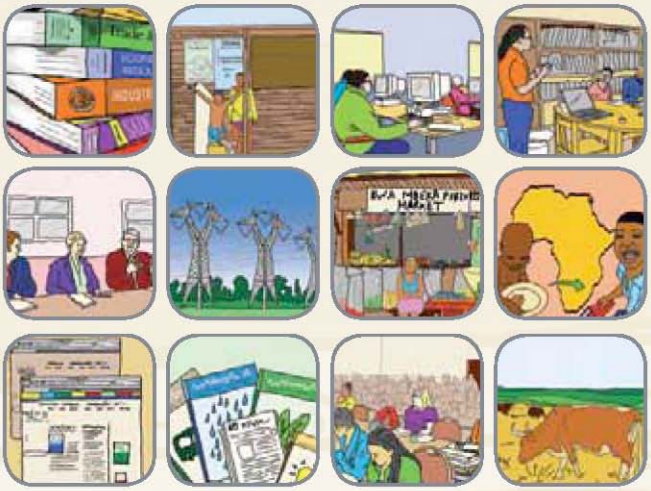
TRADE & INDUSTRIAL POLICY STRATEGIES



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INFRASTRUCTURE AND TOURISM DEVELOPMENT: A DUAL APPROACH

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Abstract

This paper models tourist arrivals into Mauritius from various parts of the world with a view to understand the contribution of different determinants in explaining the success of the island as an international tourism destination. A dual methodological approach was adopted namely panel date and survey frameworks. Results from the econometric analysis indicate that infrastructure capital is positively related to total tourist arrivals as well as on arrivals from the three regions considered. European and American tourists are observed to attach sizeable importance to such infrastructure. Results from the dynamic panel data analysis (GMM methods) are overall consistent those of the fixed effect model. The presence of repeat visits was also detected. Results from the survey analysis overall validate that of the initial set of results particularly to comfort, cleanliness and security. The respondents tended to place lot of emphasis on the availability and quality of public transport, where many of the elements falling under this dimension were rated high with mean score. Univariate descriptive statistics also reveal that public utilities (water and electricity) were the most important. The mean score for the case of soft infrastructure were relatively high side which indicating that the tourists equally ascribe high importance to the soft infrastructure.

Key words: Infrastructure, Dynamic Panel data, Tourists arrival

JEL classification: C33, L83; L91

INTRODUCTION

There exists a significant literature investigating the determinants of tourism flows (Lim 1997 provides a useful survey). Income in country of origin, the cost of travel, relative prices, exchange rates and tourism infrastructure figure among the most prominent determinants of tourism flows in the existing empirical literature. A number of authors, including Gunn (1988) and Inskeep (1991), have cited the infrastructure base of a country as a potential determinant of the attractiveness of a tourism destination. Infrastructure forms an integral part of the tourism package for instance road infrastructure enhances accessibility of tourists to different parts of the destination country while sound airport infrastructure ensures that tourists experience a comfortable transition from the plane into the borders of the destination country and vice versa. As such communication infrastructure allows quick and cheap communication between the origin and destination country as well as providing maximum information about the destination thereby reducing uncertainty, fear and asymmetric information. Other infrastructure such as waste water and energy among others are also believed to result in more reliable services and thus enhancing the attractiveness of the destination.

The cultural diversity, racial harmony and political stability of the island make Mauritius an attractive tourist destination. Tourist arrivals have increased at an annual average growth rate of about 7% over the last three decades, up from 103,000 in 1977 to 761,000 in 2005 and to around 800000 in 2007. The tourists in 2007 were mainly from Europe (65%) and Africa (25%), followed by Asia (6.5%), Australia (1.7%) and America (1.2%). Tourism receipts amounted to about 16% of GDP in 2007, confirming the fact that the tourism industry is indeed a pillar of the Mauritian economy. Mauritius has to date been essentially a beach resort *par excellence*, but the authorities have lately started diversifying the product base by using the concept of eco-tourism.

This paper models tourist arrivals into Mauritius over the period 1983 – 2008 from various parts of the world, namely Europe and the United States, Asia, and Africa,

with a view to understand the contribution of different determinants in explaining the success of the island as an international tourism destination. Indeed it is noteworthy that the authorities in Mauritius have long recognised the importance of sound infrastructure in promoting tourism development in the island. The networks of roads and communication together with the waste water and energy infrastructure have been subject to massive investment and expansion since the mid 80s. Mauritius presents itself as an interesting case whereby the effect of infrastructure on tourist arrivals into the island can be usefully studied. This paper does so by extending a classical demand for international tourism function to include an infrastructure proxy. Panel data equations of tourist arrivals from various parts of the world into the island over the period 1983 – 2008 are estimated. The data is further segregated into three continental panel sets (Europe/America, Asia and Africa) to enable a comparison of the determinants of tourist arrivals from different continents in the promotion of the Mauritian destination.

The findings of the econometric part are also supplemented rigorous survey analysis. In fact the econometric analysis investigates the subject matter at a more aggregate or macro level. Moreover the indicator of infrastructure is a composite stock generated by the PIM which is not without its limitations. A more micro level study which in the first instance would analyse the importance of infrastructure form the tourists themselves and also which in the second instance includes a comprehensive number of the various hard and soft infrastructure is believed to complement our previous analysis.

The rest of the paper is organised as follows: section 2 discuses briefly the theoretical underpinnings and empirical works related to the infrastructure-tourist nexus, section 3 provides an overview of the tourism sector in Mauritius, section 4 presents the econometric framework and analyses the results, section 5 discusses the results of a comprehensive survey results and section 6 concludes.

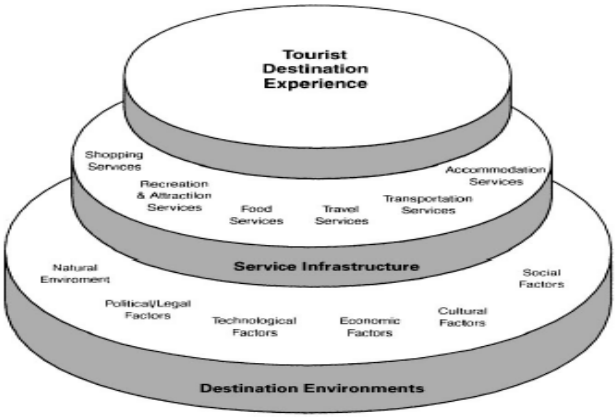
INFRASTRUCTURE AND TOURISM DEVELOPMENT

Gunn (1988) denotes the tourism product as a complex consumptive experience that results from a process where tourists use multiple of services (information, relative prices, transportation, accommodation, and attraction services) during the course of their visit. Other economic and political conditions and structural features are also important factor shaping many tourist experiences and contribute to the nature of the destination product. Murphy et al (2000) related this type of product to supply and a demand analysis and described how various components of the destination interact with travelers during their trip.

Smith (1994) was among the first to acknowledge the role of service infrastructure in creating a product experience. He argued that 'service infrastructure is housed within the larger macro-environment or physical plant of the destination'. He stressed on the fact that the level, use, or lack of infrastructure and technology in a destination (for example transportation in general, water and power supply, use of computer technology and communications among others) are also visible and determining features that can enhanced the visitors' trip experience. They posited that tourists' overall impression develops their image of a destination after their visitation and that infrastructure may play an important role in that respect.

Crouch and Ritchie (2000) interestingly summarised (refer to figure below) the various factors that together make a tourist destination experience attractive. They highlighted the importance the service infrastructure layer, which includes transport services, in tourist destination experience.

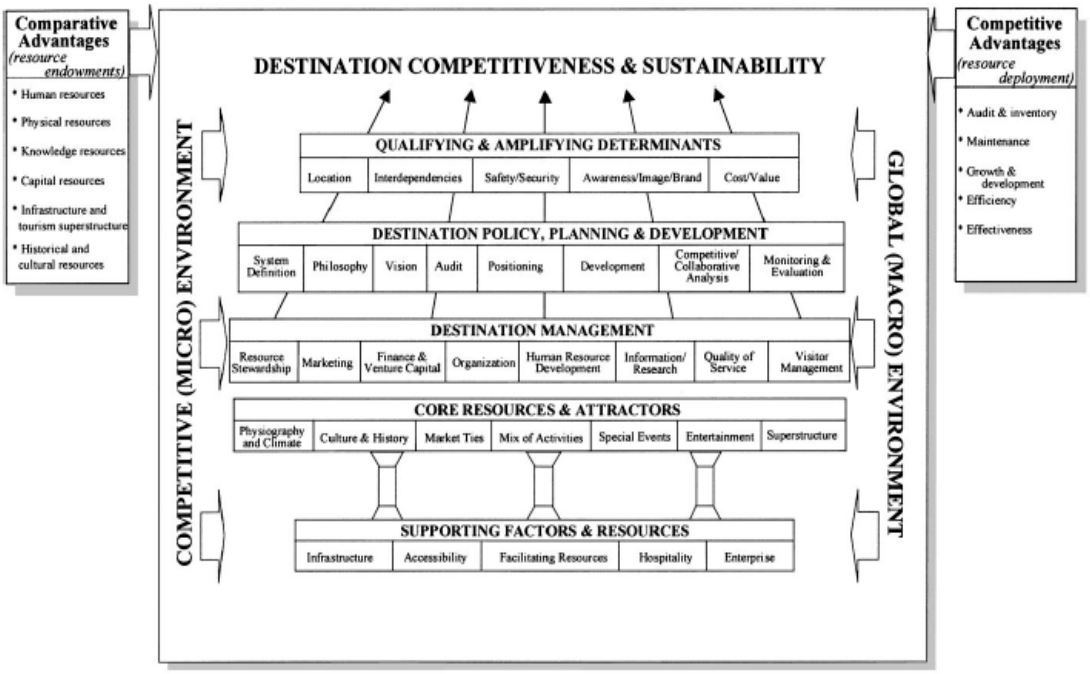
Fig 1 : The tourist destination experience



Source: Crouch and Ritchie (2000)

The tourist destination product is also better understood in the context of comparative and competitive advantage. Refer to figure 2, adapted from Crouch and Ritchie (1999), which depicts a global picture of the determinants of a destination's competitiveness. The authors argued that factor conditions are important determinants of attractiveness as tourists travel to a destination to receive the destination experience. Every element has been categorised under core attraction and supporting elements. We focus on the supporting factors and resources component. The destination's general infrastructure services in this category in fact represent one of the most important factors. The tourism phenomenon relies heavily on public utilities and infrastructural support. Tourism planning and development would not be possible without roads, airports, harbors, electricity, sewage, and potable water. The infrastructural dimension is thus a necessary element for tourism development and the above factors are all basic elements for attracting visitors to a destination. Generally, infrastructure has not been included in empirical works as they are expected to be available at a destination and has not promoted as an attraction factor (see Smith, 1994 and and Crouch and Ritchie 1999).

Fig.2 Destination competitiveness and sustainability



Source: Adapted from Crouch & Ritchie (1999)

Kaul (1985) also recognized the importance of infrastructure, more specifically transport as an essential component of successful tourism development in that it induces the creation of new attractions and the growth of existing ones. The Tourism Task Force (2003) of Australia asserts that infrastructure is a big part of the tourist equation. For instance it is posited that the transport system is responsible for connecting tourism-generating regions to tourism-destination regions as well as providing transport within the tourism destination. A destination should be easy to get to and easy to get around (Prideaux 2000).

Inhabitants of developed countries, from where the majority of tourists originate, are used to modern transport infrastructure that enables high quality service. These tourists prefer to maintain essentially the same comforts as at home while traveling (Cohen, 1979; Mo, Howard and Havitz, 1993)[1]. Prideaux (2000) argued that if the ability of tourists to travel to preferred destinations is inhibited by inefficiencies in the transport system such as uncompetitive prices or lengthy and uncomfortable journey, the likelihood that they will seek alternative destinations may increase.

[1] Mo, Howard and Havitz (1993), using survey methodology, find that tourists prefer to travel to countries that have the same infrastructures as in their home country.

Tourism resort has also often been cited as an important attractor of tourism, especially for the high-class segment. Prideaux (2000) posited that a critical mass of public infrastructure (including transport) is essential for enabling the setting up of high-quality resorts in a country. If this critical mass is not available, the operators would themselves have to incur these infrastructure costs, thereby adding to the capital and operating costs of tourism development and thus reducing competitiveness.

Empirical Evidence

The first type of studies makes use of surveys. Gearing et al (1974) study the case of Turkey as a tourist destination and find that infrastructure (comprising roads, water, electricity, safety services, health services, communications and public transportation) is a key determinant explaining tourist arrivals. Tang and Rochananond (1990) conclude that infrastructure is an important element in promoting Thailand as a tourist destination country. More recently, Kim et al (2000) for the case of Sun Lost City, South Africa, and McElroy (2003) for the case of 51 islands highlight the importance of infrastructure, particularly government financed infrastructure, in the success of a destination.

The second type of studies is based on the estimation of an international tourism demand equation. Witt and Witt (1995) and Lim (1997) provide a comprehensive overview of the regression analysis, model specification, attributes and proxies. Income in country of origin, the cost of travel, relative prices, exchange rate, tourism infrastructure and the level of development in the destination country are among the most common determinants of tourist arrivals in the literature. The majority of studies models aggregate tourist arrivals thereby disregarding the effect of the country of origin. The role of transport infrastructure in destination development has typically not been considered in the models. The regression analysis has overwhelmingly concentrated on developed country destinations to date.

A recent exception is Naude and Saayman (2004) who study the determinants of tourism flows in the case of African countries using panel data regression approach. Applying cross section Ordinary Least Squares (OLS) as well as static and dynamic panel data estimation, these authors identify political stability, personal safety, tourism marketing efforts and available infrastructure as important factors in addition to the classical usual factors in nearly all panel sets analysed, namely aggregate tourist arrivals, arrivals from America, Europe and Africa respectively. However the measure of infrastructure used relates to tourism infrastructure exclusively.

An investigation of the role of infrastructure exclusively, making use of panel regression analysis to explain tourist arrivals from different origin countries into small island economies is, to our knowledge, inexistent. It is believed that the findings of our work constitute a useful supplement to the existing literature and to be of significant relevance to island economies, most of which are tourism-based.

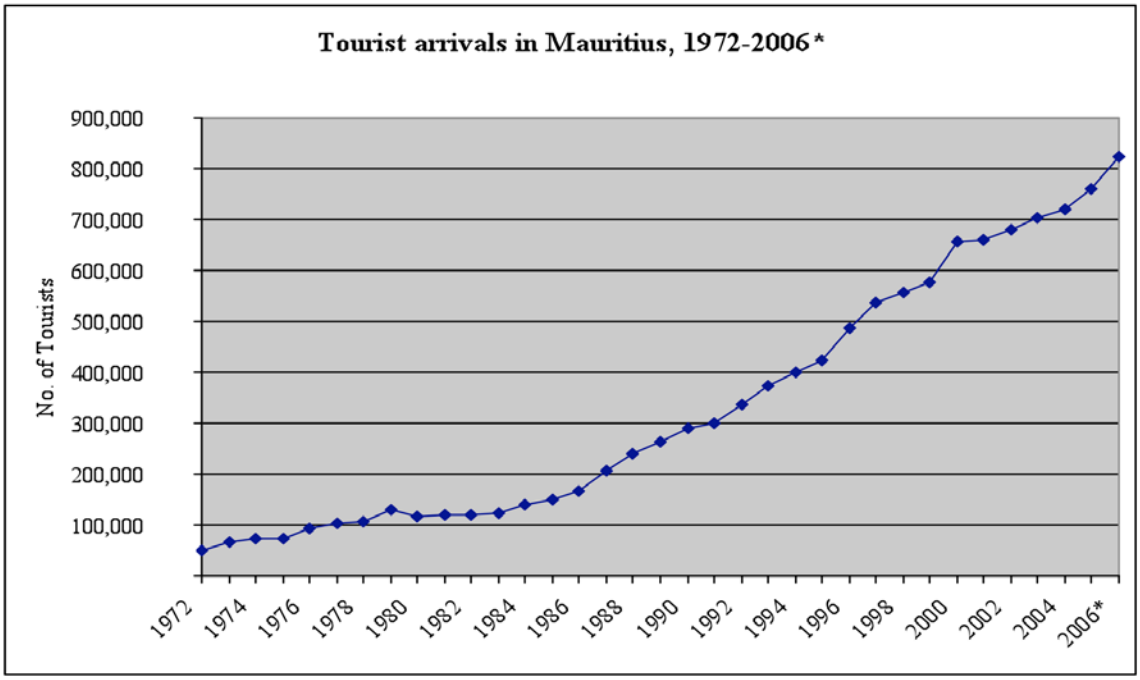
TOURISM IN MAURITIUS

Update to 2009

Mauritius is well known by holiday-makers from around the world as an up-market travel destination. Domestically, tourism has been a key engine of economic growth and development since the early 1980s. It is today among the most important pillar of the Mauritian economy. The tourism sector in Mauritius has consistently recorded robust performances over the past five years. The number of tourists coming to the island in 1975 was 74,597 and has steadily increased to 150,000 in 1985 and further to 291,550 in 1991. The rising trend further continued in 1998 with 570,000 tourists. The number of tourists visiting Mauritius in 2005 has gone up to 761,063 (representing a ten-fold increase between 1975 and 2002). Tourist arrivals rose from 681,648 to 761,063 between 2002 and 2005, representing an increase of more than 11%. The 2004-2005 growth rate was of the order of 5.9% and 825,000 tourists have been visiting the island in 2006, a rise of 8.4% over 2005. Figures below present the rising trend in total tourist arrivals, tourism earnings and

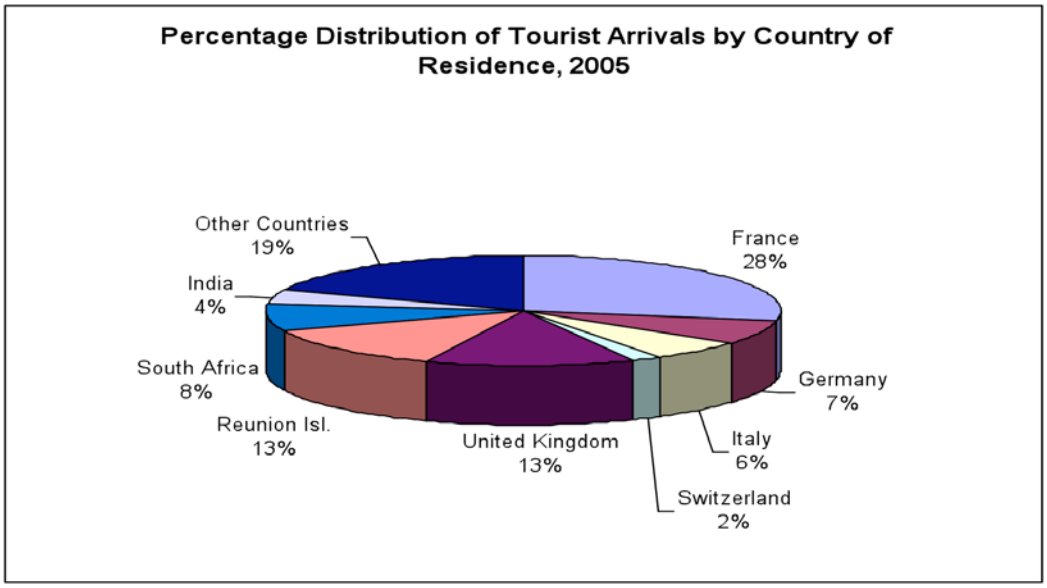
the distribution of Tourist Arrivals in Mauritius. Some key figures about the Mauritian Tourism Sector are shown in table 4.1 and figure 4.3, 4.4 and 4.5 below.

Figure : 3 Tourist Arrivals in Mauritius, 1972-2006*



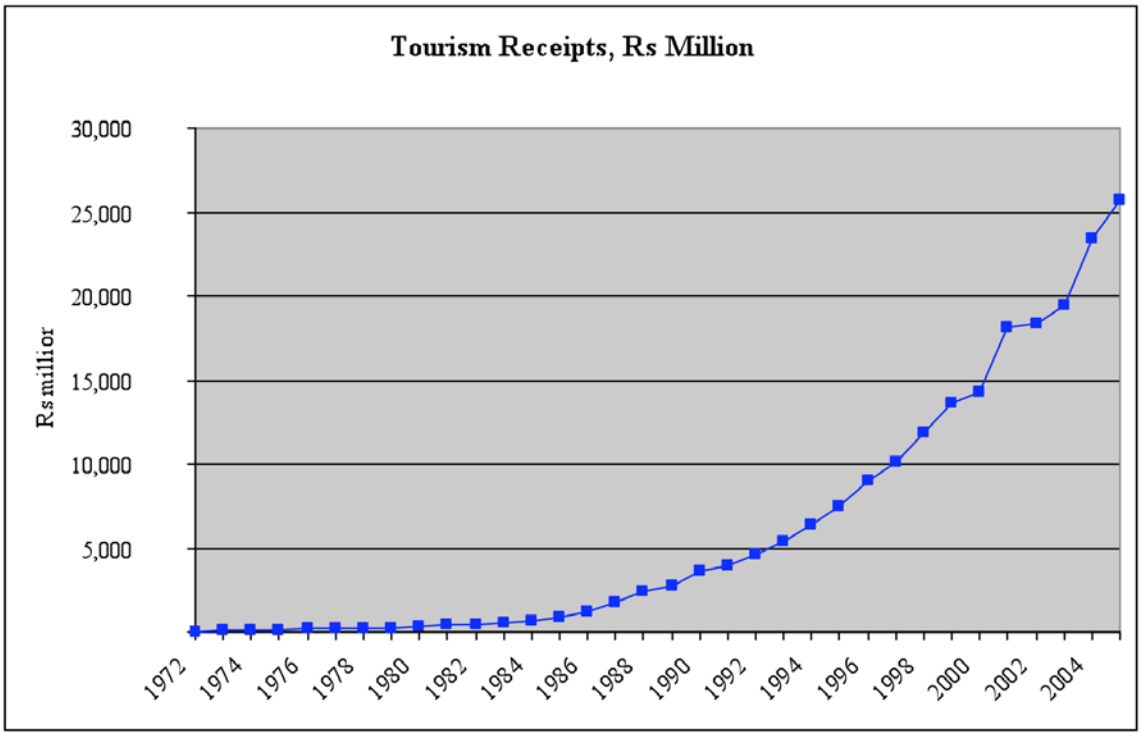
Source: Central Statistical Office *Note: The figure for 2006 is a forecast.*

Figure : Percentage Distribution of Tourist Arrivals by Country of Residence, 2005



Source: Central Statistical Office

Figure 4 : Tourism Receipts, Rs million, 1972-2005.



Source: Central Statistical Office

In the early 1970s, earnings from the tourism sector were very low amounting to only Rs 52 million in 1972. Gross tourist receipts grew to thirty-fold in 1987 to Rs 1,786 million. This phenomenal increase in receipt increased to Rs 3,940 million in 1991 and to date earnings from the tourist industry stands at around Rs 26,000 million.

The good performance in tourist arrivals can partly be attributed to the perception that Mauritius is a secure destination and to the promotional efforts made by the Mauritius Tourism Promotion Authority (MTPA) in Europe and India. Moreover, emerging markets such as Austria, Spain and Australia are rapidly growing. One should also acknowledge the different strategies have been implemented by the Mauritian government to attract tourists. Mauritius offers a number of attractions to tourists in terms of a wide range of hotels, accessibility, beautiful beaches and

richness in culture. Of interest to us, it should be noted that government also invested heavily in public infrastructure, including transportation and these have provided the necessary support infrastructure for tourism in Mauritius. Accumulation of transport infrastructure, particularly air and land transport, is believed to have been an important element in the tourism equation of Mauritius. This is because the island is only accessible by air transport from the major tourist generating countries and such mode of transport is thus crucial. Moreover, Mauritius can boast itself to have one of the best inland transportation and other infrastructure of the continent and made traveling within the tourism destination (to attraction, hotels shopping) easier, more comfortable and reliable.

	1980	***1990***	***1998***	***1999***	***2000***	***2001***	***2002***	***2003***	***2006***
Population ('000)	*1060*	*1080*	*1159.7*	*1174.4*	*1186.1*	*1189*	*1190.3*	*1195.4*	*1197.5*
No. Hotels	*43*	*75*	*90*	*92*	*95*	*95*	*95*	*97*	*110*
Hotel Rooms	*2101*	*4603*	*6809*	*7267*	*8255*	*8657*	*9024*	*9647*	*10233*
Tourist arrival ('000)	*115*	*291.5*	*558.1*	*578*	*656.5*	*660.3*	*681.6*	*702*	*810*
Tourism Receipt (million)	*7500*	*9207*	*11890*	*14668*	*14234*	*18166*	*18238*	*19397*	*21865*
Tourism Receipts (% of GDP)	*6%*	*10%*	*13%*	*13%*	*14%*	*15%*	*16%*	*17%*	*20%*

Table 1: Some key figures about the Mauritian Tourism Sector

Source: CSO (2007)

MODEL SPECIFICATION AND DATA SOURCE

The study uses a dual methodology namely panel data and rigorous survey analysis to investigate the importance of infrastructure capital in the overall tourist attractiveness of Mauritius. For the case of the panel data framework, we specify a classical demand function for international tourism along the lines of Witt and Witt (1995) and Naudee and Saayman (2004), Seetanah and Khadaroo (2007), and augment it with the public infrastructure. The resulting function is:

$$TR_{it} = f(RELATIVE_{it}, GDPF_{it}, ROOM_{it}, DISTANCE_{it}, INFRAS) \quad \textbf{(1)}$$

We use i to index country of origin and t to index year of arrival. The dependent variable TR, the total number of tourist arrivals per annum, is a measure of the demand for tourism to Mauritius. The data are available from the Central Statistical Office (Tourism section) of the island. We draw from the existing literature to identify the independent variables. Real Gross Domestic Product per capita in country of origin (GDPF) is used as a proxy for the spending capacity of tourists. A positive coefficient for variable GDPF in equation (1) would imply that the Mauritian tourism product is a normal good while a negative coefficient would imply an inferior good.

The CPI of the destination country (here Mauritius) adjusted by the US$ exchange rate is used as a proxy for relative tourism prices (RELATIVE). Naudee and Saayman (2004) argue that the inverse of this variable shows the many baskets of goods a tourist has to give up in his home country in order to buy a basket of goods in the destination country. This measure of relative prices captures changes in the real exchange rate over time as well as cross sectional variation in the cost of travel. Demand for the tourism product in a particular destination is likely to be negatively

related to relative tourism prices, as higher cost of living within the destination would make tourists less enthusiastic about that destination.

To capture tourism infrastructure, we follow the standard literature and use rooms available (ROOM) in the destination country. The more rooms there are the higher the capacity and the more competitive is the tourism sector (cheaper price as a result of competition). In any case a minimum number of rooms must be available for a destination to reach its critical mass and also to convince airlines to establish routes. Data on the number of rooms were obtained from the Central Statistical Office of Mauritius.

Distance between the origin and destination countries has also been widely included when modeling tourist arrival (see Witt and Witt 1995). The longer the distance, the higher the airfare and the higher the level of discomfort and opportunity cost. Distance is likely to have a negative effect on tourist arrivals. Distance (DISTANCE) is measured by the air distance in kilometers between the origin and destination countries and is obtained from Gallup, Sachs and Mellinger (1997).

For the purpose of our analysis we have augmented the classical tourism demand function with public capital stocks (INFRAS) of Mauritius. This stock has been constructed using the Perpetual Inventory Methodology (PIM), which has been widely used in the literature (see Lighthart 2000; Kamps 2003 among others). The PIM computes the value of the capital stock by accumulating past purchases of assets over their estimated service lives appropriately adjusted for the rate of depreciation. The implementation of the PIM in this paper is detailed in Appendix 1. Non-transport capital includes communication, energy, waste water and defense infrastructure. The Penn World Table 6.1 and the Accountant General Annual Reports (various issues) provided the data for the construction of these capital stocks. Ceteris paribus, we expect improved infrastructure to attract more tourists.

The study is based on a panel data of tourist arrivals into the small island of Mauritius over the period 1985 – 2006 from 26 major origin countries, accounting for about 90% of total arrivals. The countries of origin are:

Europe/America/Oceania: Austria, Belgium, France, Germany, Italy, Netherlands, Spain, Sweden, Switzerland, United Kingdom, USA, Canada, Australia
Africa : Comoros, Kenya, Malagasy Rep., Reunion, Seychelles, South Africa, Zimbabwe
Asia: Hong Kong, India, Japan, Malaysia, China, Singapore

The majority of tourists coming to Mauritius are from Europe (67%), followed by Africa (25%) and Asia (8%). France with 30% of total tourist arrivals has always been the major source country for Mauritius, followed by the United Kingdom (15%), the sister island Reunion (13%), Germany and South Africa (7%).

Econometric Modeling

The regression specification in equation (1) is written as a log-linear model:

$$tr_{it} = \beta_0 + \beta_1 relative_{it} + \beta_2 gdpf_{it} + \beta_3 room_{it} + \beta_4 dist_{it} + \beta_5 \inf ras + \varepsilon_{it} \qquad \textbf{(2)}$$

The lowercase letters denote that the variables are in natural logarithm. By adopting a log-linear model, we are implicitly taking the elasticity of tourist arrivals with respect to the different explanatory variables to be constant over the period 1985 – 2006.

Regression Analysis

We use panel data techniques as the latter allows for dynamic relations and also for unobserved cross-country heterogeneity. Both fixed effects (FE) and random effects (RE) models have been estimated and the Hausman specification test has been performed to discriminate between them. The Hausman test evaluates the null

hypothesis that the coefficients in the random effects and fixed effects models are the same. The Hausman test favours the fixed effect model as can be seen in Table 1.

We estimate the models for total tourist arrivals as well as for tourist arrivals from Europe/America, Asia and Africa. This approach enables valuable comparative insights by informing to what extent the determinants of tourist arrivals from different regions differ, with particular focus here on infrastructure capital.

Table 3: Panel data estimates: Fixed effects

Dependent variable is $\ln(TR_{it})$, 1985 – 2008

Variable	***Total Tourist Arrivals***	***Arrivals from Europe and US***	***Arrivals from Asia***	***Arrivals from Africa***
constant	*5.23*	*15.34*	*4.34*	*5.54*
	*(1.84)**	*(5.23)***	*(2.22)***	*(1.52)*
relative	*-0.72*	*-0.46*	*-0.46*	*-0.27*
	(-0.66)	*(-1.17)*	*(-3.11)****	*(- 1.78*)*
gdpf	*1.21*	*1.86*	*1.56*	*0.5*
	*(-1.92)**	*(3.21)****	*(1.77)**	*(4.22)****
rooms	*0.52*	*0.64*	*0.33*	*0.31*
	*(1.87)**	*(2.14)***	*(1.87)**	*(0.54)*
dist	*-0.57*	*-0.64*	*-0.22*	*-0.12*
	*(-2.23)***	*(-2.92)****	*(-3.22)***	*(-0.26)*
infras	*0.302*	*0.43*	*0.13*	*0.12*
	*(1.96)**	*(1.86)**	*(1.77)**	*(1.12)*
R^2	*0.71*	*0.76*	*0.72*	*0.52*
Hausman Test	*Prob>Chi2=0.038*	*Prob>Chi2=0.043*	*Prob>chi2=0.051*	*Prob>chi2=0.03*

*significant at 10%, ** significant at 5%, ***significant at 1%

The small letters denotes variables in natural logarithmic and t values are in parentheses

The four equations in Table 2 indicate that infrastructure capital has a positive effect on total tourist arrivals as well as on arrivals from the three regions considered. The coefficient of 0.3 for the case of total tourist arrivals implies that a

10% increase in the stock of infrastructure capital yields a 3% increase in tourist arrivals in the island. European and American tourists attach sizeable importance (coefficient of 0.43) to such capital. This is consistent with the idea that inhabitants of developed countries are accustomed to modern high-quality infrastructure and they prefer to find similar infrastructure in tourism destinations. However Asian and African (coefficients of 0.13 and 0.12 respectively) tourists tend to be less demanding on the infrastructure available in the island.

The coefficient of distance (which may be viewed as a proxy for travel costs) is negative in all four equations of Table 1 and this concurs with theory and previous studies. The distance coefficient is more negative for European and American tourists than for Asian and African tourists. Given that Europe and America are further than Asia and Africa from Mauritius, the present finding indicates that tourists prefer shorter to longer journeys so as to minimise travel discomfort.

The positive coefficients on income in country of origin suggest that the Mauritian tourism product is a normal good. This is encouraging especially given that the island is at the very moment planning to rely a lot more on the tourism sector as a source of foreign currency earnings. Tourist arrivals increase by much more from Europe/America (1.86%) and Asia (1.56%) than from Africa (0.5%) as a result of a 1% increase in income in these respective regions.

On the basis of statistical significance, Table 1 implies that relative prices (Mauritian CPI adjusted for $ exchange rate) matter for tourists from Asia and Africa but not for tourists from Europe and America. This is consistent with Eilat and Einav (2004) in that tourists are less sensitive to prices when they travel to less developed countries because of the low existing price level. Moreover in the Mauritian context, the European and American currencies have basically been on the appreciation side thus cushioning any increase in price level of the destination. Given that the cost of living in Asia and Africa is relatively less and at most comparable to Mauritius, tourists from these two regions factor in the Mauritian cost of living when deciding whether or not to visit the island.

The variable 'rooms', a proxy for tourism infrastructure, is significant overall and indicates that increased hotel capacity generates more tourist arrivals. Tourists from Europe and America, and to a lesser extent those from Asia, do care about the availability of tourism infrastructure. However, such is not the case for tourists from Africa, where the 'rooms' coefficient is statistically insignificant. This may be explained by the fact that African tourists normally reside at cheaper guesthouses, and not hotels, during their stay.

Dynamic Panel Data Regression

The above panel data framework does not capture dynamics. However the operation of reputation effects whereby tourists return to a particular destination when they have had a good experience renders the investigation of dynamics important. To incorporate dynamics into our model, we rewrite equation (2) as:

$$tr_{it} - tr_{it-1} = \alpha_t + \nu tr_{it-1} + \beta x_{it} + \mu_{it} \quad \textbf{(3)}$$

where the LHS is the log difference in tourist arrivals between year *t* and year (*t-1)*
tr_{it-1} is the log of tourist arrivals in year *(t-1)*
x_{it} is the vector of explanatory variables [*lrelative, lgdpf, lroom, ldist, linfras*]
α_t is the period specific intercept terms to capture changes common to all countries
μ_{it} is the time variant idiosyncratic error term

Equation (3) can be rewritten as:

$$tr_{it} = \alpha_t + (\nu + 1) tr_{it-1} + \beta x_{it} + \mu_{it} \quad \textbf{(4)}$$

Equation (4) can be formulated in first-difference as:

$$\Delta tr_{it} = \alpha_t + (\nu + 1) \Delta tr_{it-1} + \beta \Delta x_{it} + \Delta \mu_{it} \quad \textbf{(5)}$$

Since tr_{it-1} is likely to be endogenous to the error term through $u_{it-1,}$ it is inappropriate to estimate equation (5) by OLS. To overcome the endogeneity problem, an instrumental variable is used for Δtr_{it-1}. The Instrumental Variable (IV) method of Anderson and Hsiao (1982) and the GMM estimators (first and second step) of Arellano and Bond (1991) can be used in this regard. It has been argued that IV approach leads to consistent but not necessarily efficient estimates of the parameters (see Baltagi 1995), consequently we apply the GMM technique. Moreover, the first step GMM estimator is used as it has been shown to result in more reliable inference. The asymptotic standard errors from the two-step GMM estimator have been found to have a downward bias (see Blundell and Bond 1998).

The results from estimating equation (5) using the Arellano-Bond (1991) first step GMM estimator are shown in Table 2. The estimated equations for total tourist arrivals and for arrivals from Europe/America, Asia and Africa basically pass the Sargan over-identifying restrictions test and the Arellano-Bond 1st order and 2nd order autocorrelation tests.

The results in Table 2 are overall consistent with the results in Table 1. Infrastructure is a significant part of the tourism demand equation for tourists from Europe/America and, to a lesser extent, for tourists from Asia. Tourists are overall sensible to income in origin country, relative prices and distance. The lagged tourist arrivals variable is positive in all four equations, suggesting that Mauritius is an expanding destination over time. The best potential for expansion lies in the European and American markets (with a lagged coefficient of 0.45). A positive coefficient on lagged tourist arrivals also suggests the presence of repeat visits, which may be reflecting the positive experience of tourists in the island with respect to its multi-cultural background, hospitality, and excellent beach resorts among others.

Table 4: Dynamic Panel Data Estimation (First Step GMM estimator)

Dependent variable is dltr = $\ln(TR_{it}) - \ln(TR_{i,t-1})$, 1985 – 2008

Variable	***Total Tourist Arrivals***	***Arrivals from Europe and US countries***	***Arrivals from Asia***	***Arrivals from Africa***
Constant	*1.37*	*17.4*	*2.14*	*1.34*
	*(1.88)**	*(2.56)***	*(1.23)*	*(2.31)***
ltr(lagged)	*0.32*	*0.45*	*0.14*	*0.16*
	*(1.78)**	*(1.78)**	*(1.47)*	*(1.26)*
dlrelative	*-0.39*	*-0.78*	*-0.31*	*-0.11*
	*-(3.24)****	*-(3.35)****	*(-2.25)***	*(-0.65)*
dlgdpf	*0.61*	*0.73*	*0.16*	*0.37*
	*(1.97)**	*(1.98)**	*(1.76)**	*(1.85)**
dlroom	*0.42*	*0.54*	*0.33*	*0.14*
	*(2.23)***	*(4.85)****	*(1.81)**	*(1.27)*
dldist	*-0.27*	*-0.34*	*-0.16*	*-0.15*
	*(-2.45)***	*(-1.98)**	*(-2.22)***	*(1.93)*
dlinfras	*0.18*	*0.26*	*0.14*	*0.05*
	*(1.95)**	*(2.36)***	*(1.87)***	*(0.46)*
<u>Diagnosis tests</u>				
Sargan Test of Overidentifying restrictions	*prob>chi2= 0.14*	*prob>chi2= 0.003*	*prob>chi2= 0.54*	*prob>chi2= 0.86*
Arellano-Bond test of 1st order autocorrelation	*prob>chi2= 0.23*	*prob>chi2= 0.53*	*prob>chi2= 0.21*	*prob>chi2= 0.43*
Arellano-Bond test of 2nd order autocorrelation	*prob>chi2= 0.58*	*prob>chi2= 0.23*	*prob>chi2= 0.12*	*prob>chi2= 0.005*

*significant at 10%, ** significant at 5%, ***significant at 1%

The small letters denotes variables in natural logarithmic, d denotes variables in first difference and the heteroskedastic-robust z-values are in parentheses and d denotes the first difference of the variables.

Analysis of Survey

The findings of the econometric part were supplemented by conducting a survey to some 684 tourists coming from different originating countries. In fact the econometric analysis dealt with the hypothesis at a more aggregate or macro level. Moreover the indicator of infrastructure is a composite stock generated by the PIM which is not without its limitations. A more micro level study which in the first instance captures the importance of infrastructure form the 'horse's mouth' and also which eventually includes a comprehensive number of the various hard and soft infrastructure is believed to complement our previous analysis. Thus a questionnaire was designed (based on the empirical literature and adapted to the local context) and administered at the SSR Airport in the waiting lounge. The main factors influencing the respondents' choice of destination were captured using a number of statements measured on the 5 point Likert scale. These include location, cost, tourism attraction, quality of service and availability of good infrastructure among others.

Respondents Profile

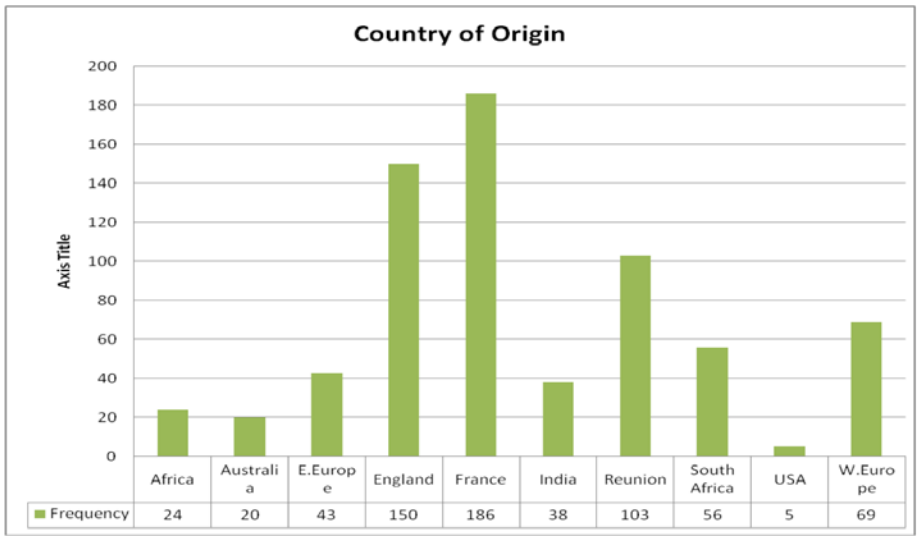
The literature review on 'Infrastructure and Tourism' has showed the importance of infrastructure in the decision to choose a destination . This information was captured by asking a number of questions related with Airport services, Road infrastructure, Hotel infrastructure (e.g. esthetic appeal of room shopping malls, provision of indoor sports and recreational activities etc), Tourist Sites/Attractions infrastructure, Utility infrastructure and Soft Infrastructure that exist in Mauritius. Prior to the analysis, summary statistics are given first on the respondents' profile.

Overall level of Satisfaction

The overall level of satisfaction was mostly positive with 54% and 27% of respondents rated their stay on the island as satisfied and very satisfied. Only few of them claimed that they were not satisfied. The majority of the tourists came from Europe (England and France) as displays in the chart below and Reunion Island is also an important group given its proximity to our island. The survey results are in

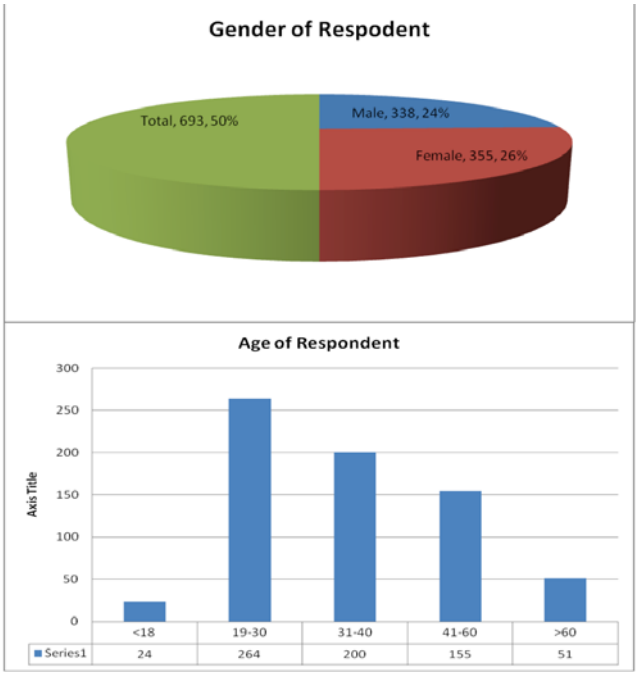
line with the national statistics on tourist arrivals. Mauritius as a tourist destination is not popular among the Africans, Australian and Americans.

Country of Origin

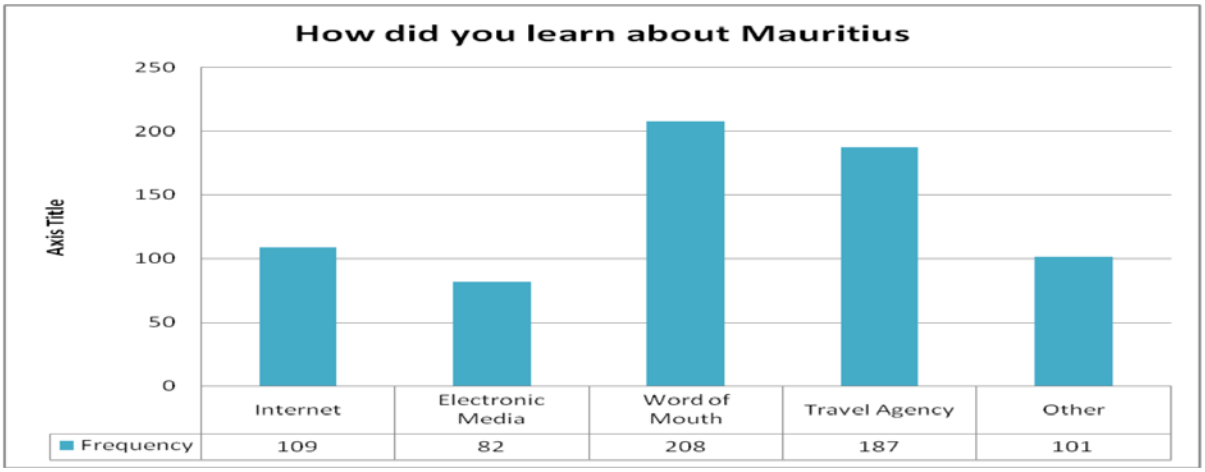


Gender and Age group

The sample is spread among male and female respondents and they represent 48.8% and 51.2% respectively. This frequency is aligned with the national statistics on tourist arrivals and most tourists travel with their partner or as couple. This is confirmed as 56% of the sample is accompanied by only one person during the visit. The variable age is of nominal type and is mainly concentrated in the age bracket (<18, 19-30, 31-40, 41-60, 60>). Most respondents were between (19-30 to 41-60) which makes 89% of the sample.

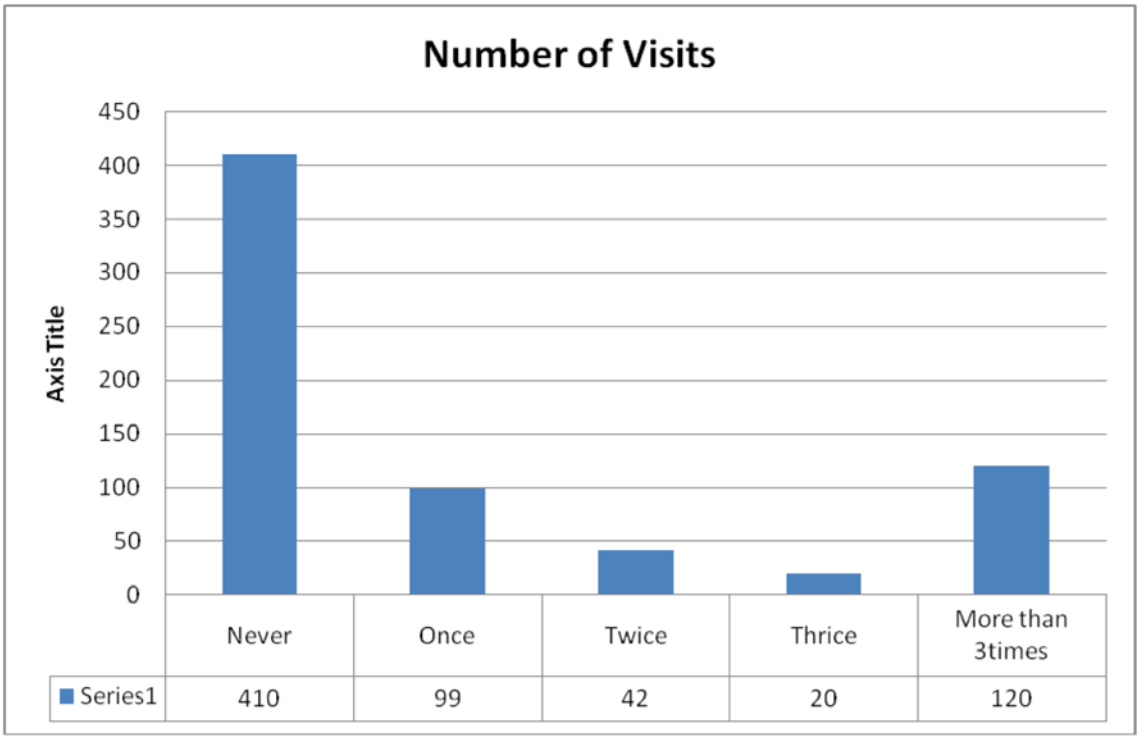


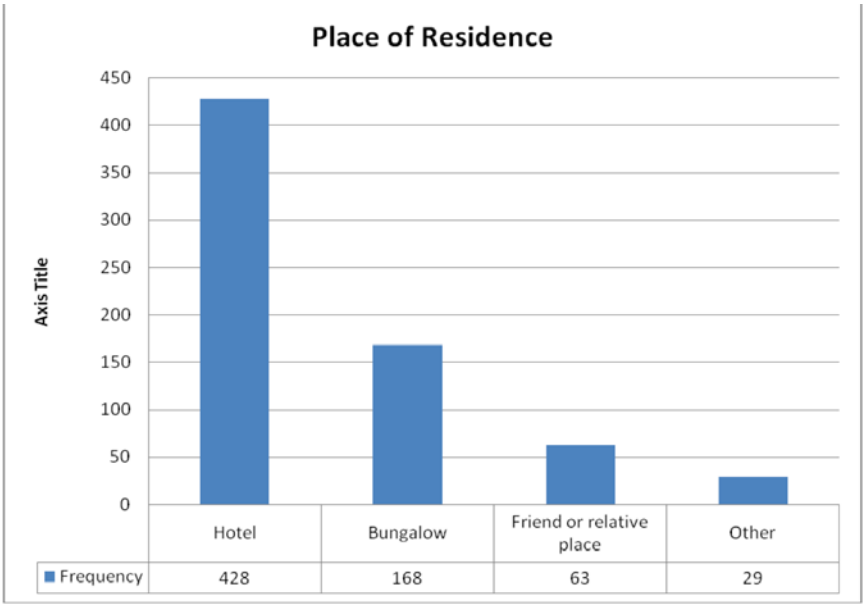
The most popular means of selling Mauritius as a tourist destination is word of mouth followed by travel agency and internet. We may thus expect that exposure to the different dimension of infrastructures will have an incidence on the word of mouth mode of selling Mauritius as a destination. Direct experience of the travellers to the different infrastructure of the country is very important and should thus be taken seriously by the authorities. The chart below shows the statistics for the four main modes of marketing.

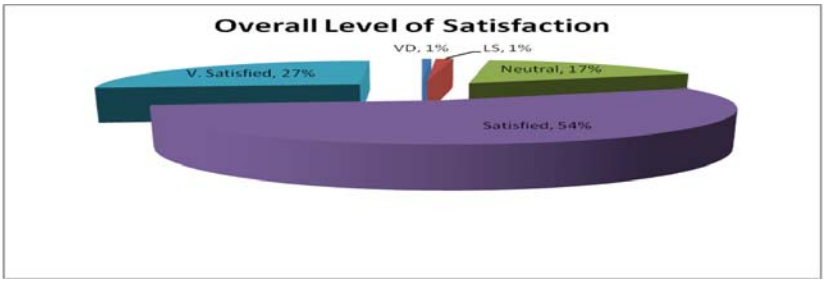


Number of Visits, Length of stay and Place of Residence

Most of the respondents were on their first trip to the island, representing 60% of the sample and 17% of the sample was on their fourth visit, which are tourist from Reunion island. The cross tabulation on the variables country of origin and number of visits is highly significant where 52% of tourists who are on their fourth trip came from Reunion island. The majority of the visitors spent at the most 1 to 2 weeks, which again is in line with the national statistics and thus adds to the representation of the sample. Mauritius is quite renowned for its hotels and has international operators, which attach importance to the different elements of hotel infrastructures. The chart below confirms that hotel accommodation (62%) is the most popular followed by bungalows, which represents 24% of the sample.







Analysis of the initial 14 statements used to capture the most influential factors in the respondents' decision reveal that hospitality of people, overall quality of service, hotel standards and quality infrastructure are important dimension, with mean score of 4.48, 4.39, 4.35 and 3.83 respectively. These dimensions were reduced into three specific components namely Service Level, Stage of Development and Cost using the Principal Component Analysis (PCA) and the results are displayed in Table 1. The variables falling under each component make theoretical sense and the Cronbach Alpha reliability test is high enough to confirm the validity of the technique.

Table 5: Rotated Component Matrix – Importance of General Factors

	Component		
	Service Level	Stage of Development	Cost
Cost of living			.889
Exchange rate			.887
Level of Development		.527	.439
Hotel Standards	.872		
Hospitality of people	.844		
Environmental Tourism		.619	
Overall quality of service	.787		
Political Stability		.688	
Marketing and Media promotions		.737	
Quality Infrastructure	.447	.541	
% Variances	24.69	21.18	18.87
Eigen Values	2.47	2.12	1.89
Cronbach's Alpha	.819	.725	.785

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
Percentage of variance Explained: 64.74.
Kaiser-Meyer-Olkin Measure of Sampling Adequacy: .801

Hotel Infrastructure

Tourists generally spend quality time at the place of their accommodation and would thus pay particular attention to comfort, cleanliness and security. The survey instrument includes 32 statements to capture the respondents rating of the different dimension of the hotel related logistics and infrastructure. The initial descriptive statistics points to the importance attached to the availability of clean room (mean 4.7) and the least importance is the operating time of the casinos and pubs. However, it is to be observed that most of the variables get a mean score of 4 and above, which clearly indicates the importance attached to the hotel infrastructure. Attempt was made to establish if there is any significant difference between these variables and the respondents' profile. Except for the variable number of people accompanying the respondents, the Kruskal Wallis tests show no significant difference between the test variables and the respondents profile.

We may therefore conclude that provision of outdoor sports, provision of emergency facilities, cleanliness of shopping malls and accessibility to leisure centres become critical where the respondents are accompanied by family members.

These variables were reduced into 5 components using the Principal Component Analysis (PCA) and were labeled as Entertainment, Shopping Malls, Room Condition Restaurants and Leisure Activities. This technique was used in order to produce new combinations of the original data which could then be used as independent and orthogonal reference axes (or variables) in later analysis. All the assumptions of the PCA model were satisfied (Hair *et al*., 1998). The results were rotated, using the varimax rotation to isolate more meaningful dimensions. The statistics are displayed below Table 2 and the five components accounted for 72.5 percent of total variance and with eigen values greater than 1. Five variables, namely provision for emergency facilities, information desk, crafts shops, location of restaurant and cable TV were eliminated in the final model since they were not loaded adequately into the components they conceptually belong. Each variable had its highest loading on the component it conceptually belongs to and variables with side-loadings of .40 or less were suppressed. The final model was found to be an appropriate factor-analytic model as indicated by Barlett's Test of Sphericity, the Kaiser-Meyer-Olkin measure of sampling adequacy (.929), and the test for communality.

Table 6: Rotated Component Matrix – Importance of Hotel Infrastructure

	Component				
	Entertainment	Shopping Malls	Room Condition	Restaurants	Leisure Activities
Attractiveness of Hotels			.804		
Customer care and Efficiency			.781		
Esthetic appeal of the room			.834		
Availability of clean room			.853		
Level of Security			.600		
Room Entertainment					.736
Provision of Outdoor sports					.674
Provision of Indoor sports					.767
Music and Entertainment					.690
Restaurants		.636			
Restroom Facilities		.699			
Value for money		.628			
Signage Facility		.753			
Operating Hours		.768			
Level of Security		.701			
Cleanliness of Shopping Malls		.713			
Value for money				.648	
Variety of Dishes				.762	
Cleanliness				.761	
Level of Security				.636	
Restrooms				.738	
Accessibility	.832				
Operating Times	.882				
Value for money	.891				
Level of Security	.824				
Restrooms	.859				
Food & Beverage Services	.885				
% Variances	18.31	16.00	13.94	12.34	10.23
Eigen Values	4.94	4.32	3.76	3.33	2.76
Cronbach Alpha	.963	.914	.923	.903	.820

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
Percentage of variance Explained: 70.82.

Road Infrastructure

The study also attempts to capture the importance of road infrastructure on the tourists decision to choose Mauritius as a destination. Along this line, the survey instrument contains a number of elements encompassing road quality, road security, public transport, car rental facilities and traffic congestion. The respondents tend to place lot of emphasis on the availability and quality of public transport, where many of the elements falling under this dimension were rated high with mean score ranging from 4.17 (Taxi safety) to frequency of public transport (3.97). This was found to be more significant where the number of people accompanying the respondent is above 2 members of the same family. The non-parametric Kruskal – Wallis tests show a highly significant difference for the variables hump/speed breaks, level crossing/footpath, state of public transport, taxi availability and traffic congestion. However, it is interesting to note that there are no significant difference for most of the infrastructural issues based on the respondents profile such as gender, age, length of stay and country of origin.

Utility Infrastructure

The questionnaire also includes a section on the utility infrastructure to capture the respondents' perception on the overall status of this dimension on their decision to choose Mauritius as a destination. These include telephone services, internet facilities and provision of water and electricity. The different elements falling each of the dimension were measured on a 5 point likert scale and the univariate descriptive statistics reveal that public utilities (water and electricity) are the most important with a mean score of 4.47 and 4.44. The next few important elements are speed of internet, network coverage and international phone network. It is interesting to note that affordability of private health and banking facilities are important factors where the respondents are accompanying by family members. The Kruskal Wallis tests show statistical significance between the tests variables.

The 13 statements were grouped into separate components using the PCA, a data reduction technique used to group the number of variables that connote the same utility infrastructure dimension. The final solution includes all the 13 statements, falling under three components which are labelled as Internet Services, Telephone services and Public Utilities. The PCA removed the distorting effect that strong inter-correlations among the 13 variables would have on the calculation of the various 'distance' and 'variance' measures used in the grouping procedure. It is confirmed that there is a need to provide quick and reliable means of communication and should thus become an area of focus from the part of the authorities and the private sector.

Table 7:Rotated Component Matrix – Importance of Utility Infrastructure

	Component		
	Internet Services	Telephone Network	Public Utilities
Phone Network		.771	
International phone network		.810	
Reliability/Connectivity		.806	
Availability of public phones		.789	
Availability of support services		.758	
Network Coverage		.595	
Speed	.827		
Cost	.867		
Reliability	.876		
Availability of Internet Café	.760		
Network Coverage	.854		
Availability/Quality of water			.879
Availability/Reliability of electricity			.882
% Variances	30.76	29.33	15.94
Eigen Values	3.99	3.81	2.07
Cronbach's Alpha	.948	.933	.873

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

Percentage of variance Explained: 76.03.
Kaiser-Meyer-Olkin Measure of Sampling Adequacy: .894

The consistency of the items falling under each component was verified using the Cronbach's Alpha reliability test and the values obtained confirmed same. Initial statistics (showed below the table) suggested that the variables would factor well. The varimax rotated factor loadings show variables clustering as predicted. Most of the variables had a factor loading of .7 and above except for the variable network coverage with a factor load of .595.

Soft Infrastructure

Another important focus of our study is to assess the importance attached to the soft infrastructure. Along this line, the questionnaire contains a number of statements (measured on a 5pt likert scale with anchored 5 for 'very important' and 1 for 'not important at all') to obtain the respondents' views on the overall status of the country's soft infrastructure. They encompass availability of health services, banking services and security services including Tsunami Alert system. The mean score for the 16 statements ranges from 3.85 to 4.28, which indicates that the tourists equally ascribe high importance to the soft infrastructure. The availability and quality of health service is very important in their decision to choose Mauritius as a destination and they also attach equal importance to their security.

Table 8: Rotated Component Matrix – Importance of Soft Infrastructure

	Component		
	Banking Services	Security Services	Health Services
First Aid Facilities			.738
Access to Health Services			.860
Value of money for private health services			.797
Access and Operating hours of drug store			.811
Banking Halls	.763		
Availability of Banking Halls	.733		
Availability of FOREX facilities	.806		
Operating times	.823		
Quality of services	.805		
Security	.680		
IT security services		.585	
Public security services	.404	.732	
Availability of Night patrols		.787	
Street Lightings		.739	
CCTV in public places		.794	
Tsunami/Severe weather notifications		.786	
% Variances	26.54	24.40	18.95
Eigen Values	4.25	3.90	3.03
Cronbach's Alpha	.932	.921	.911

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

Percentage of variance Explained: 69.89.
Kaiser-Meyer-Olkin Measure of Sampling Adequacy: .918

Along the same line as for the previous dimensions of infrastructure (ROAD, HOTEL and UTILITY), these variables were grouped into distinct components using the PCA, a data reduction technique. After varimax rotation three components were identified as showed in *Table 8.* They were labeled as Banking Services, Health Services and Security Services. The consistency of the items falling under each components was verified using the Cronbach's Alpha reliability test and the values obtained confirmed same. Initial statistics (showed below the table) suggested that the variables would factor well.

CONCLUSIONS

This paper models tourist arrivals into Mauritius over the period 1983 – 2008 from various parts of the world, namely Europe and the United States, Asia, and Africa, with a view to understand the contribution of different determinants in explaining the success of the island as an international tourism destination. This paper did so, in the first instance, by extending a classical demand for international tourism function to include an infrastructure proxy. Panel data equations of tourist arrivals from various parts of the world into the island over the period 1983 – 2008 are estimated. The data is further segregated into three continental panel sets (Europe/America, Asia and Africa) to enable a comparison of the determinants of tourist arrivals from different continents in the promotion of the Mauritian destination. Results from the analysis indicate that infrastructure capital has a positive effect on total tourist arrivals as well as on arrivals from the three regions considered. European and American tourists are observed to attach sizeable importance to such infrastructure. This is consistent with the idea that inhabitants of developed countries are accustomed to modern high-quality infrastructure and they prefer to find similar infrastructure in tourism destinations. However Asian and African tourists tend to be less demanding on the infrastructure available in the island.

Given the possibility of dynamism and endogeneity in tourism demand modelling, dynamic panel data analysis and GMM methods were used and the results obtained were are overall consistent those of the fixed effect model. Infrastructure is seen to be a significant part of the tourism demand equation for tourists from Europe/America and, to a lesser extent, for tourists from Asia. Tourists are also observed to be overall sensible to income in origin country, relative prices and distance. A positive coefficient on lagged tourist arrivals also suggests the presence of repeat visits, which may be reflecting the positive experience of tourists in the island with respect to its multi-cultural background, hospitality, and excellent beach resorts among others.

The findings of the econometric part are also supplemented rigorous survey analysis. Results from the analysis overall validate that of the initial set of results Tourists generally spend quality time at the place of their accommodation and would thus pay particular attention to comfort, cleanliness and security. The initial descriptive statistics points to the importance attached to the availability of clean room (mean 4.7) and the least importance is the operating time of the casinos and pubs. Most of the variables got a mean score of 4 and above, which clearly indicated the importance attached to the hotel infrastructure.

The survey also attempted to capture the importance of road infrastructure on the tourists decision to choose Mauritius as a destination. The respondents tended to place lot of emphasis on the availability and quality of public transport, where many of the elements falling under this dimension were rated high with mean score. This was found to be more significant where the number of people accompanying the respondent is above 2 members of the same family. It is noteworthy that there are no significant difference for most of the infrastructural issues based on the respondents profile such as gender, age, length of stay and country of origin.

The questionnaire also includes a section on the utility infrastructure to capture the respondents' perception on the overall status of this dimension on their decision Univariate descriptive statistics reveal that public utilities (water and electricity) were the most important. The next few important elements were speed of internet, network coverage and international phone network. It is interesting to note that affordability of private health and banking facilities were important factors where the respondents are accompanying by family members.

The mean score for the case of soft infrastructure were relatively high side which indicating that the tourists equally ascribe high importance to the soft infrastructure. The availability and quality of health service was very important in their decision to choose Mauritius as a destination and they also attach equal importance to their security.

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Appendix 1

Description of the methodological computation of capital stock

The PIM approach computes the value of the capital stock by accumulating past purchases of assets over their estimated service lives (gross capital stock) appropriately adjusted for the rate of depreciation (net capital stock). This methodology has been recommended by the OECD (2001a) (For interested reader see OECD 2001a) and the US Bureau of Economic Analysis (1999) and has been widely used in the literature (see for instance Pedroni and Canning 1999; Lighthart 2000; Canning and Bennathan 2000; Kamps 2003). The PIM requires current price estimates of Gross Domestic Fixed Capital Formation and price indexes over many years and also assumptions about the expected lifetime of the respective assets. It should be noted that although the perpetual inventory method has been widely applied in the literature, however it is not free from criticism. Among the main ones features the assumptions concerning the life-spans of capital good and appropriate deflators (Sturm and de Haan 1995).

Under the simplifying assumption of a constant rate of deterioration, δ, the general equation for the PIM is

$$CapitalStock_{yr} = CapitalOutlay_{yr} + (1 - \partial)CapitalStock_{yr-1}$$

To feed the above model, dissagregated data on total transport (include air, sea and land) and non transport government capital investment over the whole period under study was collected and these were available from the various individual Accountant General Annual Reports. The straight line method, recommended in the System of National Accounts (SNA) has been used to calculate the annual estimates of consumption of fixed capital and the Central Statistical Office provided the relevant asset lifespan.