RESEARCH NOTE

A ESTIMATING MALAYSIAN ECOTOURISM DEMAND USING FUZZY MODEL (CASE STUDY OF STATE OF MALACCA)

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Fuzzy regression model (FRM) is an alternative to evaluate the relation between variables among the forecasting models, when the data are not sufficient to identify the relation and we have uncertainty in data. Behavior and thinking of the people, with their differences on emotions and intuitions, produce the ambiguity in social studies. Instead of using point estimation in conventional probability theory, fuzzy set theory can be used to granulate a concept into a set with membership function and thus decreases the amount of required data. In the last two decades, Fuzzy Sets Theory that was introduced in 1965 by Prof. Lotfi A. Zadeh has received wide attention particularly with successful applications in various fields ranging from engineering to social science studies. Besides being an alternative to Conventional Regression Model (CRM), the Fuzzy Regression Model (FRM) has the ability to evaluate relationships between variables when the data series are limited and uncertain. Moreover, the fuzzy regression is able to address the ambiguity in the variables, such as human behavior, thinking and subjectivity. In this paper, we estimate the demand model for ecotourism in Malacca state by using FRM as an alternative approach. Results show that trip cost, opportunity cost, time and income are the significant variables that could explain variation in number of trip as dependent variable.

Fuzzy regression, ecotourism demand

INTRODUCTION

The Malaysian Tourism Policy, formulated in 1992, identifies ecotourism as one form of tourism to be expanded and sustained. This was due to the fact that ecotourism was recognized to grow faster than any other form of tourism. It was a strategic effort to focus on ecotourism as a niche market rather than grouping it within the broader tourism market. The national ecotourism plan is intended to serve both as an appropriate instrument within the overall sustainable development of Malaysia, and as an effective tool for conservation of the natural and cultural heritage of the

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country. Many researchers have defined ecotourism in various perspectives often synonymous with nature tourism. The International Ecotourism Society (TIES), in 1991 produced one of the earliest definitions: "Ecotourism is responsible travel to natural areas that conserves the environment and sustains the well being of local people." The International Union for Conservation of Nature (IUCN) stated in 1996 that ecotourism is: "environmentally responsible travel and visitation to relatively undisturbed natural areas, in order to enjoy and appreciate nature, and any accompanying cultural features, both past and present that promotes conservation, has low negative visitor impact, and provides for beneficially active socio-economic involvement of local populations"(UNEP*, 2002).

The thinking of people, with their differences on emotions and intuitions, produce the ambiguity in their behavior (Toshiro, 1992) and lead to uncertainties, particularly in planning and estimating of visitor's decision making system. Although a more comprehensive approach is difficult to apply in the context of developing countries due to lack of information, Moreover, Some approaches have been published to deal with the ambiguous problems of man and society, and uncertainty involved in environment and people behavior (Amir et. al. 1991; Toshiro, 1992; Arnold & Ilan, 1994). Most of these approaches used Fuzzy Sets Theory (FST) as a tool to optimize decision making systems with a large number of decision variables. The fuzzy sets theory, described by the membership function (Zadeh, 1965), is suggested as an alternative approach to deal with the vagueness of planning goals and the uncertainties in the number of researches and papers. (Jowitt, 1984; Koo et al, 1991; Julien, 1994; Chang and Wang, 1996). In this paper we applied Fuzzy Regression Model (FRM) to estimate ecotourism demand function in Malacca state.

Tourism and Ecotourism in Malaysia

Tourism is becoming the second most important sector for Malaysian economy (Badaruddin M. 2002). Despite the scare of the September 11, 2001 attack on the United States and it's short time affect on the tourism industry, over 13.29 million tourists visited Malaysia in year 2002 and generating over RM25.78 billion in revenue to the economy, an RM8.5 Billion jump compared to 2000. Prior to this, Malaysian tourism enjoyed an impressive average growth in tourist arrivals, about 9.77% between 1981 and 2002. As indicated in Table 1, the number of international arrivals to Malaysia showed a significant annually growth.

Peninsular Malaysia has, over the years, been establishing a network of protected areas for the conservation of biological diversity. Some of these national parks include wildlife reserves and sanctuaries, nature parks, birds' sanctuaries and marine parks that have been established since 1930's. Peninsular Malaysia's largest national park covering 434, 351 ha was gazetted as early as 1939, which comprises mainly virgin forests of various forest types according to altitudes and soils. Currently, Peninsular Malaysia has 0.74 million ha of conservation areas that are protected by legislations. Of these, 0.55million ha are located outside the Permanent Forest Estate, whilst another 0.19 million ha are within the Estate. Due to the prevailing legal requirements and the economic development strategy, the promotion of tourism and ecotourism activities in Malaysia involves a number of institutions. The Federal Government through the Ministry of Culture, Arts and Tourism (MOCAT) undertakes the tasks to plan implement and coordinate strategic policy decisions. It is also involved in managing development funds to provide basic infrastructure facilities as well as performing a regulatory role in the industry. Meanwhile, Tourism Malaysia, which is a federal statutory body, is involved in the marketing and promoting of tourism products.

Considering that the ecotourism destinations such as the National Parks and wildlife sanctuaries are often located in remote places, the government would, more often than not, provide basic infrastructure facilities such as access roads, jetties and some amenities. Also, the government is supporting ecotourism development by means of sponsoring the cost of technical consultancy work on particular ecotourism destinations.

Table 1
Tourist arrivals in Malaysia 1981-2002

Year	Tourist Arrival	Growth (%)
1990	7445908	53.6
1991	5847213	-21.5
1992	6016209	2.9
1993	6503860	8.1
1994	7197229	10.7
1995	7468749	3.8
1996	7138452	-4.4
1997	6210821	-13
1998	5200000	-16.3
1999	7931149	52.5
2000	10221582	28.9
2001	12775073	25
2002	13,292,010	4

Source: Tourism Malaysia, 2003

Study Area

The study area is the state of Malacca. Malacca has population of 635,791 (2000) and is the second smallest state in Malaysia, and it is undoubtedly the wealthiest when it comes to history, culture and cuisine. Melaka city is a land of beauty. Her sights and attractions, rich in colors and contrasts, and her multi-racial population lives and works in harmony as one. Visited places in Melaka divided into three main groups composes Museums, Historical & Cultural attractions, nature and recreation attractions. Museums including Maritin Museum, Malaysia youth Museum, people Museum and Malacca Soltanate Museum. Cultural and historical attractions including the Stadthuys , Jonker Walk , Portuguese Sauare , See Food Restaurant and Mini Malaysia. Nature and outdoor destinations including AK Recreational Forest, Malacca Zoo, Crocodile Farm and Butterfly Farm. Melaka is a city with a glorious past hidden behind each façade of the centuries-old buildings. Albeit being Melaka was found in 1396 by an exiled Sumatran prince named Parameswara. It was once a port call for ships from the Middle East, China, India, Arab and South American. By the of the 15th century, Melaka had become a great trading empire as well as a rendezvous for every seafaring nation- Arab, Indians, South Americans, Chinese, Portuguese, Dutch and English.

The state of Malacca is located in Peninsular Malaysia, facing the straits of Melaka, with an area of only 1,658sq. km, it is divided into three districts, namely, Alor Gajah, Central and Jasin. As for the climate of Malacca, it is generally warm and sunny in the days and cool in the nights with occasional rain in the evenings. The temperature ranges from 23C to 33C, with humidity that usually exceeds 82.3%. The annual rainfall is approximately 3,218mm. Malacca is definitely a state that is not to be missed by visitors when they are in Malaysia. That's why Malaysian say, visit historic Melaka city means visit Malaysia.

Figure 1
Map of Malacca

METHODOLOGY

Fuzzy logic is an approach to computing based on "degrees of truth" rather than the usual "true or false" (1 or 0) Boolean logic on which the modern computer is based. Fuzzy logic includes not only 0 and 1 as extreme but also the various level of truth in between. The fuzzy sets theory, described by membership function, is identified as an alternative approach to supplement the description of planning goals and uncertainties involved in the parameter values, respectively. Demand based on appropriate analytical methods is an absolute necessity for decision-making processes by public and private sectors. In this sense, the objective of this study is to identify the important determinants of demand for ecotourism in Malacca through fuzzy regression model. Fuzzy regression was first introduced by Tanaka et al. in 1982. It is an alternative approach to evaluating the relation between independent variables and dependent variable. Comparison of conventional regression and fuzzy regression can be referred to Wang and Tsaur.[3] The basic model assumes a fuzzy regression equation as below:

$$\widetilde{Y_i} = \tilde{\alpha}_0 + \tilde{\alpha}_1 x_{i1} \ldots\ldots + \tilde{\alpha}_n x_{in} = \tilde{\alpha}_0 + \tilde{\alpha}_i x_i \quad (1)$$

where:

$X_i = [x_{i1}; \ldots\ldots; x_{in}]$ is a vector of independent variables for the ith data and
is a vector of fuzzy coefficients presented in the form of symmetric triangular fuzzy numbers denoted by $\tilde{\alpha}_j = (\alpha_j, c_j)$ where $á_j$ is its central value and c_j is the spread value, therefore formula can be rewritten as:

$$\widetilde{Y_i} = (\alpha_0, c_0) + (\alpha_1, c_1)x_{i1} + \ldots + (\alpha_n, c_n)x_{in}$$

The membership function of fuzzy number $\tilde{Y}_i$ as shown below and each value of dependent variable can be estimated as a fuzzy number where the lower bound of

$\tilde{A} = [\tilde{\alpha}_0, \tilde{\alpha}_1, \ldots$

; the central value of $\widetilde{Y}_i$ is

and the upper bound of $\widetilde{Y}_i$ is

In order to get the fuzzy regression with minimized fuzziness, the objective function is to minimize the total spread of the fuzzy number $\tilde{Y}_i$ as follow:

$$MINc^t|X = MIN|\sum_{j=0}^{N}\left[c_j\sum_{j=1}^{M}|X_{ij}|\right] \quad (2)$$

S.T.

$$\sum_{j=0}^{N}\alpha j X_{ij} + (1-h)\sum_{j=0}^{N}c_j|X_{ij}| \geq Y_i, i = 1,2,...,M$$

$$\sum_{j=0}^{N}\alpha j X_{ij} - (1-h)\sum_{j=0}^{N}c_j|X_{ij}| \leq Y_i, i = 1,2,...,M$$

$c \geq 0, \alpha \in R, X_{i0} = 1, 0 \leq h \leq 1 ; \forall_i = 1,2,...,M$

MODEL SPECIFICATION

$NTD = \tilde{\alpha}_1 IN + \tilde{\alpha}_2 TRC + \tilde{\alpha}_3 TC + \alpha_4 OC + \alpha_5 S + \alpha_6 ED$ (3)

$Y_i^{h=1} = \pm \sum_{j=0}^{N}\sum_{j=0}^{M}(a_j X_{ij} c_j) X_{ij}$ A fuzzy regression model applied to estimate factors affecting the demand of ecotourism. Demand for ecotourism is affected by variables both quantitative and qualitative. Most of these variables are fuzzy factor in real world and usually respondents give fuzzy answer such as almost, about, maybe,… , so fuzzy model can gives better result in analysis of the variables. A review of previous studies indicates that income and prices are the most important determinants of tourism demand. In this study number of trips as a proxy of demand, is the dependent variable and income, transport cost, trip cost, opportunity cost (quantitative explanatory variables) and general respondents satisfaction and education (qualitative explanatory variables) are independent variables. The fuzzy regression equation is as follows:

Where:

NTD = The Number of Trip to Destination

$\alpha_1, \alpha_2, \alpha_3, \alpha_{4,5,} \alpha_6$ = regression coefficient

IN = Income

TRC = Trip cost

TC = Transportation Costs

OC = Opportunity Cost

S = General satisfaction

ED = Education

Equation (3) is estimated using fuzzy regression model and Lingo programming software. In this study primary data collected through questionnaire from the number of 228 respondents out of 250 local ecotourists in Melaka as a sampling group. Fuzzy regression method is a mathematical method that estimates an equation that fits the data best by minimizing the sum of spread value as proxy of ambiguity in data system.

RESULT AND DISCUSSION

Table 1 presents the overall fuzzy regression results that were derived for the local ecotourists demand for visit Melaka. The value for different explanatory variables show the central value of fuzzy coefficients for regression and the value for C variables show the spread of them. Classical economic theory suggests that the major determinants of the demand for travel are the income of tourists and the price of goods and services relative to the price of substitutes (Stronge and Redman 1982). In this study, the income variable is one of the important elements in the model. Variables of transport cost, trip cost and opportunity cost show the different aspects of tourism price in the model and finally qualitative variables of respondent's satisfaction and respondent's education express the attractiveness of destination and tourist attribute respectively. As indicated in methodology each coefficient in the model has two elements including central value to show the value of coefficient and spread value to show the range of it. For example for one unit changes in income, the number of trip will change by 0.68E-04 unit but this changes will happened within the range of +/- 0.94E04 unit. On the other hand, coefficient in fuzzy regression model comes from solution of mathematical programming through minimizing total sum of spread value whereas coefficient in standard regression model comes from statistical solution through minimizing error term. So the interpretation of coefficient in fuzzy regression model is different from standard regression model and it is more consistent with real world.

Table 2
Fuzzy regression result of local ecotourist to Melaka

Variables	Value
Income	0.6799854E-04
Transport cost	0.5958492E-02
Trip cost	0.1735000E-01
Opportunity cost	0.1290582E-02
Satisfaction	0.7348373
Education	0.1655167
Spread value of income	0.9379100E-04
Spread value of transport cost	0.2278237E-02
Spread value of trip cost	0.3496123E-01
Spread value of opportunity cost	0.000000
Spread value of satisfaction	1.686011
Spread value of education	0.3422353

CONCLUSION

In this paper, we have presented a new model to evaluate linear regression models based on Tanaka's approach using fuzzy method. FRM is ideally suited for the analysis of ambiguous systems, where the output, which is related to human reaction, is too complicated to be represented crisply. Fuzzy approach has ability to use qualitative variables as well as quantitative variables.

Moreover fuzzy model can uses wide range data (fuzzy data) as well as pointed data (fixed data). As we can see in table 1 satisfaction and education, both are qualitative variables and appear in model by using fuzzy membership function. In addition, the outstanding feature of fuzzy sets is the ability to express the amount of ambiguity in human thinking, behavior and subjectivity (including natural language) in a comparatively undistorted manner.

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