles analysed. Regional studies were conducted by, for example, Crotts and Mazanec (2013) in Florida, Berenguer et al (2015) in Santa Lucía de Cuba and the North Region of Portugal, and Neves et al (2015) in several Portugal regions. Teixeira and Fernandes (2014) also did research in the North Region of Portugal; Guizzardi and Stacchini (2015) in Rimini, Italy; and Otero-Giráldez et al (2012) in Galicia, Spain. Many researchers focused on cities, including Gunter and Önder (2016) in Vienna, Austria; Gunter and Önder (2015) in Paris, France; Süssmuth and Woitek (2013) and Herrmann and Herrmann (2014) in Munich, Germany; and Ellero and Pellegrini (2014) in Milan, Rome and Turin, Italy. Some studies covered small destinations, such as Falk (2013a, 2013b), Falk and Hagsten (2016) and Falk and Vieru (2016a) in ski areas and Czernek (2013) in a southern mountain tourist region in Poland.

Research on city tourism in Europe can be quite important since, between 2008 and 2013, this continent's overnight stays' growth rate grew from 1.3% to 2.9%. Nonetheless, few studies have been conducted on this topic, which, according to Mazanec and Wöber (2010), is mainly due to the lack of availability of data, as well as the difficulty of conducting comparison studies between European nations.

Taleb Rifal, the secretary-general of UNWTO (2012), sees cities as vibrant epicentres of culture and commerce. Currently, half of the world's population lives in cities, and, by 2030, experts predict that five billion people will be urbanised. As some of the world's greatest tourism destinations, cities attract a growing number of visitors every year. This generates a positive impact on the local economy by creating jobs, stimulating foreign exchange and promoting investment in infrastructure that benefits residents and visitors alike.

With regard to urban tourism, Shaw and Williams (2002) believe that tourists' main motivations are business and conference tourism, as well as gaining more knowledge about cities' history and cultural heritage. Some cities have gone through a process of urban renewal that has led to tourism development, as in Barcelona where urban spaces were completely transformed for the Olympic Games in 1992. In addition, the creation of slogans such as 'I Love New York' or 'Bogotá, 2600 meters closer to the stars' have attracted visitors and contributed to cities' renewal. Shaw and Williams (2002) state that the tourism industry is an important reinforcement of the success of global cities such as London, New York and Paris.

The present systematic literature review revealed that, since 2012, the existing studies have covered the five continents but have main concentrated on Asia (57%) and Europe (54%). The continent on which the least research has been carried out is Africa, with only 16% of the articles modelling tourism demand for African destinations. The countries on which more research on forecasting tourism demand are Australia, Spain, the United States of America (USA), China, Hong Kong (Special Administrative Region of China), Austria, Portugal, Taiwan, Thailand, Turkey, Aruba, Germany, Italy, New Zealand, Singapore and the United Kingdom (UK). Each of these nations has been the focus of three or more studies (see Table 3).

Table 3. Articles reviewed by authors, year and country analysed.

Authors (Year)	**Country**
Culiuc (2014) Balli and Jean Louis (2015) Croce *et al* (2015) Saha and Yap (2014) Ghaderi *et al* (2016) Jackman (2014) Balli *et al* (2016) Saayman *et al* (2016) Lv and Xu (2016) Su and Lin (2014) Liu and Pratt (2017) Frost *et al* (2014) Laframboise *et al* (2014) Nowak *et al* (2012) Antonakakis *et al* (2015) Nonthapot and Lean (2015) Gunter and Smeral (2014) Croce (2016)	World, Continent or Multiple Countries
Ridderstaat, Croes *et al* (2014)	Aruba

Authors (Year)	**Country**
Ridderstaat, Oduber *et al* (2014) Ridderstaat and Nijkamp (2015)	
Assaf *et al* (2012) Seetaram (2012) Yap (2013) De Vita (2014) Dwyer *et al* (2014) Balli and Tsui (2015) Tsui and Balli (2015) Valadkhani and O'Mahony (2015a, 2015b) Divisekera (2016) Tan *et al* (2016) Wu *et al* (2016)	Australia
Falk (2013a, 2014) Gunter and Önder (2016) Önder *et al* (2016) Vergori (2016)	Austria
Lorde and Jackman (2013) Jackman and Natiram (2015)	Barbados
Kaynak and Rojas-Méndez (2014)	Chile
Deng *et al* (2014) Yang *et al* (2014) Zhou-Grundy and Turner (2014) Chen *et al* (2015) Yang *et al* (2015) Sun *et al* (2016) Tang *et al* (2016)	China
Gunter *et al* (2017)	Costa Rica
Mamula (2015) Pavlic *et al* (2015)	Croatia
Berenguer *et al* (2015)	Cuba
Can and Gozgor (2016)	Egypt
Falk and Vieru (2016a, 2016b)	Finland
Gunter and Önder (2015)	France
Süssmuth and Woitek (2013) Herrmann and Herrmann (2014) Ahlfeldt *et al* (2015)	Germany
Choi and Varian (2012) McKercher and Tse (2012) Wu *et al* (2012) Li *et al* (2013) Liu and McKercher (2016) Tang, King *et al* (2016) Wan *et al* (2016)	Hong Kong
Agiomirgianakis *et al* (2015)	Iceland
Kuncoro (2016)	Indonesia
Ellero and Pellegrini (2014) Guizzardi and Stacchini (2015) Baggio and Sainaghi (2016)	Italy
Bangwayo-Skeete and Skeete (2015)	Jamaica
Ji *et al* (2016) Cheng *et al* (2017)	Japan
Kim *et al* (2012) Park *et al* (2017)	Korea
Ghaderi *et al* (2014) Habibi (2016)	Malaysia
Constantino *et al* (2016)	Mozambique
Becken and Lennox (2012) Balli *et al* (2015) Dekimpe *et al* (2016)	New Zealand
Raza and Jawaid (2013)	Pakistan
Deluna Jr and Jeon (2014)	Philippines
Czernek (2013)	Poland
Teixeira and Fernandes (2012) Serra *et al* (2014)	Portugal

Authors (Year)	**Country**
Teixeira and Fernandes (2014) Neves *et al* (2015) Andraz and Rodrigues (2016)	
Liu *et al* (2014) Zhu *et al* (2016) Agiomirgianakis *et al* (2017)	Singapore
Saayman and Botha (2015) Saayman and Saayman (2015)	South Africa
Otero-Giráldez *et al* (2012) Claveria and Torra (2014) Perles-Ribes *et al* (2014) Alvarez-Díaz *et al* (2015) Artola *et al* (2015) Claveria *et al* (2015a, 2015b, 2015c) Morales and Devesa (2015) Albaladejo *et al* (2016)	Spain
Fernando *et al* (2013)	Sri Lanka
Falk and Hagsten (2016)	Sweden
Falk (2013b)	Switzerland
Chang *et al* (2012) Chang *et al* (2013) Della Chang and Chen (2013) Liang (2014) Chen and Della Chang (2016)	Taiwan
Bunnag (2014) Tang, Sriboonditta *et al* (2014) Untong *et al* (2014) Bunnag (2015) Untong *et al* (2015)	Thailand
Bronner and de Hoog (2016)	The Netherlands
Akar (2012) Balli *et al* (2013) De Vita and Kyaw (2013) Agiomirgianakis *et al* (2014) Akin (2015)	Turkey
Page *et al* (2012) Cang (2014) Perez-Rodríguez *et al* (2015)	UK
Crotts and Mazanec (2013) Ritchie *et al* (2013) Hassani *et al* (2015) Lee *et al* (2015) Pan (2015) Smeral and Song (2015) Dragouni *et al* (2016) Pan and Yang (2016) Gozgor and Ongan (2017)	USA

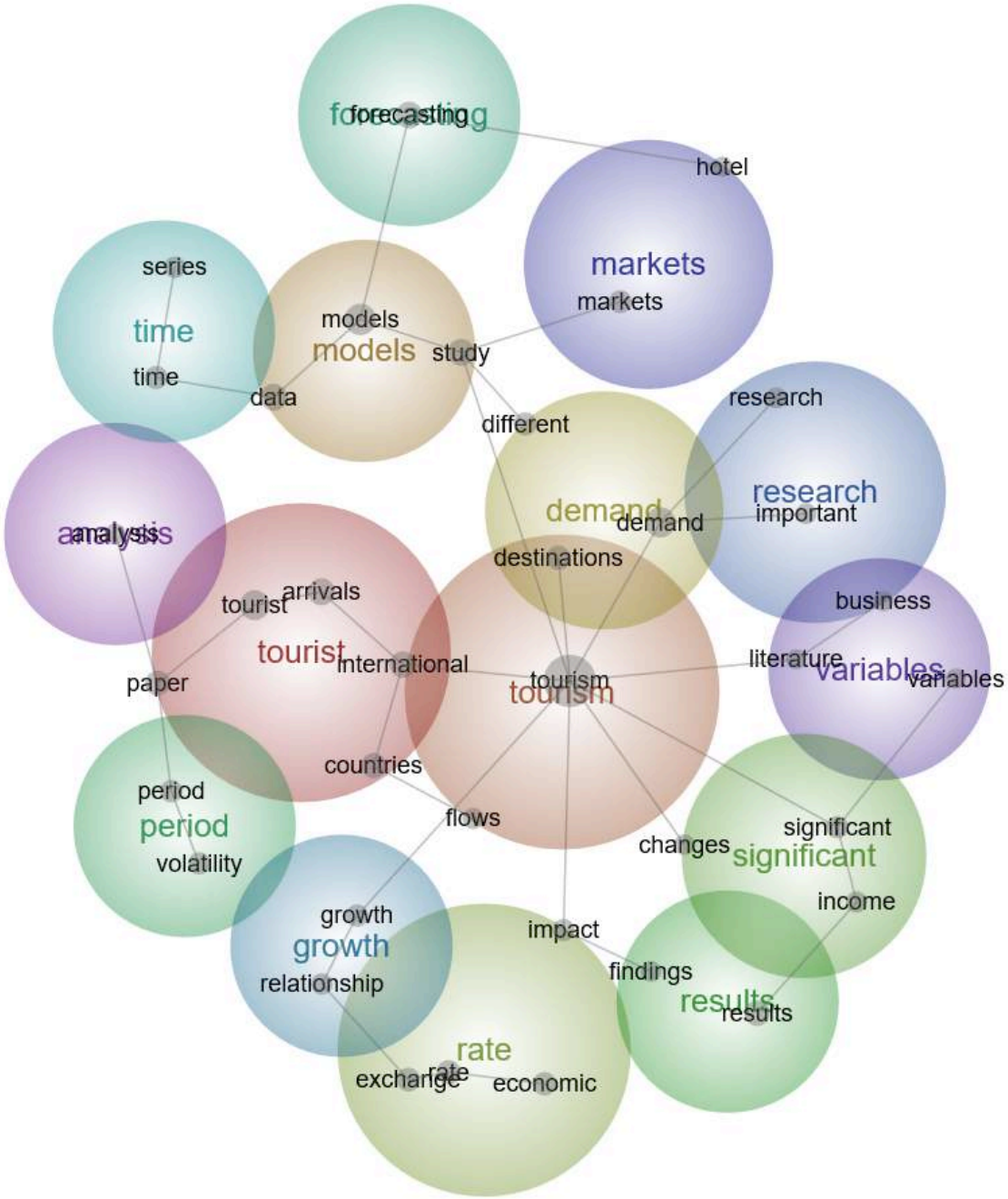
Semantic analysis

Regarding the keywords in the articles analysed, 77% of the articles used keywords related to tourism flows (i.e. tourism demand, tourism flows, tourism arrivals and tourism data), 30% had keywords about financial or economic factors (i.e. exchange rate, income, expenditure and receipts), while 27% included forecasting (i.e. tourism demand and short-term forecasts) and 21% mentioned security, crises and risks. In addition, 13% of the articles' keywords focused on seasonality (i.e. seasonal patterns and seasonal autoregressive integrated moving average), 13% mentioned Internet data (i.e. Google, Internet searches and websites), and 13% dealt with panel data models. Finally, 10% of the articles' keywords included neural networks, as well as 7%, respectively, for autoregressive conditional heteroscedasticity methods, volatility, time series and climate conditions.

An analysis using Leximancer produced 37 concepts grouped into 16 themes (see Figure 1). The most prominent themes are 'tourism', 'tourist', 'models' and 'demand', which are consistent with the results of the keyword analysis. These four themes include the following concepts: 'tourism', 'models', 'demand', 'tourist', 'data', 'study', 'arrivals', 'international(ity)', 'countries', 'paper', 'destinations', 'difference' and 'flows'. One of the emergent themes (i.e. least prominent themes) is 'period', which is

linked with the concepts 'period' and 'volatility' and closer to the themes 'tourist', 'growth' and 'analysis'.

Figure 1. Concept map.



Conclusions

This systematic literature review covered research in the field of tourism that has implemented forecasting and modelling methods to study tourism demand. Since the last literature review, which was conducted by Song et al (2012), focused on articles published up to 2011, we sought to identify which new methodologies have been applied to modelling tourism demand and volatility since then.

No single methodology can be considered the best for all contexts because, even within regions, the best models vary according to different tourism source markets. Thus, the accuracy of two or more models' results must be tested in order to achieve good outcomes that can facilitate the development of appropriate tourism planning policies. Combinations of different forecasting models have ensured greater accuracy in recent studies. In addition, volatility analysis appears to be an emerging topic in tourism demand modelling as this trend can be seen in the results of both the systematic literature review and the conceptual semantic analysis using Leximancer, which provide consistent evidence for this recent tendency.

The most common variables used in tourism demand modelling to improve accuracy include overnight stays in hotels, arrivals, the main markets' GDP, tourism revenue and, more recently, data from search engines. The factors that appear to influence the volatility of domestic and international tourism demand are economic factors such as GDP, income and exchange rates, as well as crime, major events, big earthquakes, epidemics, weather conditions and the absence or existence of direct flights. After identifying the factors that are usually responsible for volatility in tourism demand, variables must be included in models in order to help identify determinants of volatility in each destination.

Modelling tourism demand on a smaller territorial scale has benefits for tourism policy planning. More recently, researchers have begun more often to disaggregate demand by source markets, which has produced findings about the interdependence between regions, among other possible determinants of tourism volatility. In some destinations, however, data is unavailable at a more disaggregated level (i.e. counties, cities or localities).

Regarding previous literature reviews, the present analysis updated the information on trends in research on demand modelling and, due to the current analyses' systematic nature, offered less biased results than traditional reviews. In addition, the use of a semantic analysis tool, which is still uncommon in tourism literature reviews, revealed emerging themes such as volatility modelling.

Expanding the number of journals in which the search was conducted might have helped to confirm a larger number of studies using volatility modelling of tourism demand, as the present review was based on a limited number of scientific journals. Nonetheless, the use of 'all fields' in this search (i.e. 'tourism demand AND volatility') considerably increased the number of studies analysed, including many studies that do not use volatility models in tourism. The search results thus enriched the analyses, enabling them to uncover the latest trends. A further enhancement resulted from the use of studies suggested by searches carried out in scientific databases.

Tourism demand modelling is highly dependent on the availability of data and the possibility of comparison studies. Furthermore, official data are often only available for large regions within countries, without being disaggregated by source markets. These data are often annual and lag by about a year from the current date. Using data from search engines has produced good results in the studies conducted thus far, revealing that this approach can overcome data lags.

This field of research has the potential for opening up avenues to improved modelling, forecasting and planning of tourism demand – taking into account which factors can cause 'ups' and 'downs', as well as the time extent that these variables introduce volatility. Tourism demand planning must be adapted for each source market and, by taking into account data from search engines, could facilitate successful short-term measures that counteract declines in demand.

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