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What is This?
An Overview of Approaches Used to Forecast Tourism Demand

Muzaffer Uysal and John L. Crompton

Decisions regarding appropriate investments in both the public and private sectors, as well as short-term marketing decisions, depend heavily on the accuracy of forecasts of tourism demand. This article reviews both the qualitative and quantitative approaches to demand forecasting in tourism and suggests that the two approaches combined produce more accurate forecasts.

In the long term tourism can be an effective generator of new money into a destination area as well as a source of employment opportunities. At the international level tourism offers a means of reducing balance of payments deficits, diversifying the structure of a host country's economy, and ameliorating regional economic imbalances. However, achievement of such objectives assumes that appropriate investment decisions will be made in both the public and private sectors. Decisions on elements such as infrastructure and superstructure, accommodations, transportation, attractions, promotion, and other services depend on reasonably accurate forecasts of how many tourists will be served, their seasonality, and their service needs. Short-term marketing decisions concerning price, promotion, distribution and staff deployment are similarly based upon predictions of the future. Indeed, any decision is associated with an implied forecast even though no explicit forecast has been made (Sararos 1973).

Tourism forecasting contributes data that help answer three vital questions: (1) How many tourists are likely to arrive at a destination in a given time period? (2) Which origin areas represent the best marketing opportunities for a destination? and (3) Which factors are most influential in determining future visitation to a destination?

Figure 1 identifies the principal qualitative and quantitative approaches which have been used in demand forecasting. The quantitative approaches may be broadly categorized into time series, gravity and trip-generation models, and multivariate regression models. Both the multivariate regression models and the gravity and trip-generation models may be regarded as causal models, which explicitly attempt to quantify the relationship between a set of causal variables.

In contrast to the three quantitative approaches which require the existence of past data, qualitative approaches to assessing future demand are designed to elicit and capture the pooled opinions of groups of experts in the tourism field. Even the most exacting of the numerical approaches involve an element of subjective judgment about the future. For this reason, qualitative approaches and quantitative analyses often are employed together to improve the reliability of demand forecasting (Archer 1980).

Qualitative methods of forecasting are characterized by the use of accumulated experience of individual experts, or groups of people assembled together, to predict the likely outcome of events. This approach is particularly appropriate where past data are insufficient or inappropriate for processing or where changes of a previously unexperienced dimension make numerical analysis of past data inappropriate. For example, a newly established tour operator or a resort business would not have historical data concerning its business trend. Thus, the necessary data upon which quantifiable forecasting depends would not be available. Similarly, where social and political unrest has affected the life of a particular nation or region the data base may not be useful for quantitative forecasting.

Traditional Approaches

Two traditional qualitative approaches to forecasting which have been used frequently are (1) analysis of

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QUALITATIVE APPROACHES

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national or regional vacation surveys and (2) survey inquiries of potential visitors in tourism-generating areas. A less expensive approach is to analyze vacation surveys and to look for changes over time. A careful analysis of several annual surveys may give valuable insights into emerging trends.

Inquiries within a potential generating population may offer useful insights about the attitude or prevailing image of the potential market towards a tourist-receiving destination. This approach may be combined with a survey of the opinions and intentions of tour operators, travel agencies, and/or airlines. Conducting primary market research such as this, however, is expensive and time-consuming. The rapidity with which tourist trends change and the very limited time span for which tourist surveys are done mean that the tourist trends change and the very limited time span for which tourist trends remain useful often mititigate against using such approaches. Further, the usefulness of surveys depends on their accuracy and representativeness. Unfortunately, many surveys which are used for forecasting tend to mislead and misinform because of biases introduced by using non-probability samples, non-response of selected respondents, and invalid or unreliable instruments.

The survey method is likely to be a useful complement to demand forecasts based solely on trend extrapolation or projections based on alternative rates of growth. Since extrapolation consists of the extension of past trends into the future, it is based on an assumption that past conditions will continue into the future: that is, that causal factors will continue to operate in the same ways and to the same extent that they have operated in the past. In contrast, the survey approach takes into account possible changes in the direction of causal factors and the possible effects of individuals' subjective judgments about the future.

The Delphi Model

The Delphi technique is a special type of survey used to forecast the occurrence of specified long-term and short-term events and to generate estimates of the probability of specified conditions prevailing in future times. Delphi modeling is one of the more recent methods of long-term forecasting. The technique was pioneered in the 1960s by the Rand Corporation, and is a means of reaching concensus among experts in the area of interest through administering a series of questionnaires, collating judgments, and providing feedback from each series of questionnaires to all participants. This feedback is reviewed by each participant before the participant responds to the next round of the questionnaire. Additions and comments from earlier rounds are taken into consideration so that ultimately the most desirable solution emerges from the collective knowledge of the experts (Robinson 1979).

The Delphi, as it was originally designed, taps individual judgments, generates ideas for solving problems, is task-oriented, and "minimizes conforming influences because face-to-face discussion is eliminated and respondents are anonymous to one another" (Dalkey and Helmer 1963). Its development and use as a technology assessment tool has been well documented (Linstone and Turoff 1975). Usually the aim is to provide an indication of the degree of probability that selected events will take place within specified time periods. The Delphi method, however, is not "pure brainstorming." The weakness of a brainstorming group meeting is that the outcome may reflect only the opinion of the dominant personalities in the group.

The results of a Delphi can be affected by how the directors of the study interpret replies and by the way in which information is fed back to panel members. In addition, "non-response" of experts may be high. Bruges (1980) reported on an application of the Delphi method to tourism undertaken by Kirppendorf. In this case non-response was low and inputs from the experts were substantive and insightful so the results were useful. The usefulness of the results is likely to depend on the qualifications of the participants addressing the issue, the response rate, and the interpretation of the replies by the study directors.

Dyck and Emery (1970) used a Delphi model in their attempt to forecast the likelihood and probable dates of the occurrence of events in Alberta associated with leisure and recreation over the years 1970 to 2005. In their study, 305 experts were selected to form six panels, each addressing a different subject area: social goals and values, the needs of the individual, political life, family life and child rearing, leisure and recreation, and intercultural relations. Two rounds of questionnaires were used. After the questionnaires had been completed, the results were summarized to provide forecasts, dates, and trends. Dates were assigned for the occurrence of each of the specified events. Dates shown with a 50% "probability" were those by which 50% or more of the panel members considered an event would occur, "with some degree of certainty." Similarly, 90% "probability" dates were those by which 90% of the panel members thought an event would occur. These were supported by scenarios developed from the forecasts themselves and from the reasons and arguments presented by the panel members.

Shafer, Moeller and Getty (1974) also utilized the Delphi technique to predict leisure environments of tomorrow. The aim of this study was to provide "an aid to policy and decision-making about future environmental problems; particularly in relation to future changes in the availability of leisure time and its effects upon the physical and recreational environment." This group started with 904 experts and ended with 405 experts, and proceeded through four rounds in the study. They sought to predict the likelihood of future events associated with natural resource management, wildland recreation management, population-workforce-leisure, urban environment, and environment pollution.

Because reliability of the results depends on a large extent upon the expertise of panel members, the procedure's usefulness is often limited because relatively few participants are likely to possess true expertise over more than one dimension of a subject area. To surmount this difficulty of weighting varying levels among participants, it is desirable to ask them to rate their own expertise on each variable to be forecast. This is distinct from their probability rating of the variable or event occurring.
The study findings are normally expressed in the form of degrees of “probability” that particular events or trends will occur during specific time periods, but these results are not accurate in a statistical sense. The term “probability” as used in Delphi studies does not indicate a precise statement about the statistical likelihood that particular events or trends may occur, but rather is a subjective assessment of the possibility. However, Linstone and Turoff (1975) point out that the Delphi technique does have advantages over other qualitative approaches:

Since an honestly executed Delphi makes the communication process and its structure explicit, most pitfalls assume greater clarity to the observer than if the process proceeds in a less structured manner.

Judgment-Aided Model (JAM)

The most common qualitative approach is to assemble a panel of experts and attempt to achieve a consensus. Such gatherings may take the form of committee meetings, seminars or colloquia. The aim is to generate as much debate and interchange of ideas as possible in order to reach an agreed upon forecast.

BarOn (1979) reported on an application of JAM to tourism in Thailand. The scenarios (optimistic, intermediate, pessimistic) were based on alternative assumptions regarding the environment for international tourism. The fields of interest to the scenarios were mainly concentrated on political factors, economic tourism development and promotion, and air transport.

Basically, a scenario is an account of what could happen given the known facts and trends. In the case of demand forecasting, a hypothetical sequence of events is described showing how demand is likely to be affected by particular causal processes. Attention is focused both on the variables which affect demand and on the decision points which occur. The intent is to indicate what actions can be taken to influence the level of demand at each stage, and what the repercussions of such actions might be. Scenario writing is not a forecasting technique per se but a method of clarifying the issues involved.

Morphological analysis is a similar technique used for drawing attention to the issues involved in order to forecast demand. It was initially developed by Zwicky (1969). Here the aim is to structure existing information in an orderly manner and so identify the probable outcome of events. The first stage is to identify the most important variables. This is usually carried out intuitively, although the use of multivariate regression adds rigor to the work. Second, each of the variables is considered in turn and all possible parameters and constraints for each are identified and classified. Third, the parameters are categorized into particular groupings which are then put into matrix form. The matrix shows all the possible combinations of the parameters. Management looks closely at the potential combinations and makes an assessment of various attainable levels of demand under different assumptions about the performance of each of the variables.

 QUANTITATIVE APPROACHES

Time Series

A time series consists of statistical data which are collected, or observed, over successive increments of time. A model of a time series may be defined as a specification of the forces which contribute to movements in the series, as well as an analysis of the manner in which these factors interact in influencing the series’ direction and magnitude (Pfaffenberger and Patterson 1977). Time series models are not concerned with explaining the reason why a forecast is what it is. All causal factors are considered in the aggregate. It is assumed that the net result of these variables is what has caused whatever trends, seasonalities, or cyclical behavior may exist in the data, and that an extrapolation of the trend, seasonal, or cyclical pattern will yield an appropriate forecast (Swart, Var and Gearing 1978).

BarOn (1972, 1973) describes the use of a time series analysis program “X-11,” developed by Shiskin at U.S. Bureau of the Census, to quantify the seasonal and cyclical component trends of several time series associated with the tourism industry in Israel. Specifically, he analyzed the following time series:

a) Tourists arriving and departing by air

b) Tourist arrivals only (tourists received by Israel)

c) Foreign currency-income from tourism in Israel

d) Residents departing

e) Bed nights in tourist recommended hotels, broken down into visitors from abroad, Israelis, and total.

In his later study (1973) BarOn compared these series to those in several other countries. He offers several examples illustrating how the results can be used as input to, and guidelines for, planning studies.

The traditional time series methodology used for forecasting has dealt mainly with univariate analysis, i.e., trying to extrapolate a given series based on its own movement through time. The historical values of a single time series have been used to project future values of the series. This type of approach may be useful for relatively short term forecasts. (See Clawson and Knetsh 1966, who provide illustrations of this approach in the field of recreation.) While this approach is often quite successful, it is sometimes criticized because it does not take into account the impact of “other” variables on the variable to be forecast. This criticism may be overcome by the introduction of transfer function models described by Box and Jenkins (1970).

For example, Wander and Van Erden (1980) used a Box-Jenkins (B-J) transfer function model to project tourism demand in Puerto Rico. The time series—tourism arrivals to Puerto Rico—was estimated using other variables which were believed to be related to tourism arrival. In their study, two models of arrivals were developed—a simple univariate analysis and a transfer function model. The data used covered the time period July 1967 to June 1977, for a total of 120 observations. To assess the usefulness of the methodology, forecasts were made for 12 months beginning July 1977. While the transfer model was better for the first six months, the univariate model was better for the entire period.
They indicated that the transfer model allows the forecaster to take into account discrete changes external to the system. For example, a reduction in air fares or a special promotion may have an impact on the arrival series. This impact may result in a permanent shift. Using B-J intervention analysis, this process may be incorporated into the overall model.

The Canadian Government Office of Tourism (1983) used the Box-Jenkins technique to forecast short-term (up to 2 years) changes in Canada’s major travel markets. Their medium term forecasting models were derivatives of the B-J transfer function technique. The forecasts which were produced were based on four alternative scenarios of economic performance together with a controlled solution generated internally by the models through extrapolating existing economic trends.

In another application of time series forecasting methods, Geurts and Ibrahim (1975) applied both the Box-Jenkins technique and an exponential smoothing model to tourist arrival data for Hawaii. The main purpose of the study was to compare the two approaches, and the results indicated that for the Hawaii tourist arrival data, the exponential smoothing approach was preferable to the Box-Jenkins technique because of its lower costs, although the accuracy was not superior. Geurts (1982) conducted a follow-up study for Hawaii to illustrate the accuracy improvement from data modifications. He concluded that a forecaster should monitor the data to detect changing patterns over the time period in order to produce more accurate forecasts.

Liepa and Chau (1977) reported the results obtained when the Box-Jenkins technique was applied to eight time series of variables important to the tourism industry. Four of these series were travel accounts consisting of quarterly data from the first quarter of 1959 to the first quarter of 1976. Their conclusions were rather tentative, but indicated that the Box-Jenkins technique may be useful in some forecasting situations.

In summary, the Box-Jenkins model-building approach involves complex mathematical and statistical algorithms, together with subjective judgments by the modeler. Experience is a mandatory requirement for improving the final models in the analysis of a time series. In addition, the transfer model building process is several times more difficult than the univariate process. The use of two or more time series introduces additional modeling problems.

Gravity and Trip Generation Models

Gravity models are somewhat similar in form to regression models except that they focus more on the effects of distance or journey time as a constraint which affects travel. The gravity models are derived from the principles of Newton’s law of gravitation: two bodies attract each other in proportion to the product of their masses and inversely by the square of their distance apart. There are also some conceptual and technical differences in their formulation. In contrast to regression models which are estimated statistically, the gravity model is usually “calibrated” by trial-and-error procedures (Cesario 1969).

The Crampon model (1973) starts from the notion that the total number of visits made to any destination is the sum of the number of visits made by travelers arriving from each of the various travel markets or origins. Consequently, factors that exert an impact on travel between such origin-destination pairs must influence travel in total. The analysis of travel flows can be simplified by examining factors influencing travel between the origin-destination pairs. Therefore, these pairs are selected as the basic unit of study. A number of gravity models have been developed to explain travel flows (Ullman and Volk 1962, Ellis and Van Doren 1966, Wolfe 1972, Freund and Wilson 1974).

The basic assumption of the gravity model is that the number of trips taken by a given population from an origin to a particular destination is a function of both the total population and the distance (Ontario Research Council on Leisure 1977, p. 77). Van Doren’s (1967) gravity model takes the form shown in the following equation:

$$I_{ij} = G \frac{A_j P_i}{d_{ij}^b}$$

where:

- $I_{ij}$ = number of trips made in some time between origin i and destination j
- $P_i$ = population of origin area i
- $A_j$ = attraction index of j
- $G$ = gravitational constant (parameter)
- $b$ = empirically estimated exponent

The model predicted the number of campers traveling to each of 55 Michigan state parks from 77 counties. The attraction index ($A_j$) was developed based on the location of the park in terms of water (Great Lake or not); natural features such as vegetation, climate and topography; various man-made features such as boating facilities and beaches. This index was then used in the gravity or interaction model with the population of the counties and a time-distance measurement between each of the centers of origin and 55 state parks.

Population and distance variables are often replaced by some different explanatory factors. Archer (1976) gives as an example:

$$I_{ij} = G X_j^a A_j C_{ij}^b$$

or in logarithmic form:

$$\log I_{ij} = \log G + a \log X_j + c \log A_j - b \log C_{ij}$$

in which:

- $I_{ij}$ = number of tourists traveling from origin area i to destination area j;
- $X_j$ = a group of factors, e.g., income levels, size of population, which generate travel in origin country i;
- $A_j$ = the attractiveness of country j as a destination area;
- $C_{ij}$ = the cost (money and time spent in traveling from origin i to destination j).

Some researchers have tried to produce a dynamic
gravity model (Armstrong 1972, Crampon 1973). The Armstrong study begins with a simple relationship between the number of tourists' arrivals to country \( j \) generated by country \( i \) and the latter's population. Then, as a second step, in order to obtain the most satisfactory outcome, a number of independent variables are progressively introduced: per capita income, language similarity, attractions and distance. The model is shown in the following form:

\[
N_{ij} = A_j(P_i; Y_i; L_{ij}; D_{ij})^a
\]

in logarithmic form:

\[
\log N_{ij} = A_j + b \log P_i + c \log Y_i + d \log L_{ij} - a \log D_{ij}
\]

where:

- \( N_{ij} \) = number of tourist arrivals recorded in country \( j \) coming from country \( i \);
- \( P_i \) = population country \( i \);
- \( Y_i \) = GNP per capita of country \( i \);
- \( D_{ij} \) = the distance between generating country \( i \) and recipient country \( j \);
- \( L_{ij} \) = a value given to the adjacency of frontiers and/or common language, if any between countries \( i \) and \( j \);
- \( A_j \) = a value given to the tourist appeal of country \( j \);
- \( b, c, a \), and \( d \) = elasticities of each variable respectively.

In order to explain progressive changes in explanatory variables such as leisure time, Armstrong introduced a time element into his model as shown in the following equation:

\[
N_{ij} = A_j P_i^b Y_i^c L_{ij}^d T_n^e
\]

where \( T_n \) is the value of time each year 1 to \( n \).

A typical trip-generation model is Laber's model (1969). He analyzed the determinants of international travel between Canada and the U.S. using gravity model in a log linear form:

\[
\log (l_{ij}/P_i) = \log G + a \log Y_i + b \log AN_i + c \log D_{ij} + d \log D_{ij}
\]

in which:

- \( l_{ij}/P_i \) = actual number of trips made from origin \( i \) to destination \( j \) per capita;
- \( Y_i \) = income per capita in country \( i \);
- \( AN_i \) = an ancestry link, represented by the number of persons per 1,000 population in origin \( i \) who were born in Canada;
- \( DV_i \) = a dummy variable inserted to measure the effect on travel of the existence of a common frontier between particular U.S. states and Canada;
- \( D_{ij} \) = distance

Trip generation models are sometimes derived from gravity models (Gordon and Edwards 1973, Ewing 1980). In other cases, they are merely refined forms of consumer demand equations.

Three more ambitious applications of the technique were those developed by Mansfield (1969), Gordon and Edwards (1973), and the Roskill team (1971). The aim of the first two studies was to examine how the demand for pleasure travel to particular areas would be affected by road improvements or by the construction of new highways. All three investigations involved an examination of the relative part played by journey cost and travel time in influencing trip generation.

The gravity models are widely used and can be useful predictors of tourist travel flows. Although Wolfe (1972) introduced an element of inertia into the gravity model, such models still have a number of weaknesses:

1. the gravity model is frequently characterized by and tourism researchers as a model of demand yet, when measured against the economic definition of demand, it is a model of use or consumption, since it does not contain an independent variable for price;
2. distance alone may not always be an accurate measure of frictional retardation. Some researchers have experimented with time and travel costs as alternative measures;
3. lack of accuracy of basic data, and danger of multicollinearity;
4. origin zones are usually determined arbitrarily, yet their bounds are critical to a model's performance. Often the distance between an origin and destination area is measured from the population center of a region or an urban area, but this may produce errors in measurement. Although reducing the size of an origin zone can help to locate accurately the population center, the reduced size may be too small from which to generalize about the nature of the population;
5. the difficulty of forecasting individual explanatory variables.

Multivariate Regression Models

The most commonly employed quantitative techniques are multivariate regression models (see Gray 1966, Diamond 1977, Little 1980, Quayson and Var 1982). Multivariate regression analysis is a method of determining the degree of influence exerted upon the demand by each of several variables.

Conceptually, any number of variables can be used to explain and predict demand levels (McIntosh and Gupta 1980). Data, preferably on a time series basis, are used to investigate the explanatory variables. The most frequently used method in time series tourism demand forecasting is multivariate regression using ordinary least squares (OLS) (Krause, Jud and Joseph 1973). However, when the problem of multicollinearity among explanatory variables exists and the pattern of collinearity among regressors changes over time, ridge regression models can yield forecasts with significantly lower error relative to OLS models (Fujii and Mak 1980).

A typical multivariable regression model hypothesizes that demand for tourism to a particular destination is a function of factors such as per capita income and income distribution, population size of the tourist-generating areas, the cost of travel, the relative price levels, and, in the international context, the rate of exchange variables in the destination area compared with competing alternatives (Bruges 1980).

Such a model would be expressed as follows:

\[
I_{ij} = F(PoP_i Y_i P_d E_c C_f)
\]

This shows that the number of tourists who travel from
origin i to destination country j is a function of those several variables, in which the relationships among the predictors and between the predictors and the error are assumed to be linear. Thus, the model should be converted into a linear model using variable transformations so the model can be solved by taking the natural log of I_i^j and each of the predictors. 

In logarithmic form, this relationship can be written as follows:

\[
\log I_i^j = \log a + \log POP_i + \log Y_i + \log P_j + \log F_j + \log C_{ij} + u
\]

in which:

- I_i^j = the number of tourists who travel from origin country i to country j;
- POP_i = population of origin country i;
- Y_i = level of personal disposable income per capita in country i;
- P_j = relative level of consumer prices in country j compared with country j;
- C_{ij} = the cost of traveling from country i to country j;
- \( a, b, c, d, e, f \) = parameters

In order to use the model for forecasting purposes, estimates of future values of each of the independent variables have to be included in the equation.

A good example of multivariable regression was applied by Askari (1971) to estimate the demand for particular package tours by residents of each U.S. state. The following model was tested:

\[
I_i^j = a + b_1 Y_i + b_2 FA_i + b_3 CO + b_4 A_j
\]

in which:

- I_i^j = the number of people from state i who take tour j;
- Y_i = the income per capita in state i;
- FA_i = the cost of travel from state i to the departure point of tour j;
- A_j = the number of "attractions" per day on tour j;

By the use of the linear model, Askari was able to show that income levels, the daily cost of the tour, and the number of attractions it offered were very significant determinants of the number of people taking particular package tours. Such forecasts, however, are made under the assumption that the existing relationship between the variables will be constant and this assumption is only justifiable for short-term forecasts, i.e., no more than two years ahead. It is not realistic to assume that these relationships between variables will remain constant for the long term.

Artus (1972) attempted to make a systematic analysis of the short-run determinants of international travel flows by specifying a complete world travel model. The Artus study is an econometric analysis of the factors which determine the level of tourism expenditure by German travelers overseas and of German receipts from foreign visitors. The model used to estimate the parameters of those variables influencing German tourist expenditures abroad is shown in the following equation:

\[
\frac{M_G}{P_f} = AY^a G_t^B E_t^E
\]

in which:

- M_G = index of the value of German travel, expressed in U.S. dollars;
- Y_G = index of real disposable income of German households;
- P_G = index of consumer prices in Germany, expressed in U.S. dollars;
- P_f = weighted average of the indices of consumer prices in foreign countries, expressed in U.S. dollars, the weight in each country being the share of that country in German tourist expenditure in 1965;
- e = base of the natural logarithms;
- B = a stochastic disturbance term;
- \( A, a, B \) = various parameters;
- t = refers to the yearly time period.

Artus (1972) recognized the possible limitations of this approach which include the reliability of the estimated confidence intervals, the use of consumer price indices as proxies for prices of foreign travel services, and the large difference between the magnitude of the observed changes in relative prices during the period 1960-1969 and the projected relative price changes in 1970 resulting from the German revaluation and the French devaluation.

Smith and Toms (1978) generated a model which involved pooling time-series and cross-sectional data to investigate the factors affecting demand for international travel to and from Australia. The following model was specified in the study:

\[
DP = f(Y, F, E, MA, MO)
\]

where:

- DP = per capita demand for travel to an overseas country;
- Y = real disposable income per capita in the country of residence;
- F = the equivalent real fare in the country of residence (it reflects the amount travelers would be prepared to pay to avoid restrictions on low-cost tickets);
- E = the exchange rate between Australia and the overseas country;
- MA = proportion of the Australian population born in the overseas country;
- MO = number of Australian-born permanent residents in the overseas country.

Separate regression equations were estimated for Australians traveling overseas and overseas visitors traveling to Australia in order to derive quantitative estimates of the various demand elasticities. In addition to the explanatory variables, "dummy" variables were introduced in the equations to allow for seasonal fluctua-
tions or variations between origin/destination pairs due
to factors which could not be represented directly.

Loeb (1982) developed a model using regression
techniques to investigate the effects of real per capita
income, exchange rates, and relative prices on the exports
of travel services from the United States to Japan,
Germany, the United Kingdom, France, Canada, Italy,
and Mexico. The study also evaluated the effects of real
income, exchange rates and relative prices on the total
level of U.S. receipts from foreign travel. The general
model which he used for the study was:

\[ T_{j,z} = f(RYP_C_j, EX, RPI, D_i), i = 1,k \]

where:

- \( T_{j,z} \) = a measure of the demand for travel services by
country \( j \) from country \( z \), i.e., a measure of the
exportation of travel services by country \( z \) to
country \( j \).

- \( RYP_C_j \) = a measure of real per capita income in country \( j \).

- \( EX \) = relative exchange rate (measured as units of \( Z \)'s
currency/unit of \( j \)'s currency).

- \( RPI \) = relative prices, i.e., the ratio of prices in the exporting
or host country to prices in alternative travel
locations (including the country of origin of the
tourist).

- \( D_i \) = variable indicating special event \( i \).

- \( j \) = subscript denoting the country importing travel
services.

- \( z \) = subscript denoting the country exporting travel
services.

In general, the variables of income, exchange rates and
relative prices proved to have a significant effect on the
demand for travel in the U.S. However, the degree of
responsiveness attributed to the variables varied from
country to country. The income variable was found to be
significant and positive for all countries evaluated. The
coefficients associated with the relative price variable
were generally negative and significant for the demand
model, indicating the importance of price. The price
coefficients indicated substitution effects, i.e., as relative
prices in the exporting countries increased vis-a-vis prices
in the home country or alternative travel locations, there
was a reduction in the demand for travel services from the
exporting country. The study's findings suggested not
only that exchange rates and real per capita are
important but also that relative prices are an important
contributing factor to the United States' real travel
exports.

**CONCLUDING OBSERVATIONS**

Although relatively sophisticated statistical
measures have been used, forecasts of tourism demand
can produce only approximations. All of the approaches
described in the paper have limitations. Consequently, a
certain amount of error is inevitable, particularly if projections are to be made beyond a one-year time period.
For this reason, forecasts should be expressed in the form
of a range rather than by the use of absolute values. In
addition, alternative methods of deriving a forecast
should be used in order to improve confidence in the
resulting forecast. Certainly the value of the qualitative
approaches should not be overlooked in providing insights or experienced judgments and forcing
considered evaluation of the results produced by quanti-
tative approaches. These qualitative inputs are likely to
be particularly valuable when quantitative models are
used to project beyond a one or two-year time period.

Existing tourism forecasting models generally
consider only demand variables, and supply variables are
ignored (Gearing, Swart and Var 1976). There is an
implicit or explicit assumption that the supply of tourism services is perfectly elastic. For example, the availability
of natural resources, infrastructure, superstructure,
transportation facilities, and hospitality resources is not
incorporated into the models and is assumed to expand in
response to increases in demand.

There is a growing tendency to depend more upon
quantitative models. However, in most cases they are not
sufficiently widely accepted or valued that data are
collected specifically for use in them. In most instances
secondary data collected for other purposes have to be
adopted for use in the models. These data are frequently
not available in the form that is most useful for the fore-
casting effort. This need to compromise the quality of
input data leads to a temporizing of the models' accuracy.

Even in situations where part data describing the
individual explanatory variables selected for inclusion in
the model are available in the desired form, forecasting
them is often difficult. Since accuracy projections of
tourism demand depend on the accuracy of forecasts for
each of the explanatory variables in the model the
accuracy of tourism forecasts may be reduced. In addi-
tion, the appropriateness of the variables may change
over the projection time period. Indeed, the models
developed to this point are static and must be recalibrated
periodically in order to maintain their viability (Edgell
and Seely 1980).

The time period for which a forecast is to be made is
probably the most critical factor in determining the most
appropriate technique to be used (Firth 1977). In general,
quantitative techniques are more suitable for short-term
forecasting. For example, annual forecasts of tourism de-
mand using quantitative models developed from past
trend data are likely to be useful, because relationships
between the variables are likely to remain reasonably
constant over this short time period. As the time period of
the projection lengthens, the likelihood of these relation-
ships remaining constant decreases, and the accuracy of
quantitative approaches is likely to decline. Thus, for
medium or long-term projections, qualitative judg-
mental approaches may be more useful.

A major weakness of quantitative approaches has
been their reliance on aggregated data. These global or
total forecasts are of limited value because they may
obscure important regional differences. Future forecast-
ing efforts are likely to seek greater disaggregation of the
input data and to focus more attention on regional rather
than national or international estimates of demand. As
Taylor (1976) has noted:

Tourism can no longer be concerned solely
with the growth in the number of tourist
arrivals in a country or in part of a country. It
must be concerned with the effects of those arrivals upon the reception area and upon the tourists themselves.

Qualitative approaches when combined with quantitative approaches enable forecasts to be amended to incorporate relevant consumer demand data. When used alone, the quantitative models have conceptual limitations. Typically, they are “philosophically blind” (Rodgers 1976). Lack of appropriate data means that they are unable to incorporate an understanding of consumer motivations and behavior which explain tourism demand and may cause it to shift unpredictably in the future.

Although tourism forecasting may offer only approximations, it at least suggests broad directions. The questionable accuracy of many data used as model inputs is a major obstacle to reliable forecasting. However, there is no alternative to doing it because it lies at the heart of formulating tourism policy and developing marketing efforts. Further advances in forecasting tourism demand depend upon improvements in the data base and the ability to incorporate into quantitative models a deeper knowledge of the fundamental factors which affect consumer behavior.

REFERENCES

Archer, Brian H. (1976), Demand Forecasting in Tourism, University of Wales Press.


Fuji, T.E. and J. Mak (1980), “Forecasting Travel Demand when the Explanatory Variables Are Highly Correlated,” Journal of Travel Research 18 (Spring), 31-34.


Robinson, A.E. (1979), Tourism and the Next Decade: A Look to the Future Through... a return to Delphi,” from the TTRA Tenth Annual Conference, College of Business, University of Utah.


