MODELLING TOURISM DEMAND FOR SOUTH AFRICA: AN ALMOST IDEAL DEMAND SYSTEM APPROACH

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Abstract

This paper models tourism demand for South Africa from the UK and the USA, using an almost ideal demand system. An error-correction almost ideal demand system (EC-AIDS) is applied to quantify the responsiveness of UK and USA tourism demand for South Africa, relative to changes in tourism prices and expenditure or income. Short-term own-price, cross-price and expenditure elasticities are derived from the EC-AIDS models. One of the key findings of the paper is that tourism from the UK and USA is not sensitive to price changes in South Africa in the short term. Tourism to South Africa is found to be more income-elastic than price-elastic, indicating that the country is vulnerable to changing world economic conditions. Even though price competitiveness does not yet seem to be a key concern, significant substitution effects are present, with especially Spain and Malaysia benefiting from a decline in South Africa's price competitiveness.

Keywords

Tourism demand, almost ideal demand system (AIDS), error-correction mechanism, South Africa

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1. INTRODUCTION

In recent times, tourism has become a very important sector in countries' economies – partly due to the impact of tourism on a country's gross domestic product (GDP) and the employment opportunities that tourism can offer. Many countries view tourism as a means to increase income, generate foreign currency, create employment and increase revenues from taxes. With the benefits that tourism offers to a country, it is not surprising that developing countries are viewing tourism as a means of alleviating poverty.

The worldwide figures over the past few years make for interesting reading, i.e. from 2005 to 2007 international tourist arrivals grew by 9%, from 800 million to 900 million, according to the World Trade & Tourism Council (WTTC) Report of 2010. Since 2007 a lot has changed in the economic environment, however, with most countries experiencing an economic recession. The global tourism industry also suffered because of tourists' reluctance to travel due to tighter budgets and lack of disposable income. Almost all destinations saw a decline in arrivals, and South Africa was no exception. According to the WTTC summary of the Tourism industry in 2010 (WTTC, 2010), the recession of 2009 effected a drop of 2.1% in real world GDP. The recession mainly affected developed countries, which are the most important source for travel and tourism demand, and tourist arrivals declined by 877 million in 2009.

The study of tourism demand is important, since any change in demand will cause a change in the magnitude of the benefits received. Of particularly interest is the competitiveness of a destination, of which price competiveness forms a central part. The almost ideal demand system (AIDS) proposed by Deaton and Muellbauer (1980) has become the most popular model for estimating price and income elasticities associated with tourism demand. Demand systems differ from the single equation methods due to their systems of equations approach, with tourism expenditure shares as dependent variables. The AIDS system holds additional advantages over the use of single equation models, which normally have little theoretical justification and do not estimate the relationship between equations and variables. The inclusion of different destinations in the AIDS specification is useful for policymakers, since it shows the cross-price elasticities between alternative destinations.

According to the South African Minister of Tourism, Marthinus van Schalkwyk, (Anon, 2011), international tourist arrivals in South Africa grew from one million arrivals in 1990 to almost 10 million in 2010, which equates to a 13% compound growth over the last 20 years. South Africa is the twenty-sixth most visited destination worldwide (UNWTO, 2010). However, the economic recession of 2009 influenced international arrivals to South Africa negatively (see Figure 1). Furthermore, it has to be pointed out that between 2002 and 2008, the growth rate of South Africa's largest long-haul markets, the United Kingdom (UK), France, Germany, the United States of America (USA), the Netherlands and Australia (in that order) was 2.5%. This would suggest that competition for long-haul destinations is fierce, and that tourist demand is relatively elastic when it comes to choosing a destination. The competitive nature of the tourism industry makes it imperative for a country to keep its foreign demand high and therefore requires an understanding of the demand elasticities to changes in prices and income for tourists coming to South African shores.

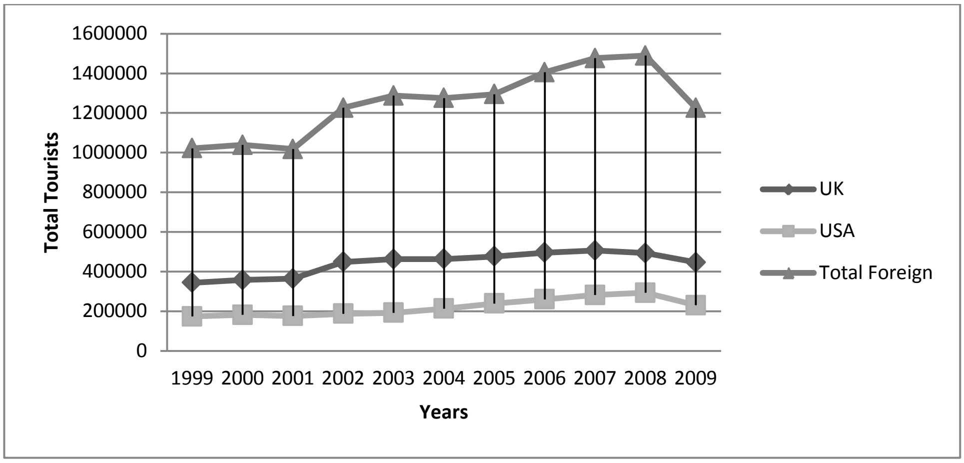

FIGURE 1: Foreign Tourist Arrivals

Source *Statistics South Africa (P0351 various years)*

The purpose of this paper is to model tourism demand for South Africa from the UK and the USA, compared to the demand for alternative destinations, namely Italy, Malaysia, New Zealand, Spain and the UK (USA). The reason for investigating the UK is because it is the largest intercontinental source of tourist arrivals in South Africa. The USA was chosen as it is the largest market for tourist departures to foreign countries in the world and therefore has the potential to become South Africa's main intercontinental tourism market. In addition, the paper will calculate the elasticities associated with tourism demand for South Africa. These elasticities serve as the basis of policy recommendations and conclusions that can be drawn from the AIDS models.

2. LITERATURE REVIEW

The theoretical justification enjoyed by the AIDS model includes the fact that the properties of demand can be imposed on the model through the estimation of a restricted model. According to Snyder and Nicholson (2008), the properties of demand are:

- Adding up: According to microeconomic theory, the adding up restriction implies that the sum of all expenditures weighted by prices should equal unity. Simply put, it means that expenditure cannot exceed the budget constraint of an individual.
- Homogeneity: In terms of homogeneity, microeconomic theory states that the homogeneity of demand assumes that all households face the same prices so that differences in household consumption are based on expenditure patterns and family composition.
- Symmetry: Symmetry applies to the consistency of consumer choice with regard to spending patterns because, without these restrictions, consumers make inconsistent choices. Negativity comes from the concave nature of cost functions due to costs being minimised and utility maximised.
- Negativity: This means that a rise in prices results in a fall in demand as required when the commodities under analysis are considered normal goods.

According to Cortés-Jiménez, Durbarry and Paulina (2009), the AIDS model is based on this microeconomic framework, but it can be generalised to an aggregation level by supposing that normal consumers make multi-stage budgeting choices. Tourists' maximising their utility can be observed when they choose between a set of alternative destinations. In a demand system, such as the AIDS, there are a group of simultaneously estimated equations, one for each budget share.

One of the main advantages of the AIDS model compared to other demand system specifications is that it provides flexibility and is easy to calculate. In terms of demand theory, the AIDS model automatically satisfies the adding up restriction. By imposing parameter restrictions, the homogeneity and symmetry restrictions can be satisfied (Li, Song and Witt, 2004). According to Fuji, Khaled and Mak (1985), the negativity restriction cannot be satisfied by parameters alone, but is likely to be satisfied by any data set created by utility-maximising behaviour.

Due to this model's ease of use and its flexibility, the linear AIDS model is very popular for empirical studies. Apart from testing tourism demand, the AIDS model has been applied successfully in various other demand studies such as the demand for meat supply in South Africa (Taljaard, Alemu & van Schalkwyk, 2004), food demand systems (Kastens & Brester, 1996) and household expenditures (Blundell, Browning & Meghir, 1994).

After Deaton and Muellbauer introduced the AIDS model in 1980, the first pilot studies using the model for tourism demand were done by White (1982), who analysed USA's tourism expenditures in Europe from 1960 to 1981, with White (1985) supplementing his study by grouping countries under seven regions and adding a transportation equation into the demand system.

Studies that used Deaton and Muellbauer's AIDS model without any alterations include those by Fuji et al. (1985). These authors assessed the demand for foreign tourists visiting Hawaii, paying special attention to the price of lodging, food and drink, recreation and entertainment, local transport, clothing and other items. Sinclair and Syriopoulos (1993) determined how tourists from the UK, Germany, France and Sweden allocate their expenditure among groups of Mediterranean countries. Papatheodorou (1999) focused on the demand for international tourism in the Mediterranean from three developed countries (the UK, West Germany and France) and their demand for six Mediterranean countries from 1957 to 1989. He also provided a detailed discussion on the various variables in the AIDS model:

- The dependent variable is the tourism expenditure from the origin country in the destination country as part of the aggregate tourism expenditure of the origin country.
- The set of explanatory variables included prices, total tourist expenditures and a time trend. A problem was encountered in finding data for advertising expenditure and dummy variables for seasonal trends proved to be insignificant. These were dropped from the specification.

De Mello, Pack and Sinclair (2002) constructed an AIDS model of the UK demand for neighbouring counties (France, Spain and Portugal). The focus of this study was to establish whether countries that were considered developing countries (in the case of Spain and Portugal, which moved into the developed country category only in the mid-1980s) had an increase in tourism demand since their 'status' changed and, alternatively, how they compared to a developed country like France. They found that, for the most part, poorer countries can catch up to their richer neighbours, but, in the case of Portugal, it was not as instantaneous, as was the case with Spain, and this holds valuable information for policymakers in attracting foreign tourists.

Han, Durbarry and Sinclair (2006) studied USA's tourism demand for European destinations using a static AIDS model and showed that price competitiveness is important for the USA's demand for France, Italy and Spain, but not so important for the UK. There is also an argument for France and Italy being substitutes for one another, and the same goes for Italy and Spain. In addition, they found that an increase in the USA's tourism expenditure caused the demand for Spain and the UK to decline, while France and Italy benefited from this increase in expenditure.

According to Anderson and Blundell (1983), the basic AIDS model by Deaton and Muellbauer assumes that there is no difference in consumers' short- and long-run behaviour. This implies that the consumer is always in balance. However, there are a few factors that cause the consumer to be out of balance before full correction takes place. These include habit persistence, imperfect information and incorrect expectation.

According to Chambers and Nowman (1997), the assumptions of the static AIDS model are unrealistic. They say that this is so because no attention is paid to the data in terms of its statistical properties and the dynamic nature of time series analysis. Their critique is particularly relevant when the data series contains unit roots, since this may cause spurious results.

Since the few early studies using the AIDS model and the criticism levelled against them, i.e. the lack of ability of the long-run specification to comprehend the dynamic adjustment of tourism demand, AIDS modelling has evolved, with recent studies focusing on a more dynamic framework and the use of different approaches. Popular among these are co-integration and the use of an error-correction mechanism (ECM).

Durbarry and Sinclair (2003) studied tourism demand from France for three markets, Italy, Spain and the UK for 1968-1999, using an error-correction AIDS model (EC-AIDS model). The authors showed that time-trends and lagged endogenous variables can be omitted from the model as they violate the restriction of homogeneity. This can be rectified by having a constant term and first-order differencing. Using the long-run model, it was found that the homogeneity and symmetry restrictions were valid. The elasticities that were derived showed that tourism demand for these destinations was very sensitive to price changes, which, again, indicates a level of price competiveness between the three countries.

With regard to the long-run implementation of the EC-AIDS model, there have been studies that incorporated the error-correction model specification into the linear AIDS model, which allows for the analysis of both the long- and short-run dynamics.

Lyssiotou (2001) was the first to use a non-linear AIDS model and introduce a lagged dependent variable. This was done to capture habit persistence while measuring UK demand for tourism to North America excluding Mexico and 16 other European destinations. One flaw in this study was that neighbouring destinations were aggregated and thus no substitution and complementary effects could be witnessed between these countries.

Li et al. (2004) used a dynamic linear AIDS model to estimate the UK tourism demand for 22 Western European Countries. While comparing the static AIDS model with the dynamic AIDS model they found that the EC-AIDS model was superior to the other models with regard to the properties of a demand function (homogeneity and symmetry) and better in terms of forecasting accuracy. They also found that tourism to Western Europe from the UK can be deemed as a luxury good in the long run; hence a larger numerical price elasticity is found in the long run than in the short run.

Cortés-Jiménez et al. (2009) used monthly data from 1996 to 2005 to evaluate Italian tourism demand for four main European destinations: France, Germany, the UK and Spain. They investigated both the short and the long run, as well as cross-price and expenditure elasticities derived from the dynamic model. They found that the dynamic model outperformed the long-run model in forecasting accuracy. Their study is unique because they measure monthly LAIDS and EC-AIDS models and thus get more accurate results than previous studies, which used yearly data.

Other extensions of the AIDS model can be found in research by Li et al. (2004). Their study introduced a time-varying parameter (henceforth, TVP) to the linear AIDS model (LAIDS) in both the long- and short-run error-correction (EC) forms. They were particularly interested in the structural instabilities in data brought about by high rates of inflation and changing consumer expectations. They conclude that an EC-LAIDS equation is the most appropriate form, but, in terms of forecasting, the TVP models for both the short and long run outperform any of the other AIDS models. They further state that their model has superior forecasting abilities to the normal fixed parameter EC-LAIDS, but that the predictive ability of the TVP needs further investigation.

3. METHOD

The AIDS model, with its system of equations, has an advantage over single-equation models since it can analyse the interaction of budget allocations for different groups or services. The AIDS is also unique in that it has its basis in microeconomic consumer expenditure theory. Therefore it shows how demand is quantified as a function of consumers' expenditure budget and the relative prices of a set of goods and services that they can purchase. In the case of tourism, it shows how tourists choose between alternative destinations based on their budget and the relative prices of destinations.

According to Chang, Khamkaew and McAleer (2010), the AIDS model is preferred to most demand models because it includes a group of consumer goods. Estimating all the consumer goods at once allows this model to interpret tourists' allocation of expenditure on alternative destinations. This potentially permits the AIDS model to provide useful information about the sensitivity of tourism demand to changes in comparative prices and expenditure as well as interaction for competing destinations. Han et al. (2006) state that the AIDS model assumes that consumption is not linked to labour supply. This is done to ensure that consumers' tourism budget shares do not fluctuate in accordance with their work time and effort.

This paper aims is to model tourism demand for South Africa for the UK and the USA using the AIDS approach, and to calculate the relevant elasticities from the model. The elasticities derived from this model are the key to understanding how UK and USA tourists decide upon the destinations they are going to visit based on their expenditure/income, exchange rate and tourism prices.

This section will proceed as follows: firstly, the AIDS model outlining the variables that will be used as well as the specification of the LAIDS model itself will be reviewed. Secondly, the pre-modelling analyses, which include unit root tests, are explained. If the data has unit roots present, a Johansen co-integration test will be performed to identify the presence of co-integration. If co-integration is present the LAIDS is not the correct model and the EC-AIDS model will have to be estimated. Thirdly, the unrestricted model will be estimated, after which a Wald test will be performed to test the homogeneity and symmetry restrictions. If the restrictions hold, it will be unnecessary to estimate the restricted model, and the restricted model will need to be estimated. Finally, after the final model has been estimated, the elasticities will be calculated and a detailed description of them given before a conclusion is reached.

3.1 Model specification

This model was estimated using quarterly data covering the period 1999 first quarter to 2008 fourth quarter. Tourism expenditure and arrivals for the countries in the model were obtained through Tourism New Zealand for New Zealand, the Office of Travel & Tourism Industries for USA arrivals, Tourism Malaysia Corporation for Malaysia, Statistics UK for the UK, Eurostat for Spain and Italy tourist arrivals and the World Bank for their expenditure data, and Stats SA for the South African data.

Price data was obtained from the International Monetary Fund's (IMF) *Yearbook of International Financial Statistics*. The base year was 2000. The same source was used to obtain the exchange rate data for the various countries.

One assumption that is made is that tourists from the UK and the USA allocate their budget expenditure between six main destinations. According to Cortés-Jiménez et al*.* (2009) this is because one assumes that preferences in each group are not influenced by the demand in other groups. The empirical analysis will examine the interrelationships in the budgeting processes of UK's and USA's tourists and the demand for j destinations. These destinations for the UK are South Africa, Italy, Spain, New Zealand, Malaysia and the USA, and for the USA the destinations are South Africa, Italy, Spain, New Zealand, Malaysia and the UK.

The reason these destinations were chosen was because of their geographical importance. South Africa is the destination that is focused on, and New Zealand was chosen as another long-haul destination in the southern hemisphere. Italy and Spain were chosen because they are the two popular destinations in Europe for both the UK and the USA. Malaysia was chosen as a representative destination in the East and because, like South Africa, it is experiencing growth in tourism. The other two countries, the UK and the USA, were chosen as they are popular destinations for USA and UK tourists respectively.

The AIDS model, in particular the LAIDS, is the most popular system used in tourism demand and takes the following functional form (adapted from Cortés-Jiménez et al*.,* 2009):

$$w_{it} = \sum_{j} c_{ij} \ln p_{jt} + b_i \ln RexP + \theta_{1i} Db + \theta_{2i} Dst + \theta_{3i} Dsd + \theta_{4i} Dsf + c_{it} \qquad \textbf{(1)}$$

where i represents the country destination, j denotes all the country destinations, t signifies time with the time being from 1999Q1 to 2008Q4 (Q meaning quarter); ln implies that the variable is transformed in natural logarithms; w_{it} shows share of tourism expenditure assigned in destination i to total tourism expenditure in j destinations. The effective relative price of tourism in each destination is denoted by $\ln p_{jt}$ respectively. The ratio between the UK and USA tourist expenditure and the Stone price index is given by $(RexP = x/P^{*})$, and D shows the dummy variables. In this research, four dummy variables are used: the first dummy variable is Db, which attempts to capture the lead-up to the recession of 2008, which is defined as 1 for the four quarters of 2007, which had abnormally high tourist figures, and 0 for all the other periods.

The other three dummies, Dst, Dsd, Dsf, are seasonal dummies to observe whether there are any noticeable seasonal trends that can be observed in tourist arrivals.

The AIDS model shares a multi-stage budgeting approach, and consists of explaining variations in the shares of budget expenditure. Papatheodorou (1999) states that the AIDS model assumes the presence of a representative consumer, which implies that aggregate data should be expressed in terms of a typical consumer. We use the budget shares constructed as suggested by Papatheodorou (2002): total tourist expenditure of the two countries, the UK and the USA, divided by the total number of tourists from the respective countries, multiplied by the number of tourists that went to each destination.

The real exchange rate is used as the tourism price index, because the exchange rates are adjusted for inflation and this gives a better indication than the nominal exchange rate does of how tourism is affected by the exchange rate (Chang et al., 2010). Eilat and Einav (2004) indicated that using real exchange rates instead of nominal exchange rates provides an improved account of the actual cost of living in both countries, and both indices have a common denominator in being measured relative to a base year. This adjustment can track the changes in costs over time, but cannot capture the real differences of cost of living between the two destinations in terms of actual cost of living.

This Stone price index is used to deflate total expenditure and is calculated by the sum of the weight of country i at time t, multiplied by the logarithm of the price. The Stone price index formula is:

$$\ln P^{*} = \sum_{i} w_{it} \, \ln p_{it} \qquad \textbf{(2)}$$

with $\ln p_{it} = \ln[\frac{CPI_{it} * E_{it}}{CPI_{iUK} * E_{ibase}}]$ for arrivals from UK and $\ln p_{it} = \ln[\frac{CPI_{it} * E_{it}}{CPI_{iUSA} * E_{ibase}}]$ for arrivals from the USA.

$\ln p_{it}$ is effective tourism price, CPI_{it} is the inflation of the destination country at time t, E_{it} is the exchange rate of destination country at time t, CPI_{iUK} and CPI_{iUSA} the inflation of tourists' origin countries; and E_{ibase} is the base exchange rate of pounds sterling for the UK and US dollars for the USA in 2005. TABLE 1 summarises the variables used, their description as well as the data sources.

TABLE 1: Variables, description of the data and source

Variable	*Description*	*Data Used*	*Source*
$w_{it}[wita, wma, wsa, wspa, wuk, wusa]$	Share of tourism expenditure assigned in destination i to total tourism expenditure in j destinations	Quarterly Arrival data from countries	Tourism New Zealand Stats SA the Office of Travel & Tourism Industries for USA Tourism Malaysia Corporation Statistics UK

Variable	*Description*	*Data Used*	*Source*
$\Delta \ln p_{jt}$	Tourism Prices calculated as the real exchange rate	Inflation of the all the countries: Base year 2005 Exchange rate of all the countries.	IMF: *Yearbook of International Financial Statistics*
$\ln RexP$	The natural logarithm of ratio between UK and USA tourist expenditure and the Stone price index is given by $(x/P*)$. Tourist expenditure is given by $\ln(\frac{\frac{\sum EXP_{it}}{POP_t}}{P_t^*})$. where the $\sum EXP$ is the sum of total expenditure by USA (UK) tourists in the six destinations, POP is total number of tourists from the USA (UK) and P^* is the Stone price index.	Sum of Expenditure by USA (UK) tourists. Total departures USA (UK) and the Stone Price index given by (2)	Tourism New Zealand Stats SA the Office of Travel & Tourism Industries for USA Tourism Malaysia Corporation Statistics UK

Source: *Authors' compilation*

3.2 Pre-modelling analysis

The first part of the pre-modelling analysis is to test the data's unit root properties. From theory it is known that a series might be non-stationary in the level form. The Augmented Dickey-Fuller test is used, where the null hypothesis states that a series has a unit root. If the null hypothesis is rejected then the series does not contain a unit root and is therefore stationary. A 5% significance level is used, which means that the null hypothesis of a unit root cannot be rejected if the probability (p) > .05, but it can be rejected if p < .05. The variables and their resulting probabilities from the Augmented Dickey Fuller test are shown in TABLES 2 and 3 below.

TABLE 2: ADF results for USA model

Weight	*Probability* *ADF(level) No Intercept*	*ADF(level) Intercept*	*ADF(First difference) No Intercept*	*ADF(First difference) Intercept*
Wita	0.8026	0.0957	0.0005**	0.0085**
Lnpita	0.7072	0.9308	<0.0001**	0.0016**
Wmal	0.8787	0.9232	<0.0001**	0.0005**

Weight	Probability			
	ADF(level) No Intercept	ADF(level) Intercept	ADF(First difference) No Intercept	ADF(First difference) Intercept
Lnpmal	0.2301	0.7079	<0.0001**	<0.0001**
Wnz	0.8234	0.3506	0.0001**	0.0001**
Lnpnz	0.2879	0.5276	0.0001**	0.0026**
Wsa	0.9939	0.5268	0.0104**	0.0015**
Lnpsa	0.8838	0.0406**	<0.0001**	-
Wspa	0.6815	0.2461	<0.0001**	<0.0001**
Lnpspa	0.7623	0.9060	<0.0001**	<0.0001**
Wuk	0.3294	0.1056	0.0018**	0.0206**
Lnpuk	0.6187	0.5379	<0.0001**	0.0001**
InrexpUSA	0.0859	0.2394	<0.0001**	<0.0001**

Source: *Authors' analysis*

** = indicates significant at a 5% level

TABLE 3: ADF results for UK model

Weight	Probability			
	ADF(level) No Intercept	ADF(level) Intercept	ADF(First difference) No Intercept	ADF(First difference) Intercept
Wita	0.9107	0.2076	0.0004**	0.0052**
Lnpita	0.3245	0.9979	0.0000**	0.0004**
Wmal	0.8946	0.9736	0.0098**	0.0752
Lnpmal	0.5661	0.5163	0.0061**	0.0694
Wnz	0.9627	0.7361	0.2374	0.0180
Lnpnz	0.3326	0.8911	<0.0001**	0.0006**
Wsa	0.8841	0.6120	<0.0001**	0.0003**
Lnpsa	0.9447	0.2851	<0.0001**	0.0005**
Wspa	0.6210	0.0214	<0.0018**	-
Lnpspa	0.4133	0.9884	<0.0001**	<0.0004**
Wuk	0.3125	0.0091	<0.0001**	-
Lnpuk	0.6182	0.6382	<0.0001**	0.0002**
InrexpUSA	0.7504	0.0345**	0.0346**	-

Source: *Authors' analysis*

** = indicates significant at a 5% level

TABLES 2 and 3 show the probabilities that the weights, logarithm of price and logarithm of expenditure data are non-stationary. The ADF test shows that all of the weights in TABLE 2 and TABLE 3 are non-stationary in level form. All the logarithms of price data in TABLES 2 and 3 are also non-stationary in level form when assuming there are no intercepts.

TABLES 2 and 3 also show that the data is stationary after first differencing the non-stationary time series – therefore all variables are integrated of order one (i.e. I(1)). Since all the variables have the same order of integration, a co-integration test can be performed to test for a possible long-run relationship between the variables. Asteriou and Hall (2007:319) indicate that the Johansen co-integration analysis must be used when there are more than two variables, since more than one co-integrating relationship is then a possibility.

The statistics that are generated by the Johansen test are the trace statistic and the maximum eigenvalue statistic respectively. The aim of these statistics is to determine the number of co-integrating vectors. To interpret the model, the use of 'r' is important, because it determines the number of co-integrating vectors. For example, if r = 0 then there are no co-integrating vectors. It is important to note that the two test statistics sometimes have conflicting results and do not always indicate the same number of co-integrating vectors.

TABLES 4 and 5 show the co-integration results for both USA tourists and UK tourists where r = 0 means no integrating vectors, $r \leq 1$ means at least one co-integrating vector. To select the appropriate number of lengths to ensure white noise residuals, the Schwartz criterion was used and the appropriate lag length is 1 for all models.

TABLE 4: Johansen co-integration test results for the USA

Model 1: Italy = wita = $f(lnpita, lnpmal, lnpnz, lnpsa, lnpspa, lnpuk, lnrexp) - 1\ lag$				
Hypothesis	r = 0	0.05 c.v.	r ≤ 1	0.05 c.v.
Trace	353.3254**	169.5991	230.8436**	134.6780
π max test	122.4818**	53.18784	70.07863**	47.07897
ECTi=WITA-(1.88)*LNPITA+(0.09)*LNPMAL+(0.09)*LNPNZ–(0.08)*LNPSA+(1.98)*LNPSPA–(0.12)*LNPUK –(0.001)*LNREPUSA+0.3452 (-1.57) (0.19) (0.38) (-1.08) (1.57) (-0.50) (-0.62) (0.45)				
Model 2: Malaysia = wmal = $f(lnpita, lnpmal, lnpnz, lnpsa, lnpspa, lnpuk, lnrexp) - 1\ lag$				
Hypothesis	r = 0	0.05 c.v.	r ≤ 1	0.05 c.v.
Trace	298.7817**	169.5991	214.7541**	134.6780
π max test	84.02755**	53.18784	68.3217**	47.07897
ECTmal=WMAL-(0.02)*LNPITA–(0.02)*LNPMAL–(0.003)*LNPNZ+(0.004)*LNPSA+(0.01)*LNPSPA+(0.02)*LNPUK+ (2.17e-06)*LNREPUSA+0.0508 (-0.22) (-0.63) (-0.14) (0.61) (0.11) (1.03) (0.48) (0.80)				
Model 3: South Africa = wsa = $f(lnpita, lnpmal, lnpnz, lnpsa, lnpspa, lnpuk, lnrexp) - 1\ lag$				
Hypothesis	r = 0	0.05 c.v.	r ≤ 1	0.05 c.v.
Trace	304.7966**	169.5991	83.74930**	53.18784
π max test	221.0473**	134.6780	70.7892**	7.07897
ECTsa=WSA+(0.02)*LNPITA+(0.003)*LNPMAL–(0.007)*LNPNZ+(0.007)*LNPSA–(0.03)*LNPSPA–(0.0004)*LNPUK+(1.1e-06)*LNREPUSA+0.0028 (0.43) (0.17) (-0.56) (1.95) (-0.57) (-0.03) (0.42) (0.07)				

Model 4: Spain = wspa = f (lnpita, lnpmal, lnpnz, lnpsa, lnpspa, lnpuk, lnrexp) – 1 lag

Hypothesis	r = 0	0.05 c.v.	r ≤ 1	0.05 c.v.
Trace	330.2352**	169.5991	219.8799**	134.6780
π max test	110.3552**	53.18784	63.78611**	47.07897

ECTspa=WSPA+(0.26)*LNPITA–(0.18)*LNPMAL–(0.005)*LNPNZ+(0.001)*LNPSA–(0.24)*LNPSPA+(0.05)*LNPUK–(2.31e-07)*LNREPUSA+0.4198

(1.13) (-2.04) (-0.10) (0.07) (-0.99) (1.17) (-0.02) (2.81)

Model 5: UK = wuk = f (lnpita, lnpmal, lnpnz, lnpsa, lnpspa, lnpuk, lnrexp) – 1 lag

Hypothesis	r = 0	0.05 c.v.	r ≤ 1	0.05 c.v.
Trace	358.2321**	169.5991	231.6262**	134.6780
π max test	126.6059**	53.18784	68.52258**	47.07897

ECTu=WUK+(1.4138)*LNPITA+(0.0931)*LNPMAL–(0.0583)*LNPNZ+(0.0560)*LNPSA–(1.5226)*LNPSPA(0.04)*LNPUK+(2.1e-05)*LNREPUSA+0.20

(1.34) (0.23) (-0.25) (0.78) (-1.37) (0.20) (0.45) (0.31)

Source: *Authors' analysis*

** signifies that a test statistic is statistically significant at the 5% level. Co-integrating vector lags were chosen on the basis of SC, criteria by employing EViews 7. Tests are run employing Eviews 7, 2010. c.v. indicates critical value.

The Johansen co-integration shows multiple co-integrating relationships for each country. According to the maximum eigenvalue and trace statistics, four co-integrating vectors are detected in each model of TABLE 4 and the same number of co-integrating vectors for TABLE 5. This is an indication of the long-term relationships between the various countries when it comes to tourism. Although there may be multiple co-integrating vectors, for the purpose of this study only the first co-integrating vector is used, as suggested by the research of Cortés-Jiménez et al. (2009). The individual equations to determine the error-correction term of individual countries are found underneath the country models in TABLES 4 and 5. The t-statistics are in parentheses.

TABLE 5: Johansen co-integration test results for the UK

Model 1: Italy = wita = f (lnpita, lnpmal, lnpnz, lnpsa, lnpspa, lnpuk, lnrexp) – 1 lag

Hypothesis	r = 0	0.05 c.v.	r ≤ 1	0.05 c.v.
Trace	398.6884**	169.5991	208.2042**	134.6780
π max test	190.4841**	53.18784	73.86753**	47.07897

ECTi=WITA+(0.17)*LNPITALUK+(0.07)*LNPMALUK+(0.0004)*LNPNZUK+(0.01)*LNPSAUK-(0.06)*LNPSPAUK+(0.06)*LNPUSA+(0.007)*LNREPUK-0.21

(0.70) (0.79) (0.008) (1.03) (-0.25) (5.63) (0.81) (-1.26)

Model 2: Malaysia = wmal = f (lnpita, lnpmal, lnpnz, lnpsa, lnpspa, lnpuk, lnrexp) – 1 lag

Hypothesis	r = 0	0.05 c.v.	r ≤ 1	0.05 c.v.
Trace	375.5843**	169.5991	227.5308**	134.6780
π max test	148.0535 **	53.18784	91.59444**	47.07897

ECTmal=WMAL-(0.14)*LNPITALUK+(0.0005)*LNPNZUK–(0.03)*LNPMALUK–(0.003)*LNPSAUK+(0.04)*LNPSPAUK–(0.01)*LNPUSA-(0.002)*LNREPUK+0.17

(-1.83) (0.029) (-1.13) (-0.72) (0.56) (-0.40) (-6.74) (3.14)

Model 3: South Africa = wsa = $f(lnpita, lnpmal, lnpnz, lnpsa, lnpspa, lnpuk, lnrexp) - 1\ lag$

Hypothesis	r = 0	0.05 c.v.	r ≤ 1	0.05 c.v.
Trace	473.3056**	169.5991	284.7124**	134.6780
π max test	188.5932**	53.18784	117.0271**	47.07897

ECTsa=WSA–(0.01)*LNPITALUK+0.04)*LNPMALUK–(0.01)*LNPNZUK+(0.008)*LNPSAUK(-0.17)*LNPSPAUK–(0.07)*LNPUSA–(0.007)*LNREPUK+0.15
(-0.16) (1.07) (-0.45) (1.12) (-1.58) (-2.01) (-12.60) (2.09)

Model 4: Spain = wspa = $f(lnpita, lnpmal, lnpnz, lnpsa, lnpspa, lnpuk, lnrexp) - 1\ lag$

Hypothesis	r = 0	0.05 c.v.	r ≤ 1	0.05 c.v.
Trace	375.8566**	169.5991	205.5345**	134.6780
π max test	170.3221**	53.18784	73.73402**	47.07897

ECTspa=WSPA+(-0.79)*LNPITALUK+(0.07)*LNPMALUK-(0.15)*LNPNZUK+(1.54)*LNPSPAUK+(0.10)*LNPSAUK–(0.18)*LNPUSA+(0.01)*LNREPUK-0.1163
(-1.68) (0.42) (-1.45) (3.11) (3.20) (-1.14) (6.34) (-0.35)

Model 5: USA= wusa = $f(lnpita, lnpmal, lnpnz, lnpsa, lnpspa, lnpuusa, lnrexp) - 1\ lag$

Hypothesis	r = 0	0.05 c.v.	r ≤ 1	0.05 c.v.
Trace	372.8839**	169.5991	206.4663**	134.6780
π max test	166.4177**	53.18784	64.96202**	47.07897

ECusa=WUSA+(0.79)*LNPITALUK–(0.18)*LNPMALUK (0.1762)*LNPNZUK+(0.13)*LNPSAUK–(1.201)*LNPSPAUK+(0.25)*LNPUSA–(0.007)*LNREPUK+0.87
(2.05) (-1.29) (2.06) (-5.06) (-2.97) (1.92) (-3.64) (3.27)

Source: *Authors' analysis*

** signifies that a test statistic is statistically significant at the 5% level. (2) Co-integrating vector lags were chosen on the basis of SC criteria by employing EViews 7. (3) Tests are run employing EViews 7, 2010. c.v. indicates critical value.

Since all the variables are integrated of order one (I(1)), and the Johansen test indicates there exists a long-run relationship between the variables, the EC-AIDS model can be estimated. This model takes into account the errors that occur from consumers and corrects them until they are in equilibrium. According to Khamkaew and Leerattanakorn (2010), the short-run AIDS model includes an error-correction term, because it implies that the present change in budget shares does not depend exclusively on the current change in the relative price of tourism and real total expenditure per tourist, but also on the degree of disequilibrium in the previous period.

The remainder of this research therefore follows the EC-AIDS specification of Han et al. (2006) and Cortés-Jiménez et al. (2009), since the model that is estimated is an error-correction model of tourism demand for South Africa by the UK and the USA. Using the basis of the model that was used by Cortés-Jiménez et al. (2009), the linear AIDs model, as defined in equation (1), is expanded to include an error-correction term. Therefore, the following econometric model for both UK and USA tourist demand is estimated:

$$\Delta w_{it} = \sum_j c_{ij}\,\Delta \ln p_{jt} + b_i \Delta \ln(x/P^*) - \gamma[ECT_{t-1}] + \delta \Delta w_{it-1} + \theta_{1i} Db + \theta_{2i} Dst + \theta_{3i} Dsd + \theta_{4i} Dsf + c_{it} \quad \textbf{(3)}$$

Definitions of the variables are as described under equation 1. Additionally, for variables that have been first-differenced the delta (Δ) is used; the error-correction term, also called the lagged co-integrating vector, is represented by ECT_{t-1}; w_{it-1} is a lagged dependent variable and is included to capture persistence in arrivals.

4. RESULTS

4.1 Unrestricted AIDS Models

According to Cortés-Jiménez et al. (2009), the three most common estimation methods for AIDS models are: ordinary least squares (OLS), maximum likelihood (ML) and seemingly unrelated regression (SUR) estimation. We use the iterative SUR estimation method. According to Moon and Perron (2006), the SUR can be used when a system of equations contains several individual relationships whose disturbance terms are correlated. According to the authors, there are two main advantages in using the SUR method: the first is to gain efficiency in estimation by combining information in different equations, and the second is that the equation can impose/test restrictions that involve parameters in different equations. The estimated results were obtained using EViews 7 econometric software and are shown in TABLE 6 (for UK tourists) and TABLE 7 (for USA tourists) respectively.

TABLE 6: Unrestricted AIDS model for UK tourists

	Italy	*Malaysia*	*South Africa*	*Spain*	*USA*
C	0.004660	-0.000699	0.000384	-0.005343	-1.89E-05
	(1.477051)	(-0.448560)	(0.376761)	(-0.625428)	(-0.002252)
Δ ln P Italy	-0.019291	0.075158	-0.005088	0.443094	-0.511288
	(-0.081057)	(0.668927)	(-0.062404)	(0.670309)	(-0.783768)
Δ ln P Mal	0.211254***	-0.004818	0.013271	-0.148140	-0.086879
	(2.974755)	(-0.136326)	(0.541246)	(-0.749241)	(-0.449598)
Δ ln P SA	-0.005153	-0.002562	0.010242*	0.056272	-0.062059
	(-0.296537)	(-0.315333)	(1.751246)	(1.164765)	(-1.306522)
Δ ln P SPA	0.001676	-0.081833	-0.005528	-0.341659	0.434720
	(0.006971)	(-0.721865)	(-0.067053)	(-0.511164)	(0.658078)
Δ ln P USA	-0.191509***	-0.002356	-0.012111	0.085922	0.141765
	(-3.095871)	(-0.079408)	(-0.571012)	(0.500543)	(0.842976)
Δ ln P NZ	-0.034161	0.015508	-0.023544**	0.105670	-0.049120
	(-1.116962)	(1.094561)	(-2.193069)	(1.266825)	(-0.599188)
Δ ln RPEX	-0.001591	-5.46E-05	-0.000495	0.008709**	-0.006255*
	(-1.196831)	(-0.081319)	(0.935542)	(2.555663)	(-1.860722)
ECT(-1)	-0.094300	0.029039	-0.181271**	-0.077328	-0.066034
	(-1.150446)	(0.170167)	(-2.083346)	(-1.096035)	(-0.87910)

	Italy	Malaysia	South Africa	Spain	USA
W(-1)	0.611222*** (8.392196)	0.543724*** (4.616016)	0.428014*** (4.054982)	0.552550*** (8.694622)	0.549488*** (7.942800)
Db	0.009117** (2.502268)	0.000974 (0.565409)	0.001172 (0.942796)	0.000831 (0.081406)	-0.012562 (-1.252020)
Dst	0.001120 (0.6887)	0.001896 (0.512787)	0.002110 (0.820925)	-0.012291 (-0.652937)	0.006736 (0.367888)
Dsd	-0.005495 (-1.610322)	0.001106 (0.640999)	-0.001026 (-0.893034)	0.001440 (0.152600)	0.004856 (0.526956)
Dsf	-0.009624 (-1.631442)	0.002971 (1.199976)	-0.002479 (-1.227602)	0.035701** (2.484901)	-0.024813* (-1.749509)
R^2	0.685495	0.498722	0.408452	0.668346	0.576643
R^2-adjusted	0.521952	0.238057	0.100847	0.495885	0.356498
DW-Stat	1.908108	1.972335	2.173765	1.746857	1.645919

Source: *Authors' analysis*

*** = 1% significance level ; ** = 5% significance level; * = 10% significance level

TABLE 7: Unrestricted AIDS model for USA tourists

	Italy	Malaysia	South Africa	Spain	UK
C	-0.001334 (-0.150263)	0.001195 (1.123775)	-0.000199 (-0.298227)	-0.003242 (-0.839009)	0.004387 (0.405726)
Δ ln P Italy	-0.556621 (-0.838777)	0.070097 (0.768719)	-0.018477 (-0.336000)	0.070794 (0.275369)	0.484150 (0.740535)
Δ ln P Mal	0.028855 (0.156733)	-0.054256** (-2.142971)	-0.006482 (-0.418105)	-0.161836** (-2.192329)	0.194356 (1.068826)
Δ ln P SA	-0.010479 (-0.227347)	-0.022097*** (-3.654828)	0.010487*** (2.857075)	-0.043275** (-2.570638)	0.055332 (1.174841)
Δ ln P SPA	0.565440 (0.828773)	-0.026420 (-0.283423)	0.02276 (0.405260)	-0.004719 (-0.017861)	-0.612940 (-0.916398)
Δ ln P USA	0.117894 (1.328178)	-0.007872 (-0.658163)	-0.006113 (-0.859416)	-0.018830 (-0.574138)	-0.087840 (-0.994961)
Δ ln P NZ	0.033041 (0.452139)	0.015999 (1.622968)	-0.007948 (-1.279610)	0.010838 (0.402059)	-0.040225 (-0.549873)
Δ ln RPEX	7.59E-06 (0.896089)	-2.07E-06* (-1.765002)	-4.35E-09 (-0.006425)	-2.50E-06 (-0.766360)	-6.00E-06 (-0.707243)

	Italy	*Malaysia*	*South Africa*	*Spain*	*UK*
ECT(-1)	-0.285292**	0.076351	-0.447335**	-0.343145**	-0.334758**
	(-2.238776)	(0.472632)	(-2.154648)	(-2.473922)	(-2.134341)
W(-1)	0.578774***	0.371585***	0.814197***	0.734039***	0.642555***
	(5.966587)	(3.495458)	(5.947657)	(7.384007)	(5.753802)
Db	-0.036930***	0.003681**	0.001714*	0.003531	0.025711**
	(-3.234293)	(2.365027)	(1.908678)	(0.829981)	(2.217986)
Dst	-0.019681	-0.002146	0.001636	-0.002659	0.019375
	(-1.249818)	(-0.951184)	(1.037393)	(-0.466938)	(1.381996)
Dsd	0.028225*	0.000138	-0.001339	0.011974**	-0.038731*
	(1.819569)	(0.109344)	(-1.417824)	(2.209738)	(-1.923137)
Dsf	0.015027	0.001050	-0.000626	0.005745	-0.018654
	(0.937761)	(0.578730)	(-0.613705)	(1.000947)	(-1.032049)
R^2	0.497246	0.625207	0.562218	0.626087	0.493998
R^2-adjusted	0.235814	0.430315	0.334571	0.431652	0.230877
DW-Stat	2.437307	1.382026	1.967177	1.573946	2.452673

Source: *Authors' analysis*

*** = 1% significance level ; ** = 5% significance level; * = 10% significance level

In both TABLES 6 and 7 it can be observed that there are a number of insignificant variables, but they are kept in the estimation to satisfy the requirements of the model. In both TABLES 6 and 7, the lagged dependent variable (W(-1)) is significant for all the countries. This is expected, as it shows that tourist expenditure is affected by that of previous years. Furthermore, the results in TABLE 6 and TABLE 7 are mixed, with the own-price variable and error-correction terms significant only for some countries. As indicated in TABLES 6 and 7, the dummy that was inserted for the recession is significant for most countries. This confirms that 2007 was an abnormal year in terms of tourism. There are also some seasonal dummies that are significant, and this captures the seasonal effect of tourism from the UK and the USA. The R-squared statistics are low, which is not surprising since a number of variables are insignificant.

The two unrestricted models have some similarities with similar models that were estimated by Cortés-Jiménez et al*.* (2009) in that the expenditure variable is not very significant for most countries. The lagged dependent variable is significant for all the countries, which is in contrast to the results found by Cortés-Jiménez et al*.* (2009).

4.2 Model restrictions

As explained in the literature review, the properties of demand can be imposed in the form of restrictions for the AIDS model, the restrictions being homogeneity and symmetry. The Wald test is used to establish whether the restrictions satisfied the null hypothesis of homogeneity and symmetry. The results are presented in TABLES 8 and 9 respectively.

TABLE 8: Wald test for homogeneity, symmetry and combined for UK tourists

	Homogeneity	*Symmetry*	*Combined*
Chi-Squared (probability)	6.3236 (0.276)	4.9690 (0.893)	13.5533 (0.560)

Source: *Authors' analysis*

TABLE 9: Wald test for homogeneity, symmetry and combined for USA tourists

	Homogeneity	*Symmetry*	*Combined*
Chi-Squared (probability)	4.1342 (0.530)	7.3643 (0.691)	12.3701 (0.651)

Source: *Authors' analysis*

For the UK model (indicated in TABLE 8) we cannot reject the null hypothesis of homogeneity and symmetry. TABLE 9 shows that the null hypothesis for homogeneity and symmetry can also not be rejected for the USA models. The models therefore satisfy the restrictions of homogeneity and symmetry, and the unrestricted EC-AIDS model will suffice when calculating the elasticities.

4.3 Elasticities

Han et al. (2006) and de Mello et al. (2002) explain the formulas for calculating the elasticities from an AIDS model. The relevant formulas are shown below and correspond to the parameters estimated according to equation (1):

Expenditure elasticity:

$$\eta_i = \frac{1}{w_i}\frac{dw_i}{d\ln RexP} + 1 = \frac{b_i}{w_i} + 1$$

Uncompensated own-price elasticities:

$$\varepsilon_{ii} = \frac{1}{w_i}\frac{dw_i}{d\ln p_i} - 1 = \frac{c_{ii}}{w_i} - b_i - 1$$

Uncompensated cross-price elasticities:

$$\varepsilon_{ij} = \frac{1}{w_i}\frac{dw_i}{d\ln p_j} - 1 = \frac{c_{ij}}{w_i} - b_i\frac{w_j}{w_i}$$

Firstly, the expenditure elasticity is calculated using the results of the estimation that was provided by the unrestricted AIDS model. The expenditure elasticities for UK and USA tourists are shown by TABLES 10 and 11 respectively.

TABLE 10: Expenditure elasticities for UK tourists

Country	Italy	Malaysia	South Africa	Spain	USA
η	0.989667**	0.996556**	0.982888**	0.999995**	0.752415**

Source: *Authors' analysis*

** = indicates significant at the 5% level

TABLE 11: Expenditure elasticities for USA tourists

Country	Italy	Malaysia	South Africa	Spain	UK
η	1.00002**	0.999874**	1.0000000**	0.999983**	0.999986**

Source: *Authors' analysis*

** = indicates significant at the 5% level

From the above tables it is evident that the expenditure elasticities are all positive, which means that, for UK and USA tourism, none of the destinations is 'inferior', because the shares increase with the real expenditure per capita.

In TABLE 10, it is evident that all of the elasticities are close to unity. This, in part, may be due to the dynamic nature of the model and the preferences of tourists such that no discernable difference can be made between the countries in terms of their expenditure elasticities. The USA's expenditure elasticity is the only one that is not close to unity and shows that UK tourists have a preference for the USA. The same pattern is evident in TABLE 11. Similarly, the dynamic nature of the model could possibly have an influence on the elasticities being so close to unity.

Demand theory dictates that own-price elasticities should be negative. Theoretically, if the price of a product/destination increases, demand should decrease (ceteris paribus). In this study, only the uncompensated own-price and cross-price elasticities are calculated, since De Mello et al*.* (2002) state that uncompensated elasticities focus on the real reaction of the dependent variable to changes in prices, without taking income effects into consideration. This is useful, because it supplies more clear and direct information about the behaviour of demand. This feature of the uncompensated elasticities makes it more viable for policy purposes.

Positive and negative signs for cross-price elasticities indicate whether countries are substitute or complementary destinations. In the AIDS context, De Mello et al*.* (2002) state that concise deductions about the substitute and complementary effects are not always possible because, in previous studies, the models have not produced distinct cross-price effects. They also add that the results of the substitute and complementary effects should not distract from their importance as far as the relative magnitudes and the direction of change in demand goes. The equations for the own-price and cross-price elasticities equations are shown above.

TABLE 12 shows, in terms of UK tourists' own-price elasticities (the diagonal in TABLE 12), that they are mostly sensitive to own price changes. For example, the figures show that a 1% increase in prices in Italy will lead to a decrease of 2.49% in UK tourism demand for Italy. The only inelastic price is that of South Africa, where a 1% increase leads to a 0.51% decrease in tourism demand from the UK. One of the possible reasons why the elasticity for South Africa is quite low is the pound sterling/SA rand exchange rate, where UK tourists do not see an increase in prices as a deterrent to travel to South Africa. Alternatively, it might also indicate that South Africa is still a value-for-money destination for these tourists. This shows that UK tourists are price-*insensitive* when travelling to South Africa.

TABLE 12: Uncompensated own-price and cross-price elasticities for UK tourists

	Italy	*Malaysia*	*South Africa*	*Spain*	*USA*
Italy	-2.48839**	1.372973**	-0.03317	0.016394	-1.24137**
Malaysia	4.742454**	-4.30649**	-0.16153	-5.16129**	0.14778**
South Africa	-0.17341**	0.459414**	-0.51455**	-0.18213**	-0.41472**
Spain	0.831246	-0.27791	0.105567**	-1.03159**	0.161192
USA	-0.51129**	-0.08688	-0.24043**	1.866288**	-1.21087**

Source: *Authors' analysis*

** = indicates significant at a 5% level

In terms of cross-price elasticities, it can be seen that most of the countries compete on prices. Positive signs mean that a country is a substitute for another country. For example, if South Africa's tourism price increases by 1%, Malaysia gains 0.45% in demand. On the other hand, it seems that South Africa and the USA are complements, with an increase of 1% in the tourism price of South Africa leading to a 0.41% decrease in tourist demand for the USA. It is also interesting to note that a 1% increase in the tourism price in Italy would lead to a 1.24% decrease in tourism demand for the USA by UK tourists, while the same increase in price by the USA would lead to a 1.87% increase in demand for Spain as a tourism demand for UK tourists.

TABLE 13: Uncompensated own-price and cross-price elasticities for USA tourists

	Italy	*Malaysia*	*South Africa*	*Spain*	*UK*
Italy	-1.12525**	0.077156	-0.02802**	1.511959**	0.315235**
Malaysia	4.271947**	-1.30349**	-1.34666**	-1.6101**	-0.47969**
South Africa	-0.85534**	-0.30004**	-0.64567**	1.053899**	-0.28297**
Spain	0.473969	-1.08348**	-0.28972**	-0.94679**	0.12606**
UK	1.162318	0.466597	0.132838	-1.4715	-0.43443**

Source: *Authors' analysis*

** = indicates significant at the 5% level

TABLE 13 shows, in terms of USA tourists' own-price elasticities (the diagonal in TABLE 13), that they are less sensitive to price change than their UK counterparts. For example, the figures show that a 1% increase in prices in Italy will lead to a decrease of 1.12% USA tourism demand for Italy. In terms of South Africa, a 1% increase will lead to a 0.64% decrease in tourism demand from the USA. It can thus be said that USA tourists are also price-*insensitive* when it comes to South African prices and that the tourists do not seem to be discouraged by a stronger rand.

In terms of cross-price elasticities, it can again be seen that most of the countries compete on prices, with positive elasticities indicating substitute destinations. For example, if South Africa's tourism price increases by 1%, this will lead to a 1.05% increase in demand in Spain. This substitute effect can possibly be put down to the two countries having the same climate. Furthermore, it shows that a 1% increase in the tourism price in South Africa would lead to a 0.85% decrease in tourism to Italy from the USA and a decrease of 0.3% in demand for Malaysia. Quite significant is that a 1% increase in the tourism price in Italy would lead to a 1.51% increase in demand for Spain from USA tourists. It is interesting to note that none of the UK cross-price elasticities with the other countries is significant.

5. MANAGEMENT IMPLICATIONS AND RECOMMENDATIONS

The EC-AIDS models estimated allow for the determination of expenditure, own-price and cross-price elasticities, which hold clear implications for management and policymakers. Within this framework, own-price elasticities show the degree to which increases in tourism prices will reduce a destination's competiveness for UK and USA tourists. All destinations show a reduction in competiveness, but it is found, particularly in the South African case, that UK and USA tourists are not sensitive to own price change and thus other factors must be the cause of less rapid growth in tourism. While this might suggest that prices in South Africa can be increased with little effect on tourism, such a conclusion should be treated with caution given the cross-price elasticity results.

Cross-price elasticities show the degree to which tourism demand for competing destinations will change in response to a price increase in one of them. All the South African cross-price elasticities are significant for both UK and USA tourists. For the UK, if there is an increase in the tourism price for South Africa, Malaysia will gain in price competiveness. The USA cross-price elasticity shows that, if South Africa has a rise in tourism prices, Spain will gain in price competiveness. Therefore, Malaysia and Spain are clear price competitors for South Africa, and management and policymakers should thus be cautious in increasing prices in South Africa to such an extent that we lose tourists to these destinations.

Expenditure elasticities show the degree to which tourism demand will change in response to changes in the expenditure of UK and USA tourists. All the elasticities are close to unity, which shows that people are still willing to visit the destinations, although a 1% decline in income leads to a similar decline in arrivals. The results therefore imply that tourism from the USA and UK to South Africa is still more sensitive to changes in income than to changes in price. The slowdown in demand for South Africa from these destinations (as was evident in Figure 1) is therefore more likely to be linked to a slowdown in income due to the financial crisis and the subsequent recession than a change in price competitiveness. This also implies that tourism to South Africa would be influenced by global events and global income, which leaves policymakers with few alternatives, except to remain price competitive, in order to keep international tourism to South Africa sustainable.

6. CONCLUSION

This study takes its place among a few other studies that have dealt with tourism demand for South Africa, and is therefore important in understanding how tourism demand is affected, especially in a developing country that places so much emphasis on tourism. This research investigated tourism demand for South Africa from the UK and the USA. Using quarterly data from 1999 to 2008, the demand for South Africa as a tourist destination for UK and USA tourists was modelled in a demand system, taking into account these countries' demand for other destinations as well – most notably their demand for Italy, Malaysia, New Zealand, Spain and UK (in the case of the USA) and the USA (in the case of UK tourist demand).

Within the microeconomic framework provided by the AIDS model, the data enabled the adoption of a dynamic error-correction AIDS (EC-AIDS) model, which incorporates the dynamic nature of consumer behaviour. The unrestricted version of the model was found to be sufficient. The paper also calculated the elasticities associated with tourism demand for South Africa, which served as the basis on which policy recommendations and conclusions can be drawn from the AIDS models, as discussed above. Further research should be done to include other markets in the analysis and to extend the current EC-AIDS models using time-varying parameters, in order to test the changing nature of the relationship.

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LIST OF REFERENCES

Anderson, G. & Blundell, R. (1983). Testing Restrictions in a Flexible Dynamic Demand System: An Application to Consumers' Expenditure in Canada. *The Review of Economic Studies,* 50(3), pp. 397-410.

Anon. (2011). *SA seeks 15-million tourists by 2020 .* [Online] Available: http://mg.co.za/article/2011-07-25-sa-seeks-15million-tourists-by-2020. (Accessed 30 July 2011)

Asteriou, D. & Hall, S.G. (2007). *Applied Econometrics: A Modern Approach Using EViews and Microfit, Revised Edition*. USA: Palgrave and Macmillan.

Blundell, R., Browning, M. & Meghir, C. (1994). Consumer demand and life-cycle allocation of household expenditures. *Review of Economic Studies,* 61, pp. 57-80.

Chambers, M.J. & Nowman, K.B. (1997). Forecasting with the Almost Ideal Demand System: Evidence from Some Alternative Dynamic Specifications. *Applied Economics,* 29, pp. 935-943.

Chang, C. Khamkaew, T. & McAleer, M. (2010). *Estimating Price Effects in an Almost Ideal Demand Model of Outbound Thai Tourism to East Asia*. (Working Paper 11-2010).

Cortés-Jiménez, I., Durbarry, R. & Pulina, M. (2009). Estimation of outbound Italian tourism demand: A monthly dynamic EC-LAIDS model. *Tourism economics,* 15(3), pp. 547-565.

De Mello, M., Pack, A. & Sinclair, M.T. (2002). A systems of equations model of UK tourism demand in neighbouring countries. *Applied Economics*, 34(4), pp. 509-521.

Deaton, A. & Muellbauer, J. (1980). An almost Ideal Demand System. *The American Economic Review,* 70(3), pp. 312-326.

Durbarry, R. & Sinclair, M.T. (2003). Market shares analysis - The case of French tourism demand. Annals of Tourism Research, 30(4), *pp*. 927-941

Eilat, Y. & Einav, L. (2004). Determinants of international tourism: a three-dimensional panel data analysis. *Applied Economics,* 30, pp. 1315-1327.

Eurostat. (2010). *Number of Tourists.* [Online] Available: http://epp.eurostat.ec.europa.eu/portal/page/portal/tourism/data/database. (Accessed 20 August 2011)

Fuji, E., Khaled, M., & Mak, J. (1985). An almost ideal demand system: For visitor expenditures. *Journal of transport economics and policy,* 19, pp. 161-171.

Han, Z., Durbarry, R. & Sinclair, M.T. (2006). Modelling US tourism demand for European destinations. *Tourism management,* 27(1), pp. 1-10.

International Monetary Fund (1999-2009). *International Financial Statistics Yearbook.* Washington DC, International Monetary Fund.

Kastens, T.L, & Brester, G.W. (1996). Model Selection and Forecasting Ability of Theory-Constrained Food Demand Systems. *American Journal of Agricultural Economics,* 78, pp. 301-312.

Khamkaew, T. & Leerattanakorn, N. (2010). *Modelling Thai Tourism Demand for Major Destinations: A Static And Dynamic Linear Almost Ideal Demand System Approach.* Maejo University, Faculty of Economics, Chiang Mai. (Working Paper).

Li, G., Song, H. & Witt, S.F. (2004). Modelling Tourism Demand: A Dynamic Linear AIDS Approach. *Journal of Travel Research,* 43(2), pp. 141-150.

Lyssiotou, P. (2001). Dynamic analysis of British demand for tourism abroad*. Empirical Economics,* 15, pp. 421-436.

Ministry of Economic Development - New Zealand. (2011). *Tourism Research and data.* [Online] Available: http://www.med.govt.nz/sectors-industries/tourism/tourism-research-data. (Accessed 20 August 2011)

Moon, H.R. & Perron, B. (2006). *Seemingly Unrelated Regressions.* University of Southern California, USA. (Working Paper).

Office of Travel and Tourism Industries. (2010). *Monthly Arrivals and Departures in USA.* [Online] Available: http://tinet.ita.doc.gov/research/monthly/arrivals/index.html. (Accessed 20 August 2011)

Papatheodorou, A. (1999). The demand for international tourism in the Mediterranean region. *Applied Economics*, 31(5), pp. 619-630.

Papatheodorou, A. (2002). Exploring Competitiveness in Mediterranean Resorts. *Tourism Economics,* 8, pp. 133-50

Sinclair, T. & Syriopoulos, T. (1993). A Dynamic Model of Demand for Mediterranean Countries. *Applied Economics,* 25, pp. 1541-1552.

Snyder, C. & Nicholson, W. (2008). *Microeconomic Theory : Basic Principles and Extensions, 10th edition.* Canada, Thomson – South Western.

StatsSA. (2009). Tourism satellite accounts. *Discussion document.* Pretoria, StatsSA. November 2010.

Taljaard, P.R., Alemu, Z.G. & Van Schalkwyk, H.D. (2004). Econometric estimation of the demand for meat in South Africa. *Agrekon,* 43(4), pp. 430-443.

Tourism Malaysia. (2010). *Tourism Facts & Figures.* [Online] Available: http://corporate.tourism.gov.my/research.asp?page=facts_figures. (Accessed 20 August 2011)

UK National Statistics. (2010). *Overseas Travel and Tourism.* [Online] Available: http://www.statistics.gov.uk/hub/people-places/people/tourism. (Accessed 20 August 2011)

UNWTO (United Nations World Tourism Organization). (2009). *World Tourism Barometer.* [Online] Available: http://www.unwto.org/facts/eng/pdf/barometer/UNWTO_Barom09_3_en.pdf. (Accessed 17 March 2011)

White, K.J. (1982). *The demand for international travel: A system-wide analysis for US travel to Western Europe*. University of British Columbia, Canada. (Discussion Paper No. 82/28).

White, K.J. (1985). An international travel demand model: US travel to Western Europe. *Annals of Tourism Research,* 12, pp. 529-545.

WTTC (World Travel and Tourism Council). (2010). *World Tourism Summary.* [Online] Available: http://www.wttc.org/bin/pdf/original_pdf_file/world2_2.pdf. (Accessed 15 March 2011)