MODELING THE SUSTAINABILITY OF TOURISM IN LEH, INDIA 'THE LITTLE TIBET': AN ECONOMETRIC ANALYSIS

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Abstract

Over the past couple of decades, tourism has become one of the most significant and vibrant aspects of the economy of the Ladakh region in Northern India. It is probably the largest revenue generating sector, especially since the past few years with tourist arrivals exceeding the local population of the region. While tourism definitely seems to have boosted economic growth, it has also led to growing concerns regarding the impact on the natural as well as the cultural environment and the possible consequences on the touristic appeal of the region. Although this forms an important issue for the stability of the local economy, it remains fairly unstudied in the context of Ladakh. This thesis attempts to contribute to the scant literature by providing quantitative evidence to back up the underlying concerns by investigating the sustainability of tourism in the town of Leh in Ladakh through the application of an ordered probit model on tourist survey results. Tourist satisfaction level is used as the sustainability indicator and is modeled in terms of the tourist's preferences and assessments of the characteristic features of the region. The paper also analyzes Leh's tourist arrival trends in the context of Butler's tourist area life cycle (TALC) model and employs the ARIMA forecasting method to produce short term predictions for tourist arrivals. The overall results suggest that Leh's strength lies in its characteristics like the unique landscape, the cultural heritage and traditions as well as the monasteries and other ancient architectural heritage. The high satisfaction levels reported from the majority of tourists combined with the forecast results seem to suggest that tourism can be sustained at least in the short term. Long term performance would be entirely determined by how the present strengths are handled and by the measures taken to counter the ongoing negative changes.

KEYWORDS: (Ladakh, Sustainable Tourism, Ordered Probit, ARIMA)

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CHAPTER I

INTRODUCTION

Tourism – An Avenue for Economic Development

Tourism is an immensely competitive and rapidly evolving commercial sector and is probably among the fastest expanding sectors in the global economy today. It plays the role of a very significant contributor to economic growth, especially in the developing regions of the world, by creating opportunities for new industries, employment and income generation and as a major source of foreign exchange. In fact in many countries, it is one of the biggest industries in terms of contribution to the growth and development of the economy (Wahab, 1997). Looking at the numbers, the tourism sector is directly responsible for about 5% of the world's GDP and it employs one out of every 12 people in the developed as well as developing countries ("International tourism," 2012). Apart from individuals, firms and regions which are directly involved in this sector, the economic benefits from tourism usually translate across channels triggering economic activity and growth in other sectors and levels of the economy as well. Hence it has the potential to be an avenue that has a much decentralized positive impact on the economy in terms of reaching out to direct as well as indirect participants.

Despite subdued consumer confidence and spending since 2009, the future of the tourism sector seems relatively optimistic as consumption rises in an increasing number

of emerging economies and as more parts of the world are being explored and popularized as tourist destinations (Oaten, S. 2013). While this is obviously good news for economic growth, it also poses a number of problems, the most serious probably being the issue of sustainable development. The introduction of this concept has the potential to change the nature of the tourism sector more than any other factor (Butler, 1999) by influencing market decisions and the behavior of the industry at large, in view of the concerns surrounding sustainable development. This paper employs an ordered probit analysis to examine the sustainability of tourism in the town of Leh situated in Northern India by using tourist preference surveys to investigate the associations between how the tourists view the region's features and how satisfied they were from their travels, hence providing strategic cues as to what qualities are favorable to sustainable tourism. In addition the paper also examines the annual tourist arrivals to Leh and employs an ARIMA forecasting method in order to produce short term forecasts of the expected volume of tourists over the next several years. The combined results of the survey analysis and forecasts indicate that a majority of the tourists are very satisfied with Leh and that the region still has a number of characteristic strengths as a tourist destination which can continue to attract a sustained number of visitors at least in the short term. It can also be inferred from the results that the long run behavior of the tourism sector will largely depend on how the present strengths and weaknesses are dealt with in the future.

What is Sustainable Tourism?

The concept of sustainable development has been extended to apply to many fields and industries, sometimes without considering what it exactly implies for that particular area of interest. Tourism is one such sector with a number of differing versions that explain the concept of 'Sustainable Tourism'. While the concept seems quite straight forward, it has been subject to a lot of varying interpretations in the literature. The United Nations World Tourism Organization UNWTO defines sustainable tourism as '*tourism that takes full account of its current and future economic, social and environmental impacts, addressing the needs of visitors, the industry, the environment and host communities.*' Thus implying that sustainable tourism should satisfy the needs of both the tourists and the host region and at the same it should also protect and improve their future prospects. The practice of making direct connections between the concepts of sustainable development and sustainable tourism has been emphasized by many as one of the major confusions in this area (Butler, 1999; Sharpley, 2009). Sustainable development was originally defined as '*development that meets the needs of the present without compromising the ability of future generations to meet their own needs*'. Thus sustainable tourism is sometimes interpreted as tourism that develops in a way that promotes sustainable development of the region as a whole. Butler (1993) defines sustainable tourism as *'tourism which is in a form which can maintain its viability in an area for an indefinite period of time*'. He makes it clear that when talking about sustainability in the context of tourism, what is being addressed is not how to carry out tourism practices to ensure sustainable development of the region, but rather specifically the issue of how to ensure that current tourism inflows and developments can be sustained for as long as

possible. This definition forms the basic construct of the present study and must be kept in mind while considering the context in which sustainable tourism is discussed.

A number of misconceptions are very commonly made in regard to what constitutes sustainable tourism activity and what does not. One of them is the misconception that mass tourism is automatically non-sustainable; the fact that it is almost impossible to have tourism development without any impact on the host region needs to be considered as well (Butler, 1999). This is especially important considering that most of the growth in global tourism has been in mass tourism as compared to other specialized forms of tourism like eco-tourism. However, these specialized forms also have the potential to expand and become forms of mass tourism. The clarification of the above misconception by Butler is taken a step further by Sharpley (2009) who describes the discord between sustainable development and tourism in the following way, '*...if the characteristics of tourism as both an economic and social activity are mapped against the fundamental elements of sustainable development, it becomes evident that there is a lack of fit between the two concepts.'* His paper titled *The Myth of Sustainable Tourism* argues that sustainable tourism is an unrealistic tourism development objective and that economic development may be hindered by the adherence to the principles of sustainable tourism. However this argument seems to be based, yet again, on a different definition of sustainable tourism since, as mentioned earlier sustainable tourism is one that strives to ensure future benefits and hence will probably not come in the way of economic development. Thus, like Sharpley's there are many differing opinions on whether sustainable tourism is an achievable idea or not.

Another practice that has been criticized by many authors is the tendency to focus entirely on the environmental context; one needs to keep in mind that the growth of tourism will have an impact on both the social and cultural as well as the physical resources of the tourism destination (Butler, 1999; Craik, 1993). The extent to which a tourist destination can sustain its resources given these impacts is what is determined by the carrying capacity of the region. Once this capacity is reached or exceeded, tourism could fall due to the decline in the natural capital of the region brought about by development, especially in the case of tourism based on natural and environmental attractions. Tourists are no longer attracted to the destination in the same way, which could possibly either lower tourist inflows or the average tourist spending. Then, only a 'cost leadership' or `mass production' strategy can be employed, as the regions are unable to provide any specific 'tourist product benefit'. The attraction of the lower end of the market is inevitable and as a consequence, there are no alternative strategies (Buhalis, 2000).

This is illustrated by the case of several coastal areas in the Mediterranean region which have been overdeveloped to such an extent that only a high volume, low profit margin orientation is feasible (Buhalis, 2000). Hence, assessing the capacities of tourist areas becomes crucial for ensuring sustainability and maintaining tourism quality in the long run, even more so for regions where tourism forms a major portion of the economic set up and is among the largest sources of revenue. This provides the key motivation for the present study which will attempt to analyze this issue of sustainability of tourism by focusing on the district of Leh in Ladakh region in North India. Before one can venture into the current state of tourism and its future prospects in Leh, it is extremely necessary

to acquire an understanding of the economic transitions that the region has gone through before arriving at the current situation where tourism is probably the largest source of revenue. The next section provides a historical background of the economy of the Ladakh region.

Ladakh – the 'Little Tibet'

Ladakh is located in the Trans-Himalayan region of Northern India and is flanked by Pakistan on the north-west and forms the northern-most frontier of India with Tibet (China) on the north-east. It is part of the state of Jammu and Kashmir and forms about two-thirds of the total area of the state but just about two percent of the overall state population (population density of 1.52 persons per sq. km and total population of about 270,000). Ladakh is one of the highest and driest inhabited places on the earth, situated at an average height of 3500 meters above sea level and receives very little precipitation since it lies in the rain shadow area of the Himalayas. Hence it is usually referred to as a cold desert characterized by the extreme harsh climate and the dry landscape.

FIGURE 1.1
LADAKH – GEOGRAPHIC LOCATION

Adapted from http://www.himalayanhealthfund.org

An independent kingdom until around 1834, Ladakh is often celebrated as a last outpost of Tibetan civilization (Rizvi, 1998), widely referred to as 'Little Tibet' since it is strongly influenced by Tibetan culture and has similar geographical features. It is one of the last places where Tibetan Buddhism continues to be practiced uninterrupted for over a thousand years.

Just about three to four decades ago, agriculture was the mainstay of the economy with family owned land that was passed on from one generation to the next. Despite the short growing season owing to the high altitude, households enjoyed a stable and almost self-sufficient agricultural economy for centuries. Although it is true that Ladakh had a very limited interaction with the outside world until the 1960s, it was very strategically located at the crossroads of many important overland trade routes that linked it with Tibet, Central Asia, Kashmir and the North Indian Plains, one of the tributaries of the silk route (Osmaston et al., 1997). These routes were used by traders and nomads who conducted trade along the old Silk Road linking South and Central Asia during the early twentieth century until trade ended when India and China closed their borders in 1962 (Fewkes, 2009). The eastern part of Ladakh is inhabited by *Changpas* (pastoral nomads) who traditionally rear herds of cattle and yaks while western inhabitants depended on agriculture, producing mainly wheat and barley. Until just about three to four decades ago, the barter system of exchange was prevalent in Ladakh where commodities like wool, meat and hide were exchanged for fruits and grain that was produced in the lower valleys of the region. Even wages were paid mostly in the form of wheat and barley.

New Developments

The scenario started changing during the Sino-Indian war of 1962 which brought in the Indian military –'the first real outsiders and infrastructure, merchants and more'. Military bases still dot the region today with the army being one of the main generators of employment. The other major development was the opening of Ladakh to tourists in 1974 before which it was a restricted area due to defence considerations (Osmaston et al., 1997). This, along with the introduction of civil air travel, had a much stronger impact on the region. Today the Indian Army, the tourism sector and the civil government, in the form of jobs and large subsidies form the major bases of the region's economy with agriculture and the traditional system of cooperative farming having slipped into the background. The culture and economy have thus moved from community-oriented to competitive, from living off the land to working for cash and spending it.

Tourism: The most important factor of change

With a total of just 527 visitors in 1974 to over 179,000 tourists in 2011[1], tourism has rapidly become one of the most important aspects of Ladakh's economy. Over the years, numerous hotels, guest houses and other facilities have sprung up in Leh and in the remote villages of Ladakh catering to the ever increasing rush of tourists every year. Tourism employs only about 4 percent of the population of Ladakh but it generates over half of the region's income[2] during the short tourist season from May to September. One can say that tourism definitely seems to have boosted Ladakh's economy in terms of creating jobs, increasing sales, improved facilities and inflow of money via tourist spending (Michaud, 1991). Although tourism has become the source of a new found

[1] Data obtained from the records maintained by the Government Tourist Reception Center in Leh.
[2] Estimates obtained from officials at the Government Tourist Reception Center in Leh.

prosperity for Ladakh, it has also become the source of its biggest problem. Some of the most apparent problems possibly being the increasing congestion in the capital town of Leh, degradation of the natural environment and that the higher commercial activity brought in by tourism could be robbing off the region of exactly what draws visitors from all over the world to it – the pristine and preserved cultural heritage and environment. Thus, it seems that it might not be very long until the carrying capacity of the region will be reached and tourism might no longer be sustainable.

Since it is not quite possible to come up with an exact figure for the carrying capacity of any region and since it is difficult find an exact measure of the level of tourism sustainability, this paper uses tourist preference and satisfaction surveys to measure the sustainability of tourism in Leh. This helps assess some of the qualities of the region that the tourists value and those which encourage sustainability of tourism and give an idea of where the region might be headed to, based on the tourist's current assessment of the qualities of the area as a tourist destination. Tourists' perceptions play an important role in examining the current characteristics of the destination – positive perceptions and high satisfaction rates could mean that the region is still attractive to visitors and hence it could have a higher possibility of receiving a sustained inflow of tourists. This study investigates the associations between how the tourists view the region's features and how satisfied they were from their travels in the region, hence providing strategic cues as to what qualities are favorable to sustainable tourism. In addition to the evaluation of tourist satisfaction as a measure of sustainability, the paper also examines the annual tourist arrivals to Leh and employs an econometric method in order to produce short term forecasts of the expected volume of tourists over the next

several years. These forecasts can provide estimates for the sustainability of tourism in the short run and can play an important role in assisting managerial decision making in the tourism sector (Witt & Witt, 1995).

Chapter II offers a review of some of the existing literature in the study of tourism sustainability. Econometric models and tools employed by various studies in order to examine tourist satisfaction and to forecast future arrivals are also discussed along with a description of the ordered probit method and the ARIMA model used for the present study. Chapter III covers the data and the methodology used for the study; the survey components and the ordered probit model are discussed along with the model specification to be used in the paper. This is followed by an analysis of the ordered probit model estimation results in Chapter IV in the context of tourism sustainability in Leh. Chapter V focuses on the analysis of annual tourist arrivals in Leh over 1974-2012 and discusses the results of the ARIMA model employed in order to generate forecasts for the next eight years. The tourist arrival trend in Leh is also analyzed in the context of Bulter's tourism area life cycle concept which broadly outlines the stages that a tourist destination might go through. Chapter VI offers a discussion of some of the strengths and limitations of the study and sums up the results and its possible implications.

CHAPTER II

LITERATURE REVIEW

Tourist Satisfaction Assessment

Similar Studies

The question of tourism sustainability is one that has been quite extensively studied. The existing literature indicates that a number of different tools have been employed in studies that focus on assessing and evaluating tourism sustainability in an area. Tools such as Sustainability Indicators, Environmental Impact Assessments, Life Cycle Assessments, Environmental Audits, Multi-Criteria Analysis and Adaptive Environmental Assessments are among the ones most commonly used. Sustainability Indicators are stressed upon as the tool most widely used in these kinds of assessments due to the ease of use and the flexibility in the type of data (qualitative/quantitative) that can be used (Schianetz et al., 2007).

Another tool that is suggested is the Adaptive Environmental Assessment (AEA) with a core element called Tourism Futures Simulator (TFS) that can 'help explore the complexities of the tourism industry and its interactions with the economy, the environment and local communities', though it is also described as having the possibility to become very complex due to the scale of the inter-relationships in processes in the tourism industry (Walker et al., 1999). To restrict the level of complexity, it is suggested that the AEA be used in combination with tools like Sustainability Indicators. Although

Sustainability Indicators cannot entirely account for dynamic systems, they are still capable of detecting simple cause-effect relationships and they can still be applied for a holistic site-specific assessment since they cover all three aspects of sustainability – social, economic and environmental (Schianetz et al., 2007). Their application has also been pioneered by the WTO as a fundamental part of overall destination planning and management, and an integral element in the promotion of sustainable tourism development at all scales (Schianetz and Kavanagh, 2008).

One such indicator which measures the changes that could affect sustainability is the increase or decline in the number of tourists who intend to return (WTO, 2004). The tendency to visit again, recommending others to visit or positive word-of-mouth statements represents tourist loyalty (Lee, 2009; Moniz, 2011) which is clearly positively associated with the prospects for the sustainability of tourism in a region. Several studies have examined various determinants of the tendency of tourists to repeat visits. These determinants could be factors which are destination specific characteristics, the quality of services offered or the overall satisfaction from the region. Lee (2009) examines factors such as destination image (a tourist's overall perception of a specific destination) and interpretation services (which include interpreters, visitor centers, trail signs, self-guided trails, and publications) in his case study which investigates the impact of these factors on tourist satisfaction in Taiwan's Taomi eco-village and then uses satisfaction to further examine future visitation behavior. Empirical analysis then indicates the significant role of destination image and interpretation services in determining satisfaction and also that satisfaction plays a significant mediating role in the tourist behavioral model. While tourist satisfaction is used as an intermediate explanatory factor for repeat visitations in

this study, several other studies have examined factors that determine tourist satisfaction as the sole dependent variable. Akama and Keiti (2002), in light of Kenya's poor performance in the volume of international tourists to the national parks, investigate the reduction of the quality of tourist products offered in wildlife parks as it relates to tourist satisfaction. A similar study focusing on nature based tourism attractions in Mauritius identifies the factors that influence visitor satisfaction as a tool to sustain the growth of such attractions and to ensure that the visitors are satisfied with the experiences provided (Naidoo et al., 2011). This theme of ensuring tourism satisfaction is also examined by Tripathi and Siddiqui (2010) in their paper which proposes the development of an in depth understanding of tourist preferences in order to deliver the desired tourism package for higher customer satisfaction in the state of Uttar Pradesh, India. While there have been similar studies for other tourist destinations in India, specific focus on the Ladakh region is almost non-existent. This paper attempts to fill in the prevailing gap and hence contribute by possibly stimulating further research and strategies to ensure tourism sustainability in the region.

Econometric Models and Methods Used

The existing literature on tourism sustainability contains a wide range of econometric models and methods that have been employed to investigate indicators such as tourist satisfaction and repeat visitations. Some of the most widely used models are the expectation-performance (satisfaction based on how expectation compares to performance), importance-performance (satisfaction based on the performance of the most important attributes) and the performance-only (avoids the use of expectations in measuring satisfaction) models (Kozak, 2001). Fishbein (1967) suggests the application

of a type of importance-performance model that assesses satisfaction by multiplying beliefs (importance or motivations) and evaluations (perceived quality or performance). This approach can accommodate most of the important aspects of the dynamics of tourism satisfaction.

Considering the econometric regression methods employed in this area, Naidoo et al. (2011) use linear regression analysis using general overall visitor satisfaction as a dependent variable and several dimensions of service quality as the independent variable to test the hypothesis that these dimensions have a significant influence on visitors. Their results indicate significant relationships between the independents and the dependent variable and that visitors' satisfaction play an important role in enhancing visitors' loyalty intentions.

The assessment of preferences and destination attributes requires the use of models that allow for a quantified representation of qualitative aspects. This calls for models involving dummy dependent variables typically taking the values of 0 or 1, estimated using Linear probability models such as the binomial logit and probit models. Alternatively models like the multinomial logit and ordered probit allow for a greater range of outcomes for the dependent variable. One can find an increasing number of studies in the tourism economics literature that analyze tourism demand using discrete choice models like the ones mentioned above. Brau (2000) uses the multinomial logit estimation to study tourist preferences in the island of Sardania, Italy with the tourist's willingness to pay as the dependent variable. Since the willingness to pay is a qualitative estimation in which the choices are not ordered, a model like the multinomial logit is used. Oliveira and Pereira (2008) use an ordered probit model to investigate how the

socio-demographic characteristics of the tourists and different aspects of the trip affect the valuation given to different aspects of the destination. Methods like the probit and logit have also been applied to adapt to dynamic systems. Moniz (2011) analyzes the underlying reasons behind repeat visits to the Azores Islands using a Static as well as Dynamic Probit model which allows the investigation of time lags and causal loops in the variables such as tourists' socio-demographic characteristics and income, destination attributes and trip satisfaction. The present study, with satisfaction as the dependent variable, would also call for similar models that accommodate discrete and ranked qualitative choices.

Forecasting Tourist Arrivals

The tourism literature also contains a wide range of studies that carry out forecasts of tourist arrivals in a region. While, the present study aims to produce tourist arrival forecasts as a tool for assessing tourism sustainability in the short term, these same estimates are generally used by government planners and businesses like airlines, hotels and tour operators in order to effectively plan their daily operations and long term investment decisions and strategies. Typically forecasts also take into account the impact of explanatory economic variables like income, prices and tourism/trade policies (Gabroveanu et al., 2009; Ibrahim, 2011). Several other studies have also performed forecasts based solely on past time series records of arrivals to assess sustainable tourism demand (Divino and McAleer, 2009). This paper will use a similar approach by using time series data for the tourist arrivals to Leh in order to estimate the future trend in tourist inflows.

While numerous studies have use causal forecasting methods by examining tourist arrivals as being determined by independent economic variables such as household incomes and consumer price indices of the host region (Gabroveanu et al., 2009) and trade volumes as a representation for trade openness (Ibrahim, 2011), one can also find studies that use time series data for tourist arrivals to conduct econometric forecasts using only a single variable. Divino and McAleer (2009) estimate alternative time-series models and conditional volatility models of the shocks (models like the Auto Regressive Integrated Moving Average ARIMA) to provide forecasts of monthly and annual international tourist arrivals to the Brazilian Amazon. Geurts et al. (1976) used the Box-Jenkins technique to forecast tourist visits to Hawaii using monthly data and assessed the accuracy of the forecasts in terms of percentage error. They concluded that "The Box-Jenkins technique produced a very accurate forecast of tourists coming to Hawaii... the average forecasting error is 3.50%". Similar models could be applied to annual tourist arrivals in Leh over the period 1974-2012 to estimate tourism demand in the short term.

CHAPTER III

DATA AND METHODOLOGY

Tourist Satisfaction Model

Survey Design

Tourist satisfaction is defined as 'the result of the interaction between a tourist's experience at the destination area and the expectations he/she had about that destination' (Kozak, 2001). In general, customer satisfaction from any good or service 'can be measured as a weighted average of multiple indicators' (Johnson and Fornell, 1991). The tourist satisfaction survey was thus designed keeping in mind the importance of including all significant areas that might determine satisfaction and hence the sustainability of tourism – the quality of the natural, social and cultural environment of Leh. It covers the tourist's assessment of multiple aspects which are expected to have a negative impact on tourist satisfaction levels such as pollution and congestion in the town, declining societal ties among the locals, degradation of the cultural heritage and in the quality of the visit. The survey also asks tourists for background information such as their native country, travel budget and spending in the region, the hotel or guest house they are staying in, characteristics of the region that compelled them to visit and additional information about the nature of their travels in Leh. The tourists were also asked to rate satisfaction from travel experience in Leh by selecting one of the four categories – *very satisfied, satisfied, somewhat satisfied* and *not satisfied*. They were also asked whether they would visit Leh

again in the future or recommend others to visit. These attributes and the offered response choices are summarized in Table 3.1 below.

TABLE 3.1

A SUMMARY OF THE COMPONENTS OF THE TOURIST SURVEY

Attributes	Response Choices
1. Tourist's country of origin (dummy)	• Foreign Tourist • Domestic(Indian) Tourist
2. Travel companions (dummy)	• Alone • With family • With friends • In a travel group
3. Approximate travel budget for Leh (continuous)	
4. Factor that compelled the tourist to visit Leh (dummy)	• The unique culture, traditions and way of life. • The landscape. • Opportunities for adventure tourism (biking, trekking, rafting etc.) • The remoteness. • The pristine and preserved heritage and environment. • The Monasteries and ancient structures.
5. Approximate amount of spending in tourist shops (continuous)	
6. Extent to which Leh fulfilled the tourist's expectations (scale 1-4)	1. Very satisfied (y = 1) 2. Satisfied (y = 2) 3. Somewhat satisfied (y = 3) 4. Not satisfied (y = 4)
7. Changes occurring in Leh due to increasing tourism and growth, according to the tourist (dummy)	• Environmental pollution. • Increasing congestion in the town due to influx of more people and more structures/vehicles. • Degradation of the Ladakhi culture and heritage • Decrease in the pleasant nature and hospitality of the people. • A decrease in the quality of tourism (due to mass tourism and hence cheaper facilities) • Change in the traditional order of society.
8. Implications of the above changes for the sustainability of tourism in Leh (scale 1-4)	1. Definitely a negative impact. Tourism cannot be sustained this way. 2. May have impact, could lead to some fall in tourism in future. 3. Not a very significant impact, tourism will probably continue to increase. 4. It won't have an impact at all. Tourism in Ladakh is sustainable this way.
9. Would the tourist visit Leh again in the future/recommend others to visit? (dummy)	• Yes • No

The categorization of foreign vs. domestic tourists forms an important aspect. While the tourist population has been predominantly foreign, starting with 500 foreign and 27 domestic tourists in 1974, Leh witnessed a higher inflow of domestic tourists in the last three to four years with 36,662 foreigners and 142,829 domestic tourists in 2011. One of the main reasons for the increasing popularity of the region among Indian tourists being that a couple of hit Bollywood movies were shot in Ladakh in the last few years, drawing huge numbers of Indian tourists to the region. This has significant repercussions since the two categories are substantially different in terms of spending levels, preferences and the tourism activities they engage in and hence bring about different impacts. The attribute for travel companion should be an important aspect as well, especially in order to consider the effect of travelling in travel groups with package tours and trips organized by travel agents which are becoming increasingly popular. The attributes like travel budget and spending could also play a significant role in determining satisfaction since they influence the quality of services the tourists can get during their stay in Leh. The qualities of Leh that compelled the tourist to visit are important factors since they will be more satisfied if the quality that attracted them is more preserved and better presented to them during their visit – for example features like monasteries, landscape, remoteness that are more likely to be in their original form. Similarly their choice for the changes happening in Leh should also form an important determinant of their satisfaction along with their choice of what the changes imply for tourism sustainability. As mentioned earlier, although the choice of whether they will revisit or recommend Leh (repeat visitation) does seem more directly connected to the assessment of tourism sustainability as compared to tourism satisfaction levels, the lack of variability in the responses to the

question of whether they would visit again or not (all responses yes, except one or two) is a major hindrance in using this indicator as our dependent variable. Hence, satisfaction can be thought of as an equivalent indicator that is determined by all of the other attributes chosen by the tourist. Thus the sustainability model will attempt to explain the tourist's satisfaction level as a dependent variable determined by the tourist's preferences and assessment of Leh's qualities using the above quality indicators as the independent variables. Apart from the variables for budget and spending, all the other variables are dummies (0 or 1) or measured on a numerical scale (1-4) as specified in table 3.1.

The tourist survey was conducted over the month of August, 2012 and the sample selection process was kept as random as possible. Both foreign as well as domestic tourists are included in the sample and from different locations like restaurants, market places and hotels in the main town as well as from the nearby villages. Tourists from both the high spending end as well as lower end were included. This resulted in the collection of a total of 97 surveys with 53 of them being complete and adequate for the application of models for analysis.

The Ordered Probit Model

Since most of the explanatory variables that have to be employed in the model, including the indicator for sustainability that measures tourist satisfaction– the dependent variable, are qualitative, the analysis of tourist preferences calls for a model that accommodates discrete choices. In the case of Leh's tourist preferences, the model being considered is one with multiple, ordered outcomes for satisfaction such as very satisfied, satisfied, somewhat satisfied and not satisfied. This analysis requires a method such as the Ordered

Probit regression which imparts ranked values to each of the choices involved and hence is suitable for the analysis of ordinal data.

The dependent variable here is the degree of tourist satisfaction in Leh (S_i) for each tourist i where $i = 1, \dots, 53$ (for all 53 tourists who took the survey). Satisfaction is determined by several characteristics of the tourist and the region, included in the survey as described earlier. Hence S_i for each tourist is to be modeled as a linear function of the independent explanatory variables x_{ik} where $k = 1, \dots, K$ and K is the total number of independent variables:

$$S_i = \sum_{k=1}^{K} \beta_k x_{ik} + \varepsilon_i = Z_i + \varepsilon_i \quad (3.1)$$

Where $Z_i = \sum_{k=1}^{K} \beta_k x_{ik}$ and β_k, the coefficient associated with the k^{th} variable, describes the association between satisfaction and that particular explanatory variable.

The degree of satisfaction S_i is a latent variable in that it is unobservable in either principle or practice, hence eq. 1 is a latent regression i.e. it cannot be estimated as it stands. However, what can be observed is the tourist's satisfaction level - through the classifications provided in the survey (very satisfied, satisfied, somewhat satisfied and not satisfied). As in the present study, an ordinal variable Y_i can be associated with the satisfaction levels, such that $Y_i = 1$ if the tourist is *very satisfied*, $Y_i = 2$ if the tourist is *satisfied*, $Y_i = 3$ if the tourist is *somewhat satisfied* and $Y_i = 4$ if the tourist is *not satisfied*. Thus, a lower value for Y_i is associated with a higher degree of satisfaction. It also needs to be noted that the ordinal nature of these outcomes does not imply that, for instance, the outcome associated with $Y_i = 1$ is twice as strong as that associated with $Y_i = 2$ in terms of satisfaction. The model also assumes that each of these outcomes is mutually exclusive and collectively exhaustive. The categorization of the tourists in the

sample in terms of the four satisfaction levels is implicitly based on the values of the latent variable S_i, in conjunction with 'threshold' values δ_1, δ_2 and δ_3 for satisfaction such that:

$$\begin{aligned} Y_i &= 4 \ \ if \ S_i \leq \delta_1 \\ Y_i &= 3 \ \ if \ \delta_1 \leq S_i \leq \delta_2 \\ Y_i &= 2 \ \ if \ \delta_2 \leq S_i \leq \delta_3 \\ Y_i &= 1 \ \ if \ S_i \geq \delta_3 \end{aligned}$$

Where δ_1, δ_2 and $\delta_3 \geq 0$ are unknown parameters to be estimated along with the coefficients β_k in eq.1. Also $\delta_1 < \delta_2 < \delta_3$.

Thus, a tourist's categorization in terms of the level of satisfaction is determined by whether or not his/her degree of satisfaction S_i crosses a threshold. The probabilities of Y_i taking values 1, 2, 3, 4 are given by:

$$\begin{aligned} \Pr(Y_i = 4) &= \Pr(Z_i + \varepsilon_i \leq \ \delta_1) \ = \Pr(\varepsilon_i \leq \ \delta_1 - \ Z_i) \\ \Pr(Y_i = 3) &= \Pr(\delta_1 \leq Z_i + \varepsilon_i \leq \ \delta_2) \ = \Pr(\delta_1 - \ Z_i \leq \varepsilon_i \leq \ \delta_2 - \ Z_i) \\ \Pr(Y_i = 2) &= \Pr(\delta_2 \leq Z_i + \varepsilon_i \leq \ \delta_3) \ = \Pr(\delta_2 - \ Z_i \leq \varepsilon_i \leq \ \delta_3 - \ Z_i) \\ \Pr(Y_i = 1) &= \Pr(Z_i + \varepsilon_i \ \geq \delta_3) \ = \Pr(\varepsilon_i \geq \delta_3 - \ Z_i) \end{aligned} \qquad (3.2)$$

Supposing that, out of *N* number of tourists, N_1 were *very satisfied*, N_2 were *satisfied*, N_3 were *somewhat satisfied* and N_4 were *not satisfied*, the likelihood L of observing the sample is:

$$\begin{aligned} L &= [\Pr(Y_i = 1)]^{N_1} \ [\Pr(Y_i = 2)]^{N_2} \ [\Pr(Y_i = 3)]^{N_3} \ [\Pr(Y_i = 4)]^{N_4} \\ &= [\mathrm{F}(\delta_1 - \ Z_i)]^{N_1} \ [\mathrm{F}(\delta_2 - \ Z_i) - F(\delta_1 - \ Z_i)]^{N_2} \\ &\quad \times [\mathrm{F}(\delta_3 - \ Z_i) - F(\delta_2 - \ Z_i)]^{N_3} \ [1 - \mathrm{F}(\delta_3 - \ Z_i)]^{N_4} \end{aligned} \qquad (3.3)$$

Where $F(x) = P(\varepsilon_i < x)$ is the cumulative probability distribution of the error terms. The knowledge of the type of the cumulative distribution $F(x)$ of these error terms would allow for the estimation of the values for the coefficients β_k and the threshold values δ_1, δ_2 and δ_3 which maximize the likelihood L of observing the sample observations. These

estimations then allow for the estimation of the probabilities of being at different levels of satisfaction for every tourist in the sample.

The Ordered Probit model assumes that the error terms ε_i are normally distributed. The cumulative distribution of a standard normal variate X is:

$$\Pr(X < x) = \Phi(x) = \int_0^x (1/2\pi)\, e^{(-\frac{X^2}{2})} dX$$

So assuming that ε_i are standard normal variates, the probabilities would be:

$$\Pr(Y_i = 4) = \Phi(\delta_1 - Z_i)$$
$$\Pr(Y_i = 3) = \Phi(\delta_2 - Z_i) - \Phi(\delta_1 - Z_i)$$
$$\Pr(Y_i = 2) = \Phi(\delta_3 - Z_i) - \Phi(\delta_2 - Z_i)$$
$$\Pr(Y_i = 1) = 1 - \Phi(\delta_3 - Z_i) \qquad (3.4)$$

The estimates for the coefficients and the threshold values can then be obtained by maximizing the likelihood function (3.3) substituting $F(.)$ with the normal distribution function $\Phi(.)$

Thus, we would maximize:

$$L = [1 - \Phi(\delta_3 - Z_i)]^{N_1} [\Phi(\delta_3 - Z_i) - \Phi(\delta_2 - Z_i)]^{N_2}$$
$$\times [\Phi(\delta_2 - Z_i) - \Phi(\delta_1 - Z_i)]^{N_3} [\Phi(\delta_1 - Z_i)]^{N_4} \qquad (3.5)$$

The next section discusses some of the characteristics of the survey data and briefly outlines the specification process for the tourist preferences ordered probit model using the survey data.

Survey Results

The characteristics of the data obtained from the survey are presented below in Table 3.2.

TABLE 3.2

TOURIST SURVEY DESCRIPTIVE STATISTICS

Variable	Obs	Mean	Std. Dev.	Min	Max
Satisfaction	96 Y=1 (60) Y=2 (31) Y=3 (5) Y=4 (0)	1.4271	0.5937	1	3
Foreign(71)	95	0.7474	0.4368	0	1
Indian(24)	95	0.2526	0.4368	0	1
Alone (20)	96	0.2083	0.4082	0	1
WithFamily (18)	96	0.1875	0.3924	0	1
WithFriends(37)	96	0.3854	0.4892	0	1
WithTravelgroup(24)	96	0.2500	0.4353	0	1
*Budget	76	892.2104	947.0944	46.0000	5251.2
*Spending	71	149.1512	174.1964	0.0000	920.00
logbudget	76	6.3633	0.9699	3.8286	8.5662
logspending	71	4.4200	1.3146	1.0152	6.8244
Culture/traditions (55)	94	0.5851	0.4953	0	1
Landscape (77)	94	0.8191	0.3870	0	1
AdventureTourism (48)	94	0.5106	0.5026	0	1
Remoteness (39)	94	0.4149	0.4953	0	1
Heritage/Environment (32)	94	0.3404	0.4764	0	1
Monasteries (53)	94	0.5638	0.4986	0	1
EnvPollution (63)	92	0.6848	0.4671	0	1
Congestion (68)	92	0.7391	0.4415	0	1
DegradingCulture (35)	92	0.3804	0.4882	0	1
DecliningHospitality (20)	92	0.2174	0.4147	0	1
DeclinongTourismQuality (18)	92	0.1957	0.3989	0	1
ChangingSociety (20)	92	0.2174	0.3989	0	1
Implications (I)	88 I=1 (10) I=2 (37) I=3 (33) I=4 (8)	2.4432	0.8145	1	4

*Amounts for budget and spending converted to USD from various currencies according to exchange rates as on 09/14/2012.

The number of respondents who chose a particular option is given in parenthesis beside the variable name in the table above. The majority of the sample (60) was *very satisfied*

with their travels in Leh and none of the tourists chose the *not satisfied* option. Most of the tourists in the sample are foreigners (71) with 24 Indian tourists and most of them were travelling with friends (37) with organized travel groups coming in second. The mean travel budget, based on the respondents who provided the figure amounts, is about $892 and the mean spending in tourist shops is about $149. The landscape of the region seems to be the major compelling factor for this sample with 77 people choosing it, while the heritage/environment factor has the least number of picks (32). The major changes underway in the region, according to the tourists in the sample, are the increasing congestion (68) followed by environmental pollution (63) with the least number of people choosing the declining tourism quality variable. Also, most of the tourists responded to the question of implications for sustainable tourism with the middle two responses that (a) there could be a fall in tourism (37) and, (b) tourism will probably continue to increase (33).

Model Specification

Based on the data obtained from the survey, the following variables are used as the explanatory variables for the tourist satisfaction Ordered Probit Model:

- $Origin_i = 1$, in case of a foreign tourist; $Origin_i = 0$, in case of an Indian tourist.
- Travel Companions:
    1. $Alone_i = 1$, in case the tourist is travelling alone; $Alone_i = 0$, otherwise.
    2. $WithFamily_i = 1$, in case the tourist is travelling with family; $WithFamily_i = 0$, otherwise.
    3. $WithTravelGroup_i = 1$, in case the tourist is travelling with an organized travel group; $WithTravelGroup_i = 0$, otherwise.

- $LogBudget_i$, natural log of the tourist's travel budget in dollar amounts.
- $LogSpending_i$, natural log of the tourist's spending in tourist shops in the town, in dollar amounts.
- Attracting factors:
    1. $Culture\&Traditions_i = 1$, in case the tourist was drawn to Leh because of its culture and traditions; $Culture\&Traditions_i = 0$, otherwise.
    2. $Landscape_i = 1$, in case the tourist was drawn to Leh because of its landscape; $Landscape_i = 0$, otherwise.
    3. $AdventureTourism_i = 1$, in case the tourist was drawn to Leh because of the opportunities for adventure tourism; $AdventureTourism_i = 0$, otherwise.
    4. $Heritage\&Environment_i = 1$, in case the tourist was drawn to Leh because of the heritage and environment; $Heritage\&Environment_i = 0$, otherwise.
    5. $Monasteries_i = 1$, in case the tourist was drawn to Leh because of the monasteries in the region; $Monasteries_i = 0$, otherwise.
- Ongoing Changes due to increasing tourism and development:
    1. $EnvPollution_i = 1$, in case the tourist chose environmental pollution as one of the ongoing changes; $EnvPollution_i = 0$, otherwise.
    2. $Congestion_i = 1$, in case the tourist chose increasing congestion as one of the ongoing changes; $Congestion_i = 0$, otherwise.
    3. $DegradingCulture_i = 1$, in case the tourist chose degrading culture as one of the ongoing changes; $DegradingCulture_i = 0$, otherwise.

4. DecliningTourismQuality$_i$ = 1, in case the tourist chose the declining in tourism quality as one of the ongoing changes; DecliningTourismQuality$_i$ = 0, otherwise.
5. ChangingSociety$_i$ = 1, in case the tourist chose change in societal structure as one of the ongoing changes; ChangingSociety$_i$ = 0, otherwise.

- Implications$_i$ = 1, in case the tourist considers the above changes to have a definite negative impact on tourism sustainability , leading to a fall in tourism in Leh; Implications$_i$ = 2, in case the tourist considers the above changes to have *possible* negative impact on tourism sustainability in Leh; Implications$_i$ = 3, in case the tourist considers the above changes to not have a significant impact on tourism sustainability in Leh; Implications$_i$ = 4, in case the tourist considers the above changes to not have a negative impact on tourism sustainability in Leh at all.

Tourist satisfaction Y_i , as described earlier, is measured on a scale of 4 with 1 being the highest level of satisfaction and 4 the lowest. Thus, the regression to be estimated is:

$$\begin{aligned} Y_i = {} & \beta_1 + \beta_2 Origin_i + \beta_3 Alone_i + \beta_4 WithFamily_i + \beta_5 WithTravelGroup_i \\ & + \beta_6 LogBudget_i + \beta_7 Culture\&Traditions_i + \beta_8 Landscape_i \\ & + \beta_9 AdventureTourism_i + \beta_{10} Heritage\&Env_i + \beta_{11} Monasteries_i \\ & + \beta_{12} LogSpending_i + \beta_{13} EnvPollution_i + \beta_{14} Congestion_i \\ & + \beta_{15} DegradingCulture_i + \beta_{16} DecliningTourismQuality_i \\ & + \beta_{17} ChangingSociety_i + \beta_{18} Implications_i + \varepsilon_i \\ & = Z_i + \varepsilon_i \end{aligned} \tag{3.6}$$

CHAPTER IV

RESULTS AND ANALYSIS

Tourist Satisfaction Model

The estimated coefficients and threshold values maximize the likelihood of observing the sample in which $N_1 = 60$, $N_2 = 31$, $N_3 = 5$ and $N_4 = 0$. The ordered probit model helps estimate the propensity of the tourists to choose each of the three options for satisfaction levels. Coefficient estimates for each of the variables are generated[3] which can then be used to calculate the predicted probabilities of the tourists choosing each of the three options. Table 4.1 summarizes the results from the ordered probit estimation.

The Wald Chi-Square test statistic is 71.83. This tests that the parameters of interest are simultaneously equal to zero. Based on the value above, this null hypothesis of zero coefficients can be rejected implying that at least one of the regression coefficients in the model is not equal to zero and the model as a whole is statistically significant. However, these coefficients cannot be interpreted the way Ordinary Least Squares regression coefficients are; Ordered Probit coefficients do not represent the impact of a small change of the independent variable on the dependent variable. They have to be converted into figures that reflect the actual marginal effects of these variables on the probability of choosing each of the satisfaction levels. The marginal effect of an

[3] Using the *oprobit* command in Stata Software.

TABLE 4.1

ORDERED PROBIT ESTIMATION

Log pseudolikelihood = -23.49214; Number of Obs = 53; Wald $ch^2(17)=71.83$; Prob>chi^2 = 0.0000; Pseudo R^2 = 0.4153						
Y_i	Coefficient.	Robust Std. Err.	z	P>|z|	[95% Conf. Interval]	
Origin	0.9968	1.2471	0.80	0.424	-1.4475	3.4410
Alone	-3.3710	1.4910	-2.26	0.024	-6.2933	-0.4490
With Family	-1.8378	0.9586	-1.92	0.055	-3.7167	0.0410
With Travel Group	1.5518	0.8650	1.79	0.073	-0.1435	3.2470
Log(Budget)	0.5165	0.2887	1.79	0.074	-0.0492	1.0823
Culture/Traditions	-1.5042	0.5611	-2.68	0.007	-2.6039	-0.4040
Landscape	-1.1716	0.6902	-1.70	0.090	-2.5244	0.1812
Adventure Tourism	-1.6204	0.7709	-2.10	0.036	-3.1313	-0.1100
Heritage/Environment	1.6978	0.5891	2.88	0.004	0.5431	2.8525
Monasteries	-1.0587	0.7353	-1.44	0.150	-2.4999	0.3825
Log(Spending)	-0.9861	0.1980	-4.98	0.000	-1.3742	-0.5980
Environmental Pollution	1.6081	0.4833	3.33	0.001	0.6608	2.5554
Congestion	-0.4602	0.7362	-0.63	0.532	-1.9032	0.9827
Degrading Culture	1.4799	0.6180	2.39	0.017	0.2687	2.6911
Declining Tourism Quality	1.4261	1.0438	1.37	0.172	-0.6197	3.4719
Changing Society	1.2832	0.6939	1.85	0.064	-0.0767	2.6432
Implications	-0.7737	0.5563	-1.39	0.164	-1.8640	0.3166
/cut1	-2.0295	1.7704			-5.4994	1.4404
/cut2	-0.2569	1.7334			-3.6543	3.1405

independent variable x_{ik} is the change in the probability $\Pr(Y_i = 1|x_{ik})$ of observing a certain outcome, if the independent variable changes by one unit, with all other variables remaining constant:

$$Marginal\ Effect\ of\ variable\ x_{ik} = \frac{\partial \Pr(Y_i = 1|x_{ik})}{\partial x_{ik}} = \frac{\partial F(x_{ik}\beta_k)}{\partial x_{ik}} \qquad (4.1)$$

$F(x_{ik}\beta_k)$, as described earlier, is the cumulative normal distribution of the error terms. Thus, using the chain rule:

$$\frac{\partial F(x_{ik}\beta_k)}{\partial x_{ik}} = \frac{\partial F(x_{ik}\beta_k)}{\partial x_{ik}\beta_k}\beta = f(x_{ik}\beta_k)\beta, \qquad (4.2)$$

where $f(x_{ik}\beta_k) = \Phi(x_{ik}\beta_k) \rightarrow$ the standard normal distribution function

This implies that in order to evaluate the impact of a small change in x_{ik} on the probability of choosing, for instance, $Y_i = 1$ ($\Pr(Y_i = 1|x_{ik}) = F(x_{ik}\beta_k)$, the estimated coefficient β_k needs to multiplied by $f(x_{ik}\beta_k)$ which is the density evaluated at $x_{ik}\beta_k$. Since this density takes on different values for each tourist, one of the methods for computing this marginal effect is to evaluate $f(x_{ik}\beta_k)$ at the average value of x_k so that Marginal Effect $= f(\overline{x_k}\beta_k)\beta_k$. Table 4.2 summarizes the results of this marginal effect estimation as applied to the present model[4].

TABLE 4.2

ORDERED PROBIT AVERAGE MARGINAL EFFECTS

	A Pr(satisfaction=1), predict(outcome(1))		B Pr(satisfaction=2), predict(outcome(2))		C Pr(satisfaction=3), predict(outcome(3))	
	dy/dx	Std. Error	dy/dx	Std. Error	dy/dx	Std. Error
Origin	-0.1768	0.2104	0.1004	0.1144	0.0764	0.1042
Alone	0.5979***	0.2446	-0.3394***	0.1596	-0.2585**	0.1607
With Family	0.3260**	0.1787	-0.1850*	0.1287	-0.1409**	0.0833
With Travel Group	-0.2752**	0.1569	0.1562*	0.0982	0.1190*	0.0861
Log(Budget)	-0.0916**	0.0550	0.0520*	0.039	0.0396**	0.0247
Culture/Traditions	0.2668***	0.0874	-0.1514***	0.0578	-0.1154**	0.0679
Landscape	0.2078**	0.1237	-0.1180*	0.0935	-0.0899**	0.0479
Adventure Tourism	0.2874***	0.1403	-0.1631**	0.0995	-0.1243**	0.0738
Heritage/Environment	-0.3012***	0.0900	0.1709***	0.0761	0.1302***	0.0633
Monasteries	0.1878*	0.1343	-0.1066	0.0854	-0.0812***	0.0644
Log(Spending)	0.1749***	0.0384	-0.0993***	0.0409	-0.0756***	0.032
Environmental Pollution	-0.2852***	0.0754	0.1619***	0.0674	0.1233***	0.0584
Congestion	0.0816	0.1273	-0.0463	0.0732	-0.0353	0.0574
Degrading Culture	-0.2625***	0.0902	0.1490***	0.0527	0.1135*	0.0717
Declining Tourism Q-uality	-0.2530*	0.1899	0.1436	0.1152	0.1094	0.0946
Changing Society	-0.2276**	0.1281	0.1292*	0.0949	0.0984**	0.0552
Implications	0.1372*	0.0880	-0.0779**	0.0447	-0.0593	0.0534

➔ Statistically significant at about a *20%, **10% and ***5% level of significance.

➔ Note that the data on the probability of choosing $Y_i = 4$ is not included since none of the surveyed tourists responded with *not satisfied*.

[4] Estimated in Stata using the margins command.

These average marginal effect estimates allow us to interpret the meanings of each of the coefficients in terms of their impacts on the dependent variable – the probability of choosing each satisfaction level. Examining all the variables and their coefficients, it can be noted that some of the variables such as $Origin_i$ and $Congestion_i$ seem to be statistically insignificant. This is also suggested by a chi-square test for the joint significance of these two variables[5]. As discussed previously, the classification of foreign/domestic tourist is an important one since they tend to have different preferences; hence the omission of this variable is not theoretically justified. Similarly, congestion is an important factor in determining the appeal of a tourist destination which is also illustrated by the fact that most of the tourists picked increasing congestion as one of the major negative changes occurring in the region. An alternative estimation was performed without these two variables, which led to significantly large changes in the rest of the factors' coefficient estimates.

The low levels of significance of these variables could imply that they are not very significant in terms of determining the tourists' satisfaction in case of Leh. However at the same time it is also possible that the low statistical significance is a consequence of the presence of multicollinearity among the variables which is likely because many of the variables are somehow related to each other in terms of how they are caused – as in the case of ongoing changes in the region. There is also a possibility of variable specification errors in our model since there could be other factors or factor combinations which are not included in our model that influence a tourist's satisfaction. So our final model includes all of the attributes originally included, as in Table 3.1 and 3.2.

[5] Joint Significance test result provided in Appendix A.

Analysis of Ordered Probit Estimation Results

As mentioned earlier, the average marginal effects coefficients for each variable will act as the tool for interpreting our regression results in terms of how it applies in the context of contributing to tourist satisfaction and hence towards sustaining tourism in the future. Table 4.2 provides these coefficients for all variables for each of the three responses for satisfaction, more specifically the probability that the tourist picks the option of *very satisfied* - Pr(satisfaction==1) or *satisfied* - Pr(satisfaction==2) or *somewhat satisfied* - Pr(satisfaction==3). We can see that the coefficient for $Origin_i$ is negative in column A and positive in columns B and C. This implies that, all others held constant, being a foreign tourist lowers the probability of responding with the option of *very satisfied* while it increases the probability of responding with the options of *satisfied* and *somewhat satisfied*. Although this coefficient is not statistically significant at conventional levels of significance, a possible interpretation for the observed sign could be that foreign tourists who used to form the major portion of total tourist inflows into Leh just several years ago, are more likely to be less satisfied in the recent years due to increased overcrowding of the town and the increased influx of Indian tourists which makes Leh seem like any other common hill-station in India rather than the unique "Little-Tibet-like" features that foreign tourists come here for – both in terms of the natural as well as social environment. This possibility is also reinforced upon examining the coefficient for Heritage/Environment which is the variable for the pristine and preserved heritage and environment as a factor that compelled the tourist to visit. This coefficient is statistically significant and negative in column A, positive in columns B and C which could mean that, all others held constant, tourists who were drawn to Leh after reading or hearing

about its characteristic of a preserved and unspoiled heritage and environment had a lower probability of responding with *very satisfied* (by about 0.301) and a higher probability of picking *satisfied* (by about 0.171) and *somewhat satisfied* (by about 0.130). This could probably mean that their experience or perception of the region's heritage and environment did not quite match their expectations and hence a lower probability of being *very satisfied*.

Considering the effect of travel companions, we can observe that the coefficients for Alone and With Family, each statistically significant at different significance levels, are positive in column A and negative in columns B and C. Whereas the coefficient for With Travel Group is negative in column A and positive in columns B and C. This means that, all others held constant, tourists travelling alone or with family have a higher probability of responding with *very satisfied* as compared to the ones who are travelling in organized travel groups who have a higher probability of responding with *satisfied* and *somewhat satisfied*. This could probably raise important concerns regarding the quality of services provided by travel agents and tour operators and hence is a negative point for sustainable tourism.

An examination of the coefficients for the other compelling factors – Culture and traditions, Landscape, Adventure Tourism and Monasteries, shows that these coefficients are positive in column A and negative in columns B and C. This implies that, all others held constant, being a tourist who was drawn to Leh due to one or more of the above characteristics leads to a higher probability of responding with *very satisfied* and a lower probability of responding with *satisfied* and *somewhat satisfied*. This could point to the possibility that all these characteristics are, as compared to preserved

heritage/environment, more able to match the expectations of tourists and hence lead to higher satisfaction. One of the possible reasons for this might be that these attributes have a lesser possibility of undergoing rapid changes due to the influx of people and the general growth of the region, unlike the factor of the pristine heritage and environment which goes through more observable changes. Thus the culture and traditions of the region still seem to be a plus point for tourism along with the landscape. In case of adventure tourism, its contribution to tourist satisfaction for tourists who are mainly interested in engaging in adventure tourism activities would only get higher as the tourism sector grows and provides better facilities and opportunities for all tourism related activities in the region. The same applies for the factor of monasteries and other ancient structures in Leh which are being given more attention recently with an increasing number of restoration projects being carried out at several locations all over the district.

Looking at the attributes for the tourist's perception of changes happening in Leh, the coefficients for the variables Environmental Pollution, Degrading Culture, Declining Tourism Quality and Changing Society are negative in column A and positive in columns B and C. This implies that, all others held constant, being a tourist who recognizes one or more of the above as changes happening in Leh leads to a lower probability of responding with *very satisfied* and a higher probability of responding with *satisfied* and *somewhat satisfied*. The issues of degrading heritage and environment go back to the previously discussed aspect of the negative effect on satisfaction of the factor of the preserved environment and heritage. Thus, although at the moment these characteristics

are a positive factor for determining tourist satisfaction, the ongoing and future changes in them could be another cause of concern regarding the sustainability of tourism in Leh.

If we observe the coefficient for the variable of increasing congestion as an ongoing change in Leh, we see that it is the least statistically significant in our model, is positive in column A and negative in columns B and C. This means that, all held constant, being a tourist who recognizes increasing congestion as one of the changes happening in Leh leads to a higher probability of responding with *very satisfied* and a lower probability of responding with *satisfied* and *somewhat satisfied*. This is the opposite of what one might expect the impact of increasing congestion to be on tourist satisfaction. While we could say that although the tourist recognizes congestion to be increasing in Leh, it hasn't had a very significant impact on determining overall tourist satisfaction with most of the tourists still responding with *very satisfied*. However, the fact that recognition of increasing congestion as an ongoing change also seems to lead to a lower probability of responding with just *satisfied* and *somewhat satisfied* doesn't make much sense theoretically. Also, this interpretation is not well backed up given the statistical insignificance of the Congestion variable in our model as observed earlier.

We can also note that the coefficient for log of budget which is somewhat statistically significant is negative in column A and positive in columns B and C. This seems to suggest, that all else held constant, a higher budget leads to a lower probability of responding with *very satisfied* and a higher probability of responding with *satisfied* and *somewhat satisfied*. This contradicts how we might think budget affects satisfaction – a higher budget should mean better facilities and services and hence higher satisfaction. However, it could also relate to cost efficiency and the relationship of satisfaction with

amount spent on the entire travel – that tourists want maximum satisfaction at the lowest possible price. On the whole, the relationship of budget with satisfaction doesn't seem very clear from our results. But in case of spending (in tourist shops), we see that the variable is statistically significant, is positive in column A and negative in columns B and C. This implies that, all else held constant, a higher amount of spending in tourist shops leads to a higher probability of responding with *very satisfied* and lower probability of responding with *satisfied* and *somewhat satisfied*. This is in line with what we might expect, since numerous shops and facilities catering to tourists have and are coming up increasingly in Leh which might translate to a higher level of satisfaction for tourists. Thus, the increase in facilities like tourist shops, not considering the increase in congestion they cause, seems to be a positive aspect and hence one of the several ways of improving tourism services and hence satisfaction. The coefficient for the Implications_i variable is also according to what we might expect from theory– being a tourist who said that tourism cannot be sustained in view of the current changes happening in Leh leads to a lower probability of responding with *very satisfied and* a higher probability of responding with *satisfied* and *somewhat satisfied*. The process of interpreting this coefficient is slightly different from the other dummies since it is on a 1-4 scale. Thus it seems that tourists who feel more strongly about the negative impact of the changes on tourism sustainability are less likely to be *very satisfied.*

The large differences, in fact opposite effects, in the way our variables explain the probabilities for *very satisfied* and *satisfied*, could be because in the survey no tourist responded with *not satisfied*. Thus *very satisfied* could be taken as the reference response for indicating tourist satisfaction with *satisfied* being a mild response and *somewhat*

satisfied reflecting very low satisfaction – comparable to what *not satisfied* would represent usually.

CHAPTER V

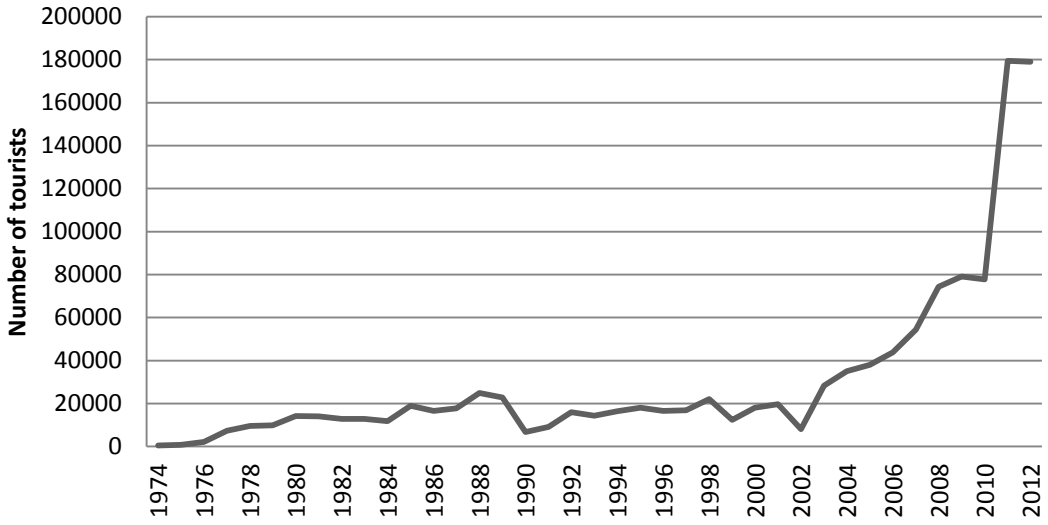
FORECASTING TOURIST ARRIVALS

Data

This section attempts to forecast the number of tourists that Leh is likely to receive over the next several years using actual annual tourist arrivals in the past years as a tool. The time period being considered is 1974-2012 since 1974 is the year when the region was opened for tourism.

FIGURE 5.1

TOURIST ARRIVALS IN LEH 1974-2012

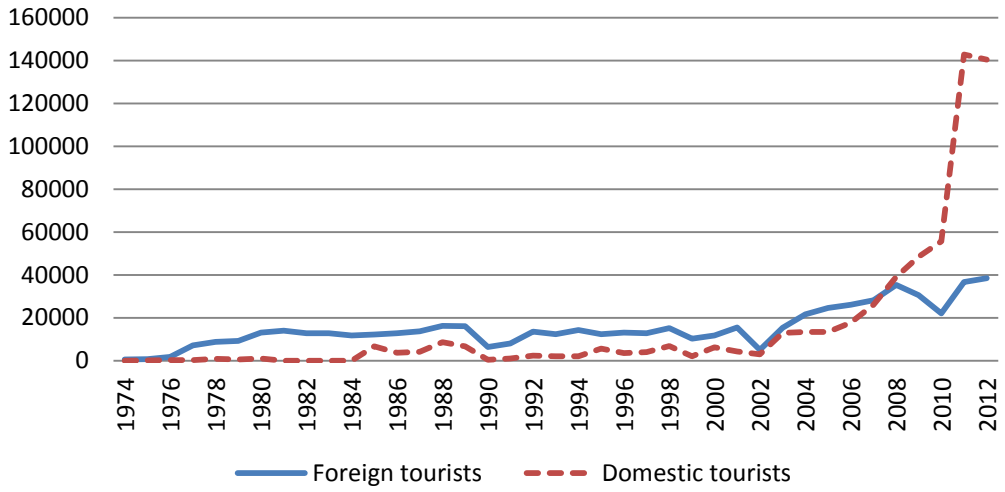


*Data for annual tourist arrivals provided in appendix B.

Examining Figure 5.1 one can see that tourist arrivals increased gradually till 1980 after which the trend line flattens out and remains so until about 1985. The main reason behind this observation seems to be merely the unavailability of arrival data for domestic tourists for the years 1981-84. There is then a trend of overall increase from 1985 onwards until 1989-90. This would mainly be attributed to the several changes that took place in the political scenario within Ladakh as well as in the state of Kashmir as a whole during this period. The year 1989 marked the beginning of the armed resistance to Indian rule in the Kashmir valley; Muslim political parties complained that the 1987 elections to the state's legislative assembly were rigged against them, and they formed militant wings. Some groups called for independence while others were calling for union with Pakistan (bbc.co.uk). During this period, Ladakh also became involved in a struggle for increased regional autonomy followed by a communal conflict between the Buddhists and Muslims in Leh marked by violent incidents and social boycotts. These scenarios could be the major reasons for the observed drop in tourist arrivals in the late 1980s. Yet another, though smaller, drop can be observed in the year 1999. The most evident reason is the 1999 Kargil War – an armed conflict between India and Pakistan that took place during May and July in the Kargil district, triggered by the infiltration of Pakistani soldiers and Kashmiri militants into positions on the Indian side of the Line of Control LOC. The year 2002 sees yet another drop in tourist arrivals with foreign tourist inflows falling by about 66 percent of the 2011 inflows. This could be due to international and national reasons: the 2001 September 11 terrorist act in the US and the attack on Indian parliament and the looming threat of a India– Pakistan nuclear war.

FIGURE 5.2

FOREIGN VS. DOMESTIC TOURIST ARRIVALS



As depicted in Figure 5.2, from 2002 onwards the rate of increase in tourist inflows rises significantly, in case of both foreign as well as domestic Indian tourists. The even steeper increase after 2006 is attributed to the large increases in the inflow of domestic tourists. This sudden increase in Indian tourists could be due to a number of factors like the increase in services consumption by the rising Indian middle class, increase in the number of flights to Leh, the introduction of tour packages by online travel companies such as *Makemytrip.com* and perhaps most visibly due to the increasing number of Indian films being shot in the remote and touristic locations in Ladakh. The more than two-fold increase in tourist inflows from a total inflow of 77,800 tourists in 2010 to 179,491 tourist in 2011 is attibuted by many to the extremely successful 2009 Bollywood film *3 Idiots*, parts of which were shot in Ladakh. In additon, the flash floods of August 2010 in Ladakh led to a slight fall in tourist inflows in that year but could also have played an important part in garnering an increased number of tourists the following

year in support of the local economy. Figure 5.2 also depicts the downward trend in the foreign tourist arrivals during 2008-10 which can be attributed to the 2008 global financial crisis. However, Indian tourist arrivals continued to increase during this period as the Indian economy was still able to grow since it is not as dependent on global flows of trade and capital as most other countries.

TABLE 5.1

DESCRIPTIVE STATISTICS – TOURIST ARRIVALS 1974-2012

Variable	Obs	Mean	Std. Dev.	Min	Max
Foreign tourists	39	15214.85	9181.029	500 *(1974)*	38510 (*2012*)
Domestic tourists	39	15042.77	32524.96	27 (*1974*)	142829 (*2011*)
Total tourist arrivals	39	30257.62	40092.04	527 (*1974*)	179491 (*2011*)

Looking at the descriptive statistics for the arrival data as well, we can see that on average over the years, Leh has received more foreign tourists that domestic tourists with the number of domestic arrivals rising drastically over the recent years and overtaking the number of foreign tourists by a very large margin. The highest total inflow was observed in 2011 while the lowest inflow was in 1974 when the region was first thrown open to tourism. The standard deviations are significantly large, even larger than the average inflows in case of domestic and foreign arrival values. These large deviations illustrate the extent of the variability and the volatile nature of the region's tourism industry.

Methodology

Given the unavailability of information regarding factors that determine the tourist arrivals in Leh, this study uses a univariate time series forecasting method which is particularly useful in scenarios with unavailability of or high costs of obtaining relevant

extraneous information. An Auto Regressive Moving Average (ARMA) Model is used to generate tourist arrival forecasts. The ARMA model is considered to be a highly refined curve fitting device with the potential to provide short term forecasts (Studenmund, 2011). The model combines two different processes into one equation: 1) An Auto Regressive process which expresses a dependent variable as a function its past values and 2) A Moving Average process which expresses a dependent variable as a function which is a moving average of past error term observations that can be added to the mean of the variable to obtain a moving average of its past values. Starting with an econometric equation with no independent variables: $Y_t = \beta_0 + \epsilon_t$ and adding the auto regressive and the moving average processes, the ARMA model is:

$$Y_t = \beta_0 + \theta_1 Y_{t-1} + \theta_2 Y_{t-2} + \cdots + \theta_p Y_{t-p} + \epsilon_t + \Phi_1 \epsilon_{t-1} + \Phi_2 \epsilon_{t-2} + \cdots + \Phi_q \epsilon_{t-q}$$

where p and q are the number of lagged values of the dependent variable and the error terms respectively.

In order to apply the above equation to a time-series, it is recommended that the time series be one that is stationary: its basic properties such as the mean and the variance should stay constant over time (Studenmund, 2011). From a visual examination of the time series data for annual tourist arrivals in Leh (Fig 5.1), it seems that the basic properties are not constant over time; the series is marked by fluctuations and an upward trend. This is also revealed by conducting a Dickey-Fuller Test for unit roots[6] which determines a unit root for the time series data. Therefore, a first difference approach will be employed while forecasting the tourist arrivals; the first differences $\Delta Y = Y_t - Y_{t-1}$ will be used in place of the actual tourist arrival values Y_t.

[6] A unit root is present if $p = 1$ in the expression: $Y_t = pY_{t-1} + \epsilon_t$, where Y_t and Y_{t-1} are the current and one period lagged dependent variables, implying that the time series is non-stationary. The dickey-fuller test tests the null hypothesis that the series has a unit root. The test result is provided in appendix B.

A number of different ARIMA (p,d,q) models were tested in order to produce the arrival forecasts where p, q and d are the number of lagged values of the dependent variable and the error terms and the number of differences respectively. The use of several different values for p and q revealed that the q value i.e. the moving average component seems to be more dominant in terms of determining the overall trend while the auto regressive component contributes by incorporating the observed periodic fluctuations. However, no significant differences were observed among most of the tested models which implies that the ARIMA model gives a generally similar prediction for the present time series, irrespective of the parameters used. The paper uses the ARIMA (2,1,1) model to forecast Leh's tourist arrivals. The results from another possible specification (ARIMA (2,1,2)) along with the generated forecast are included in Appendix B.

ARIMA(2,1,1) Results

An ARIMA specification with first differenced, two lagged values of the annual total tourist arrivals and 1 lagged value of the error term i.e. ARIMA (2,1,1) is employed to model the tourist arrivals from 1974 to 2012 and to generate forecasts for 2013-2020.[7]

From the ARIMA results summarized in table 5.2 below, it can be noted that the Chi-square p-value is 0 implying that the model as a whole is statistically significant. The same holds for the coefficients of the AR and MA components as well, with a statistical significance of at least 10 percent.

[7] Using the *arima* and *predict* command in Stata Software.

TABLE 5.2

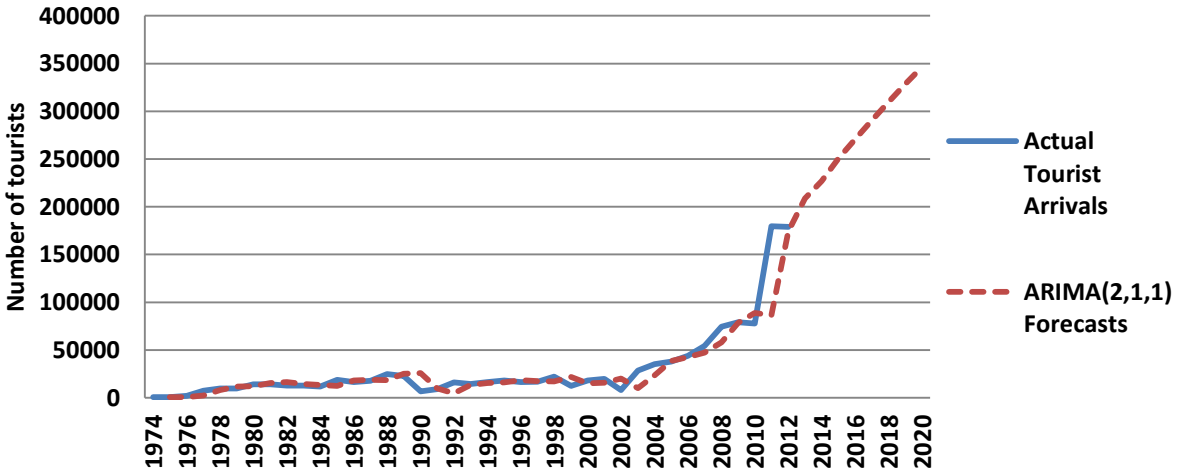
MODELING 1974-2012 TOURIST ARRIVALS – ARIMA (2,1,1)

ARIMA regression				Number of obs = 38		
Sample: 1975-2012	Wald chi^2 (3) = 140.39			Prob > chi^2 = 0.0000		
Log likelihood = -423.8364						
Total tourist arrivals	Coefficient	OIM Std. Error	z	P>|z|	[95% Confidence Interval]	
ARMA						
AR						
AR1	0.5771	0.2225	2.59	0.0090	0.1411	1.3598
AR2	0.3707	0.2107	1.76	0.0790	-0.0424	0.7838
MA						
MA1	-0.6812	0.1787	-3.81	0.0000	-1.0315	-0.3309
/sigma	16642.76	1925.35	8.64	0.0000	12869.14	20416.38

This model is used to generate forecasts for the total tourist arrivals to Leh from 2013-20 which is then compared to the actual arrivals in Figure 5.3.

FIGURE 5.3

ARIMA(2,1,1) FORECASTS



Aside from the conflicting minor periodic fluctuations, the model seems to capture the overall trend and the predictions seem fairly close to the actual tourist arrival values. But the numbers start getting quite close for the more recent years. As expected, we can see

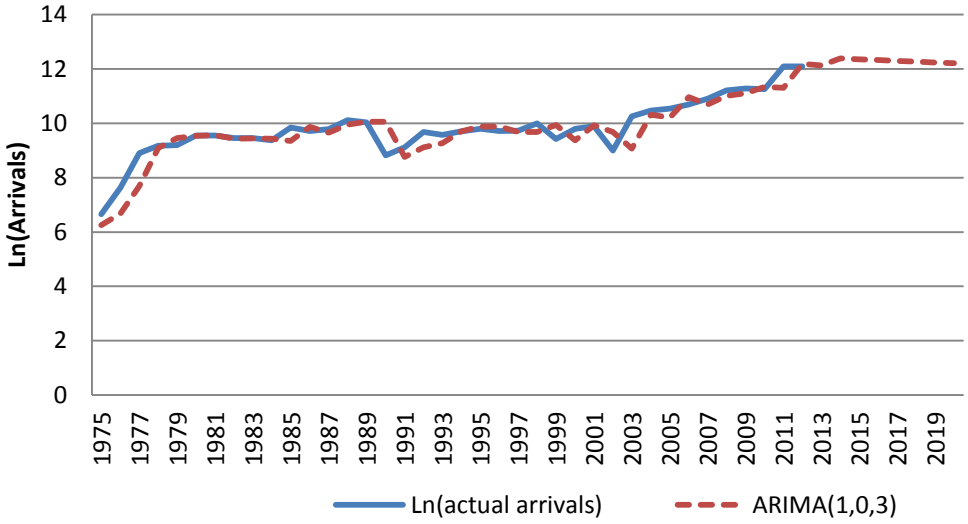
that for the year 2011, the forecasted value (86,350) is almost half of the actual arrivals (179,491). This is because of the large increase in tourist arrivals which happened as a result of increased domestic visitors in that year. We get a forecast of 208,929 visitors for the year 2013 which seems like a significant increase considering both the actual total number of visitors in 2012 (178,970) and the model's 2012 prediction (174255). This is probably due to the more than two-fold increase in arrivals over 2010-11. Since the model also incorporates lagged variables and a moving average of the previous error terms, the large increase in 2011 leads to considerably large predictions of future values. Looking at forecasts over 2013-20, we see a continued rise in arrivals with a growth rate lower than that observed over 2010-12 but somewhat similar to the rate observed during the late 2000's. Hence, these forecasts determine a sustained rise in tourism levels, at least in the short run.

While the above model first differenced the arrival time series data as a remedy for the non stationarity, another approach could be to examine the natural logs of the time series data In this case, what is being considered is the growth rate of the tourist arrivals rather than the actual arrival data. Thus the forecast would then predict future growth trends rather than future arrivals. An ARIMA(1,0,3) model is applied to the time series after conversion to natural logs[8].

[8] The application of ARIMA(1,0,3) to the natural log of tourist arrivals time series produces a statistically significant model with 1 lagged variable and 3 lagged error values. The summary of results and generated forecasts are provided in appendix B.

FIGURE 5.4

FORECASTS USING NATURAL LOGS



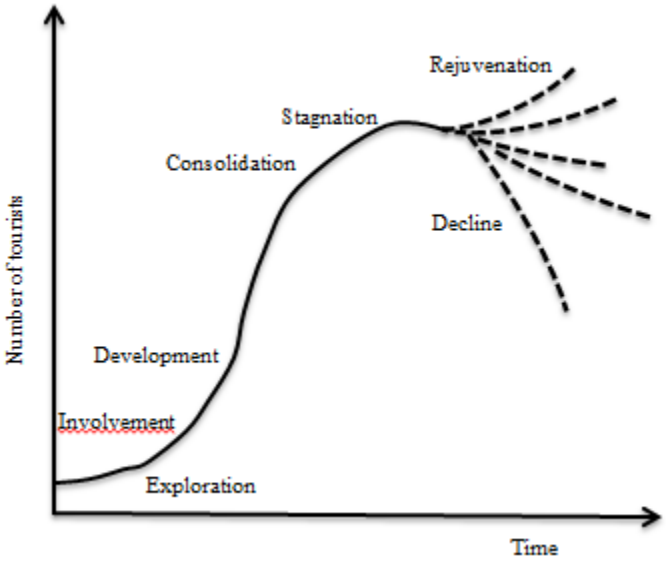
Examining the trend of the natural logs of the actual arrival data, one can note an overall trend of increase in the growth rate of tourist arrivals over the period 1974-2012. As in the case of our previous ARIMA(2,1,1) model, this model also does a fairly close job of predicting the growth rates. As Figure 5.4 depicts, we see an almost constant rate of increase in arrivals over 2013-20. This observation, combined with the forecasts from the previous ARMA model, produces a positive evaluation for the sustainability of tourist arrivals in the near future. However, these forecasts are certainly not robust enough for us to draw the conclusion from it that tourism is sustainable. Being univariate time series models, they are entirely determined by the past trends followed by the tourist arrivals. Hence, these models do not take into account the most important, external factors that could impact the number of tourists to the region such as the domestic and international income levels, prices and exchange rates, qualitative indicators for factors such as trade openness and the region's political/social/environmental stability. It seems that the

forecast could be mostly useful for a rough estimation of future trends rather than accurate predictions.

The possible future trend of Leh's tourist arrival can also be analyzed and evaluated by using Butler's Tourism Area Life Cycle (TALC) model which is a tool that is popularly employed in the analysis of tourist arrivals. The model is based on the product cycle concept which follows a basic asymptotic curve characterized initially by a slow proceeding of sales, a rapid growth rate, stabilization and subsequently decline, and can help provide a broad estimate for where Leh might currently be in the tourism cycle.

FIGURE 5.5

HYPOTHETICAL EVOLUTION OF A TOURIST AREA



Adapted from "The concept of a tourist area cycle of evolution: implications for management of resources," by R. Butler, 1980, The Canadian Geographer, 24, p.7

Following this model, Butler (1980) suggests several stages through which tourist areas pass. These stages, illustrated in Fig.5.5, are:

1. Exploration: Characterized by small numbers of tourists making individual travel arrangements and irregular visitation patterns. At this stage the region does not have specific tourism facilities.
2. Involvement: This is arrived at as the number of visitors increases and becomes somewhat regular. Some local residents begin to provide facilities primarily for tourists. As this stage progresses, there could be some advertisement to specifically attract tourists and a basic initial market can be defined along with the emergence of a tourist season.
3. Development: At this stage there is a well-defined tourist market area, natural and cultural attractions are developed and marketed specifically, supplemented by man-made facilities. Thus there could be noticeable changes in the physical appearance of the area. Also, the number of tourists at peak periods probably equal or exceed the permanent local population and the type of tourist will also have changed as a wider market is drawn upon.
4. Consolidation: Here, the rate of increase in visitors declines, although the numbers still increase. The large numbers of visitors and facilities provided for them could cause some opposition and concern among permanent residents, particularly those not involved in the tourism industry.
5. Stagnation: The peak number of visitors as well as the resource capacities will have been reached or exceeded with associated socio-economic and environmental problems. The tourist area will have an image that is well established but it will no longer be unique and ‘in fashion’.

Here on, either decline or rejuvenation is possible depending on how the region copes and manages its resources for tourism. Rejuvenation could be achieved by either adding man-made attractions or by taking advantage of previously untapped natural resources.

A close examination and analysis of the trend followed by tourist arrivals reveals that tourism in Leh also seems to be going through stages similar to the ones proposed by Butler's TALC model. The tourism industry in Leh is only about 37 years old which is a relatively short time period in order for a complete application of the tourist area life cycle model. However, one can distinguish the initial stages based on the path followed by tourism in the region as shown in figure 5.1. The period from 1974-80 clearly resembles the *exploration* stage with very small numbers of tourists; they were mostly European tourists, mainly from Germany. Flight services to Leh did not exist at that time and there were very few accomodation facilities; tourists were accomodated with the local families (Jina, 1994). Thus, there was a high level of contact between the tourists and the local residents which is an important feature of the initial *exploration* stage of a tourism area. Later, as the tourist inflow became more regular, the State Government provided upto 50 percent subsidies for the construction of hotels in order to promote the development of tourism.This led to a significant jump in the number of hotels and guest houses in the region which, supplemented by the introduction of scheduled air services in the 1979, led to rapid development of tourism (Jina, 1994). The period from around 1980 onwards resembles a stage of increased involvement among the local residents with more local residents and households engaging in providing services catering to tourists as well as continued increase in the frequency of daily flight services to Leh. During the 1990s, tourism in Leh started developing as an industry, with an increased level of organization

(Jina, 1994). Examining the trend visually from the graph in Figure 5.1, this stage seems to have continued until around early 2000's. This is also backed by several facts about the tourism sector during this period. It can be noted that, after a periodic slump in arrivals in the year 2002 owing to international socio-political instability, the numbers rapidly picked up in 2003 and continued to increase at a much higher rate than ever before. Leh started getting more advertized as a travel destination and the unique natural environment and cultural heritage started being more specifically marketed as its strengths. This period also saw a more rapid change in the region's infrastructure such as roads connecting the remotest villages as well as facilities and services in Leh town. More importantly, the number of domestic tourists, which had always been lower than foreign tourists, started picking up after 2003 and finally exceeded foreign visitors in 2008. This is owing to factors such as the rise of the Indian middle class and the global financial crisis in 2008 which India remained almost unaffected by. Thus there has been a change in the type of tourists the region receives. Also, in 2011 the number of tourists exceeded the town's permanent local population for the first time. All these events are characteristic of the *development* stage of a tourist area suggesting that Leh is currently in the *development* stage of the tourist area life cycle model.

The above discussion illustrates the broad applicability of the life cycle model to Leh's tourism sector. It is not yet possible to determine whether the tourism trend is approaching the *consolidation* stage. The *development* stage might continue for several years or more until the region's natural capacity is reached, which it does seem to be close to reaching according to the observations of tourists from the survey as well as from general opinions among the locals and administration. From then on, tourism in Leh could

either go through a decline or rejuvenation depending on the measures that will be carried out in this regard by the tourism industry and its stakeholders.

CHAPTER VI

DISCUSSION AND CONCLUSION

Analyzing the role played by tourist preferences in determining satisfaction provides a useful assessment about the characteristics of Leh that are currently driving tourism and those that could potentially either positively or negatively impact the sustainability of the sector in the future. The positive aspects need to be emphasized and improved upon further while appropriate measures have to be taken to monitor and control the factors that could threaten tourism in the region. These types of assessments do not seem to have been carried out at all in the context of Ladakh's tourism sector; hence the present study can be taken as a pioneering step toward conducting further research and analysis of tourism in the region. These assessments can play a pivotal part in formulating policies and development strategies to enhance the performance of the tourism sector in Leh.

The most significant contribution of this study is that it collects and presents a unique data set and provides an econometric analysis for a fairly unstudied part of the economy of Leh. The paper attempts to contribute to the scant literature by providing solid, quantitative evidence to back up the underlying concerns regarding tourism sustainability in Leh through an evaluation of the current situation of tourism by connecting the tourists' assessments and satisfaction levels to the region's characteristics.

The analysis of tourist preferences suggests that in terms of tourism prospects, Leh's strength lies in its characteristics like the unique landscape, the cultural heritage

and traditions as well as the monasteries and other ancient architectural heritage. Our results also show that the cultures and traditions of the region haven't degraded as much as it is made out to be. Instead, they still play a very important role in drawing tourists and enhancing their experience. The major negative trend that is reflected in our analysis is that of the degradation in the natural environment of the region. However, the fact that the majority of the tourists are *very satisfied* is a good sign and hence combining these observations with the short term results obtained from our forecast it seems that tourism is definitely sustainable, at least in the short term. How it fares in the longer term would be entirely determined by how the present 'plus points' of the region are handled and whether constructive steps are taken to slow down or counter the ongoing negative changes.

However, there are certainly many more factors and variables which can be observed and play a very significant role in determining satisfaction levels, for example the type of accommodation the tourist was staying in and the nature of their interaction with the locals and tourism related businesses. There are also other factors such as the tourist's own personal preferences and the current condition of both the region as well the tourist, over the duration of stay. One also needs to consider the fact that the presence of some amount of bias is almost unavoidable, both in sample selection as well as the tourist's responses, even though the process was tried to be made as random as possible. One of the most significant limitations is the small sample size of 53 survey respondents. It is an extremely small sample considering the variability in the types and number of tourists Leh receives.

In case of forecasting tourist arrivals, there were some limitations in the approximation due to missing figures for some of the time periods. The univariate approach is possibly the largest limiting factor in producing the forecasts. As discussed previously, the tourism sector is highly volatile and is determined by a large variety of factors. The availability of data such as regional as well as global income and price levels would have allowed for the application of multivariate time series models that can produce far better approximations and forecasts for the tourist arrivals to Leh. Despite these limitations, the ARMA models themselves seem quite robust to changes as found by the application of several different possible specifications which produce generally similar forecasts for arrivals over the entire period.

Appendix A

AVERAGE MARGINAL EFFECTS IN THE ORDERED PROBIT MODEL

OUTCOME 1 (VERY SATISFIED)

Average marginal effects — Number of obs = 53
Model VCE : Robust

Expression : Pr(satisfaction==1), predict(outcome(1))

	Delta-method					
	dy/dx	**Std. Err.**	**z**	**P>|z|**	**[95% Conf. Interval]**	
Origin	-0.1770	0.2104	-0.84	0.401	-0.5892	0.2356
Alone	0.5979	0.2446	2.44	0.014	0.1186	1.0773
With Family	0.3260	0.1787	1.82	0.068	-0.0242	0.6762
With Travel Group	-0.2750	0.1569	-1.75	0.079	-0.5827	0.0322
Log(Budget)	-0.0920	0.0550	-1.66	0.096	-0.1995	0.0163
Culture/Traditions	0.2668	0.0874	3.05	0.002	0.0955	0.4381
Landscape	0.2078	0.1237	1.68	0.093	-0.0346	0.4502
Adventure Tourism	0.2874	0.1403	2.05	0.041	0.0124	0.5624
Heritage/Environment	-0.3010	0.0900	-3.35	0.001	-0.4776	-0.1250
Monasteries	0.1878	0.1343	1.40	0.162	-0.0754	0.4510
Log(Spending)	0.1749	0.0384	4.55	0.000	0.0996	0.2503
Environmental Pollution	-0.2850	0.0754	-3.78	0.000	-0.4331	-0.1370
Congestion	0.0816	0.1273	0.64	0.521	-0.1679	0.3311
Degrading Culture	-0.2620	0.0902	-2.91	0.004	-0.4393	-0.0860
Declining Tourism Quality	-0.2530	0.1899	-1.33	0.183	-0.6252	0.1192
Changing Society	-0.2280	0.1281	-1.78	0.076	-0.4788	0.0236
Implications	0.1372	0.0880	1.56	0.119	-0.0353	0.3097
Origin	-0.1770	0.2104	-0.84	0.401	-0.5892	0.2356

OUTCOME 2 (SATISFIED)

Average marginal effects Number of obs = 53
Model VCE : Robust

Expression : Pr(satisfaction==2), predict(outcome(2))

	Delta-method					
	dy/dx	**Std. Err.**	**z**	**P>|z|**	**[95% Conf. Interval]**	
Origin	0.1004	0.1144	0.88	0.380	-0.1238	0.3246
Alone	-0.3394	0.1596	-2.13	0.033	-0.6522	-0.0270
With Family	-0.1850	0.1287	-1.44	0.151	-0.4373	0.0672
With Travel Group	0.1562	0.0982	1.59	0.111	-0.0361	0.3486
Log(Budget)	0.0520	0.0390	1.33	0.182	-0.0244	0.1284
Culture/Traditions	-0.1514	0.0578	-2.62	0.009	-0.2648	-0.0380
Landscape	-0.1180	0.0935	-1.26	0.207	-0.3012	0.0653
Adventure Tourism	-0.1631	0.0995	-1.64	0.101	-0.3582	0.0319
Heritage/Environment	0.1709	0.0761	2.24	0.025	0.0217	0.3202
Monasteries	-0.1066	0.0854	-1.25	0.212	-0.2741	0.0609
Log(Spending)	-0.0993	0.0409	-2.43	0.015	-0.1795	-0.0190
Environmental Pollution	0.1619	0.0674	2.40	0.016	0.0297	0.2941
Congestion	-0.0463	0.0732	-0.63	0.526	-0.1897	0.0970
Degrading Culture	0.1490	0.0527	2.83	0.005	0.0458	0.2522
Declining Tourism Quality	0.1436	0.1152	1.25	0.213	-0.0823	0.3694
Changing Society	0.1292	0.0949	1.36	0.173	-0.0569	0.3152
Implications	-0.0779	0.0447	-1.74	0.082	-0.1655	0.0098

OUTCOME 3 (SOMEWHAT SATISFIED)

Average marginal effects				Number of obs =	53	
Model VCE : Robust						
Expression : Pr(satisfaction==3), predict(outcome(3))						
	Delta-method					
	dy/dx	**Std. Err.**	**z**	**P>|z|**	**[95% Conf. Interval]**	
Origin	0.0765	0.1042	0.73	0.463	-0.1279	0.2808
Alone	-0.2585	0.1607	-1.61	0.108	-0.5736	0.0565
With Family	-0.1409	0.0833	-1.69	0.091	-0.3043	0.0224
With Travel Group	0.1190	0.0861	1.38	0.167	-0.0497	0.2877
Log(Budget)	0.0396	0.0247	1.61	0.108	-0.0087	0.0879
Culture/Traditions	-0.1154	0.0679	-1.70	0.089	-0.2485	0.0178
Landscape	-0.0899	0.0479	-1.87	0.061	-0.1838	0.0041
Adventure Tourism	-0.1243	0.0738	-1.68	0.092	-0.2689	0.0203
Heritage/Environment	0.1302	0.0633	2.06	0.040	0.0062	0.2542
Monasteries	-0.0812	0.0644	-1.26	0.207	-0.2074	0.0450
Log(Spending)	-0.0756	0.032	-2.37	0.018	-0.1383	-0.0130
Environmental Pollution	0.1233	0.0584	2.11	0.035	0.0089	0.2377
Congestion	-0.0353	0.0574	-0.62	0.538	-0.1477	0.0771
Degrading Culture	0.1135	0.0717	1.58	0.113	-0.0270	0.2540
Declining Tourism Quality	0.1094	0.0946	1.16	0.248	-0.0760	0.2948
Changing Society	0.0984	0.0552	1.78	0.074	-0.0097	0.2066
Implications	-0.0593	0.0534	-1.11	0.266	-0.1639	0.0452

JOINT SIGNIFICANCE TEST FOR ORIGIN AND CONGESTION COEFFICIENTS.

Test $Origin_i = 0$, $Congestion_i = 0$	
$Chi^2(2)$	0.97
$Prob>Chi^2$	0.6170

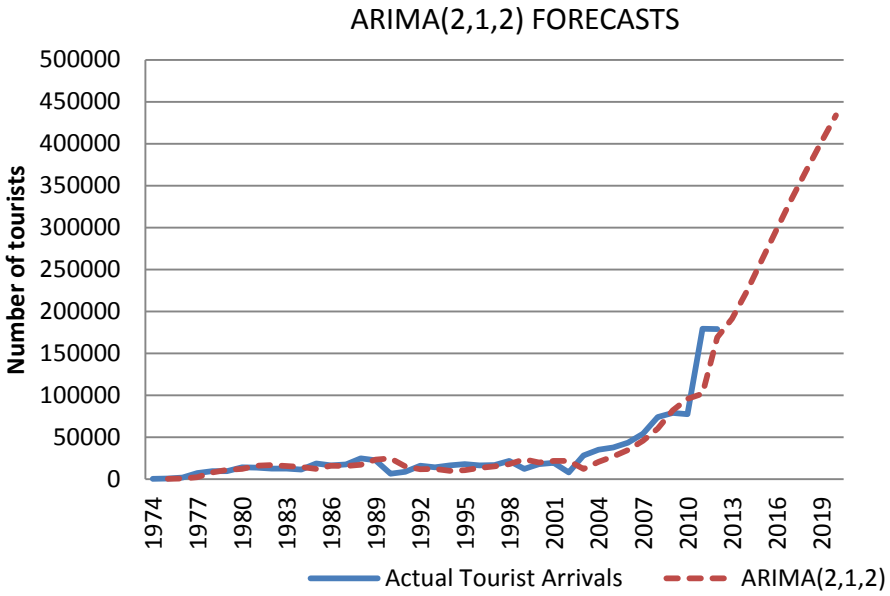
Appendix B

DICKEY-FULLER TEST FOR THE STATIONARITY OF TOURIST ARRIVALS

Dickey-Fuller test for unit root			Number of obs = 38	
	Test Statistic	---------- Interpolated Dickey-Fuller ---------		
		1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	1.557	-3.662	-2.964	-2.614
MacKinnon approximate p-value for Z(t) = 0.9977				

MODELING 1974-2012 TOURIST ARRIVALS – ARIMA(2,1,2)

ARIMA regression					Number of obs = 38	
Sample: 1975-2012 Wald chi^2 (4) = 831.95 Prob > chi^2 = 0.0000 Log likelihood = -421.0975						
Total tourist arrivals	Coefficient	OIM Std. Error	z	P>|z|	[95% Confidence Interval]	
ARMA						
AR						
AR1	1.3445	0.1788	7.52	0.000	0.9941	1.6949
AR2	-0.3716	0.1829	-2.03	0.042	-0.7299	-0.0132
MA						
MA1	-1.7271	0.1285	-13.44	0.000	-1.9791	-1.4752
MA2	1.0001	0.1394	7.17	0.000	0.7268	1.2734
/sigma	14376.85	1954.43	7.36	0.000	10546.24	18207.47



MODELLING THE NATURAL LOGS OF 1974-2012 TOURIST ARRIVALS – ARMA(1,0,3)

ARIMA regression				**Number of obs = 39**		
Sample: 1974-2012	**Wald chi^2 (4) = 94268.96**			**Prob > chi^2 = 0.0000**		
Log likelihood = -28.30972						
Total tourist arrivals	**Coefficient**	**OIM Std. Error**	**z**	**P>|z|**	**[95% Confidence Interval]**	
ARMA						
AR						
AR1	0.9976	0.0034	295.05	0.000	0.9910	1.0042
MA						
MA1	0.3707	0.3349	2.1	0.036	0.0475	1.3604
MA2	-0.6812	0.2186	-1.89	0.058	-0.8428	0.0143
MA3	0.2084	0.2084	3.13	0.002	0.2439	1.0607
/sigma	-0.3383	0.0667	-5.07	0	0	-0.2075

TOURIST ARRIVALS 1974-2012 WITH FORECASTS: 2013-2020

Year	Foreign tourists	Domestic tourists	Total	ARIMA(2,1,1)	Ln(actual arrivals)	ARIMA(1,0,3) (natural logs)
1974	500	27	527	-	6.2672	0
1975	650	128	778	527	6.656726	6.258917
1976	1798	253	2051	834.5836	7.626083	6.673294
1977	7127	266	7393	2320.921	8.908289	7.684922
1978	8748	873	9621	7947.78	9.171703	9.086917
1979	9213	621	9834	11812.92	9.193601	9.455627
1980	13104	1013	14117	12095.79	9.555135	9.535528
1981	14000	NA	14000	15307.35	9.546813	9.563871
1982	12786	NA	12786	16405.83	9.456106	9.431721
1983	12833	NA	12833	14501.55	9.459775	9.442362
1984	11785	NA	11785	13545.37	9.374583	9.432565
1985	12245	6666	18911	12396.11	9.847499	9.356292
1986	12828	3683	16511	18198.26	9.711782	9.868728
1987	13668	4114	17782	18916.71	9.785942	9.654436
1988	16256	8608	24864	18398.78	10.12118	9.946468
1989	16079	6669	22748	25018.33	10.03223	10.05506
1990	6342	396	6738	25698.6	8.815518	10.05235
1991	8014	1041	9055	9629.795	9.111073	8.759507
1992	13580	2438	16018	4848.909	9.681468	9.112883
1993	12401	2000	14401	13287.02	9.575053	9.266009
1994	14369	2080	16449	15290.1	9.70802	9.698442
1995	12391	5594	17985	16242.09	9.797294	9.88499
1996	13036	3537	16573	18443.37	9.71553	9.87599
1997	12810	3991	16801	17601.59	9.729194	9.683549
1998	15229	6767	21996	16954.52	9.998616	9.679258
1999	10234	2110	12344	21644.41	9.420925	9.943127
2000	11828	6227	18055	15034.83	9.801178	9.372744
2001	15439	4260	19699	15715.65	9.888323	9.92558
2002	5120	2959	8079	20051.37	8.997024	9.676527
2003	15362	13031	28393	10137.85	10.2539	9.073577
2004	21608	13483	35091	23373.75	10.4657	10.31087
2005	24536	13444	37980	38505.07	10.54482	10.20967

TOURIST ARRIVALS 1974-2012 WITH FORECASTS: 2013-2020 (CONTD.)

Year	Foreign tourists	Domestic tourists	Total	ARIMA(2,1,1)	Ln(actual arrivals)	ARIMA(1,0,3) (natural logs)
2006	26114	17707	43821	42487.9	10.68787	10.96126
2007	28178	26168	54346	47354.8	10.90313	10.69454
2008	35311	39023	74334	57823.02	11.21632	11.01247
2009	30570	48517	79087	78523.79	11.2783	11.10859
2010	22115	55685	77800	88855.85	11.2619	11.33757
2011	36662	142829	179491	86350.41	12.09788	11.30047
2012	38510	140460	178970	174254.6	12.09497	12.19148
2013	NA	NA	NA	208928.9	NA	12.13323
2014	NA	NA	NA	226999	NA	12.38531
2015	NA	NA	NA	250281.3	NA	12.35586
2016	NA	NA	NA	270416.6	NA	12.32649
2017	NA	NA	NA	290667.7	NA	12.29718
2018	NA	NA	NA	309819.1	NA	12.26794
2019	NA	NA	NA	328378.8	NA	12.23877
2020	NA	NA	NA	346189.3	NA	12.20967

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