

Analysing Transport Capital as a Determinant of Tourist Arrival in a Co-integration and Error Correction Framework.

Boopen Seetanah*

Although many writers acknowledge the need for efficient transport as an overall element in a successful tourism development program, yet little serious research has been undertaken into the significance of transport as a factor in destination development. Given the importance of the tourism sector to the economy of Mauritius, the objective of the study is double folded and attempts to identify and quantify the factors that made Mauritius attractive to tourists and also to investigate the importance of public capital, particularly transportation capital, in the overall destination's attractiveness. The paper uses co-integration and error correction analysis in an extended demand for international tourism function. Results from the analysis show that transport capital stock of the country has been contributing positively of the number of tourist arrival during our period of study in both short and long run. Such is not observed for the case of non transport infrastructure was found to be insignificant. Interestingly tourism infrastructure is reported to be a more important ingredient than transport, in the tourism equation.

Field of Research: Tourism Economics

1. Introduction

It is often believed and cited that the infrastructure base of a country may be a determinant of the attractiveness of a tourism destination. In particular, we believe that transport infrastructure which provides the vital base for transportation services is an important element in this respect. If the ability of tourists to travel to preferred destinations is inhibited by inefficiencies in the transport system (including the internal transportation system), there is some likelihood that they might seek alternative destinations (Prideau, 2000). Moreover Kaul (1985) recognised the role of transport system as an essential component of successful tourism development and stated that 'transport plays an important role in the successful creation and development of new attractions as well as the healthy growth of existing ones. Provision of suitable transport has transformed dead centers of tourist interest into active and prosperous places attracting multitudes of people'. However although many writers acknowledge (Robinson, 1976; Chew, 1987; Gunn, 1988; Inskeep, 1991; Martin & Witt, 1988 and Naudee and Saayman, 2004 among others) the need for efficient transport as an overall element in a successful program of tourism development, little serious research has been undertaken into the significance of transport as being a potential element in the attractiveness of a destination.

*Seetanah Boopen, School of Public Sector Policy and Management, University of Technology Mauritius, E-mail: b.seetanah@utm.intnet.mu.

The aim of this paper is thus to analyse the determinants of international tourism with focus on public and especially transport capital as potential inputs. It extends a classical demand for international tourism function by including a proxy for both transport and non transport infrastructure to capture the benefits, is any of these inputs in the tourism equation. The study importantly analyses the time series properties of the data from the island economy of Mauritius for the period 1968-2004. It subsequently uses cointegration and error correction analysis to model tourism determinants.

Mauritius provides a good case study given the importance of this sector to the economic growth of the country (see Durbarry, 2002, 2004). In fact international tourism has become a major industry in Mauritius during the past decade following the declining trends of the Sugar sector and Export Processing Zone. The sector now positions itself as the second pillar of the economy. It has nearly surpassed Mauritius traditional exports and there has been a significant increase in the number of tourist arrivals and receipts are shown in table A1 in Appendix 1. Results from the analysis are expected to yield interesting insights into the debate and also supplement the existing body of literature.

The structure of the paper is as follows: section II deals with the theoretical underpinnings of the role of transport in a destination's attractiveness and also with a brief literature review of major studies in the area, Section III explains the model specification, data collection and discusses the empirical results. Section IV concludes and deals with some policy implications.

2. Literature Review

2.1 Theoretical Underpinnings

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. Other authors such as Choy, (1992), Buharis (2000) and Ritchie and Crouch (2000) were of the same opinion of him and 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.

Prideaux (2000) particularly focused on the role of transportation in the tourism equation. He defined the transport system relevant to tourism 'as the operation of, and interaction between, transport modes, ways and terminals that support tourists into and out of destinations and also the provision of transport services within the destination'. A good and attractive transportation system rests to a large extent on quality and availability of transportation infrastructures. These can be seen as comprising of international/domestic air services and international/domestic airport, land transport systems and routes and water transport infrastructures as well. The author argued that the transport system is responsible for connecting tourism generating regions to tourism destination regions and providing transport within the tourism destination (to attraction, hotels, shopping etc). A destination should be easy to get to and easy to get around, particularly if the country is geographically dispersed.

Improved transport infrastructure, particularly for the case of road and land transport, are expected to lead to reduced price of transport. In fact road capacity improvements such as more lanes and higher speed, improved reliability or via higher quality road surfacing causing less strain on vehicles parts, improved access to new destinations and attractions, improved safety (more overtaking lanes, wider road shoulders and improved signage) results in fuel economy and reduced wear and tear and reduced transit time of traffic in general. So these hard transport infrastructure investments will impact the price and quality of tourism travel experiences. In turn these improvements to the price and quality of using hard transport infrastructure can influence the choice of destination and travel mode.

Furthermore inhabitants of developed countries (which constitute the major part of tourist) are used to modern transport infrastructure that enables high quality service. These tourists prefer to maintain essentially the same comforts as home while traveling (Cohen, 1972; Mo, Howard and Havitz, 1993). 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, there is likelihood that they will seek alternative destinations.

Tourism resort has often been cited to be an important attractor of tourism, especially the high class segment of it. The best and renowned resorts definitely appeal to tourist and may prompt them to choose a destination in favour of a competitor. It is believed (see TTF, 2003 and Prideaux, 2000) that for the best of resort, particularly internationally renowned resort, to set up such a mass investment or to expand investment, an adequate level of public infrastructure (together with other fiscal and other incentives) is essential in the country. If not available, it becomes necessary to install expensive backup systems. These add to the capital and operating costs of tourism development and act as a tax on tourism and thus reduce the competitiveness of tourism business relative to other where infrastructure is in place.

From the foregoing discussion there exists a quite strong theoretical support for the role of transport in the enhancing destination attractiveness. However empirical study of the importance of transport on the tourism industry in general and the development of destinations has been particularly lacking.

2.2. Empirical Evidences

Existing empirical researches in the field of the determinants of international tourism attractiveness have tended to ignore the importance of transport and infrastructure at large. Moreover they have mainly been on a national basis and for developed countries cases using survey analysis or lately by modelling an international demand for tourism equation. In the first instance we briefly review the main studies from which we specify our econometric framework to analyse the importance of transport infrastructure as a determinant of tourist arrival.

Gearing et al (1974) offered one of the most comprehensive resource inventories in determining the attractiveness of a tourist destination by taking Turkey as a case study. The authors identified the following the list of attribute groups which were seen to be important namely natural factors, social factors, historical factors, recreational and shopping facilities, food and shelter. They emphasised on the infrastructure of the destination. Under this category feature highways and roads, water, electricity and gas, safety services, health services, communications and public transportation facilities. The category was also extended to tourism infrastructure including hotels, restaurants, vacation villages, bungalows, motels, camping facilities. Subsequently Richtie and Zins (1978) and Ferrario (1979) among others also identified more or less the same factors which they found to contribute to the attractiveness of a tourism destination.

Tang and Rochananond (1990) built on the significant factors affecting tourism as identified by Ritchie and Zins (1978). They analysed the importance of the above factors for a sample of tourists from different countries traveling to Thailand. Based on survey analysis, they reported natural beauty and climate, culture and social characteristics, attitudes towards tourists and cost of living to be important for all cases. The study also ranked infrastructure of a destination country as an important element.

Braithwaite et al (1998) (available in TTF 2003) also reports on research looking specifically at the factors responsible for ensuring success of tourism in 13 regional areas of Australia. Analysis of the survey results showed that attractions (natural, cultural and man made) are considered as the most pivotal factor in regional tourism. Equal second were what they termed 'infrastructure and marketing and promotion' followed by other factors. Infrastructure included air and marine access, road and rail access and non transport tourism infrastructure as well.

Recent studies mostly based on surveys from Murphy, Pritchard and Smith (1995) for the case of Victoria in Canada, Kozak and Rimmington (1999) for the case of Turkey, and McElroy (2003) for the case of 51 islands also highlighted the importance of infrastructure, particularly government financed infrastructure, in enhancing a destination's attractiveness.

Recent studies on the determinants of tourism have been widely based on the estimation of an international tourism demand equation. Among the most common independent variables used and reported to be important in the literature are income of origin country, cost of travel, relative prices, exchange rate, tourism infrastructure and level of development in home country among others. Witt and Witt (1995) and Lim (1997) provide a comprehensive overview of the regression analysis, model specification, attributes and proxies. It is important to point out that the majority of studies using econometric time series approach have overwhelmingly concentrated on developed countries cases and none to our knowledge for the case of small island economies. One rare study in the African context feature Naude and Saayman (2004) who studied the determinants of tourists in the case of African countries using panel data regression approach. Among the important factors they identified political stability, the relative cost of living, health, and hotel capacity. Though infrastructure has been analyzed in the study as a potential element and was found to be overall important however related exclusively to tourism infrastructure like hotels and restaurants.

It is pertinent to point out that existing works have inadequately investigated the time series properties of the data, particularly with respect to the non-stationarity issue which can lead to spurious results. In fact we have hardly come across any study using rigorously testing for stationarity of the series and employing cointegration and error correction econometric modeling to include transport capital as likely potential factors as part of the explanatory variables.

3. Methodology and Analysis

3.1 Model Specification and Data Source

The study attempts to rigorously test the time series properties of the data so that the appropriate econometric modeling is employed. We specify a demand function for international tourism following recent empirical works (see Witt and Witt, 1995; Lim, 1997; Eilav and Einav, 2004, and Naudee and Saayman, 2004), and extended the function to include the public capital stock of the country, segregated into transport and non transport. The economic function is thus specified as follows:

$$TR = f(GDPF, XRAT, RELATIVE, ROOM, TRANS, NONTRANS) \quad (1)$$

The study is based on the small island of Mauritius over the year 1968- 2004. The dependent variable (TR), the total number of tourist arrivals per annum is the measure of demand for tourism to Mauritius. The data were available from the Central Statistical Office of the country.

Among the key independent variables in the model features *GDPF*, the real Gross Domestic Product per capita in countries of origin (weighted average) as proxy for total expenditures on tourism. Overseas travel (especially recreational) is expensive and regarded as a luxury good in which case the discretionary income of origin is important. This proxy has been widely used in both classical and recent works (see Witt and Witt, 1995, Eilat and Einav, 2004 and Naude and Saayman 2004)

Demand for overseas travel in a particular destination is expected to be negatively related to relative tourism prices as higher within the country and relatively higher cost of living would make most tourists less enthusiastic about the destination. Thus for the case of relative prices (measured as *RELATIVE*), we follow Eilat and Einav (2004) and Naudee and Saayman (2004) by using the Consumer Price Index (CPI) of a destination country adjusted by the \$ exchange rate as a proxy for relative tourism prices. As Eilat and Einav (2004) argued 'the inverse of it 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'.

In an attempt to specifically examine the influence of nominal exchange rate on international tourism demand, exchange rates (*XRAT*) have often been introduced into tourism demand models in addition to and separately from the relative price variable (see Martin & Witt (1988) and Witt & Witt (1995) among others). The above variables were obtained and constructed from the Penn World Table 6.1.

In case of tourism infrastructure, we follow the standard literature and use rooms (*ROOM*) available in the country as a measure for the capacity of the tourism sector. The more the room the more the capacity and more competitive that country's tourism sector (cheaper price as competition). Moreover a minimum is hotel accommodation size needed for a destination to reach its critical mass and also to convince airlines to establish routes (Naudee and Saayman, 2004). Data on the number of rooms were obtained from the Central Statistical Office of the country.

To segregate the effects of transportation from the overall infrastructure on tourism arrival, the country's capital stock has been decoupled into transport (*TRANS*) (inclusive of air, land and water transport) and non transport capital (*NONTRAN*) stock. These stocks have been constructed using the Perpetual Inventory Methodology (PIM) as recommended by the OECD (2001). It should be noted that non-transport is equivalent to total public capital minus transport capital. It encompasses other public capital such as communication, energy, waste water and defense among. The Penn World Table 6.1 provided the data for the construction of these forms of capital stock.

3.2 Econometric Modeling

The regression model of equation 1 can be written as

$$tr_t = \beta_0 + \beta_1 gdpf_t + \beta_2 xrat_t + \beta_3 relative_t + \beta_4 room_t + \beta_5 trans_t + \beta_6 nontran_t + \varepsilon_t \quad (2)$$

The specification is of a log linear one and the small letters denotes the natural logarithm of the variables for ease of interpretation of parameters.

3.3 Tests of Stationarity.

We employ both the augmented Dickey-Fuller (ADF) (1979) and Phillips-Perron (PP) (1988) unit-roots tests to investigate the data univariate properties and to determine the degree to which they are integrated. The results are shown in table 2. The tests in fact provide solid evidence and tend to suggest that that the series are non-stationary in levels but indeed stationary in first difference.

Table 1: Summary results of Unit Root Tests in level form: Dickey-Fuller and Phillips/Perron Test

<u>Variables (in log)</u>	<u>Lag selection</u>	<u>Aug. Dickey Fuller</u>	<u>Phillips Perron</u>	<u>Critical Value</u>	<u>Variable Type</u>	<u>Aug Dickey Fuller (time trend (t))</u>	<u>Critical Value</u>	<u>Variable Type</u>
<i>tr</i>	0	+0.26	+0.66	-2.97	<i>I(1)</i>	-1.86	-3.59	<i>I(1)</i>
<i>gdpf</i>	1	-0.193	-0.942	-2.97	<i>I(1)</i>	-2.45	-3.59	<i>I(1)</i>
<i>room</i>	0	-0.298	-0.769	-2.97	<i>I(1)</i>	-1.33	-3.59	<i>I(1)</i>
<i>xrat</i>	1	-1.57	-1.96	-2.97	<i>I(1)</i>	-1.72	-3.59	<i>I(1)</i>
<i>relative</i>	1	-1.52	-1.66	-2.97	<i>I(1)</i>	-2.48	-3.59	<i>I(1)</i>
<i>trans</i>	1	+ 1.13	+ 1.65	-2.979	<i>I(1)</i>	-1.42	-3.59	<i>I(1)</i>
<i>nontran</i>	1	-1.55	-1.28	-2.979	<i>I(1)</i>	-0.92	-3.59	<i>I(1)</i>

Table 2: Summary results of Unit Root Tests in first difference : D/F and Phillips/Perron Test

<u>Variables (in log)</u>	<u>Lag selection</u>	<u>Aug. Dickey Fuller</u>	<u>Phillips Perron</u>	<u>Critical Value</u>	<u>Variable Type</u>	<u>Aug Dickey Fuller (with time trend(t))</u>	<u>Critical Value</u>	<u>Variable Type</u>
Δ <i>tr</i>	0	-5.25	-6.51	-2.98	<i>I(0)</i>	-4.92	-3.60	<i>I(0)</i>
Δ <i>gdpf</i>	0	-4.33	-5.85	-2.98	<i>I(0)</i>	-4.75	-3.60	<i>I(0)</i>
Δ <i>room</i>	0	-5.22	-6.34	-2.98	<i>I(0)</i>	-5.25	-3.60	<i>I(0)</i>
Δ <i>xrat</i>	0	-3.75	-7.21	-2.98	<i>I(0)</i>	-3.74	-3.60	<i>I(0)</i>
Δ <i>relative</i>	0	-3.85	-4.85	-2.98	<i>I(0)</i>	-3.72	-3.60	<i>I(0)</i>
Δ <i>trans</i>	0	-7.34	-9.73	-2.98	<i>I(0)</i>	-4.77	-3.60	<i>I(0)</i>
Δ <i>nontran</i>	0	-4.23	-5.23	-2.98	<i>I(0)</i>	-5.72	-3.60	<i>I(0)</i>

3.4 Co-integration issues

Even when variables are non stationary but stationary in first difference they may still be co-integrated (see Stock, 1987). In fact it can be shown that in a case of co-integrated non-stationary series, ordinary least squares (OLS) estimates of the co-integration vector are consistent and more importantly converge on their true parameter values much faster than in the stationary case. A test for cointegration is undertaken using the Johansen procedure and the results are reported in the table below. The Schwarz Bayesian Criterion (SBC) was used to determine the optimal lag length of the VAR and this chose 1. Results of cointegration rank by Johansen procedure are reported in table 3. Evidence from both trace and maximal eigenvalue tests suggests that there is at most a single cointegrating vector or analogously 2 independent common stochastic trends within the variables equation. At the 5% level, trace value and maximum eigenvalue test both shows there is one cointegrating vector.

Table 3: Test result from Johansen procedure

Johansen Maximum Likelihood procedure of the cointegrating regression $tr = (gdpf, room, relative, xrat, trans, nontran)$:number of cointegrating vectors(s) using the cointegration likelihood ratio.

	Null Hypothesis	Alternative Hypothesis	Test Statistic	Critical Value 5%	Critical Value 10%
Maximal eigenvalue of the stochastic matrix	$r=0$	$r=1$	36.85	33.64	31.02
	$r \leq 1$	$r=2$	19.74	27.42	24.99
	$r \leq 2$	$r=3$	7.56	21.12	19.02
	$r \leq 3$	$r=4$	6.21	17.34	15.56
	$r \leq 4$	$r=5$	4.32	14.88	12.43
	$r \leq 5$	$r=6$	1.34	10.66	8.54
	$r \leq 6$	$r=7$.607E-4	8.07	6.65
Trace of the stochastic matrix	$r=0$	$r > 1$	72.1	70.49	66.23
	$r \leq 1$	$r > 2$	33.24	48.88	45.7
	$r \leq 2$	$r > 3$	12.49	31.54	28.78
	$r \leq 3$	$r > 4$	6.34	25.67	22.65
	$r \leq 4$	$r > 5$	4.34	18.65	15.34
	$r \leq 5$	$r > 6$	1.23	15.65	12.34
	$r \leq 6$	$r=7$	0.607E-4	8.07	5.45

3.5 Theoretical derivation of the ECM

In what follows, since all the series have been proved to be $I(1)$, we shall derive an Error Correction Model (ECM) of our demand for international tourism model. It has a number of useful properties and particularly provides us with a possible approach to deal with problems of non-stationary time series and spurious correlation. In fact it has often been argued that a major advantage of ECM is that it result in equations with first difference and hence stationary dependent variables but avoid the lost of valuable information on the long run relationship.

Recall equation

$$tr_t = \beta_0 + \beta_1 gdpf_t + \beta_2 xrat_t + \beta_3 relative_t + \beta_4 room_t + \beta_5 trans_t + \beta_6 nontran_t + \varepsilon_t \quad (2)$$

where the lower case variables denotes the natural logarithmic of the variables

If the explanatory variables were at all the times in equilibrium then clearly

$$tr_t = \beta_0 - \beta_1 gdpf_t - \beta_2 xrat_t - \beta_3 relative_t - \beta_4 room_t - \beta_5 trans_t - \beta_6 nontran_t = 0. \quad (3)$$

However there are many times when tr will not be at its equilibrium value relative to the explanatory variables and such times, the quantity $y = \beta_0 - \beta_1 gdpf - \beta_2 xrat - \beta_3 relative - \beta_4 room - \beta_5 trans - \beta_6 nontran$ will be non-zero and will measure the extent of disequilibrium between tr and the explanatory variables. Such quantities are therefore known as disequilibrium errors.

Since the explanatory variables are not always in equilibrium we cannot observe the long run relationship (1) directly. We can only observe is a disequilibrium relationship involving lagged values of tr and the explanatory variables which in effect reduces to (1) whenever equilibrium happens to occur. We will denote the disequilibrium relationship by

$$tr_t = \beta_0 + \beta_1 gdpf_t + \beta_2 xrat_t + \beta_3 relative_t + \beta_4 room_t + \beta_5 trans_t + \beta_6 nontran_t + \beta_7 gdpf_{t-1} + \beta_8 xrat_{t-1} + \beta_9 cpi_{t-1} + \beta_{10} room_{t-1} + \beta_{11} trans_{t-1} + \beta_{12} nontran_{t-1} + \alpha tr_{t-1} + u_t \quad (4)$$

where u_t is a disturbance term.

The problem with (4) is that it is an equation in the levels of variables that are likely to be non-stationary. However it can be re-arranged and re-parametrised as follows. Subtract tr_{t-1} from either side and this yields

$$tr_t - tr_{t-1} = \beta_0 + \beta_1 gdpf_t + \beta_2 xrat_t + \beta_3 relative_t + \beta_4 room_t + \beta_5 trans_t + \beta_6 nontran_t + \beta_7 gdpf_{t-1} + \beta_8 xrat_{t-1} + \beta_9 cpi_{t-1} + \beta_{10} room_{t-1} + \beta_{11} trans_{t-1} + \beta_{12} nontran_{t-1} + (\alpha tr_{t-1} - tr_{t-1}) + u_t \quad (5)$$

$$\Delta tr_t = \beta_0 + \beta_1 \Delta gdpf_t + \beta_2 \Delta xrat_t + \beta_3 \Delta cpi_t + \beta_4 \Delta room_t + \Delta \beta_5 trans_t + \Delta \beta_6 nontran_t + (\beta_1 + \beta_7) gdpf_{t-1} + (\beta_2 + \beta_8) xrat_{t-1} + (\beta_3 + \beta_9) cpi_{t-1} + (\beta_4 + \beta_{10}) room_{t-1} + (\beta_5 + \beta_{11}) trans_{t-1} + (\beta_6 + \beta_{12}) nontran_{t-1} - (1 - \alpha) tr_{t-1} + u_t \quad (6)$$

Further re-parameterising, we obtain

$$\Delta tr_t = \beta_0 + \beta_1 \Delta gdpf_t + \beta_2 \Delta xrat_t + \beta_3 \Delta cpi_t + \beta_4 \Delta room_t + \Delta \beta_5 trans_t + \Delta \beta_6 nontran_t - (1 - \alpha) (tr_{t-1} - \gamma_2 gdpf_{t-1} + \gamma_3 xrat_{t-1} + \gamma_4 cpi_{t-1} + \gamma_5 room_{t-1} + \gamma_6 trans_{t-1} + \gamma_7 nontran_{t-1}) + u_t \quad (7)$$

And again re-parameterising,

$$\Delta tr_t = \beta_1 \Delta gdpf_t + \beta_2 \Delta xrat_t + \beta_3 \Delta cpi_t + \beta_4 \Delta room_t + \Delta \beta_5 trans_t + \Delta \beta_6 nontran_t - (1 - \alpha) (tr_{t-1} - \gamma_1 - \gamma_2 gdpf_{t-1} + \gamma_3 xrat_{t-1} + \gamma_4 cpi_{t-1} + \gamma_5 room_{t-1} + \gamma_6 trans_{t-1} + \gamma_7 nontran_{t-1}) + u_t \quad (8)$$

Where $\gamma_1 = \beta_0 / (1 - \alpha)$; $\gamma_2 = (\beta_1 + \beta_7) / (1 - \alpha)$; $\gamma_3 = (\beta_2 + \beta_8) / (1 - \alpha)$; $\gamma_4 = (\beta_3 + \beta_9) / (1 - \alpha)$; $\gamma_5 = (\beta_4 + \beta_{10}) / (1 - \alpha)$; $\gamma_6 = (\beta_5 + \beta_{11}) / (1 - \alpha)$; $\gamma_7 = (\beta_6 + \beta_{12}) / (1 - \alpha)$

Equation 8 is just another way of writing the disequilibrium relationship (4). However it gives very appealing interpretation. It can be regarded as stating that changes in tr depend on changes in the explanatory variables and on the term in the square brackets which is the disequilibrium error from the previous period. This makes sound sense since it implies that the lower (higher) is tr compared with its equilibrium value relative to the explanatory variable, the greater (smaller) will be the immediate rise in tr . The value of tr is thus being corrected for the previous disequilibrium error. Although (3) can be derived from 1 without referring to the long run relationship, it clearly makes sense to give it an error correction interpretation and regard the new parameters $\gamma_1, \gamma_2, \gamma_3, \gamma_4, \gamma_5, \gamma_6,$ and γ_7 as parameters in a long-run relationship like (1). Notice that α and hence $1 - \alpha$ determine the extent to which the disequilibrium in period $t-1$ is 'made up for' in period t .

An ECM makes use of any long-run information about the levels of variables that is contained in the data. An ECM such as 3 involves a parametrisation which clearly distinguishes between long-run and short-run effects. We can observe that the parameters which appear in the disequilibrium error term are the long-run parameters. The coefficients of Δ explanatory variables β_s , are clearly short term parameters, measuring the immediate impact effect on y of a change in the explanatory variable.

So the equation to regress is equation 8. There are two ways in which the final preferred ECM can be estimated. Engle and Granger (1987) proposed a two-step procedure for the estimation of the above equation. Wickens and Breusch (1988) developed an alternative approach. They shown that while the properties of the short-run parameters are identical to those in the two-step procedures estimators, this does not appear to be the case for the estimators of the long-run parameters. There is evidence that the small sample bias is smaller for these latter estimators than it is with the two-step procedure. Since our sample is not a large one, the second approach is preferred¹.

The authors suggested applying OLS to (3) directly and hence to estimate both short and long run parameters together.

Consider equation 8 again that is,

$$\Delta tr_t = \beta_1 \Delta gdpf_t + \beta_2 \Delta xrat_t + \beta_3 \Delta cpi_t + \beta_4 \Delta room_t + \Delta \beta_5 tran_t + \Delta \beta_6 nontran_t - (1 - \alpha)(tr_{t-1} - \gamma_1 - \gamma_2 gdpf_{t-1} + \gamma_3 xrat_{t-1} + \gamma_4 cpi_{t-1} + \gamma_5 room_{t-1} + \gamma_6 tran_{t-1} + \gamma_7 nontran_{t-1}) + u_t \quad (8)$$

The equation can be can be rewritten as

$$\Delta tr_t = \beta_0 + \beta_1 \Delta gdpf_t + \beta_2 \Delta xrat_t + \beta_3 \Delta cpi_t + \beta_4 \Delta room_t + \Delta \beta_5 trans_t + \Delta \beta_6 nontran_t - (1 - \alpha)tr_{t-1} + (1 - \alpha) \gamma_2 gdpf_{t-1} + (1 - \alpha) \gamma_3 xrat_{t-1} + (1 - \alpha) \gamma_4 cpi_{t-1} + (1 - \alpha) \gamma_5 room_{t-1} + (1 - \alpha) \gamma_6 trans + (1 - \alpha) \gamma_7 nontran + u_t \quad (9)$$

Where $\gamma_1 = \beta_0 / (1 - \alpha)$; $\gamma_2 = (\beta_1 + \beta_7) / (1 - \alpha)$; $\gamma_3 = (\beta_2 + \beta_8) / (1 - \alpha)$; $\gamma_4 = (\beta_3 + \beta_9) / (1 - \alpha)$; $\gamma_5 = (\beta_4 + \beta_{10}) / (1 - \alpha)$; $\gamma_6 = (\beta_5 + \beta_{11}) / (1 - \alpha)$; $\gamma_7 = (\beta_6 + \beta_{12}) / (1 - \alpha)$

The estimates of the long run parameter $\gamma_2, \gamma_3, \gamma_4, \gamma_5, \gamma_6,$ and γ_7 can then be obtained from the ratio of the estimated coefficients of $gdpf_{t-1}, relative_{t-1}, relative_{t-1}, room_{t-1}, trans_{t-1}, nontran_{t-1}$ and tr_{t-1} . Similarly we can get estimate of γ_1 .

The following is obtained when running equation 9 using our time series data.

Table 4 : OLS results of the unrestricted regression in difference.
Dependent Variable : Number of Tourist arrivals (1968-2004)

Regressor	Coefficient	t-ratio
β_0	-1.17	4.23
$\Delta gdpf$	0.873	3.45
$\Delta xrat$	-0.367	-2.21
$\Delta relative$	-0.242	-2.11
$\Delta room$	0.234	1.89
$\Delta trans$	0.162	2.43
$\Delta nontran$	0.125	1.23
tr_{t-1}	-0.723	-2.12
$gdpf_{t-1}$	0.887	1.84
$xrat_{t-1}$	-0.191	-2.13
$relative_{t-1}$	-0.587	-2.12
$room_{t-1}$	0.271	1.94
$trans_{t-1}$	0.161	1.83
$nontran_{t-1}$	0.121	1.02
R^2	0.74	

The results also passes all diagnosis test of serial correlation (DW = 2.10 and Lagrange multiplier test of residual serial correlation), Heteroscedasticity (based on the regression of squared residuals on squared fitted values) and R square of 0.74 is reported

The respective long run parameters were subsequently calculated to be

$$\gamma_1 (\text{constant}) = -1.63; \gamma_2 (gdpf) = 1.20; \gamma_3 (xrate) = -0.264; \gamma_4 (relative) = -0.81; \gamma_5 (room) = 0.375; \gamma_6 (trans) = 0.22; \gamma_8 (\text{nontrans}) = 0.17$$

The results from the above analysis show that transport infrastructure is indeed an important element of the tourism equation and confirms previous theoretical discussions. In fact there is a positive contribution of transport capital both in the short run (0.16) and in the long run as well (0.22) suggesting thus that a one percent increase in transport capital of the country will lead to a 0.22 percent increase in the number of tourist arrival in the country. Tourism infrastructure is also seen to impact positively on tourist arrival and appears to be a more important element than transport infrastructure as witnesses by its higher coefficient. It should be noted that non public transportation capital, though having a positive sign, has an insignificant effect. The other classical variables in our specification seem to have sensible signs and are significant. In particular, the long run coefficient of 1.2 of *gdpf* tallies with the literature and favours the fact that Mauritius is seen as a more luxury destination in the market. The negative and significant coefficient of *relative*, a measure of price elasticity, indicates the tourists are price sensitive, though the reported is less as compared to the

literature (Crouch (1995) found that the price elasticity often fall with the range of unitary). This might be consistent with Eilat and Einav's (2004) view that tourist are less sensitive when they travel to less developed countries because of the low existing price level. Lastly the exchange rate variable (*xrat*) is reported to have negative coefficient and suggest that it may have favoured bargain hunting tourists.

4. Summary

This paper investigated the role of transport infrastructure in enhancing the attractiveness of Mauritius as a tourism destination over the period 1968-2004. After fully analysing the time series properties of our data, the use of co-integration analysis and an error correction framework was preferred. Results from the analysis show that transportation capital is an important element and has contributed positively to the number of tourist arrival. Such is not the case for non transport infrastructure, though having a positive sign, was found to be insignificant. Tourism infrastructure is reported to be a more important ingredient than transport in the tourism equation. Interestingly the positive and high income elasticity suggests that tourism to Mauritius is a luxury product and there is also evidence that tourists are price sensitive to some extent. The study thus highlights the importance of transport infrastructure in adding to the attractiveness of a destination.

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End notes:

1. The Engle Granger Approach was also performed involved regressing the following regression namely $\Delta tr_t = \beta_1 \Delta gdp_t + \beta_2 \Delta xrat_t + \beta_3 \Delta cpi_t + \beta_4 \Delta room_t + \beta_5 \Delta trans_t + \beta_6 nontran_t - (1 - \alpha) e_{t-1} + u_t$. Interestingly the results obtained did not differ significantly as compared to the preferred approach.

Appendix A**Table A1: Some key figures about the Mauritian Tourism Sector**

	1980	1990	1998	1999	2000	2001	2002	2003
Population of MUS	1060000	1080000	1159730	1174400	1186140	1189000	1190344	1195433
No. Hotels	43	75	90	92	95	95	95	97
Hotel Rooms	2101	4603	6809	7267	8255	8657	9024	9647
Tourist arrival	115080	291550	558195	578085	656543	660318	681648	702018
Tourism Rcpt (million)	7500	9207	11890	14668	14234	18166	18238	19397
Tourism Receipts (% of GDP)	6%	10%	13%	13%	14%	15%	16%	17%
Sugar Exports (% of GDP)	18%	16%	9%	8%	8%	7%	7%	6%
EPZ Exports (% of GDP)	17%	35%	28%	26%	25%	22%	20%	18%

Source: Mauritius CSO.