



**EATSA**  
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# **A PATHWAY FOR THE NEW GENERATION OF TOURISM RESEARCH**

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**Gr**  
**Grácio**  
EDITOR



EDITED BY FRANCISCO DIAS

# **A PATHWAY FOR THE NEW GENERATION OF TOURISM RESEARCH**





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## VOLATILITY OF TOURISM DEMAND: A REVIEW OF RECENT RESEARCH

Alexandra Mendes<sup>1</sup> and Ana Brochado<sup>2</sup>

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### ABSTRACT

Modeling tourism demand is essential to the planning of this activity by those responsible for tourism policies in each region. This fact has led to the development and testing of different methodologies and its comparison with the goal of finding the “best” model. Comparison of different methods not clearly conclude on the best way to model the tourism demand and the majority of studies is concerned with finding a model that allows making good forecasts in the short and medium term. The tourism industry is very susceptible to specific events, so it is important not only to find good forecasting models, but also to study the volatility of this industry over time. This article aims to provide a systematic review of the recent literature targeting the models used to analyze this volatility. The recent literature reveals some determinants of volatility of the tourism industry, such as currency devaluation, the absence/existence of direct flights, climate change, economic crises, events and shocks among others. Moreover, this study reveals that the main approaches used in the analysis of time series volatility include generalized autoregressive conditional heteroscedasticity models, Markov chain models, grey forecasting models, exponential smoothing models, and neural networks, among others. This paper offers avenues for future research and discusses the managerial implications for decision-makers.

### KEYWORDS

Tourism Demand, Volatility, Modelling, Tourism Economics, Search Engine Data

### Introduction

According to World Tourism Organization [1], tourism represents, for many regions, a crucial industry and plays a key role in the growth of the world economy. In 2013, the number of international tourists amounted to 1087 million, generating 9 percent of gross domestic product in the world and creating 1:11 world jobs each.

A perishable product such as tourism should be the subject of appropriate planning. Modeling through forecasting models allows anticipating the future, by providing, those who are responsible for tourism policies, an essential tool in the management.

The research on city tourism in Europe seems to be of great importance since that, between 2008 and 2013, the growth rate of the overnight stays rose from 1.3% to 2.9%. Despite this importance, few studies have been conducted on the topic, which, according to Mazanec & Wöber [2], is mainly due to the lack of availability of data, as well as the hard comparability.

For Taleb Rifal, secretary-general of UNWTO [3], cities are vibrant epicenters of culture and commerce as, nowadays, half of the world’s population lives in cities and it is expected that by 2030, five billion people will be urbanized. Being some of the world’s greatest tourism destinations, cities attract a growing number of visitors every year, generating a positive impact on the local economy by creating jobs, stimulating foreign exchange and promoting investment in infrastructure that benefits residents and visitors alike.

<sup>1</sup> Instituto Universitário de Lisboa (ISCTE-IUL), Business Research Unit (BRU-IUL) & Universidade Europeia, ESTM - Polytechnic Institute of Leiria, Santuário N.ª Senhora dos Remédios, 2520-641 Peniche - Portugal, Tel: +351- 262 783 607, Fax: +315- 262 783 088, E-mail: alexandra@ipleiria.pt

<sup>2</sup> Instituto Universitário de Lisboa (ISCTE-IUL), Business Research Unit (BRU-IUL), Avenida das Forças Armadas, 1649-026 Lisbon - Portugal, Tel: +351- 217903422, Fax: +315- 262 783 088, E-mail: ana.brochado@iscte.pt

With regard to urban tourism, Shaw & Williams [4] believe that the main motivations are business tourism and conferences, but also knowledge of history and cultural city. In some cities there has been a process of urban renewal that has led to development of tourism, as in Barcelona, where there was a great transformation of the spaces for the Olympic Games in 1992. The creation of slogans such as “I Love New York” or “Bogotá, 2600 meters closer to the stars” have attracted visitors and contributed to the renewal of cities. These authors mention the importance of tourism industry as a reinforcement of global cities like London, New York and Paris.

According to the UNWTO [5], in 2014 the growth in the number of international tourists (overnight stays) had a growth of 4.4% in relation to 2013, an increase for the fifth consecutive year, above the average forecast. This growth was of 3% in Europe which kept the first place in international tourist arrivals, with about of 584 million.

The general objectives of this paper research are: conducting a systematic literature review of the forecasting methods, used in tourism literature, to model tourist demand and volatility, during the last decade, and identifying the factors that influence tourism demand.

To achieve this goal, we used mainly the following databases: ScienceDirect®, Web of Science, Directory of Open Access Journals, RePEc (Research Papers in Economics), Ingenta Connect and Social Science Research Network using the following keywords: “tourism demand”, “tourism forecasting” “volatility AND tourism demand” and “search engine data AND tourism demand”.

## Tourism Forecasting

Studying the characteristics of tourism from the economic perspective is an area of research established by Guthrie [6], Gerakis [7] and Gray [8].

Tourism activity has become very important for the economy, in general, and, particularly, for regions, and it represents a strategic sector of economic and social development. In this context, tourism constitutes a privileged field of research, indispensable for understanding and analyzing the various underlying phenomena and the supporting aspects of differentiation, that are at the base of the international competitiveness of destinations (countries, regions or locations). It should be noted, that the tourism development of a given territory, described with the various stages of the life cycle of tourism [9], should be directed and controlled, taking into consideration certain conditions of the sector of activity and the current situation.

The importance of anticipating the future with regard to tourism allows better planning and the development of appropriate policies. With this in mind, van Doorn [10], performs an analysis that relates planning, policy-making and predictions, measuring the utility of these by the person who plans and those responsible for tourism policy. Schwaninger [11] analyzes trends in tourism for twenty years, opposing the demand growth with changes in the economy, consumer behavior and technology. This author considers essential a long-term articulation between all these factors and the trends of growth in tourism. Growth trends in tourism may be affected by the economic downturn as concludes Chew [12] when analyzing factors that can influence tourism, highlighting others with greater weight.

Considering the enormous consequences of various crises and disasters, events' impact evaluation has attracted much interest in tourism demand forecasting research [13]. For

these authors it is crucial to develop some forecasting methods that can accommodate unexpected events in predicting the potential impacts of these on-off events through scenario analysis. Other areas that have not been extensively researched include tourism cycle analysis, turning point and directional change forecasting. Greater attention has been put on forecasting the magnitude of tourism demand while limited research has been conducted in forecasting the directional change or turning point forecast accuracy. Considering the significant policy implications of these forecasts, additional efforts need to be made in this research area in the future.

More recently, Song, Dwyer, Li & Cao [14] updated the research trends in tourism. In their research, they identified as the variable most used to measure tourism demand: the number of arrivals and the level of tourist expenditure. On the most frequent methods, the authors identified that the combination of different models can significantly improve the quality of predictions. Wong, Song, Witt & Wu [15], Andrawis, Atiya & El-Shishiny [16] and Shen, Li & Song [17] had also reach to that conclusion when they compared several forecasts combination methods, showing that this strategy provides a better forecasting performance than individual forecasts.

## **Tourism Forecasting Methods**

The two types of methodological approach to forecasting in tourism include qualitative analysis and quantitative analysis [18].

### **Qualitative Methods**

Qualitative methods are used when there are no relevant historical data that can produce good forecasts, or when the patterns that would allow using historical data are no longer present. The qualitative methods of forecasting are not hints, but rather, include very structured methodologies. Qualitative methods used in tourism demand forecasting include the jury of executive opinion, subjective probability assessment, Delphi method and consumer intentions survey [19]. The application of qualitative methods in tourism demand forecasting can give a better accuracy because of existing volatility in this industry and its elasticity after events [20].

### **Quantitative Methods**

Within the quantitative methodologies we can find causal and time series models. First are based on the assumption that what is intended to predict depends on a relationship of cause and effect of one or more variables. On the other hand, the approach using time series is based on past information on a variable to generate forecasts. Song & Li [13], established that tourism demand modelling includes forecasting models based on non-causal models (or time series models), causal models (or econometric models) and, more lately, models that include artificial intelligence, neural network models, among others. The use of this third class of tourism demand models is very infrequent in modelling tourism demand, compared with time series models or econometrics models [21].

Song, Dwyer, Li & Cao [14] consider that the particular characteristics of the tourism industry call for new perspectives and approaches, stating that the analysis of demand continues to dominate the economic studies of tourism (articles published until 2011).

466 | Askitas & Zimmermann [22] compiled very relevant literature with the uses of internet data in social sciences. These authors found examples of application of this kind of data, since 2005, analyzing and predicting unemployment, “nowcasting”, in health, labor and demographic issues and in political processes and they predict that this kind of data will be soon applied frequently in research.

The methodology to model and estimate tourism demand is based on the formulation of hypotheses based on the theory of demand, the specification of the model of tourism demand, the collection of data considered relevant to the study, modelling and estimation of tourism demand, test the hypotheses considered, make predictions and assess the results of the forecast. In tourism forecasting we can distinguish three different time horizons according to the objectives of development policies and planning. Short time forecasting covers a year or less and it allows take decisions for current operations, an intermediate run that includes forecasting in two to five years its indicate to expansions and changes in products or services and the long range forecasting is indicated to tourism planning and policies development and it includes at least over a five years analysis [23].

### Comparison Methods

The comparison of precision models accuracy has been widely analyzed in the literature, in particular in tourism demand modelling. In this sense it is important to perform a review of the existing literature related to the modelling of the tourist demand, in a way that allows to: identify the most common variables in this type of study, identify the type of data that can be used and also identify the best models. The advantages and disadvantages of different methods of forecasting and estimation of tourism demand have been analyzed by different authors. The use of time series models provides concepts and techniques that facilitate the specification, the estimation and evaluation, often producing more accurate results than other more complex modeling techniques, based on the analysis performed by Choy [24], Martin & Witt [25] and Chen, Bloomfield & Cabbage [26]. Wong, Song & Chon [27] compared various VAR<sup>3</sup> models introducing Bayesian restrictions and found that lead to an improvement in forecasting performance.

No single method could outperform others on all occasions. Some common issues are identified in the recent forecasting competition studies. Firstly, only a limited number of models were selected for forecasting competition, and no clear justifications were given as to why these candidates instead of others were chosen in the forecasting competition [13]. However Coshall [28] shows that univariate volatility models are proving to be important tools in the modelling of positive and negative shocks on tourism demand.

Athanasopoulos, Hyndman, Song & Wu [29] made a research based on a competition between the different forecasting methods applied to tourism, having exclusively used variables

<sup>3</sup> Vector Autoregressive

related to tourism. They found supremacy of time-series methods, clarifying that even in tests where causal models have proved best, certainly the time-series methods would also be good. Also Ellero & Pellegrini [30] tested six models in hotel occupancy forecasting and found that pick-up models work better for the noisy data provided by Italian hotels. The predictive accuracy of seven models in forecasting international city tourism demand for Paris was studied by Gunter & Önder [31]. These authors concluded that univariate models (ARMA<sup>4</sup>) and exponential smoothing are more accurate for United States and United Kingdom markets, otherwise multivariate models that have a better performance with German and Italian markets.

Chu has modeled and compared international tourism arrivals to Singapore in various studies with combined forecast model, seasonal and non-seasonal ARIMA<sup>5</sup> and sine wave nonlinear regression [32] and with fractionally integrated ARMA [33]. This author also applied three univariate ARMA models to tourism demand to Hong Kong, Japan, Korea, Taiwan, Singapore, Thailand, Philippines, Australia and New Zealand [34]. A piecewise linear model was constructed to forecast the touristic demand for Macau by this author [35] and its forecasts were compared with AR<sup>6</sup>, SARIMA<sup>7</sup> and fractionally integrated autoregressive moving average models. This author concluded that piecewise linear model is significantly more accurate than those models.

Song, Li, Witt & Athanasopoulos [36] combined a STSM<sup>8</sup> with a time-varying parameter regression approach to develop a causal STSM to model and forecast tourist arrivals to Hong Kong from four source markets comparing this model to other seven competitors, and it proved to be much more accurate.

Regarding to causal models, according to Morley, Rosselló & Santana-Gallego [37] gravity models can be applied to evaluate the roll of structural factors and can be an important tool to analyze the policy determinants of tourist demand, such as tourist taxes and promotional expenditure policies.

The potential of using SSA<sup>9</sup> was examined by Hassani, Webster, Silva & Heravi [38] using tourist arrivals into United States of America. These authors found that SSA offers significant advantages than alternatives methods like ARIMA, exponential smoothing and neural networks.

Claveria & Torra [39] tested the performance of ARIMA, SETAR<sup>10</sup> and ANN<sup>11</sup> models to forecast Catalonia's tourism demand and, especially for shorter horizons ARIMA outperformed SETAR and ANN models.

Akin [40] proposed an approach to model selection based on a decision tree that must be constructed after we have identified the components of a time series using STSM. This author used arrival data to Turkey to compare performances of SARIMA, SVM<sup>12</sup> and ANN models.

<sup>4</sup> Autoregressive Moving Average

<sup>5</sup> Autoregressive Integrated Moving Average

<sup>6</sup> Autoregressive

<sup>7</sup> Seasonal Autoregressive Integrated Moving Average

<sup>8</sup> Structural Time Series Model

<sup>9</sup> Singular Spectrum Analysis

<sup>10</sup> Self-Exciting Threshold Autoregression

<sup>11</sup> Artificial Neural Networks

<sup>12</sup> Support Vector Machine



## Tourism Forecasting Studies

### Qualitative Studies

468 | The application of qualitative methods for modeling and forecasting tourism demand has, recently, been more frequent. For example, Delphi method was applied to forecast international expo tourism in Korea 2012 combined with quantitative techniques [41] and more recently, in a study on the future of tourism in Chile [42].

The online marketing information system TourMIS that is used by tourism practitioners since 2000 includes a group forecasting support system that uses the predictions from users based not only on quantitative methods but also on judgements from experts [20].

### Quantitative Studies

Deviations in tourism demand, specifically the conditional variance or volatility was modeled by Chan, Lim & McAleer [43] using the logarithm of monthly tourist arrival rate from the four leading tourism source countries to Australia.

Many studies have modeled tourism demand using time-series, like Shareef & McAleer [44] that analyzed arrivals from the eight major tourist source countries using GARCH<sup>13</sup> and GJR<sup>14</sup> models. These type of models were also used to model international tourist arrivals to the five major Spanish destinations by Alvares, Hoti & McAleer [45]. Tourism demand in Taiwan was analyzed and forecasted with heterogeneous AR, GARCH and GJR models by Chang, McAleer & Slottje [46], with an adaptive fuzzy time-series model by Tsaur & Kuo [47] and with a SARIMA-GARCH model by Liang [48] that compared his predictive power regarding other methods.

Recently, Valadkhani & O'Mahony [49] used a five-variable VAR model to forecast tourism demand from Australia's five largest markets and they could understand the dynamic interplay between these markets. This allowed concluding that Australia should diversify cross-country tourism portfolios to minimize volatility of inbound tourism.

A dynamic econometric model was proposed by Albaladejo, González-Martínez & Martínez-García [50] to study the reputation effect in Spain and found that tourism congestion (ratio of visitors over the carrying capacity) influences tourism demand.

Panel GLS<sup>15</sup> models have been used to determine factors that influences the touristic demand from Australians [51]. Panel data was also used to analyze international tourist arrivals from 66 countries between 2006 and 2009 [52] and with data from the 15 main markets of Australia including variables like income, own price, substitute destination price, airfare and immigration [53].

Serra, Correia & Rodrigues [54], estimated dynamic panel data models to explain the evolution of international overnight stays in each region from main Portuguese tourism source markets using per capita income, unemployment rate and final household consumption as explanatory variables. Dynamic panel data have been also used by Deng & Athanassopoulos [55] to model Australian domestic and international inbound travel and by Falk [56] to model Australia's winter tourism.

<sup>13</sup> Generalized Autoregressive Conditionally Heteroscedastic

<sup>14</sup> GJosten-Jagannathan-Runkle

<sup>15</sup> Generalized Least Squares

The use of ANN to forecast and model tourism demand was tested by Wu, Law & Xu [57] who explored the use of a sparse Gaussian process model in tourism demand forecasting in Hong Kong and found its effectiveness compared with ARMA model and SVM models.

Berenguer, Berenguer, García, Pol & Moreno [58] used ANN in mature and nonconsolidated destinations with a model that uses time-series, different arrival seasons and values of months with similar behavior. This type of model turned out to be much more accurate towards the most time-series models and, this supremacy, proved to be better, especially in non-consolidated destinations. Also Claveria, Monte & Torra [59] applied a multivariate neural network that incorporates common trends in inbound international tourism from all visitor markets to a specific destination. In Portugal, Teixeira & Fernandes [60] used tourism revenue and overnight stays in North region hotels to analyze the performance of dedicated ANN and found a very good forecasting quality in these kind of models.

Recently Baggio & Sainaghi [61] applied a horizontal visibility graph algorithm (geometric transformations that transform time-series in a graph) to identify turning points on tourism demand to Livigno, Italy.

### Quantitative Studies with Search Engine Data

The use of search engines is one of the most common strategies on the Internet to find touristic information and most of the Web users began online searches by selecting “their” search engine [62] and Google captures 86% of Europe search engine market in 2012 [63].

The importance of travel queries in search engines was studied in 2011 [64] and they concluded that the ratio of travel queries about a specific city seems to be associated with the tourist level of that city. Choi & Varian [65] were pioneers in the application of internet data in modeling monthly visitors to Hong Kong from nine countries, and they achieved good results. These researchers found economically significant improvements in forecast performance using search engine data from Google Trends, not because of the increases in predictability (which also exists) but because of the facility in acquiring this kind of data. Pan [66] modeled click-through rates from three websites and search engine ranking to analyze the power on this kind of internet data for tourist destinations.

The use of search engines data is very recent on tourism forecasting methodologies. This type of data shows some advantages over official statistics, since it is real time data, with no revisions and it is available for regions or cities [67].

Bangwayo-Skeete & Skeete [68] used weekly Google search data from the three main source countries to five popular tourist destinations in Caribbean, using a composite search with the words “hotels and flights”. These authors compared the performance of the approaches MIDAS<sup>16</sup>, SARIMA and AR and found supremacy of MIDAS methodology.

Search engine data have also been used to forecast tourism demand to Hainan Province by Yang, Pan, Evans & Lv [69]. These authors compared two different search engines using co-integration of this kind of data and visitor volumes and found evidence of decreasing forecasting errors when using this kind of data.

<sup>16</sup> Autoregressive Mixed-Data Sampling

Based on the volume of internet searches with the keyword “tourism Malaysia” in Google Trends, Kadir, Tahir, Yassin & Zabidi [70] developed a model that is a combination of a neural networks model with a moving average model.

#### 470 | **Factors Affecting Tourism Demand**

The concept of volatility was, originally, typical of finance, but the fact that the tourism industry is very susceptible, occurring long periods of ups and downs in the activity, characterizes a volatile behavior. The possibility that negative shocks cause greater volatility than the positives may also demonstrate the need for use of asymmetric volatility models [28].

Shareef & McAleer [71] have modeled the volatility of small islands tourism through log analysis of international arrivals and growth rates of international arrivals, stating that volatility is a measure of the variation of price or return, where periods of high volatility are followed by low volatility periods, and vice versa.

The overall economic impacts from oil prices increase was analyzed by Becken & Lennox [72] using a general equilibrium model for New Zealand and the authors found a negative impact in tourism exports. This impact is different in the 18 segments studied and the greatest negative impact was observed in tourists from United Kingdom.

The determinants and their impacts in Galicia’s domestic tourism was quantified by Otero-Giráldez, Álvarez-Díaz & González-Gómez [73]. These authors found that income, eastern vacations, a religious celebration and a meteorological phenomenon have a positive impact on tourism, otherwise, the differential rates of inflection (between Galicia and other regions of Spain) and the 2008 economic crisis had had a negative impact.

Seetaram [53] developed a dynamic panel data using data from main markets of Australia and the results proved that immigration is an important demand determinant. Income, substitute destination price and domestic tourism price were used by Yang, Liu & Qi [74] to investigate their effect on domestic tourism in some China’s regions. These authors found a positive influence of income versus a negative effect of domestic tourism price and also significant differences in these effects between different sub regions in China. Also Yap [51] examined the economic factors that influence touristic domestic and outbound demand and found that exchange rates influence the Australians’ decisions to travel, Falk [75] found this kind of influence in Swiss Alps winter tourism too and Santana-Gallego, Ledesma-Rodríguez & Perez-Rodríguez [76] also conclude that less flexible exchange rates regimes promote tourism.

The interdependence of international tourism demand and volatility was analyzed in New Zealand [77] and in leading destinations of Association of South East Asian Nations [78] using multivariate GARCH models.

Cycles in tourism are mainly determined by delayed effects of the overall business cycle which may permit the adoption of countercyclical policy interventions to safeguard tourism industry [79]. This relation was also analyzed by Smeral [80] who concluded that these effects depend on the phase of the business life cycle of the source market.

Andraz & Rodrigues [81], analyzed how tourism demand from major source markets has been affected by economic cycles in Portugal. These authors concluded that German tourism shows more resilience to shocks and, in contrast, tourism from United Kingdom and The Netherlands have revealed very irregular patterns.

The impact of crime on tourism demand in Barbados was examined by Lorde & Jackman [82] and they conclude that an increase in the overall crime rate have a negative impact on arrivals to the island, starting six months after and taking about twenty months to return to normalcy.

The significance of world events have been analyzed in Australia by Athanasopoulos & Hyndman [83] who found an increase in business travel after 2000 Sydney Olympic Games. These authors also established a positive relation between 2002 Bali bombings and a significant upturn in visiting friends and relatives.

The importance of events as the terrorist attacks of ETA, the 11th March and the riots in some Arab countries of the Mediterranean have been identified by Álvarez-Díaz, González-Gómez & Otero-Giráldez [84] in their analyze of the determinants of touristic demand from Russian visitors.

Among the factors that influence tourism demand, Falk [85] found that the impact of the weather on domestic and foreign overnight stays in Austria in the peak summer season, namely a positive impact of temperatures and sunshine duration and a negative effect from average precipitation, using error-correction models. This author also found that tourism demand in Austria ski resorts is significantly related to weather conditions, such as the amount of natural snow, sunshine and cloudiness [86]. More recently, Falk & Hagsten [87] found evidence of a positive relation between early snow and Swedish winter tourism demand and Zhang & Kulendran [88] concluded that temperature in the destination and temperature in the country of origin also have impact in the tourism demand, with different significances between different origin markets.

Su & Lin [52] found an important role of world heritage sites on tourism numbers with a greater positive evidence for natural sites than for cultural sites. Laframboise, Mwase, Park & Zhou [89], Culiuc [90] and Deluna & Jeon [91] found that tourism demand seems to be very sensitive to absence/existence of direct flights.

## Conclusions

This literature review covered mainly on existing forecasting methods and on studies in tourism which have already implemented them. Since the last literature review performed by Song, Dwyer, Li & Cao [14] concentrated on articles published up to 2011, it was our aim comprise what new methodologies can be applied to the modeling of tourism demand and volatility, especially after this date.

Since no single methodology can be considered the best in all contexts because, even within a region, the best model vary between different source markets, it is important to test the accuracy of two or more models when we want to achieve good models that can assist in the development of tourism planning policies. The combination of different kind of forecasting models have been introducing some accuracy in recent studies.

The most common variables in the analysis of tourism demand include overnight stays in hotels, arrivals, GDP of the main markets, revenue from tourism and, more recently, data from search engines.

Modelling of tourism demand is very dependent on the availability of data and the possibility of comparability. Furthermore, official data are often available for large regions within

a country, without being disaggregated by source markets, often annual and about a year lag to the current date.

More recently it began to be more common the disaggregation of demand by source markets which allowed to find, among the determinants of tourist volatility, the interdependence between regions.

472 | The factors that seem to influence the volatility of domestic and international tourism demand include economic factors such as GDP, income and exchange rates, and also big events, large shocks, epidemics, weather conditions, absence/existence of direct flights and crime. Knowing factors that are, usually, responsible for volatility in tourism demand make it important to include variables in forecasting models that can help to identify determinants of volatility in each destination.

In some destinations, there is little availability of data at a more disaggregated level (county, city or local) and, when it exists, it is available only about one year after they have occurred. Using data from search engines has shown good forecasting results in the studies conducted so far and can overcome this lag.

This research can open up avenues for improved modelling, forecasting and planning of tourism demand, taking into account which may cause “ups” and “downs”, as well as the length of what introduces some volatility. Such planning must be adapted to each of the source markets and, taking into account data coming from search engines, may allow short-term measures to counteract declines in demand.

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