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AN APPLICATION OF THE ALMOST IDEAL DEMAND SYSTEM METHOD TO THE EUROPEAN TOURISM MARKET: COMPARING THE PURCHASING POWER PARITY INDEX AND THE CONSUMER PRICE INDEX IN INTERNATIONAL TOURISM DEMAND MODELING

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ABSTRACT

This study explored whether the Purchasing Power Parity (PPP) index can be used in the Almost Ideal Demand System (AIDS) method. The researcher developed two AIDS models with different price variables – one that used the PPP index and the other that included a conventional Consumer Price Index (CPI). Three criteria were used to compare estimation results: statistical significance of coefficient estimates, adjusted R^2, and the Durbin-Watson (DW) statistics. A fourth criterion involved comparing each model's performance in tourism demand forecasting.

Eight European tourism destinations were involved in this study: Austria, France, Germany, Italy, Spain, Switzerland, the UK, and Others. These eight countries were chosen in order to represent European tourism as a whole. Five European countries were selected as tourism origins: France, Germany, Italy, Spain, and the UK. These countries seemed to represent a cross section of variation in tourism demand throughout Europe.

The estimation and forecasting results of the models indicated there were variations among the five different origin countries' AIDS models. Based on the quantitative assessment in terms of the four comparison criteria, the PPP model outperformed the CPI model in Italy and Spain whereas the opposite is true for the other three origin countries. Study results may suggest that researchers need to consider an alternative price variable to the conventional CPI-based price variable in future studies of international tourism demand.

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CHAPTER I

INTRODUCTION

The international tourism industry has grown rapidly for the last two decades and currently occupies the fourth position in the ranking of worldwide exports of goods and services after manufacturing goods, mining products and agricultural products (WTO, 2005). Consequently, the international tourism industry has increased its contribution to regional and national economies by foreign exchange earnings, employment creation, high recognition of the destination countries, and high investment and growth (De Mello, Pack, & Sinclair, 2002; Seddighi & Theocharous, 2002).

In the period 1975 – 2000, the total number of international tourism arrivals increased at an average rate of 4.7 percent a year whereas economic output growth measured by Gross Domestic Product (GDP) recorded a 3.5 percent increase worldwide. In 2003, 691 million total international tourist arrivals and 525 billion US dollars of international tourism receipts were estimated compared to 287 million arrivals and 105 billion US dollars of receipts in 1980 (WTO, 2004).

Along with a phenomenal growth in the international tourism industry, research needs of both business and academic sectors have generated great interest in tourism demand modeling and forecasting (Song & Witt, 2000). Since the 1960s, tourism researchers and applied economists have focused their research interests in identifying the characteristics of the international tourism demand and its determinants. In that regard, Crouch (1994a) showed that, up until the early 1990's, there were about eighty studies on international tourism. Since that time, modern advances in econometric theory and methodology have provided researchers with more empirical analysis tools to advance the state of the art of reliable international tourism demand modeling.

Economists recognize that managers of tourism-related businesses and tourism policy planners continually need updated accurate and reliable forecasts of international tourism demand (Witt & Witt, 1992). Failure in the tourism sector of a country's economy is quite often due to the failure to meet tourism market demand (Song & Witt, 2000). The airline industry, tour operators, hotels, cruise lines, recreational facility providers, and shop owners need to understand the characteristics of international tourism demand and be aware of changes in demand for their international tourism-related goods and services.

This need for accurate modeling and forecasting of international tourism demand has been especially acute because of the characteristics of international tourism as a unique service industry. From a micro perspective, O'Hagan and Harrison (1984) proposed that tourism demand involves a "bundle" of goods and services that exist in a highly capital intensive business that requires accurate estimations and forecasts of international tourism demand. In addition, investment decisions regarding tourism-related facilities need to be based on a well-executed demand analysis in order to avoid possible fiduciary damage from irreversible sunk-costs.

From the macro point-of-view, efficient government tourism-planning agencies also need valid and reliable statistical analysis of international tourism demand. Archer (1987) emphasized that accuracy in tourism demand forecasting is especially critical in planning and policy-making because of the perishable nature of the tourism products such as unfilled airline seats and unoccupied hotel rooms.

1.1. Major Tourism Destinations/Origins

Europe accounts for over fifty percent of international tourism arrivals and receipts (Table 1).

Table 1. International tourism arrivals and receipts (by destination regions)

Regions	International tourist arrivals (2002)		International tourism receipts (2002)	
	(million)	Market share (%)	(billion US$)	Market share (%)
World	702.6	100	474.2	100
Europe	399.8	56.9	240.5	50.7
Asia and the Pacific	131.3	18.7	94.7	20.0
Americas	114.9	16.4	114.3	24.1
Africa	29.1	4.1	11.8	2.5
Middle East	27.6	3.9	13.0	2.7

Source: World Tourism Organization (WTO)

Six out of the world's top ten tourism destinations, in terms of number of international tourist arrivals, are European countries. And, in terms of tourism receipts, eight out of the top ten countries are in Europe (Table 2).

Within European tourism markets in 2002, approximately 88 percent of international tourist arrivals were from and/or between countries within Europe itself, where Germany, UK, France and Italy were all ranked among the world's top ten tourism spenders (WTO, 2004).

Table 2. World's top tourism destinations

Rank	International tourist arrivals		Rank	International tourism receipts	
	(million)	Market share (%)		(billion US$)	Market share (%)
France	77.0	11.0	USA	66.5	14.0
Spain	52.3	7.4	Spain	33.6	7.1
USA	41.9	6.0	France	32.3	6.8
Italy	39.8	5.7	Italy	26.9	5.7
China	36.8	5.2	China	20.4	4.3
U.K.	24.2	3.4	Germany	19.2	4.0
Canada	20.1	2.9	U.K.	17.6	3.7
Mexico	19.7	2.8	Turkey	11.9	2.5
Austria	18.6	2.6	Austria	11.2	2.4
Germany	18.0	2.6	Greece	9.7	2.0

Source: World Tourism Organization (WTO)

1.2. Tourism Demand Modeling Techniques

In the past, international tourism demand estimation and forecasting studies have underscored the need to develop models that better explain international tourism demand. The majority of this research has involved one of three approaches: a causal single equation approach, non-causal time series techniques, or the Almost Ideal Demand Systems (AIDS) approach, each of which is briefly described next.

Causal Single Equation Approach

The traditional single equation approach has been used primarily in the international tourism demand literature (Crouch, 1994a). The objective is to identify the relationship between tourism demand and possible economic or non-economic explanatory variables, which can be used for tourism policy evaluations (Song & Witt, 2000). A major advantage of the single equation method in tourism demand studies is that it shows how the changes in the explanatory variables affect the tourism demand (Witt & Witt, 1992).

However, limitations of this approach, such as data availability, errors in formulating significant variables, and insufficient knowledge of the demand systems, have made it difficult for researchers to adopt new methodologies for empirical analyses.

Researchers have criticized the drawbacks of the single equation approach mainly because the approach lacks theoretical support or practical fit to international tourism (Divisekera, 2003). The single equation approach has also shown its ineffectiveness in offering accurate forecasting for international tourism demand (Song & Witt, 2000). In that regard, Eadington and Redman (1991) stressed the need for further theoretical economic research to substantially advance the development of the international tourism demand systems and the identification of appropriate dependent variable(s) and independent variables.

Furthermore, the practical and theoretical implications from research results on this topic have been limited to certain international tourism destination(s) that researchers chose in a somewhat subjective, convenient and arbitrary way for their research on this topic (Durbarry & Sinclair, 2003; Papatheodorou, 1999; Syriopoulos, 1995).

As a result, over the last two decades, alternative quantitative economic analysis tools developed by statisticians and econometricians have been applied broadly in studies of international tourism demand.

Non-causal Time Series Techniques

Increasing business needs for accurate international tourism demand forecasting along with advances in non-causal time series techniques have driven researchers' quest for better models with superior forecasting performance rather than use of the conventional single equation approach.

Most of the time series techniques have relied on the assumption that international tourism demand cannot be forecasted by explanatory variables associated with economic theory and that past tourism data can be best used to explain future tourism demand. Therefore, time series techniques are not based on theory but rather used for essentially pragmatic purposes (Witt & Witt, 1992).

Forecasting performance can be used as a major criterion to evaluate econometric models. The *ex post* forecasting accuracy of the models can be measured by using out-of-sample data in order to provide an indicator of the 'goodness-of-fit' of the model.

The AIDS Approach

The AIDS method, developed by Deaton and Muellbauer (1980b), is a relatively new causal approach to demand analysis. The method is based on consumer economic theory and has been recommended as a more desirable methodology than the single equation approach to explain international tourism demand. This approach is considered a best fit to situations in which competing destinations border each other, and are considered to be in the same tourism market such as Europe. Consequently, the results of those studies described the interdependence among multiple tourism destination countries in the model.

Many AIDS studies analyzed a single origin country's tourism demand for specific European tourism destinations (Durbarry & Sinclair, 2003; Han, Durbarry, & Sinclair, in press; Li, Song, & Witt, 2004; O'Hagan & Harrison, 1984; White, 1985). In order to enhance the reliability of the AIDS method, a few AIDS studies have investigated international tourism demand from multiple origins. However, the choice of destinations in these studies was either restricted to Mediterranean countries only (Papatheodorou, 1999; Syriopoulos & Sinclair, 1993) or expanded to countries that do not share common tourism characteristics (Divisekera, 2003).

In most of the previous studies, another major limitation of the AIDS approach may have involved the use of the exchange rate-adjusted consumer price index (CPI) as a price variable. Even though the CPI's were commonly adjusted for differences in appropriate exchange rates, the variable may have limitations for comparing interregional price levels and economic well-being because the CPI basically measures the changes in price levels within a country over a certain period of time (Rao, 2001; Rogers, 1994).

In that regard, purchasing power parity (PPP) index, which measures differences in levels of prices across different countries, can be considered as a possible alternative to CPI by eliminating national differences whenever currency conversion is considered in international economic models.

Recently, the AIDS method has also been used to measure performance in international tourism demand forecasting (De Mello et al., 2002; Han et al., in press; Li et al., 2004). The empirical results may be evaluated in terms of statistical measures of accuracy and significance of the forecasting equations (Witt & Witt, 1992).

1.3. Objective of the Study

The objective of the study was to determine if the PPP index would produce similar or different results than the conventional model that uses CPI for the price variable in AIDS model. The two AIDS models were appraised in terms of (1) estimation results and (2) accuracy of forecasting international tourism demand.

1.4. Significance of the Study

This study investigated the general reliability and applicability of the AIDS method for measuring demand for major tourism destinations in Europe. The PPP index was used to develop a price variable of an AIDS European international tourism demand model. An exploratory study was conducted to examine the validity of this new alternative price variable that was expected to facilitate quantitative assessment of relative price competitiveness across international tourism destinations.

This study developed a comprehensive list of destinations and multiple origins from Europe that best represented European tourism. The origin countries were chosen based on how well they represented different economic characteristics. Study results underscored the need for researchers to be more cautious in using a price index in future AIDS research.

This study also can contribute to international tourism forecasting by expanding the boundary of forecasting measurement literature. Most of the previous studies on international tourism demand forecasting have relied either on a single equation model or on various time series techniques. Only a few AIDS studies have discussed the issue of forecasting the international tourism demand from a particular origin country such as the

UK and the USA (De Mello et al., 2002; Han et al., in press; Li et al., 2004). However, based on the literature review of this study, no studies have compared forecasting performance between the two AIDS models using rival price variables. The forecasting performance comparison between the two AIDS models can (1) help national level tourism policy makers gain insight of future tourism demand and (2) develop appropriate tourism product supply plans.

Lastly, the four appraisal criteria were used for an innovative evaluation of the two AIDS models. Three criteria that were measured from the estimation process were; (1) statistical significance of coefficient estimates; (2) magnitude of Adjusted-R^2 and; (3) Durbin-Watson (DW) statistics. Additionally, a forecasting accuracy criterion was chosen with a practical purpose of providing national level tourism policy makers and tourism-related businesses with an accurate prediction of future tourism demand for certain destinations. A rigorous description of the empirical findings from estimation and forecasting procedures that used the above criteria was the fundamental basis for comparing the two AIDS models.

CHAPTER II

LITERATURE REVIEW

This chapter has three sections. The first section briefly reviews the two main approaches – micro and macro perspectives – conducted in tourism research.

The second section discusses how researchers, from a macro perspective, have developed econometric models in order to estimate international tourism demand. In this section, the causal approaches, such as conventional single equation methods and the AIDS models are discussed in the order of: (1) brief description of methodologies; (2) identification and operationalization of dependent and independent variables; (3) functional form and estimation methods; (4) implications from study results and; (5) limitations of methodology in the literature.

The third section contains a literature review of the studies on international tourism demand forecasting. Following a brief review of the single equation approach, major time series techniques that have been applied to international tourism demand forecasting are discussed. A description of recent applications of the AIDS method to forecast international tourism demand concludes the chapter.

2.1. Different Approaches for Studying Tourism Demand

Tourism is a very complex phenomenon which has been viewed from various perspectives and studied by disciplines, such as economics, psychology, sociology, marketing, geography, and political science (Lundberg, Krishnamoorthy, & Stavenga, 1995; Przeclawski, 1993). Consequently, each discipline has provided a partial rather than a holistic point of view regarding the factors that influence tourism activities including choice of destinations, and expenditure patterns (Song & Wong, 2003).

As discussed next, the literature review on the characteristics of tourism studies revealed that research had been conducted either in a micro (non-economic) perspective or in a macro (economic) perspective.

2.1.1. Micro perspectives

Studies based on a micro perspective have mostly chosen non-economic factors as explanatory variables to explain tourism. For example, marketing research analyzes individual tourist's behavior and tends to include factors, such as the destination image, tourists' attitudes toward the destination, perceived risk, lifestyle, activities, interests, political/cultural issues, weather, service quality, and options (Crouch, 1994a; Song & Wong, 2003). For empirical analysis, structural equation models have been tested using survey data from actual and/or potential tourists.

Research on the micro scale has provided implications for mainly industry-level practitioners, such as tourism business managers and travel agencies that actually deal with individual tourists. Specifically, managers of tourism enterprises will have a better insight of what influences tourists' choices for tourism products and make appropriate marketing decisions accordingly (Song & Wong, 2003).

2.1.2. Macro perspectives

Researchers have applied analytical tools developed in statistics and econometrics to estimate and forecast tourism demand. Secondary data sets collected by national government and international organizations have been utilized to operationalize dependent variable and explanatory variables of the demand model under consideration.

The focus of the studies has been on estimations of tourism demand elasticities with respect to price and income and on efficient forecasting of future tourism demand (Song & Wong, 2003). The research results provide tourism policy makers with economic implications which are closely related with tourism policy development at national or regional level.

2.2. International Tourism Demand Estimation

Depending on the objectives and circumstances of the research, various functional forms have been used in empirical international tourism demand studies. Until the mid-1980s, most of the international tourism demand studies adopted a causal econometric approach that is represented by the single equation method, either in a linear or in a power equation format (Barry & O'Hagan, 1972; Gray, 1966; Stronge & Redman, 1982).

As new economic theory and econometric methods have developed, tourism researchers applied those techniques in an attempt to develop an international tourism demand model, which was expected to include the most appropriate variables in the model and provide significant estimation results. Since the introduction of the Almost Ideal Demand System (AIDS) method (Deaton & Muellbauer, 1980b), tourism researchers and applied economists adopted the AIDS method to analyze international tourism demand particularly in a region where many competing tourism destinations adjoin each other.

2.2.1. Brief description of methodologies

2.2.1.1. Single equation model

Researchers prefer the single equation method because it provides statistical measures of accuracy and significance when many international tourism demand relationships can be approximately represented by a linear relationship among the variables under consideration. According to a brief literature review, the single-equation, linear model is the most common functional form in tourism demand studies (Witt & Witt, 1992; Song & Witt, 2000).

2.2.1.2. AIDS model

Since the mid-1980's, several tourism researchers have applied the AIDS method to explain international tourism demand (Bakkal, 1991; O'Hagan & Harrison, 1984; Papatheodorou, 1999; Syriopoulos & Sinclair, 1993; White, 1985).

An implicit and fundamental assumption in the AIDS model is that goods/services can be partitioned into groups, so that preferences within groups can be described independently of quantities in other groups (Durbarry & Sinclair, 2003; Han et al., in press; Li et al., 2004; Syriopoulos & Sinclair, 1993). For example, a "three-stage budgeting" process for a European tourism demand study can be assumed as follows. First, the tourists allocate their consumption expenditure between total tourism consumptions and consumption of other goods and services. Second, tourists allocate their expenditure between tourism in Europe and in other regions. In the last stage, tourists make their decisions among the alternative destinations in Europe. This assumption may be considered acceptable if goods/services which bear special relationships to one another in consumption either as substitutes or complements are always kept in the same group (Deaton & Muellbauer, 1980a).

The AIDS method is explicitly based on the microeconomic theory of consumer expenditure and uses a modern econometric method (Deaton & Muellbauer, 1980b). Therefore, many AIDS studies empirically tested the validity of the theoretical restrictions, such as symmetry and homogeneity that are consistent with the theory of consumer utility and demand (Papatheodorou, 1999; Song, Romily, & Liu, 2000; Song & Witt, 2000; Syriopoulos & Sinclair, 1993).

Since the AIDS method is an ideal tool for empirical analysis of the evolution of market shares in international tourism among the competing destination countries, the study results provide useful information about the interdependencies among those countries (Lim, 1997; Papatheodorou 1999; Song et al., 2000; Song & Witt, 2000). According to Durbarry and Sinclair (2003), an increase in tourism market shares of a particular destination requires tourism policy makers in that country to provide sufficient labor and capital to meet the exact increase in demand whereas a decrease in market shares cause decreases in income and jobs in tourism-related sectors.

The AIDS approach also provides measures of the responsiveness of destinations' shares of their origin tourism markets to changes in economic variables, such as relative prices, total tourism expenditure and changes in non-economic factors, such as recessions, war, and political instability (Durbarry & Sinclair, 2003; Syriopoulos & Sinclair, 1993).

Such research has made a significant contribution in understanding the characteristics of international tourism demand, with specific focuses on the analyses of: (1) the interrelationship among individual international tourism destinations; (2) the role of economic and non-economic factors in deciding international tourism demand and; (3) the practical implications for national or regional tourism policy makers.

Considering geographical, cultural and socioeconomic proximity along with the significance of international tourism worldwide, most of the previous studies were conducted on European countries. Previous studies claimed that geographical proximity and homogeneity of tourism products are common criteria to decide tourism destinations for the demand model (Han et al., in press; Papatheodorou, 1999; Syriopoulos & Sinclair, 1993).

Table 3 summarizes the choices of origins and destinations by major system studies using AIDS model. Total number of tourism destinations for a particular study varies from a few major European countries (De Mello et al., 2002; Durbarry & Sinclair, 2003; Han et al., in press) to over twenty individual destinations in Europe (Li et al., 2004). Countries in the Mediterranean region have also been clustered as a destination of interest based on the recognition that Mediterranean countries share common tourism-related attributes, such as natural conditions (Syriopoulos & Sinclair, 1993; Papatheodorou, 1999).

United States' tourism demand for European destinations has been the most popular subject in the AIDS study literature (Divisekera, 2003; Han et al., in press; O'Hagan & Harrison, 1984; Papatheodorou, 1999; Syriopoulos & Sinclair, 1993; White, 1985). Studies on European origin country's tourism demand for major European tourism destinations have also been conducted. Countries, such as Germany, France, and the U.K. were studied to analyze within-regional tourism in Europe (Durbarry & Sinclair, 2003; Li et al., 2004; Papatheodorou, 1999; Syriopoulos & Sinclair, 1993).

Table 3. Summary of the origins and destinations from an AIDS literature review

	Origin(s)	Destinations
O'Hagan and Harrison (1984)	USA	15 European countries
White (1985)	USA	16 Western European countries into 7 groups
Syriopoulos and Sinclair (1993)	USA and 4 European countries (France, Germany, Sweden, UK)	5 Mediterranean countries: Greece, Spain, Portugal, Italy and Turkey
Paptheodorou (1999)	USA and 3 European countries (France, Germany, UK)	6 Mediterranean countries: Greece, Spain, Portugal, Italy, Turkey and Yugoslavia
De Mello, *et al.* (2002)	UK	France, Spain, Portugal
Divisekera (2003)	Japan, New Zealand, UK, USA	Australia, New Zealand, UK, USA
Durbarry and Sinclair (2003)	France	Italy, Spain and UK
Li *et al.* (2004)	UK	22 Western European countries into five destinations and others (17 aggregated destinations)
Han *et al.*, (forthcoming)	USA	France, Italy, Spain and UK

2.2.2. Specification and operationalization of dependent and independent variables

2.2.2.1. Dependent Variable

Defining and measuring international tourism demand has been a highly controversial issue due to the tourism industry's uniqueness compared with the manufacturing industry. While the manufacturing industry's quantity demanded for a certain product can be measured by total number of units purchased by consumers for a given period of time, the international tourism quantity demanded can be measured in various ways.

Single equation model

International tourism demand has been commonly measured either by the number of tourist visits from an origin country to a destination country or by the level of tourism expenditure by visitors from the origin country in the destination country. The choice of dependent variables has relied on the identity of the tourism industry on which the research focused (Crouch, 1994b).

Tourist visitation data is conventionally collected at the airport or border whereas tourism expenditure data is relatively complex to collect and manage. Basically, there are two elements of cost involved in international tourism: the cost of travel to the destination and the tourists' cost of living in the destination, both of which can be acquired by survey among tourists and/or owners and managers in the tourism industry. Another alternative, but less frequently used compared with arrivals or expenditures, is the number of nights spent by tourists of the origin in the destination residents (Song & Witt, 2000).

Over sixty percent of the previous international tourism demand studies adopted the number of international tourist visitations (or arrivals) as the measure of international tourism demand (Crouch, 1994).

Both tourist arrivals and tourism expenditure have their own limitations. Song and Witt (2000) indicated that tourist visitation data are collected via frontier counts, or registration at accommodation establishments, but this procedure does not account for day-trippers or visitors with friends and relatives especially when the data relied on the records from lodging facilities.

Tourist expenditure data collected by bank reporting methods or sample surveys also have concerns, such as identification of tourism-related expenditure, non-reporting of relevant expenditure for bank reporting, and small sample sizes from sample survey methods (Morley, 1997). Another drawback of expenditure is that, although theoretical justification for including transport cost as a demand determinant is well accepted, many empirical studies exclude this variable from the demand function because of potential multicollinearity problems and lack of data availability (Song & Witt, 2000). Consequently, most tourism demand studies are conducted on tourists' expenditures in the destination, which represent cost-of-living only.

Because of these limitations and drawbacks of both dependent variables, Papatheodorou (1999) suggested that the intended use of study results should be the guiding factor in deciding which type of dependent variable to use. For example, if research were focused on the evolution of the international tourism market share in an international tourism destination area which consists of many competing countries, the tourist expenditure data would be the better dependent variable to use. On the other hand, if the objective of a study were to promote an individual country's tourism products, the tourist visitation data would play a better role, especially in terms of the power of forecasting actual international tourist visitation to a certain destination country.

AIDS model

The dependent variable of the AIDS model is defined as the tourism expenditure of origin country *i,* in destination country *j,* as a percentage of the aggregate tourism expenditure of origin country *i* in all the destination countries under consideration (Papatheodorou, 1999). Each destination country's share of an origin country's aggregate tourism expenditure spent in all destinations is used for analysis.

An ideal data set would be the actual amount spent by tourists of origin country *i* in each destination country *j* during a given period (O'Hagan & Harrison, 1984). However, country specific data is not available in most cases (Papatheodorou, 1999).

In order to account for this data problem, researchers developed a proxy variable that is obtained by multiplying total international tourism receipts of destination *j* by the share of the tourist quantity supplied by the origin country *i* in the total tourist quantity of destination country *j* (Durbarry & Sinclair, 2003; Han et al., in press; Papatheodorou, 1999; Syriopoulos & Sinclair, 1993). Divisekera (2003) pointed out that tourism receipts of the destination countries not only correspond to destination-specific spending on tourism goods and services but also matters for destination countries as an indicator of the level of demand.

Another issue of this process arises from the implementation of tourist quantity supplied by an origin country. Literature review shows that either tourist arrivals

(Papatheodorou, 1999; Syriopoulos & Sinclair, 1993) or nights spent by international tourists (Durbarry & Sinclair, 2003; Han et al., in press) has been used to represent tourist quantity supplied.

2.2.2.2. Independent variables

Single equation model

The type and quantity of independent variables for a particular international tourism study have been dependent on not only economic theory but also the objectives of the study. Major economic variables have been conventionally included in the demand model. However, difficulties in data availability, quantifiability, and statistical problems such as serial correlation and multicollinearity among these variables have been critical obstacles in identifying and operationalizing independent variables of international tourism demand studies.

With the exception of income and prices (own and substitutes), which are common independent variables conventionally identified in the single equation tourism demand models, other variables, such as tourist's taste, marketing, and dummy variables have been added to the model based on the researcher's subjective decision (Song & Witt, 2000; Witt & Witt, 1992).

Income

The origin country's income level (e.g. Gross Domestic Product or National Income) or consumption in *per capita* form has been used as the income variable in single equation approach.

Price

As discussed previously, the TPI is considered an ideal price index for tourism research. A well-developed TPI is expected to enhance the reliability of tourism demand studies by incorporating sectors, such as lodging, food and beverage, transportation (e.g. airfare) that are directly related with tourism activities. However, the TPI has been rarely used in the actual tourism demand research due to the lack of data availability in destination and/or origin countries.

Therefore, CPI has been commonly used as a proxy for TPI in international tourism research (Martin & Witt, 1987; Witt & Witt, 1992). Even though CPI data have an advantage in convenience and accessibility, the reliability of the CPI as a representative price variable has long been questioned by tourism researchers.

The major concern is that CPI, by including goods and services that are not necessarily related with the tourism industry, may not capture the actual difference between the cost-of-living for the local residents and that for foreign visitors to the destination under consideration.

Another problem relates to the adjustment of price level by exchange rates due to the fact that multiple national currencies are involved in international tourism transactions (Dwyer, Forsyth, & Rao, 2000; Papatheodorou, 1999). Even though exchange rates are expected to indicate the exact differences in currency value internationally, non-economic factors, such as governmental foreign exchange policies, quite often affect a country's currency value and also affect the validity of study results and interpretations.

Lastly, the development of a substitute price variable draws attention. Gray (1966) claimed the existence of high elasticity of substitution among international tourists in response to a price change in a country. According to Witt and Witt (1992), substitute(s) for a destination country can be defined by either of the following two ways. First, the tourists' cost of living variable has been specified in the form of the destination price relative to the origin price assuming that domestic tourism in the origin country is the most important substitute for travels to foreign destinations (Gray, 1966; Witt & Martin, 1987). This approach, therefore, does not investigate substitutions between competing foreign tourism destinations. Other researchers allow for the impact of competing foreign destinations by specifying the tourists' cost of living variable as destination value relative to a weighted average value calculated for a set of alternative destinations under consideration (Song & Witt, 2000). The usual practice to derive weighted average substitute price variables is to develop a "composite" index of all the substitute prices by allocating weights to each competing destination. The weights are derived from the relative market shares of the most important competing destinations for the origin country (Barry & O'Hagan, 1972; Stronge & Redman, 1982).

Since the substitute price is represented by a weighted average of competing destinations' prices, the comparison is between a particular destination country and the average among the rest of the other competing destinations. Therefore, it is impossible to analyze the relationship between individual international tourism destinations, which is the more interesting and practical research question for the development of tourism policies.

Other explanatory variables

Tourist's taste, affected by socio-economic factors such as age, gender, education, etc., can have an important impact on international tourism demand. Most empirical studies use a time trend to represent the impact of taste change on the popularity of a destination country due to data limitations (Song & Witt, 2000). Song et al. (2000) attempted to examine the influence of tastes on tourism demand by using a destination preference index.

Tourism flows to a destination are more likely to be influenced by destination specific tourism promotional expenses administered by national tourism organizations (Barry & O'Hagan, 1972). Witt and Martin (1987) summarized various forms of marketing variables applied in tourism demand models. Lack of data availability and difficulties in calculation of promotion effect over time are major problems related with the inclusion of promotional expenditure variables into the tourism demand model (Witt & Witt, 1992).

Dummy variables have been used to detect the impact of a special event on international tourism demand. Examples of special "one-off" events are restrictions on foreign currency by a specific country, oil crises, temporary political instability, and sporting activities (Witt & Witt, 1992).

AIDS model

Almost every AIDS application to the international tourism demand studies applied exchange rate-adjusted CPI as the price variable due to the difficulty of constructing the TPI. Another explanatory variable derived by economic theory is the real *per capita* tourism expenditure of origin country.

Other variables, such as dummy variables and time trend, have been included in the demand model depending on the focus of the research and the interpretation of the time series trend of the level data.

Price

According to the literature review conducted for this study, only Dwyer et al. (2000, 2002) and Divisekera (2003) managed to calculate TPI's for a few countries. The other AIDS research on international tourism demand used exchange rate-adjusted CPI (Durbarry & Sinclair, 2003; Han et al., in press; Li et al., 2004; O'Hagan & Harrison, 1984; Papatheodorou, 1999; Syriopoulos & Sinclair, 1993; White, 1985).

A relative price increase in a tourism destination is expected to lower the international tourism market share of that country through price impact. Substitute prices are essential factors to investigate the interrelationship between individual international tourism destination countries that are in the same tourism market, such as countries in Europe.

A composite price index has been developed to represent the weighted average of substitute countries that are either categorized into several groups (White, 1985) or minor tourism destinations but need to be considered in analysis (Li et al., 2004).

Real *per capita* tourism expenditure

The *per capita* expenditure has been calculated by dividing an origin country's total tourism expenditures spent in the destinations under consideration by the total number of tourist arrivals from the origin country (Papatheodorou, 1999). However, tourist arrivals data may have a "double counting" problem, which underestimates budget size of the international tourists who make multiple travels for a certain period of time. For example, if a tourist from a particular origin country made three international travels throughout the whole year, his total tourism expenditure would be significantly underestimated when each one of those three travels would be considered as travels conducted by three different travelers. In order to avoid this problem, an origin country's population has been used as an alternative to tourist arrivals (Han et al., in press; Li et al., 2004; O'Hagan & Harrison, 1984; White, 1985; Syriopoulos & Sinclair, 1993). Durbarry and Sinclair (2003) used the share of nights spent by the origin country's tourists in the same destination. The composite price indexes, such as Stone Price Index, Paasche Index, or Laspeyres Index have been used to derive "real" *per capita* tourism expenditure (Han et al., in press).

Other explanatory variables

Dummy variables have been incorporated into AIDS research in order to capture the impact of particular events on international travel. Depending on the characteristics of the events, dummy variables represent researchers' interpretation on the range and magnitude of the impact.

Some studies applied dummy variable(s) to a limited number of destinations, which researchers believed were exclusively affected by the event such as the political trouble at France in 1968 and the Olympic Games in Germany in 1972, etc. (Divisekera, 2003; O'Hagan & Harrison, 1984). Other studies applied dummy variables to every demand equation assuming that an event that affects a country definitely affects the other countries under the characteristics of AIDS models (Durbarry & Sinclair, 2003; White, 1985).

The trend variable in the AIDS model is expected to reflect changes in travel patterns due to tourists' tastes and preferences that are not captured by the other explanatory variables (White, 1985). Consequently, the coefficients of the trend can be interpreted as the annual average change in the dependent variable that would take place in the absence of any change in the other explanatory variables (Han et al., in press). Papatheodorou (1999) concluded that the inclusion of the trend variable in the AIDS system of equations is beneficial for the stability and significance of the price and expenditure coefficients.

Most of the early AIDS studies on international tourism demand included a trend variable in the equation systems (De Mello et al., 2002; Han et al., in press; O'Hagan & Harrison, 1984; Papatheodorou, 1999; White, 1985). Introduction of a trend variable is a common practice to avoid the problem of spurious relationship among the levels of econometric variables when time series data is involved in regression analysis (De Mello et al., 2002). Other studies adopted cointegration (CI) analysis as an alternative of way approaching the issue of nonstationarity in time series data (Divisekera, 2003; Durbarry & Sinclair, 2003; Li et al., 2004).

Researchers sometimes dropped dummy variables and/or trend variable after the model estimation. Syriopoulos and Sinclair (1993) originally included unidentified dummy variables and trend variables but dropped them because the inclusion of those variables did not improve the study results. Papatheodorou (1999) also dropped the dummy variable for the same reason.

2.2.3. Functional form and estimation methods

2.2.3.1. Single equation model

Witt and Witt (1992) indicated that the most popular form in tourism demand analysis is the power model. The advantage of a power model is that marginal effects of each independent variable on tourism demand are not constant, but depend on the value of the variable, as well as on the values of all other variables in the demand function (Song & Witt, 2000). Lee et al. (1996) recommended that the power model is superior to the general linear form in terms of a better fit of the data and convenience in getting demand elasticity. Additionally, the power model can be transformed into a log-linear form making estimation of coefficients relatively simple in explaining international tourist visitation trends (Tremblay 1989; Carey 1991; Yavas & Bilgin 1996). Empirical results from log-linear form were proven to be superior to the results of linear form in terms of expected coefficient signs and statistical significance of the coefficients (Witt & Witt, 1992).

The estimated coefficients of the log-linear demand equation are estimates of demand elasticities in terms of price and income variables that provide useful information for tourism policy makers.

Literature reviews by Crouch (1994a, 1994b) and Lim (1997) revealed that the ordinary least square (OLS) multivariate regression analysis was the primary estimation method for single equation models.

2.2.3.2. AIDS model

The derivation process of an AIDS model is as follows. First, a tourist's utility function, representing preferences for a group of destinations, is given by a class of consumer preferences known as Price Independent Generalized Log-Linear (Deaton & and Muellbauer, 1980a; Syriopoulos & Sinclair, 1993). The preferences are represented by the cost (or expenditure) function, *c(u,p)* which defines minimum expenditure necessary to attain a specific utility, *u*, at given prices, *p*.

The particular functional form used in this study is the one proposed by Deaton and Muellbauer (1980b), whose cost/expenditure function takes the following form:

$$\log c(u,p) = \alpha_o + \sum_{i=1}^{n} \alpha_i \log P_i + \frac{1}{2} \sum_{i=1}^{n} \sum_{j=1}^{n} \gamma_{ij}^{*} \log P_i \log P_j + \beta_o \prod_{i=1}^{n} p_i^{\beta_i} \qquad (1)$$

$$i,j = 1,\ldots,n$$

where α_i, β_i, and γ_{ij}^{*} are parameters,

P_i is the price of tourism products at the destination *i*,

n is the number of destinations,

u is the level of utility, and

$c(u, p)$ is the cost/expenditure function.

Using Shepard's lemma, the following system of demand equations in share form is obtained:

$$w_i = \alpha_i + \sum_{j=1}^{n} \gamma_{ij} \log P_j + \beta_i \ln(x/P^*) + u_{ij} \qquad (2)$$

$$i,j = 1,\ldots,n$$

where w_i is the percentage share of destination country i in origin countries' tourist expenditures in all the destination countries under consideration;

P_j is the exchange rate-adjusted price faced by the origin countries' tourists in destination country j;

x is the total expenditure by the origin countries per head of the tourist population of those countries;

P^* is the weighted price index for all the destination countries;

u_{ij} is the disturbance term that captures all other factors which may influence the quantity of the tourism product demanded in destination i by residents of origin country j.

n is the number of the destination countries.

Stone's index is commonly used to construct a weighted price index:

$$\log P^* = \sum_{i=1}^{n} w_i \log P_i \qquad (3)$$

where w_i are the observed sample budget shares.

For the theoretical properties of the demand theory, the following parametric restrictions are imposed on the equation (Deaton & Muellbauer, 1980b).

$$\sum_{i=1}^{n}\alpha_i = 1\ ,\ \ \sum_{i=1}^{n}\gamma_{ij} = \sum_{i=1}^{n}\beta_i = 0, \tag{3a}$$

$$\sum_{j}\gamma_{ij} = 0, \tag{3b}$$

$$\gamma_{ij} = \gamma_{ji} \qquad \forall i,j \tag{3c}$$

Restrictions (3a) are *adding-up* restrictions to ensure that $\sum_{i=1}^{n} w_i = 1$.

Homogeneity of the demand functions requires the second restriction (3b), which can be tested equation by equation. The last restriction (3c) is *symmetry*.

Estimation, then, can be carried out with and without the restrictions where the first restriction is not testable. The test results for the homogeneity restriction implies the change in expenditure share of a particular product when there was a proportional increase in prices and expenditure. In other words, if the sign of $\sum_{j}\gamma_{ij}$ is positive for product *i*, the expenditure on product *i* increases when prices and expenditure increase proportionally. Unlike homogeneity, symmetry cannot be tested on an equation by equation basis (Deaton & Muellbauer, 1980a).

As shown before, depending on model specification of individual studies, dummy variable(s) and/or trend variable(s) have been included in the demand equations.

Estimation method

Zellner (1962)'s Seemingly Unrelated Regression (SUR) method has been used in most of the previous AIDS studies. The AIDS model is considered a set of equations that has contemporaneous cross-equation error correlation that is called a seemingly unrelated regression (SUR) system. Specifically, the equations do not seem unrelated at first, but the equations are related through the correlation in the errors (UCLA Academic Technology Services).

For example, if the equations are demand functions such as the AIDS model, a shock affecting demand for one good may spill over and affect demand for other goods. In this case, estimating these equations as a set, using a single (large) regression, should improve efficiency (Kennedy, 1992).

The seemingly unrelated regression (SUR) model can be viewed as a special case of the generalized regression model. The basic SUR model assumes that, for each individual observation i, there are M dependent variables $y_{i1}, \ldots, y_{ij}, \ldots y_{iM}$ available, each with its own linear regression model:

$$y_{ij} = X'_{ij}\beta_j + \varepsilon_{ij}, \quad i = 1, 2, \ldots, N, \tag{4-1}$$

Or, with the usual stacking of observations over i,

$$y_j = X_j \beta_j + \varepsilon_j \tag{4-2}$$

for $j = 1,2,\ldots, M$, where y_j and ε_j are N-vectors and X_j is an N x K_j matrix.

The SUR model permits nonzero covariance between the error terms ε_{ij} and ε_{ik} for a given individual i across j and k, i.e.,

$$Cov\,(\varepsilon_{ij}, \varepsilon_{ik}) = \sigma_{ij} \tag{4a}$$

while assuming

$Cov\ (\varepsilon_{ij}, \varepsilon_{i'k}) = 0$ (4b)

It is the potential nonzero covariance across equations j and k that allows for an improvement in efficiency of GLS relative to the classic LS estimator of each β_j.

Tests of stationarity of data and cointegration (CI)

Variables in tourism demand models, such as international tourism expenditure, arrivals, prices in the destination countries, and income of the origin country, are often trended (non-stationary). This can cause a potential problem of spurious correlation among the variables (Song & Witt, 2000).

According to Engel and Granger (1987), if a pair of non-stationary economic variables belongs to the same economic system, such as tourism demand and income, there should be a cointegration relationship that prevents these two time series from drifting away from each other. If these two move together in the long run, they can be modeled by a long-run equilibrium model. In other words, if the long-run equilibrium regression is estimated using OLS, the residuals of the model should follow a stationary process and fluctuate around the value of zero over time, i.e., the two non-stationary variables are cointegrated (Song & Witt, 2000). The discussions of stationarity of level data and CI test have been conducted in the AIDS studies, such as Durbarry & Sinclair (2003), Li et al. (2004), and Han et al. (in press).

Test of theoretical restrictions

Imposition of the restrictions, such as homogeneity and symmetry, helps to reduce the number of parameters to be estimated and increase the degrees of freedom (Li et al., 2004). Overall, the test results confirming the validity of theoretical restrictions implied in consumer demand theory are important in their own right and permit meaningful interpretation of estimated demand parameters (Divisekera, 2003).

The literature review revealed that the Wald test (De Mello et al., 2002; Han et al., in press), Likelihood test (Syriopoulos & Sinclair, 1993; White, 1985) and Langrange multiplier test (Li et al., 2004) were popular techniques for testing those restrictions. Test results varied across the individual restrictions.

Depending on the test results, the researcher can conduct either unrestricted or restricted SUR estimation.

2.2.4. Implications from study results

One of the major objectives of the causal econometric demand studies – Single equation model and AIDS model – are the interpretation of coefficient estimates that are expected to measure the responsiveness of tourism demand in terms of variations in the explanatory variables.

2.2.4.1. Single equation model

The coefficient estimates from the single equation method, specifically, the power model constructed in log-linear form, measures the elasiticities of the tourism demand in response to changes in price, income, and/or other variables specified in the model. Numerical representations and characteristics of the demand elasticities are explained in the next section since the single equation model and the AIDS model are quite similar in terms of analysis of demand elasticities.

2.2.4.2. AIDS model

The majority of the previous AIDS studies focused on the issue of identifying inter-country relationships between the countries involved in each study. Consequently, research objectives tend to be limited to the calculation of tourism demand elasticities.

By definition, the demand elasticity gives the percentage change in international tourism in response to a one percent change in the explanatory variable under consideration. Based on the AIDS model established in the study, uncompensated price elasticities and/or compensated price elasticities along with expenditure elasticities have been calculated (Divisekera, 2003; Durbarry & Sinclair, 2003; Han et al., in press). The price elasticities measure the sensitivity of tourism demand shares toward the price changes whereas the expenditure elasticities interpreted tourism products provided in a particular destination either as a luxury good or a necessary good perceived by tourists from the origin country under consideration.

The estimation results of the AIDS model not only explain how the market share of an individual international tourism changes over time due to changes in the price and expenditure variables but also provide researchers with values that quantify the degree of relationship between different international tourism destinations (Song & Witt, 2000).

The signs and statistical significance of cross-price elasticities shows the existence of substitutability or complementarity between different tourism destinations. High substitutability between two European countries implies that those countries provide homogeneous tourism products, which may result from a similar history and cultural background. For example, an international tourist visiting France may decide not to go to Spain if the tourist perceived that two countries provide similar tourism products.

On the other hand, the estimation results showing insignificant substitutability or even complementarity can explain factors such as geographical proximity. For example, an international tourist visiting Spain may extend his/her trip to France since the extra transportation cost from visiting the second destination is not significant when two countries are located near each other. In this case, the change in inbound international tourism flow to a particular destination country will show a similar pattern of change as other adjoining countries.

The literature review showed that there have been mixed results regarding substitutability and complementarity between the tourism of individual European countries (White, 1985; Syriopoulos & Sinclair, 1993).

2.2.5. Limitations of methodology in the literature

2.2.5.1. Single equation model

Investigating the exact characteristics between two individual tourism destinations is a crucial task for tourism policy development. Many international tourists include multiple destinations in their itineraries, especially for the travel to a region where many countries are adjoining each other (Divisekera, 2003). Therefore, the desire for tourism in a given destination must be derived by considering the demand for potentially competing and complementary tourism destinations.

The single equation approach has limitation in providing the demand elasticities that measure the degree of interdependence among individual destinations (Han et al., in press; Syriopoulos & Sinclair, 1993). It is mainly because the substitute price for a destination country is developed as a weighted average of the prices from all the other tourism destinations (Eadington & Redman, 1991). The single equation approach has also been criticized as being relatively *ad hoc*, lacking a strong basis in economic theory and having just provided disparate sets of findings (Durbarry & Sinclair, 2003; Papatheodorou, 1999).

Misspecification of model structure is another main problem with the single equation model. Tourism demand models, in general, are unlikely to satisfy conditions on errors in different equations such as constant variance and no correlation. Errors across equations are commonly correlated with each other due to the influence of factors which are not explicitly incorporated into tourism demand models. Examples of those extraneous factors are weather, bad publicity, etc. (Morley, 1991; Crouch 1994a). In many cases, the functional form of tourism demand model is likely to be finalized after data and variable manipulations (Syriopoulos, 1995).

The limitations of the single equation approach described above have led several researchers to implement a systematic demand approach by using the AIDS approach, a relatively modern econometric method with solid theoretical foundations on consumer behavior economics.

2.2.5.2. AIDS model

There are some limitations in application of the AIDS methods to international tourism demand studies. First, the AIDS method fails to incorporate the cost of international travel such as transportation costs although it is a technical limitation applied to any type of research approach. Most of the international tourism demand studies could not identify a representative measure of transportation cost mainly due to the fact that airfare varies across nations, airlines, and travel agencies. Therefore, tourism expenditure data captured only tourists' expenditure in the destination countries such as lodging, food and beverage, souvenir, local transportation, etc.

Another limitation is associated with the operationalization of the tourism price variables. Ideally, a realistic measure of prices should reflect the cost of a common basket of goods and services consumed by tourists (O'Hagan & Harrison, 1984). However, the lack of consistent data availability in tourism-related industry specific prices prevented most of the previous studies from developing a tourism price index (TPI) for most of the countries of interest. Once again, this limitation is not a unique concern for the AIDS method since it applies to any type of econometric approaches. Lastly, AIDS models do not take the supply side of tourism into consideration (Papatheodorou, 1999).

2.3. International Tourism Demand Forecasting

International tourism demand forecasting has been considered an important measure in tourism planning and decision making at both the national and business level (Witt, Song, & Louvieris, 2003). Due to the perishable nature of the tourism goods and services, forecasting future tourism demand is vital to the management of tourism-related businesses (Goh & Law, 2002).

2.3.1. Single equation model

In order to generate forecasts for the dependent variable in a single equation model, the explanatory variables need to be forecasted first. Results from this type of demand model can be used for policy evaluation (Song & Witt, 2000).

Chu (2004) and Song and Witt (2000) argued that the traditional, single equation tourism demand model has poor performance in forecasting future tourism demand in comparison with alternative specifications. One of possible reasons for the poor forecasting power of the method may be that the explanatory variables need to be successfully forecasted in order to acquire a correct forecast for future tourism demand. The poor forecasting performance of the single equation model rationalized the researchers' adoption of time series techniques in order to enhance forecasting accuracy in predicting future international tourism demand.

2.3.2. Time series techniques

Time series models often generate acceptable forecasts at relatively low cost and have outperformed causal single equation models in terms of forecasting accuracy (Goh & Law, 2002; Martin & Witt, 1989; Veloce, 2004; Witt & Witt, 1992, 1995). When causal models are inappropriate due to lack of data or incomplete knowledge regarding the causal structure, time series techniques have been used if sufficiently large amount of data are available on the variable to be forecasted.

Research has been conducted under the format of "one destination - multiple origins" (Cho, 2003; Chu, 2004; Goh & Law, 2002; Kim & Moosa, 2005). The tourism destinations are mostly from Asia-Pacific countries, such as Hong Kong, Singapore, Canada, etc. whereas the origin countries vary.

With an accurate estimate, the destination government and the hospitality industry can perform better tourism strategic planning for various tourism activities. Some market targeting policies may help to stimulate tourism demand from specific origins (Cho, 2003).

2.3.3. AIDS applications

The AIDS model is a relatively recent addition to the tourism demand forecasting literature. Only a few studies have briefly discussed and explored the reliability of the AIDS model as an accurate forecasting tool in international tourism studies.

De Mello et al., (2002) is one of the first studies to introduce forecasting ability of the AIDS method. In their study of UK tourists, they measured forecasting accuracy using two different criteria and confirmed the findings by Song et al., (2000) that econometric models can provide accurate forecasts of international tourism demand.

Li et al. (2004) employed an *ex post* forecast (one-year-ahead procedure), using the observations from 1972 to 1996 for model estimation. By adding one more out-of-sample observation each time until the observations up to 2000, four one-year-ahead forecasts were obtained for each destination.

Han et al. (in press) focused on the comparison of forecasting performance among three different price indexes – Stone Price Index, Paasche Index, and Laspeyres Index –

which are candidates for an aggregate price index to calculate real *per capita* tourism expenditure in the AIDS model. No significant differences were found among them.

Since the AIDS method is based on a sound theoretical foundation on consumer utility theory and relates the international tourism demand with plausible explanatory variables, it may be considered a better tool than conventional time series techniques if good forecasting performance is consistently reported from future studies.

CHAPTER III

RESEARCH METHODOLOGY

Based on the literature review of econometric analyses of international tourism demand studies, this study proposes an AIDS model which incorporates a price variable that is different from conventional CPI. The study adopted the concept of PPP in order to eliminate a major drawback of CPI, which is its inability to capture possible gaps between countries in terms of price levels and the economic welfare of their residents.

The study compared the estimation results and forecasting accuracy of the two AIDS models – one with the CPI and the other with the PPP price variables – to evaluate the overall validity and reliability of the PPP index in the international tourism demand studies. This study utilized pooled macro economic indicators and tourism-related data sets of multiple European countries to operationalize the variables of the suggested AIDS models.

This chapter consists of five sections. First, the European destinations and origins for the study were identified. Second, after the dependent variable and the independent variables of the AIDS models were described, those variables were operationalized using the data sets obtained from international organizations' statistical databases and publications. Third, the functional form of the AIDS model for this study was specified. Fourth, pre-regression tests (stationarity of the level data and the theoretical restrictions of the AIDS method) and the estimation method were explained. Finally, the definitions and the characteristics of the four criteria were provided for a comparison between the CPI model and the PPP model.

3.1. Identification of International Tourism Destinations and Origins

Europe has been considered a region that best satisfies a "three-stage budgeting" process with a minimal substitutability between European travel and non-European travel (O'Hagan & Harrison, 1984). Specifically, European tourism and non-European tourism may be heterogeneous in terms of significance of factors, such as motivation of trip, travel planning process, and sensitivity of tourism demand in response to variations in independent variables (e.g. prices, expenditure). For example, 88 percent of international arrivals to European countries are by European travelers who make frequent trips to other European countries and have sufficient information about each destination. However, travel to non-European destinations may be less frequent and need a longer planning process considering many more factors which may not be considered for travel to European countries. Consequently, the estimation results of demand equations may identify significant differences in independent variables' power of explaining international tourism demand variations between European tourism and non-European tourism.

Individual destination country's political/social stability is also considered to select tourism destinations and origins in an effort to minimize the potential effects from non-economic variables that cannot be included in the demand system. Europe, especially OECD member countries, is arguably the most stable region in the world, politically and economically.

After reviewing historic data of international tourism in Europe, this study identified European countries into the following international tourism market.

First, European tourism destinations were categorized into eight destinations – seven major countries and a group of other European countries – in order to represent Europe tourism as a whole region. These eight European tourism destinations are: France, Spain, Italy, Germany, the United Kingdom (UK), Austria, Switzerland, and other European countries that are members of the Organization for Economic Co-operation and Development (OECD). The countries in "others" are Belgium, Denmark, Finland, Greece, Iceland, Netherlands, Norway, Portugal, and Sweden. These countries are relatively minor tourism destinations compared with the other seven countries. However, by incorporating these countries into an aggregate data set, this study tried to fulfill a basic requirement of the AIDS method – a comprehensive coverage of European tourism, especially in mid-western and Mediterranean regions.

Five European countries – Germany, France, UK, Italy, and Spain – were selected as the international tourism origins based on their role as international tourism spenders according to World Tourism Organization (WTO) data. Germany, France and the UK were chosen to represent major tourism exporting countries that are located in central and northern Europe. On the other hand, Italy and Spain represented the Mediterranean countries that are considered to be in a somewhat different economic development status and have heterogeneous tourism characteristics than the three aforementioned countries.

There were minor variations in the list of top European tourism destinations for each individual origin country under consideration. However, this study analyzed the international tourism demand of these origin countries toward a common set of the destinations in order to provide more efficient and meaningful study results to examine relationships and characteristic differences among the countries of interest.

3.2. Specification and Operationalization of the Variables

3.2.1. Dependent variable

In this study, the data on international tourism market share variables was obtained by multiplying total international tourism receipts of destination *i* by the share of the tourist quantity supplied by the origin country in the total tourist hosted by destination country *i* (Han et al., in press; Papatheodorou, 1999; Syriopoulos & Sinclair, 1993). The data of international tourist arrival at frontiers or borders of the destination countries was used to operationalize the tourist quantity. The representative market share of "others" – an aggregate region of nine European countries – was calculated by using a weighted average method such as the Stone price index formula (Li et al., 2004).

3.2.2. Independent variables

Price Variables

Since this study involved most of the European countries, many of them do not provide disaggregated data necessary for development of country specific TPI. Therefore, CPI was used for the first AIDS model whereas the second AIDS model adopted the PPP index in order to compare the estimation and forecasting results between the two competing models. The US data were taken as the base for the CPI and the PPP indices in order to establish relative prices, which facilitated the comparison of the normalized indices across various countries.

CPI

As explained in the literature review, CPI has traditionally been used in the international tourism demand studies without major conceptual or econometric distortions especially when the necessary data to develop TPI were unavailable for most of the subject countries (White, 1985; Papatheodorou, 1999).

In order to incorporate international factors to the price index, a relative CPI between the two countries was adjusted by the proper exchange rates. This study applied the following equation to calculate the price variable P-CPI for an AIDS model.

$$\text{P-CPI}_{ij} = \frac{ExchangeRate_{ij}}{CPI_{ij}} \times 100 \qquad (5)$$

$$i,j = 1,\ldots,n$$

PPP

The second AIDS model adopted the PPP index in order to incorporate international tourists' perception on the difference in price levels and economic welfare between various tourism destination countries. PPP is defined as currency conversion rates that both converts to a common currency and equalize the purchasing power of different currencies (OECD, 2005a). Using market prices for the basket of goods and services covered by Gross Domestic Product (GDP), the PPP's are calculated by giving weights to each product based on the expenditure share on those products.

In the studies of international economics, the PPP index has been conceptually preferred to the CPI in order to convert the data of a service industry, such as tourism-related businesses, considering that the CPI may provide misleading results. While the CPI measures changes in levels of prices of goods and services over time within a country the PPP index measures differences in levels of prices across countries or regions (Rao, 2001). Therefore, CPI data has limitations in its use for interregional cost-of-living comparisons (Rogers, 1994). In contrast, a price variable (P-PPP) which incorporates a PPP index may best represent the relative price competitiveness among different tourism destinations, since it is calculated by using the same basket of products to compare tourism expenditures in different destinations (Dwyer et al., 2000).

O'Hagan and Harrison (1984) also claimed that a higher than expected price level in one destination country may result in a reduction in the length of stay and/or expenditure *per diem* in that country. Tourists may try to compensate for the amount of time and money being spent in other countries that might be in his/her multi-destination itinerary. Considering that the potential development of any country's tourism industry depends substantially on its ability to maintain competitive advantage in its delivery of tourism goods and services, exchange rate adjusted consumer price index does not measure price competitiveness among individual countries at a certain point of time (Dwyer *et al.*, 2000).

Therefore, it is ideal to incorporate internal price level in developing the appropriate price variable for the model. In that regard, PPP is a legitimate concept to include effects of real movement in internal competitive price levels across different countries.

Based on the reasons described above, this study used a formula suggested by Dwyer et al. (2000) to develop an alternative price variable defined as follows:

$$\text{P - PPP}_{ij} = \frac{ExchangeRate_{ij}}{PPP_{ij}} \times 100 \qquad (6)$$

$$i,j = 1,\ldots,n$$

where,

$ExchangeRate_{ij}$ is nominal exchange rate between the two countries' currencies,

PPP_{ij} is PPP index (in domestic currency) between the two countries,

A demand study using the PPP concept may provide researchers with better tools for international tourism demand analysis than the conventional CPI approach and eventually help tourism policy makers formulate national level programs and policies in European tourism destinations.

Price for "others"

Unlike the other six price variables, which are relative prices between a European destination country and the US, the price level for "others" is calculated following Stone's price index format (Li et al., 2004). A proper weight was given to an individual country using the share of that country's total international tourism receipts in the aggregate receipts generated by all nine countries in "others".

$$\ln P^* = \sum_i w_i \ln p_i$$

where,

w_i are weights for countries in "others" category,

p_i is the relative price between country i in "others" and the US

Real *per capita* tourism expenditure

The *per capita* tourism expenditure of an origin country was calculated by dividing that country's total tourism expenditure spent in the European tourism destinations by its total population in order to avoid the "double counting" problem mentioned in the previous chapter. Then, the "real" *per capita* tourism expenditure was derived by dividing the *per capita* tourism expenditure by a Stone Price Index aggregating European countries' price level in the same way as the price variable of the "others" was derived.

Dummy variables

Due to the fact that the AIDS model consists of multiple demand equations that are interrelated with each other, dummy variables are to be included in each demand equation even though an event that is represented by the dummy may seem to have limited impact to a certain region of Europe.

The following three dummy variables that were considered to have significant impacts on the overall European tourism market for the last three decades were included in the model.

(1) First oil shock (1974);

(2) World recession due to second oil shock (1980 – 1982); and

(3) Gulf War (1991)

This study did not include two summer Olympics (1972 Germany and 1992 Spain) mainly because those were country-specific events, which could not be applied to every destination equation.

Trend variable

A trend variable was applied to each equation system in order to capture the effect of the variation in a destination's attractiveness due to changes in tourist's taste for international tourism destinations. After a descriptive analysis on the historic trend of each destination's tourism market share of the five origin countries, the following five origin-specific trend variables were included in appropriate destination equations.

- France: Italy and Spain
- Germany: Austria and Italy
- Italy: France and Germany
- Spain: France and UK
- UK: France and Germany

3.2.3. Data

This study needed data to represent macroeconomic variables and tourism activities of the origin and destination countries under consideration. Various publications from international organizations and individual countries provided necessary data. The list of data and their sources are as follows:

Macroeconomic time series data, such as CPI, PPP index, and exchange rates among various countries were obtained from *International Financial Statistics Yearbook* (International Monetary Fund, various issues), and *Tourism Policy and International Tourism in OECD Member Countries* (Organization for Economic Cooperation and Development, various issues). The time series data for international tourism expenditures, receipts and arrivals for all the destination and origin countries were available from various issues of Tourism Policy and International Tourism in OECD Member Countries. The World Tourism Organization (WTO) database, which includes various issues of *Yearbook of Tourism Statistics* and *Tourism Market Trends* also provided similar data sets.

Annual data for the period 1970 – 1996 was used for the study. As the European Union (EU) was formed in 1992 and a common currency was introduced in January 1999, the OECD stopped the publication of *Tourism Policy and International Tourism in OECD Member Countries* in 1997. Since the objective of this study is the comparison of the two price variables in the AIDS methodology, the credibility of the research will not be affected from the exclusion of the most recent datasets. Therefore, the study did not use the data beyond 1996, which might raise serious problems to empirical results due to a common exchange rate among major European countries in this study.

A pooled data format – twenty-seven years of time series data on multiple tourism origins and destinations – was considered to take both temporal and cross-unit variations into account. Also, large numbers of observations adds power to the empirical analysis by reducing collinearity and by improving the efficiency of the estimates (Song & Witt, 2000).

Data of 1970 – 1993 were used for model estimation whereas data of 1994 – 1996 were reserved and used for one-year-ahead forecasting performance testing.

3.3. Functional form of the AIDS Model

After a rigorous review of the AIDS literature in international tourism demand studies, this study established an AIDS model that includes appropriate dummy variables and a time trend variable in the system of demand equations. Using the variables identified above, a log-linear functional form of the AIDS model was established as follows.

$$w_i = \alpha_i + \sum_{j=1}^{n} \gamma_{ij} \ln P_j + \beta_i \ln(x/P^*) + \delta_i \ln T + \eta_i d \qquad (7)$$
$$i,j = 1,\ldots,n$$

where w_i is the percentage share of destination country i in origin countries' tourism expenditures in all the destination countries under consideration;

P_j is the exchange rate-adjusted price (either P-CPI or P-PPP) faced by the origin countries' tourists in destination country j;

x is the *per capita* tourism expenditure by the origin countries;

P^* is the weighted price index for all the destination countries;

T is a time trend to capture all other factors which may influence the quantity of the tourism product demanded in international tourism;

d is a dummy variable to capture the impact of special events on international tourism demand; and

n is the number of the destination countries.

The two AIDS models differ in the operationalization of P_j. As explained previously, one model includes conventional CPI whereas the other model applies the PPP index.

For the theoretical properties of the demand theory, the following parametric restrictions are imposed on equation (7) (Deaton & Muellbauer, 1980).

$$\sum_{i=1}^{n} \alpha_i = 1 \qquad \sum_{i=1}^{n} \gamma_{ij} = \sum_{i=1}^{n} \beta_i = \sum_{i=1}^{n} \delta_i = \sum_{i=1}^{n} \eta_i = 0 \qquad (7a)$$

$$\sum_{j=1}^{n} \gamma_{ij} = 0 \qquad \forall i \quad and\, \gamma_{ij} = \gamma_{ji} \qquad \forall i,j \qquad (7b)$$

The restriction (7a) is *adding-up*, first restriction of (7b) is *homogeneity*, and the last restriction of (7b) is *symmetry*.

3.4. Pre-estimation Tests

Testing non-stationarity of time series data and CI technique

As described in Chapter 2, the cointegration (CI) technique is developed to solve the spurious correlation problem especially when time series are trended in econometric model. The cointegration method is based on the notion that the errors of the model should follow a stationary process around the value of zero over time if the long-run equilibrium regression is estimated using ordinary least square (Song & Witt, 2000). If the CI test statistics indicate that all the residuals from the demand share equations are stationary, the adoption of the long-run demand share equations for the analysis is supported (Han et al., in press).

Before the CI test, testing for non-stationarity (unit-root process) is a standard procedure to validate that the estimated results are not subject to bias (Han et al, in press). The Augmented Dickey-Fulller (ADF) test is a common test for non-stationarity. The test results will show whether variables are stationary and if non-stationary, how many differences of the level data will result in stationarity. However, the AIDS model is to focus on analysis of long-run behavior of the variables to predict value shares, whereas the dynamic (or differenced) AIDS model predicts changes in value shares.

This study conducted ADF tests on the level data and the estimation residuals to legitimize the analysis of static AIDS models.

Testing theoretical restrictions on the parameters of the AIDS model

The Wald tests were conducted to test the parameter restrictions described in (7b). If the model specification passes the Wald test, we can impose the restrictions of *homogeneity* and *symmetry* by the restricted SUR method in accordance with the underlying economic theory (Durbarry & Sinclair, 2003; Han et al., in press). By leaving one of the parameters out of the estimation, a higher degree of freedom is guaranteed. If the restrictions were not supported by the test, an unrestricted SUR estimation needs to be conducted.

3.5. Regression Method

The system of AIDS demand equations was estimated using Zellner (1962)'s Seemingly Unrelated Regression (SUR) method of which the details were explained in the literature review chapter. If the parameter restrictions are not rejected, both unrestricted and restricted regressions can be conducted using a statistical computer program *E-views*. If Wald tests fail to support those parameter restrictions, the study will conduct unrestricted SUR estimation.

3.6. Comparison of CPI and PPP

Technically, when the two rival explanatory variables are compared by conducting two separate regression analyses, the difference between the two variables and/or preference for one variable over the other variable cannot be tested using a simple test statistic. Therefore, the previous studies that conducted any type of comparative analyses had to rely on a rather descriptive method to provide research results (Leamer, 1978; Li et al., 2004).

In this study, two price variables – the exchange rate adjusted CPI (P-CPI) and the exchange rate adjusted PPP index (P-PPP) – were appraised by using four comparison criteria. The first three criteria were from the model estimation results. They were (1) magnitude of adjusted-R^2 to measure model's goodness-of-fit; (2) statistical significance of coefficient estimates to provide meaningful explanation on the relationship between the dependent variable and independent variables and; (3) Durbin-Watson (DW) statistic to test autocorrelation of error terms (Papatheodorou, 1999; Witt & Witt, 1992). The last criterion was applied to measure forecasting performance of the model. In order to measure and compare forecasting power of the two rival AIDS models, the following forecasting accuracy statistics were used: (1) Theil's U; (2) mean absolute deviation (MAD); (3) root mean squared error (RMSE); and (4) mean absolute percentage error (MAPE).

3.6.1. Adjusted-R^2

Adjusted-R^2 is a statistic that is acquired by adjusting R^2 accounting for degrees of freedom. The R^2, the coefficient of determination, is supposed to represent the proportion of the variation in the dependent variable "explained" by variations in the independent variables. However, the drawback of R^2 is that the statistic can be increased anytime when researchers add more explanatory variables.

In order to avoid this pitfall of regular R^2, adjusted-R^2 penalizes the inclusion of extra explanatory variables. When the functional form and the independent variables of a model are known, as is the case of the AIDS model, adjusted-R^2 can be applied as a criterion in the context of searching for a "good" estimator (Kennedy, 1992). The magnitude of adjusted-R^2 statistics between the CPI model and the P-PPP model were compared origin-by-origin (i.e. system by system).

3.6.2. Statistical significance of coefficient estimates

The coefficient estimates of the two AIDS models were expected to provide information regarding tourism demand elasticities to own price, cross-price, real *per capita* tourism expenditures, dummies and trend variables. Depending on the parameter restriction tests, either unrestricted SUR estimation results or both unrestricted and restricted estimation results would be used in the analysis.

The demand elasticity analysis is much more meaningful when the parameter restriction tests support the homogeneity and symmetry. However, as shown by studies such as Li et al. (2004) and Han et al. (in press), a significant number of statistically insignificant coefficient estimates may result for both restricted and unrestricted estimations.

3.6.3. Durbin-Watson (DW) statistic

The Durbin-Watson (DW) statistic was used to test for the existence of first-order autocorrelation. Autocorrelation exists if the disturbance terms corresponding to different observations are correlated. In time series data, the correlations between disturbances taken from different time periods are the main concern. (Judge, Griffiths, Hill, Lütkepohl, & Lee, 1985). When the first-order autocorrelation parameter is zero, the DW statistic is approximately 2.0. The further away the statistic is from 2.0, the less confident one can be that there is no autocorrelation in the disturbances (Kennedy, 1992).

Deaton and Muellbauer (1980b) pointed out that the imposition of a *homogeneity* restriction to the model generates a positive serial correlation in the residuals that leads to a sharp drop in the DW statistic. Papatheodorou (1999) showed that DW statistics are relatively low under a homogeneity restriction compared to the statistics from unrestricted model. The DW statistics between the CPI and PPP models were compared origin-by-origin in terms of the number of tourism destinations of each origin where no autocorrelation was detected.

3.6.4. Forecasting accuracy criteria

The last appraisal criterion was the forecasting performance of the AIDS model. An ideal demand model should be capable of adequately predicting observation not used in its estimation/specification in order to validate its parameter consistency (Kennedy, 1992).

The two rival AIDS models would be compared in terms of tourism demand forecasting accuracy using the following statistics which represent four different types of accuracy measurement:

Mean Absolute Deviation (MAD)

$$\frac{\sum\left|A_t - F_t\right|}{n}$$

Root Mean Squared Error (RMSE)

$$\sqrt{\frac{\sum (A_t - F_t)^2}{n}}$$

Mean Absolute Percentage Error (MAPE)

$$\frac{\sum\left|(A_t - F_t)/A_t\right|}{n}$$

Theil's U

$$\frac{\sqrt{\sum (A_t - F_t)^2}}{\sqrt{\sum (A_t - A_{t-1})^2}}$$

where, A_t is actual value of period t, F_t is a forecasted value of period t, and n is the number of samples

Since these evaluation criteria measure the spread or dispersion of the forecast value from its actual data, the smaller the statistic, the better the forecasting performance. Therefore, origin-by-origin comparison of the four forecasting accuracy statistics would evaluate the two AIDS models' forecasting performance.

The advantages, limitations and unique applications of the four statistics are summarized in Table 4.

Table 4. Summary of the four major forecasting accuracy statistics

	Characteristics	*Pros*	*Cons*
MAD	Measuring the spread of the forecast value from its mean.	Ease of interpretation. Each error term is assigned the same weight.	Ignores the importance of over- or under-estimation.
RMSE	Describe forecast error which is the difference between the observation and the forecast made.	Preferred when more weight is given to big errors. Preserve units such as US dollar.	Cannot compare different time series techniques and time intervals.
MAPE	Defines relative or percentage error.	Allows comparison across different techniques and time intervals.	Fails to take over- or under-estimation into consideration.
Theil's U	A relative measure, which allows comparison with the naïve or random walk model.	Use an objective comparison barometer.	Difficult interpretation. A few large values can distort the comparisons because there is no upper bound.

Source: Goh and Law (2002)

CHAPTER IV

DATA ANALYSES AND RESULTS

The objective of the study was to examine if the PPP index in the AIDS model produces similar or different results than the conventional model that uses CPI for the price variable. In order to achieve this goal, this study appraised the two AIDS models, one with the PPP index and the other with conventional CPI, in terms of estimation results and forecasting accuracy of European tourism demand.

The international tourism destinations and origins used in this study were:

- Destinations: France, Spain, Italy, Germany, the United Kingdom (UK), Austria, Switzerland, and Others (an aggregate of nine European countries).
- Origins: Germany, France, Italy, Spain and the UK

Results of an ADF test indicated that the variables were non-stationary with $I(1)$ (Appendix A). Also, the presence of stationary residuals from a regression was tested with another ADF test on the estimation residuals. As a result, cointegration relationships among the variables were detected for every demand equation for each individual destination (Appendix B). Based on the results of these two ADF tests, which supported the existence of a long-run equilibrium, the long-run static tourism demand equations were analyzed in the study.

The Wald test was used to determine if parameter restrictions regarding symmetry and homogeneity restrictions of the model were present. The test results provided by Chi-square statistics did not support either of the two restrictions (Appendix C). However, throughout the literature where the AIDS method has been used to study consumer demand and international tourism demand, the two restrictions were often statistically rejected (Bera, 1982; Deaton & Muellbauer, 1980b; Muellbauer, 1982; Syriopoulos & Sinclair, 1993). The researchers in those studies suggested that the rejection of homogeneity and symmetry may be due to inappropriate asymptotic standard tests that are biased towards rejecting those restrictions (Syriopoulos & Sinclair, 1993).

Given the limitation in this and other similar studies of this type, and given the fact that the present study objective involved comparing the two rival AIDS models, the researcher proceeded with the study and conducted unrestricted regression analysis on the data.

Tourism models for each of the five European origin countries were developed for the period 1970 – 1993 by using the SUR equation (7) in Chapter 3.

The estimated tourism demand equations were then used to evaluate forecasting performance of the two AIDS models. Four different forecasting accuracy statistics were calculated for the data of 1994 – 1996. Each forecasted value was compared with the actual value of the data for the three year period.

This chapter consists of three sections. First, key findings from the estimation procedures were summarized based on the empirical results found in Tables 5 -14. The two AIDS models were compared and evaluated in terms of the three criteria discussed in Chapter 3. For each origin country, the results of these three criteria were compared between the two models. Second, the forecasting performance of the two AIDS models was evaluated by using four major forecasting accuracy statistics proposed in the previous chapter. Finally, based on the results, a discussion is presented as to the performance evaluation of each of the two models.

4.1. Estimation Results

The European international tourism demand models for the five origin countries were compared by using the three criteria derived from the unrestricted SUR estimation process. With the rejections of homogeneity and symmetry, the coefficient estimates from an unrestricted regression did not provide satisfying results that could help the researcher interpret the inter-country relationships between various countries involved in the study.

The evaluation criteria were (1) adjusted-R^2 to measure model's goodness-of-fit; (2) the number of statistically significant coefficient estimates and; (3) Durbin-Watson (DW) statistics to test autocorrelation of error terms. The results of those comparisons are described next for each origin country.

France

In terms of statistical significance of the coefficient estimates, the CPI model produced nine more statistically significant coefficients than the PPP model. The CPI model produced three more price coefficients, four more real *per capita* tourism expenditure coefficients, and two more constants that were significant at significance levels 1% to 10%.

For the adjusted R^2, the PPP model marginally outperformed the CPI model in four out of seven destinations. That is, for the equations representing four destinations of French tourists, the PPP model had larger R^2's than the CPI model. For the DW statistic, both AIDS models had five destinations with no autocorrelations, whereas two destinations had indecisive results. The above comparisons for France were based on the estimation results summarized in Table 5 for the CPI model and in Table 6 for the PPP model.

Table 5. Parameter estimates of an AIDS model (CPI): French outbound tourism

	Austria	Germany	Italy	Spain	Switzerland	UK	Others
α_i	**0.2028**[c] (0.1096)	**0.3753**[a] (0.1363)	**-2.4070**[a] (0.7343)	**1.4233**[b] (0.6998)	**0.3892**[b] (0.1570)	**0.7888**[a] (0.2542)	**0.0888**[c] (0.0495)
γ_{iA}	0.0190 (0.0367)	0.0115 (0.0456)	0.0704 (0.2420)	**-0.4221**[c] (0.2308)	-0.0720 (0.0525)	**0.4141**[a] (0.0850)	0.0111 (0.0165)
γ_{iG}	**-0.1249**[a] (0.0321)	-0.0488 (0.0399)	0.1364 (0.2249)	**0.3523**[c] (0.2138)	-0.0205 (0.0459)	**-0.3269**[a] (0.0743)	**-0.0355**[b] (0.0145)
γ_{iI}	0.0018 (0.0106)	**-0.0921**[a] (0.0132)	**-0.2157**[a] (0.0708)	**0.3590**[a] (0.0675)	**0.0660**[a] (0.0152)	**-0.1337**[a] (0.0246)	0.0029 (0.0048)
γ_{iSP}	**0.0470**[a] (0.0155)	**0.0331**[c] (0.0192)	-0.0459 (0.1011)	-0.1089 (0.0965)	-0.0283 (0.0222)	**0.0962**[a] (0.0359)	**0.0126**[c] (0.0070)
γ_{iSW}	**0.0445**[b] (0.0173)	**-0.0399**[c] (0.0216)	0.0707 (0.1364)	0.0206 (0.1290)	0.0109 (0.0248)	-0.0447 (0.0402)	0.0003 (0.0078)
γ_{iU}	**-0.0224**[b] (0.0095)	-0.0066 (0.0118)	**0.4310**[a] (0.0620)	**-0.2739**[a] (0.0592)	**-0.0658**[a] (0.0135)	-0.0343 (0.0219)	**-0.0222**[a] (0.0043)
γ_{iO}	0.0104 (0.0221)	**0.0845**[a] (0.0274)	0.1443 (0.1473)	-0.1547 (0.1404)	0.0487 (0.0316)	**-0.1275**[b] (0.0511)	**0.0207**[a] (0.0100)
β_i	-0.0062 (0.0039)	**-0.0092**[c] (0.0049)	**0.0538**[c] (0.0276)	0.0022 (0.0262)	**-0.0110**[c] (0.0056)	**-0.0164**[c] (0.0090)	**-0.0046**[a] (0.0018)
η_i	0.0019 (0.0021)	-0.0036 (0.0026)	**-0.0359**[a] (0.0135)	0.0197 (0.0129)	**0.0072**[b] (0.0030)	**0.0090**[c] (0.0048)	0.0010 (0.0009)
δ_i	N/A	N/A	-0.0029 (0.0230)	-0.0158 (0.0213)	N/A	N/A	N/A
Adj R^2	0.8486	0.9341	0.7895	0.8269	0.8951	0.9097	0.7169
DW	1.9539	2.2882	1.5640	1.8943	1.5013	2.2709	1.9466

α_i : constant coefficient

γ_{ij} : price coefficient (i = destination country, j = country where price changes)

β_i : real *per capita* tourism expenditure coefficient

η_i : dummy coefficient

δ_i : trend coefficient

Note: The coefficient estimates in bold type were statistically significant at a = 1%, b = 5% and c = 10% level. Values in parentheses are standard errors.

Table 6. Parameter estimates of an AIDS model (PPP): French outbound tourism

	Austria	Germany	Italy	Spain	Switzerland	UK	Others
α_i	0.1588 (0.1082)	**0.4638**[a] (0.1578)	**-2.2574**[a] (0.7375)	**1.3006**[b] (0.7026)	**0.3516**[b] (0.1651)	**0.7945**[a] (0.2739)	0.0712 (0.0487)
γ_{iA}	0.0271 (0.0434)	0.0241 (0.0633)	-0.2938 (0.2850)	-0.1420 (0.2720)	-0.0565 (0.0662)	**0.4619**[a] (0.1098)	-0.0058 (0.0195)
γ_{iG}	**-0.1171**[a] (0.0275)	0.0154 (0.0400)	**0.3781**[b] (0.1860)	0.1387 (0.1772)	0.0142 (0.0419)	**-0.4434**[a] (0.0695)	-0.0132 (0.0124)
γ_{iI}	-0.0024 (0.0119)	**-0.1044**[a] (0.0174)	**-0.1733**[b] (0.0798)	**0.3516**[a] (0.0761)	**0.0606**[a] (0.0182)	**-0.1447**[a] (0.0302)	0.0026 (0.0054)
γ_{iSP}	**0.0503**[b] (0.0194)	**0.0519**[c] (0.0282)	-0.1891 (0.1267)	0.0094 (0.1209)	-0.0150 (0.0295)	**0.0893**[c] (0.0490)	0.0059 (0.0087)
γ_{iSW}	**0.0379**[b] (0.0157)	**-0.0691**[a] (0.0229)	0.0281 (0.1185)	0.0629 (0.1125)	-0.0083 (0.0240)	-0.0103 (0.0398)	-0.0080 (0.0071)
γ_{iU}	**-0.0210**[b] (0.0095)	-0.0116 (0.0139)	**0.4310**[a] (0.0628)	**-0.2900**[a] (0.0599)	**-0.0695**[a] (0.0146)	-0.0135 (0.0241)	**-0.0213**[a] (0.0043)
γ_{iO}	0.0022 (0.0305)	0.0097 (0.0445)	**0.3569**[c] (0.2008)	**-0.3230**[c] (0.1916)	0.0083 (0.0465)	-0.0700 (0.0772)	**0.0287**[b] (0.0137)
β_i	-0.0063 (0.0061)	-0.0091 (0.0088)	**0.1131**[a] (0.0415)	-0.0549 (0.0396)	-0.0118 (0.0092)	-0.0235 (0.0153)	-0.0005 (0.0027)
η_i	0.0022 (0.0019)	-0.0003 (0.0027)	**-0.0291**[b] (0.0122)	0.0124 (0.0117)	**0.0088**[a] (0.0029)	0.0046 (0.0047)	**0.0018**[b] (0.0008)
δ_i	N/A	N/A	0.0011 (0.0211)	-0.0130 (0.0197)	N/A	N/A	N/A
Adj R^2	0.8524	0.9117	0.7937	0.8310	0.8839	0.8951	0.7255
DW	2.0368	2.2625	1.3716	1.8650	1.5969	2.0802	2.2099

α_i: constant coefficient

γ_{ij}: price coefficient (i = destination country, j = country where price changes)

β_i: real *per capita* tourism expenditure coefficient

η_i: dummy coefficient

δ_i: trend coefficient

Note: The coefficient estimates in bold type were statistically significant at a = 1%, b = 5% and c = 10% level. Values in parentheses are standard errors.

Germany

The CPI model produced one less significant coefficient for real *per capita* tourism expenditure than the PPP model. However, the CPI model had two more significant constants and one more price coefficient than the PPP model. For the adjusted R^2, the PPP model marginally outperformed the CPI model in four out of seven destinations. Both AIDS models had four destinations where no autocorrelations were detected, whereas three destinations had indecisive results. The above comparisons for Germany were based on the estimation results summarized in Table 7 for the CPI model and in Table 8 for the PPP model.

Table 7. Parameter estimates of an AIDS model (CPI): German outbound tourism

	Austria	France	Italy	Spain	Switzerland	UK	Others
α_i	**1.4253**[c] (0.8041)	**-1.3893**[c] (0.8025)	**1.2393**[c] (0.6954)	-0.3993 (0.3563)	0.0271 (0.1908)	**-0.2664**[c] (0.1511)	0.0350 (0.1859)
γ_{iA}	**-0.4312**[c] (0.2234)	0.2657 (0.2256)	-0.0271 (0.1906)	0.1032 (0.1001)	0.0646 (0.0536)	**0.1200**[a] (0.0425)	-0.0605 (0.0522)
γ_{iF}	0.0367 (0.1668)	0.0559 (0.1677)	**-0.2757**[c] (0.1430)	0.0287 (0.0744)	0.0455 (0.0399)	0.0343 (0.0316)	0.0284 (0.0388)
γ_{iI}	-0.0309 (0.0683)	-0.0094 (0.0690)	**-0.1854**[a] (0.0582)	**0.1542**[a] (0.0306)	**0.0686**[a] (0.0164)	**-0.0719**[a] (0.0130)	**0.0671**[a] (0.0160)
γ_{iSP}	0.1684 (0.1017)	-0.0709 (0.1028)	0.0088 (0.0866)	-0.0583 (0.0457)	**-0.0867**[a] (0.0244)	**0.0366**[c] (0.0194)	-0.0036 (0.0238)
γ_{iSW}	0.0602 (0.1116)	-0.0300 (0.1077)	0.0532 (0.0999)	-0.0073 (0.0478)	0.0146 (0.0256)	-0.0136 (0.0203)	0.0065 (0.0249)
γ_{iU}	**-0.1318**[b] (0.0579)	-0.0057 (0.0584)	**0.3560**[a] (0.0494)	**-0.0957**[a] (0.0259)	**-0.0580**[a] (0.0139)	0.0056 (0.0110)	**-0.0604**[a] (0.0135)
γ_{iO}	0.1215 (0.1344)	0.1589 (0.1353)	**-0.1924**[c] (0.1150)	-0.0094 (0.0601)	-0.0324 (0.0322)	**-0.0452**[c] (0.0255)	0.0316 (0.0313)
β_i	-0.0238 (0.0234)	**0.0424**[c] (0.0229)	0.0096 (0.0207)	0.0018 (0.0102)	0.0002 (0.0054)	-0.0062 (0.0043)	-0.0087 (0.0053)
η_i	0.0140 (0.0127)	-0.0128 (0.0128)	**-0.0248**[b] (0.0108)	0.0057 (0.0057)	**0.0127**[a] (0.0030)	0.0035 (0.0024)	0.0013 (0.0030)
δ_i	0.0022 (0.0112)	N/A	**-0.0304**[b] (0.0142)	N/A	N/A	N/A	N/A
Adj R^2	0.7594	0.7411	0.5913	0.6500	0.4968	0.7327	0.8354
DW	1.7488	1.9869	1.8088	1.7608	1.3026	1.6248	1.3616

α_i: constant coefficient

γ_{ij}: price coefficient (i = destination country, j = country where price changes)

β_i: real *per capita* tourism expenditure coefficient

η_i: dummy coefficient

δ_i: trend coefficient

Note: The coefficient estimates in bold type were statistically significant at a = 1%, b = 5% and c = 10% level. Values in parentheses are standard errors.

Table 8. Parameter estimates of an AIDS model (PPP): German outbound tourism

	Austria	France	Italy	Spain	Switzerland	UK	Others
α_i	**1.7799**[b] (0.6903)	-0.9101 (0.6645)	0.7062 (0.6185)	-0.4470 (0.2808)	-0.1313 (0.1625)	**-0.3957**[a] (0.1273)	0.0984 (0.1612)
γ_{iA}	**-0.4827**[c] (0.2497)	0.0851 (0.2465)	-0.0062 (0.2202)	**0.2131**[b] (0.1041)	0.0957 (0.0603)	**0.1592**[a] (0.0472)	-0.0416 (0.0598)
γ_{iF}	0.0455 (0.1588)	0.1332 (0.1556)	**-0.3093**[b] (0.1407)	0.0167 (0.0658)	0.0274 (0.0380)	0.0131 (0.0298)	0.0338 (0.0378)
γ_{iI}	-0.0093 (0.0813)	0.0203 (0.0802)	**-0.1785**[b] (0.0717)	**0.1186**[a] (0.0339)	**0.0616**[a] (0.0196)	**-0.0836**[a] (0.0154)	**0.0615**[a] (0.0195)
γ_{iSP}	0.1505 (0.1218)	-0.1504 (0.1202)	0.0088 (0.1075)	0.0020 (0.0508)	**-0.0796**[a] (0.0294)	**0.0506**[b] (0.0230)	0.0064 (0.0292)
γ_{iSW}	-0.0129 (0.1058)	-0.0908 (0.0978)	0.1587 (0.0971)	-0.0001 (0.0413)	0.0231 (0.0239)	0.0024 (0.0187)	-0.0085 (0.0237)
γ_{iU}	**-0.1431**[b] (0.0594)	-0.0010 (0.0584)	**0.3578**[a] (0.0525)	**-0.0968**[a] (0.0247)	**-0.0538**[a] (0.0143)	0.0114 (0.0112)	**-0.0633**[a] (0.0142)
γ_{iO}	0.1321 (0.1586)	0.2355 (0.1558)	-0.1315 (0.1402)	**-0.1280**[c] (0.0659)	-0.0270 (0.0381)	-0.0479 (0.0299)	-0.0016 (0.0378)
β_i	-0.0156 (0.0318)	**0.0750**[b] (0.0298)	0.0021 (0.0289)	-0.0157 (0.0126)	-0.0042 (0.0073)	**-0.0129**[b] (0.0057)	-0.0096 (0.0072)
η_i	0.0172 (0.0116)	-0.0063 (0.0114)	**-0.0312**[a] (0.0102)	0.0055 (0.0048)	**0.0115**[a] (0.0028)	0.0018 (0.0022)	0.0024 (0.0028)
δ_i	0.0090 (0.0151)	N/A	**-0.0381**[b] (0.0172)	N/A	N/A	N/A	N/A
Adj R^2	0.7588	0.7516	0.5638	0.6957	0.4891	0.7345	0.8266
DW	1.8540	2.0296	2.0075	1.8119	1.3324	1.5071	1.2531

α_i: constant coefficient

γ_{ij}: price coefficient (i = destination country, j = country where price changes)

β_i: real *per capita* tourism expenditure coefficient

η_i: dummy coefficient

δ_i: trend coefficient

Note: The coefficient estimates in bold type were statistically significant at a = 1%, b = 5% and c = 10% level. Values in parentheses are standard errors.

Italy

Overall, the PPP model produced seven more statistically significant coefficients than the CPI model. The PPP model had six more price coefficients and two more constants but one less trend coefficient than the CPI model. For the adjusted R^2, the PPP model outperformed the CPI model in six out of seven destinations. For the DW statistic, the CPI model had two more destinations than the PPP model where no autocorrelations were detected. The above comparisons for Italy were based on the estimation results summarized in Tables 9 for the CPI model and in Table 10 for the PPP model.

Table 9. Parameter estimates of an AIDS model (CPI): Italian outbound tourism

	Austria	France	Germany	Spain	Switzerland	UK	Others
α_i	0.1265 (0.2171)	**3.0849**[a] (1.0248)	**-1.2872**[a] (0.2932)	-0.0372 (0.6229)	0.2817 (0.2648)	**-1.1176**[a] (0.3904)	**-0.1205**[b] (0.0527)
γ_{iA}	-0.0052 (0.1089)	-0.5920 (0.5147)	0.1541 (0.1477)	0.1774 (0.3126)	-0.1483 (0.1329)	**0.4780**[b] (0.1959)	-0.0028 (0.0264)
γ_{iF}	-0.0337 (0.0836)	-0.2793 (0.3954)	-0.0671 (0.1139)	0.1783 (0.2400)	0.1370 (0.1020)	0.0094 (0.1504)	-0.0065 (0.0203)
γ_{iG}	-0.0216 (0.1019)	-0.3334 (0.4828)	0.0739 (0.1401)	0.1177 (0.2925)	0.1397 (0.1243)	-0.0965 (0.1833)	0.0150 (0.0247)
γ_{iSP}	**0.0983**[b] (0.0481)	0.1408 (0.2269)	0.0777 (0.0649)	**-0.2671**[c] (0.1379)	**-0.1588**[a] (0.0586)	0.0974 (0.0864)	**0.0220**[c] (0.0117)
γ_{iSW}	0.0217 (0.0518)	0.3902 (0.2478)	-0.0420 (0.0748)	-0.1148 (0.1488)	-0.0840 (0.0632)	-0.0673 (0.0932)	0.0000 (0.0126)
γ_{iU}	0.0075 (0.0297)	-0.2473 (0.1403)	**0.1292**[a] (0.0402)	0.0439 (0.0852)	0.0471 (0.0362)	0.0285 (0.0534)	0.0065 (0.0072)
γ_{iO}	-0.0753 (0.0658)	0.4901 (0.3107)	-0.0344 (0.0890)	-0.1363 (0.1888)	0.0166 (0.0803)	**-0.2292**[c] (0.1183)	-0.0045 (0.0160)
β_i	0.0095 (0.0094)	0.0139 (0.0447)	**-0.0247**[c] (0.0130)	**0.0476**[c] (0.0271)	0.0015 (0.0115)	**-0.0359**[b] (0.0170)	-0.0017 (0.0023)
η_i	-0.0012 (0.0062)	-0.0132 (0.0294)	-0.0038 (0.0084)	0.0034 (0.0179)	0.0047 (0.0076)	0.0113 (0.0112)	-0.0016 (0.0015)
δ_i	N/A	**-0.0265**[b] (0.0116)	-0.0042 (0.0079)	N/A	N/A	N/A	N/A
Adj -R^2	0.8356	0.1123	0.8278	0.2986	0.8725	0.6179	0.4496
DW	1.8804	1.8057	2.0984	2.4864	1.9863	2.2461	1.8337

α_i: constant coefficient

γ_{ij}: price coefficient (i = destination country, j = country where price changes)

β_i: real *per capita* tourism expenditure coefficient

η_i: dummy coefficient

δ_i: trend coefficient

Note: The coefficient estimates in bold type were statistically significant at a = 1%, b = 5% and c = 10% level. Values in parentheses are standard errors.

Table 10. Parameter estimates of an AIDS model (PPP): Italian outbound tourism

	Austria	France	Germany	Spain	Switzerland	UK	Others
α_i	**0.3298[c]** (0.1676)	**1.5638[b]** (0.7731)	**-1.0787[a]** (0.2261)	0.2890 (0.4994)	**0.4541[b]** (0.2038)	**-0.5569[c]** (0.2881)	**-0.0860[b]** (0.0395)
γ_{iA}	0.0446 (0.1183)	**-1.1727[b]** (0.5443)	0.2427 (0.1566)	0.3013 (0.3525)	-0.1164 (0.1439)	**0.7173[a]** (0.2034)	0.0089 (0.0279)
γ_{iF}	-0.0707 (0.0767)	-0.0142 (0.3528)	-0.0657 (0.1018)	0.0744 (0.2284)	0.1418 (0.0932)	-0.0809 (0.1318)	-0.0063 (0.0180)
γ_{iG}	-0.0900 (0.0789)	0.2670 (0.3635)	0.0358 (0.1056)	-0.0668 (0.2350)	0.1531 (0.0959)	**-0.3430[b]** (0.1356)	0.0108 (0.0186)
γ_{iSP}	**0.1295[b]** (0.0547)	-0.1606 (0.2515)	**0.1492[b]** (0.0721)	-0.2508 (0.1629)	**-0.1107[c]** (0.0665)	**0.2160[b]** (0.0940)	**0.0335[a]** (0.0129)
γ_{iSW}	0.0463 (0.0469)	0.2044 (0.2178)	-0.0239 (0.0660)	-0.0982 (0.1398)	-0.0790 (0.0571)	-0.0121 (0.0807)	0.0028 (0.0110)
γ_{iU}	-0.0005 (0.0299)	-0.1958 (0.1375)	**0.1129[a]** (0.0396)	0.0482 (0.0890)	0.0259 (0.0363)	0.0135 (0.0514)	0.0028 (0.0070)
γ_{iO}	-0.0982 (0.0704)	**0.8165[b]** (0.3235)	**-0.1864[b]** (0.0927)	-0.0443 (0.2097)	-0.0941 (0.0856)	**-0.3640[a]** (0.1210)	**-0.0290[c]** (0.0166)
β_i	-0.0016 (0.0117)	**0.1040[c]** (0.0537)	**-0.0421[a]** (0.0156)	0.0329 (0.0347)	-0.0077 (0.0142)	**-0.0765[a]** (0.0200)	-0.0044 (0.0027)
η_i	-0.0043 (0.0055)	0.0046 (0.0253)	-0.0046 (0.0073)	0.0019 (0.0164)	0.0049 (0.0067)	0.0033 (0.0095)	-0.0017 (0.0013)
δ_i	N/A	-0.0078 (0.0097)	-0.0052 (0.0075)	N/A	N/A	N/A	N/A
Adj-R^2	0.8443	0.2021	0.8440	0.2834	0.8799	0.6691	0.5093
DW	1.9773	2.0220	2.3981	2.3776	2.0117	2.6466	2.1613

α_i: constant coefficient

γ_{ij}: price coefficient (i = destination country, j = country where price changes)

β_i: real *per capita* tourism expenditure coefficient

η_i: dummy coefficient

δ_i: trend coefficient

Note: The coefficient estimates in bold type were statistically significant at a = 1%, b = 5% and c = 10% level. Values in parentheses are standard errors.

Spain

The PPP model produced only one more statistically significant coefficient than the CPI model. The PPP model had two more price coefficients and one more dummy coefficient but two less real per capital tourism expenditure coefficients than the CPI model. For the adjusted R^2, the PPP model outperformed the CPI model in all seven destinations. Both AIDS models had three destinations where no autocorrelations were detected, whereas four destinations had indecisive results. The above comparisons for Spain were based on the estimation results summarized in Table 11 for the CPI model and in Table 12 for the PPP model.

Table 11. Parameter estimates of an AIDS model (CPI): Spanish outbound tourism

	Austria	France	Germany	Italy	Switzerland	UK	Others
α_i	-0.0177 (0.7222)	1.8057 (0.9906)	0.4042 (0.1768)	-0.3029 (0.5235)	0.0572 (0.1653)	0.9221 (0.3724)	-1.8472 (0.5889)
γ_{iA}	-0.1015 (0.2926)	-0.5358 (0.4017)	**0.2033[a]** (0.0716)	0.1715 (0.2120)	-0.0555 (0.0670)	**0.4105[a]** (0.1517)	-0.0806 (0.2385)
γ_{iF}	0.1125 (0.2225)	0.0983 (0.3062)	-0.0327 (0.0545)	**-0.2880[c]** (0.1613)	0.0406 (0.0509)	**0.1953[c]** (0.1166)	-0.1381 (0.1814)
γ_{iG}	-0.2766 (0.2651)	-0.0712 (0.3667)	**-0.1761[a]** (0.0649)	0.2507 (0.1921)	-0.0719 (0.0607)	-0.1692 (0.1425)	**0.4928[b]** (0.2161)
γ_{iI}	-0.1373 (0.0870)	**0.2733[b]** (0.1196)	**-0.0884[a]** (0.0213)	**-0.1963[a]** (0.0630)	**0.0694[a]** (0.0199)	**-0.1114[b]** (0.0455)	**0.1860[a]** (0.0709)
γ_{iSW}	0.1247 (0.1449)	-0.0186 (0.2048)	0.0346 (0.0355)	0.0468 (0.1050)	**0.1328[a]** (0.0332)	-0.1295 (0.0855)	-0.1700 (0.1181)
γ_{iU}	**0.1911[b]** (0.0799)	**-0.2357[b]** (0.1096)	**-0.0353[c]** (0.0196)	**0.2411[a]** (0.0579)	**-0.0654[a]** (0.0183)	**-0.1851[a]** (0.0412)	0.0917 (0.0651)
γ_{iO}	0.1297 (0.1823)	0.2901 (0.2500)	0.0350 (0.0446)	-0.1775 (0.1321)	-0.0351 (0.0417)	**-0.2751[a]** (0.0940)	0.0386 (0.1486)
β_i	0.0117 (0.0229)	**0.0578[c]** (0.0317)	**-0.0339[a]** (0.0056)	-0.0141 (0.0166)	**-0.0168[a]** (0.0052)	**-0.0790[a]** (0.0124)	**0.0764[a]** (0.0186)
η_i	0.0257 (0.0173)	**-0.0424[c]** (0.0237)	0.0028 (0.0042)	-0.0112 (0.0125)	**0.0105[a]** (0.0040)	0.0133 (0.0088)	0.0012 (0.0141)
δ_i	N/A	**-0.0775[a]** (0.0144)	N/A	N/A	N/A	**0.0715[a]** (0.0120)	N/A
Adj $-R^2$	0.4626	0.6968	0.8613	0.4839	0.5974	0.8614	0.5587
DW	2.0179	2.5582	2.8002	2.4004	2.0592	2.2649	1.4460

α_i : constant coefficient

γ_{ij} : price coefficient (i = destination country, j = country where price changes)

β_i : real *per capita* tourism expenditure coefficient

η_i : dummy coefficient

δ_i : trend coefficient

Note: The coefficient estimates in bold type were statistically significant at a = 1%, b = 5% and c = 10% level. Values in parentheses are standard errors.

Table 12. Parameter estimates of an AIDS model (PPP): Spanish outbound tourism

	Austria	France	Germany	Italy	Switzerland	UK	Others
α_i	-0.3319 (0.8587)	3.2807 (1.0739)	0.2573 (0.2088)	-1.0461 (0.6058)	-0.3246 (0.1640)	0.3288 (0.4394)	-1.1352 (0.6419)
γ_{iA}	-0.2450 (0.3295)	-0.0000 (0.4144)	**0.1771**[b] (0.0801)	-0.1193 (0.2324)	**-0.1494**[b] (0.0629)	0.2363 (0.1720)	0.1264 (0.2463)
γ_{iF}	0.1389 (0.2103)	0.1903 (0.2643)	-0.0120 (0.0511)	**-0.3144**[b] (0.1484)	0.0240 (0.0402)	0.0761 (0.1095)	-0.1185 (0.1572)
γ_{iG}	-0.0307 (0.2483)	-0.2751 (0.3154)	**-0.1128**[c] (0.0604)	**0.3177**[c] (0.1751)	-0.0151 (0.0474)	**-0.2359**[c] (0.1343)	**0.3205**[c] (0.1856)
γ_{iI}	-0.0745 (0.1218)	0.0003 (0.1541)	**-0.0888**[a] (0.0296)	-0.0560 (0.0859)	**0.1256**[a] (0.0233)	0.0075 (0.0650)	0.0726 (0.0910)
γ_{iSW}	0.0732 (0.1362)	-0.0471 (0.1793)	0.0142 (0.0331)	0.0817 (0.0961)	**0.1263**[a] (0.0260)	-0.0833 (0.0824)	-0.1343 (0.1018)
γ_{iU}	**0.1566**[c] (0.0839)	**-0.1907**[c] (0.1053)	**-0.0346**[c] (0.0204)	**0.2162**[a] (0.0592)	**-0.0802**[a] (0.0160)	**-0.1827**[a] (0.0434)	**0.1208**[c] (0.0627)
γ_{iO}	0.0766 (0.0894)	**-0.2861**[b] (0.1119)	0.0181 (0.0217)	**0.1337**[b] (0.0631)	**0.0546**[a] (0.0171)	**0.1270**[a] (0.0459)	**-0.1276**[c] (0.0668)
β_i	0.0240 (0.0267)	0.0103 (0.0337)	**-0.0297**[a] (0.0065)	0.0091 (0.0188)	-0.0081 (0.0051)	**-0.0580**[a] (0.0141)	**0.0549**[a] (0.0199)
η_i	**0.0332**[b] (0.0162)	**-0.0455**[b] (0.0203)	0.0056 (0.0040)	-0.0110 (0.0115)	**0.0114**[a] (0.0031)	0.0093 (0.0083)	-0.0030 (0.0121)
δ_i	N/A	**-0.0748**[a] (0.0171)	N/A	N/A	N/A	**0.0656**[a] (0.0134)	N/A
Adj -R^2	0.4643	0.7427	0.8636	0.5127	0.7206	0.8620	0.6303
DW	2.1016	2.5831	2.6948	2.1532	2.5529	1.8544	1.5176

α_i : constant coefficient

γ_{ij} : price coefficient (i = destination country, j = country where price changes)

β_i : real *per capita* tourism expenditure coefficient

η_i : dummy coefficient

δ_i : trend coefficient

Note: The coefficient estimates in bold type were statistically significant at a = 1%, b = 5% and c = 10% level. Values in parentheses are standard errors.

UK

The CPI model produced one more statistically significant coefficient for a real per capita tourism expenditure variable than the PPP model. For the adjusted R^2, the PPP model outperformed the CPI model in six out of seven destinations. Both AIDS models had four destinations where no autocorrelations were detected, whereas three destinations had indecisive results. The above comparisons for UK were based on the estimation results summarized in Table 13 for the CPI model and in Table 14 for the PPP model.

Table 13. Parameter estimates of an AIDS model (CPI): UK outbound tourism

	Austria	France	Germany	Italy	Spain	Switzerland	Others
α_i	0.2060 (0.1027)	0.2389 (0.2529)	0.7488 (0.1586)	0.5860 (0.2528)	-0.8671 (0.4059)	0.0946 (0.0577)	-0.0323 (0.0233)
γ_{iA}	**-0.1449**[c] (0.0759)	-0.1080 (0.1852)	**0.2434**[b] (0.1146)	0.2148 (0.1870)	-0.1501 (0.3002)	**-0.1230**[a] (0.0427)	**0.0612**[a] (0.0172)
γ_{iF}	0.0430 (0.0534)	-0.1308 (0.1312)	0.0740 (0.0820)	-0.1076 (0.1315)	0.0860 (0.2111)	0.0449 (0.0300)	0.0021 (0.0121)
γ_{iG}	-0.0010 (0.0660)	-0.1530 (0.1630)	-0.1470 (0.1026)	0.1365 (0.1624)	0.1968 (0.2607)	0.0229 (0.0371)	**-0.0371**[b] (0.0150)
γ_{iI}	**0.0464**[b] (0.0215)	0.0848 (0.0530)	**-0.3625**[a] (0.0332)	**-0.2188**[a] (0.0530)	**0.4219**[a] (0.0851)	**0.0476**[a] (0.0121)	**-0.0144**[a] (0.0049)
γ_{iSP}	0.0101 (0.0292)	0.0276 (0.0712)	**0.1288**[a] (0.0440)	0.0846 (0.0719)	**-0.2283**[b] (0.1154)	**-0.0362**[b] (0.0164)	**0.0109**[c] (0.0066)
γ_{iSW}	0.0235 (0.0357)	**0.1784**[c] (0.0910)	-0.0822 (0.0595)	**-0.1972**[b] (0.0878)	0.0493 (0.1409)	0.0275 (0.0200)	**-0.0174**[b] (0.0081)
γ_{iO}	-0.0072 (0.0458)	0.1476 (0.1125)	0.0235 (0.0702)	-0.0590 (0.1128)	-0.1312 (0.1811)	0.0131 (0.0257)	0.0038 (0.0104)
β_i	-0.0036 (0.0070)	-0.0122 (0.0176)	0.0005 (0.0113)	-0.0095 (0.0173)	0.0308 (0.0278)	-0.0031 (0.0039)	**-0.0057**[a] (0.0016)
η_i	-0.0011 (0.0043)	**-0.0239**[b] (0.0104)	-0.0016 (0.0064)	-0.0133 (0.0105)	**0.0330**[c] (0.0169)	**0.0058**[b] (0.0024)	0.0012 (0.0010)
δ_i	N/A	**0.0419**[a] (0.0085)	**-0.0364**[a] (0.0080)	N/A	N/A	N/A	N/A
Adj $-R^2$	0.5425	0.8457	0.8879	0.3825	0.4776	0.8617	0.7581
DW	2.0875	2.6561	1.7291	1.3489	2.0423	2.0827	2.6946

α_i : constant coefficient

γ_{ij} : price coefficient (i = destination country, j = country where price changes)

β_i : real *per capita* tourism expenditure coefficient

η_i : dummy coefficient

δ_i : trend coefficient

Note: The coefficient estimates in bold type were statistically significant at a = 1%, b = 5% and c = 10% level. Values in parentheses are standard errors.

Table 14. Parameter estimates of an AIDS model (PPP): UK outbound tourism

	Austria	France	Germany	Italy	Spain	Switzerland	Others
α_i	0.1738 (0.1136)	-0.2803 (0.2601)	0.8936 (0.1702)	0.8735 (0.2850)	-0.6373 (0.4496)	0.0251 (0.0632)	-0.0451 (0.0215)
γ_{iA}	**-0.1669**[c] (0.0960)	**-0.3806**[c] (0.2197)	**0.3147**[b] (0.1437)	0.2390 (0.2407)	0.1171 (0.3798)	**-0.1462**[a] (0.0534)	0.0253 (0.0182)
γ_{iF}	0.0373 (0.0517)	-0.0913 (0.1190)	0.1183 (0.0783)	-0.0886 (0.1296)	-0.0157 (0.2045)	0.0436 (0.0287)	0.0064 (0.0098)
γ_{iG}	0.0001 (0.0609)	0.0555 (0.1398)	-0.1428 (0.0917)	0.0806 (0.1527)	-0.0079 (0.2408)	0.0425 (0.0339)	**-0.0199**[c] (0.0115)
γ_{iI}	**0.0560**[b] (0.0225)	0.0689 (0.0523)	**-0.3651**[a] (0.0347)	**-0.2192**[a] (0.0564)	**0.4284**[a] (0.0891)	**0.0540**[a] (0.0125)	**-0.0159**[a] (0.0043)
γ_{iSP}	0.0007 (0.0350)	-0.0625 (0.0801)	**0.1637**[a] (0.0524)	0.1012 (0.0877)	-0.1605 (0.1384)	**-0.0404**[b] (0.0195)	-0.0026 (0.0066)
γ_{iSW}	0.0231 (0.0331)	0.1158 (0.0786)	**-0.1036**[c] (0.0530)	**-0.1535**[c] (0.0831)	0.1019 (0.1311)	0.0224 (0.0184)	**-0.0220**[a] (0.0063)
γ_{iO}	0.0275 (0.0685)	**0.4035**[b] (0.1581)	-0.1252 (0.1042)	-0.1198 (0.1719)	-0.2717 (0.2712)	0.0289 (0.0381)	**0.0418**[a] (0.0130)
β_i	0.0001 (0.0120)	0.0459 (0.0281)	-0.0195 (0.0188)	-0.0203 (0.0300)	-0.0120 (0.0474)	-0.0005 (0.0067)	0.0005 (0.0023)
η_i	-0.0016 (0.0039)	**-0.0153**[c] (0.0090)	-0.0013 (0.0059)	-0.0152 (0.0099)	0.0252 (0.0156)	**0.0061**[a] (0.0022)	**0.0017**[b] (0.0007)
δ_i	N/A	**0.0322**[a] (0.0083)	**-0.0258**[a] (0.0075)	N/A	N/A	N/A	N/A
Adj $-R^2$	0.5454	0.8632	0.8880	0.3632	0.4797	0.8653	0.8318
DW	2.1867	2.5116	1.7328	1.3784	1.8039	2.1748	2.5943

α_i : constant coefficient

γ_{ij} : price coefficient (i = destination country, j = country where price changes)

β_i : real *per capita* tourism expenditure coefficient

η_i : dummy coefficient

δ_i : trend coefficient

Note: The coefficient estimates in bold type were statistically significant at a = 1%, b = 5% and c = 10% level. Values in parentheses are standard errors.

4.2. Forecasting Performance Results

The forecasting ability of an econometric model is considered an important aspect for evaluation of the model's performance and can provide the destination government and tourism organizations with critical information to analyze competitiveness and to formulate business strategies (Li et al., 2004). Hence, this study used each estimated model's forecasting accuracy statistics as the fourth criterion to compare the two AIDS models.

The forecasting accuracy of both AIDS models were measured by the four statistics; Mean Absolute Deviation (MAD), Root Mean Squared Error (RMSE), Mean Absolute Percentage Error (MAPE), and Theil's U. The estimated equations constructed from 1970 – 1993 data were used for one-year ahead forecasting. The actual data for 1994 – 1996 were used for this out-of-sample forecast.

The forecasting accuracy statistics were summarized in the Tables 15 - 19. A detailed description of a destination-by-destination comparison for each origin country in terms of the two AIDS models' forecasting performance is provided next.

France

The CPI model outperformed the PPP model in five out of seven destinations in terms of forecasting accuracy. Only Austria and Germany provided better forecasting results in the PPP model than in the CPI model (Table 15).

Table 15. Forecasting accuracy statistics: French outbound tourism

	RMSE		MAD		MAPE		Theil's U	
Destinations	CPI	PPP	CPI	PPP	CPI	PPP	CPI	PPP
Austria	0.0167	**0.0153**	0.0156	**0.0142**	57.915	**52.903**	0.2225	**0.2081**
Germany	0.0077	**0.0060**	0.0066	**0.0057**	12.310	**9.6130**	0.0637	**0.0516**
Italy	**0.0947**	0.1015	**0.0891**	0.0921	**36.282**	37.898	**0.1568**	0.1673
Spain	**0.1171**	0.1237	**0.1057**	0.1087	**22.444**	22.886	**0.1467**	0.1554
Switzerland	**0.0059**	0.0060	**0.0047**	0.0058	**13.926**	15.723	**0.0766**	0.0808
UK	**0.0140**	0.0166	**0.0095**	0.0132	**6.5270**	8.940	**0.0447**	0.0523
Others	**0.0019**	0.0029	**0.0018**	0.0027	**10.408**	15.976	**0.0572**	0.0854

Note: The statistics in bold type represent the smaller forecasting error between the two AIDS equations – CPI and PPP – for each individual destination.

Germany

For forecasting performance, The CPI model outperformed the PPP model in six out of seven destinations in terms of forecasting accuracy (Table 16).

Table 16. Forecasting accuracy statistics: German outbound tourism

	RMSE		MAD		MAPE		Theil's U	
Destinations	CPI	PPP	CPI	PPP	CPI	PPP	CPI	PPP
Austria	**0.0328**	0.0354	**0.0205**	0.0257	**8.194**	9.966	**0.0553**	0.0600
France	0.0674	**0.0610**	0.0673	**0.0604**	37.545	**33.689**	0.1582	**0.1456**
Italy	**0.0677**	0.0660	**0.0404**	0.0422	**16.241**	17.641	**0.1970**	0.1891
Spain	**0.0348**	0.0358	**0.0329**	0.0346	**22.719**	23.913	**0.1370**	0.1421
Switzerland	**0.0173**	0.0185	**0.0127**	0.0149	**15.194**	17.456	**0.0853**	0.0905
UK	**0.0028**	0.0040	**0.0025**	0.0035	**3.461**	4.8045	**0.0194**	0.0270
Others	**0.0164**	0.0178	**0.0148**	0.0163	**39.818**	43.984	**0.2910**	0.3251

Note: The statistics in bold type represent the smaller forecasting error between the two AIDS equations – CPI and PPP – for each individual destination.

Italy

For forecasting performance, The PPP model outperformed the CPI model in five out of seven destinations in terms of forecasting accuracy (Table 17).

Table 17. Forecasting accuracy statistics: Italian outbound tourism

Destinations	RMSE		MAD		MAPE		Theil's U	
	CPI	PPP	CPI	PPP	CPI	PPP	CPI	PPP
Austria	0.0215	**0.0192**	0.0198	**0.0178**	19.249	**17.287**	0.0928	**0.0839**
France	**0.0440**	0.0587	**0.0323**	0.0467	**9.401**	13.593	**0.0592**	0.0780
Germany	**0.0132**	0.0169	**0.0116**	0.0125	**8.552**	9.151	**0.0486**	0.0636
Spain	0.0706	**0.0681**	0.0636	**0.0598**	29.207	**27.172**	0.2017	**0.1926**
Switzerland	0.0095	**0.0066**	0.0084	**0.0049**	11.580	**6.879**	0.0590	**0.0415**
UK	0.0178	**0.0139**	0.0146	**0.0137**	14.074	**13.559**	0.0814	**0.0661**
Others	0.0035	**0.0024**	0.0027	**0.0019**	13.533	**9.334**	0.0775	**0.0557**

Note: The statistics in bold type represent the smaller forecasting error between the two AIDS equations – CPI and PPP – for each individual destination.

Spain

For forecasting performance, The PPP model marginally outperformed the CPI model in four out of seven destinations in terms of forecasting accuracy (Table 18).

Table 18. Forecasting accuracy statistics: Spanish outbound tourism

	RMSE		MAD		MAPE		Theil's U	
Destinations	CPI	PPP	CPI	PPP	CPI	PPP	CPI	PPP
Austria	0.0290	**0.0142**	0.0289	**0.0127**	72.969	**32.936**	0.2660	**0.1527**
France	0.0767	**0.0720**	0.0658	**0.0633**	14.782	**14.327**	0.0990	**0.0911**
Germany	**0.0118**	0.0161	**0.0084**	0.0110	**7.862**	10.277	**0.0624**	0.0878
Italy	0.0131	**0.0135**	0.0119	**0.0113**	13.158	**12.768**	0.0659	**0.0685**
Switzerland	0.0123	**0.0106**	0.0117	**0.0092**	19.566	**15.570**	0.0939	**0.0820**
UK	**0.0128**	0.0109	**0.0083**	0.0106	**4.759**	7.0034	**0.0422**	0.0347
Others	**0.0390**	0.0485	**0.0341**	0.0448	**26.988**	35.109	**0.1301**	0.1562

Note: The statistics in bold type represent the smaller forecasting error between the two AIDS equations – CPI and PPP – for each individual destination.

UK

For forecasting performance, The CPI model outperformed the PPP model in five out of seven destinations in terms of forecasting accuracy (Table 19).

Table 19. Forecasting accuracy statistics: UK outbound tourism

Destinations	RMSE		MAD		MAPE		Theil's U	
	CPI	PPP	CPI	PPP	CPI	PPP	CPI	PPP
Austria	**0.0170**	0.0197	**0.0164**	0.0189	**45.717**	52.766	**0.1909**	0.2152
France	0.0503	**0.0449**	0.0427	**0.0412**	10.230	**10.077**	0.0657	**0.0576**
Germany	0.0277	**0.0222**	0.0235	**0.0213**	18.616	**16.713**	0.0989	**0.0827**
Italy	**0.0167**	0.0167	**0.0141**	0.0159	**20.542**	22.727	**0.1083**	0.1103
Spain	**0.0296**	0.0368	**0.0266**	0.0317	**8.386**	9.962	**0.0498**	0.0627
Switzerland	**0.0050**	0.0064	**0.0044**	0.0051	**9.577**	10.964	**0.0518**	0.0646
Others	**0.0016**	0.0021	**0.0014**	0.0017	**13.353**	17.943	**0.0805**	0.0977

Note: The statistics in bold type represent the smaller forecasting error between the two AIDS equations – CPI and PPP – for each individual destination.

4.3. Overall Evaluation

Considering the findings from the estimation and forecasting procedures, the two AIDS models were evaluated for each origin country's international tourism demand systems.

France

The study results revealed that the CPI model marginally outperformed the PPP in the comparison of the three criteria that were related to estimation results. Results were mainly due to the CPI model's superiority in producing coefficient estimates that were statistically significant. The CPI model clearly outperformed the PPP model in its forecasting ability. Considering overall results of those four criteria, the CPI outperformed the PPP and seemed to be a better index for a price variable to explain the variation in French tourism demand for seven European destinations.

Germany

It is practically impossible to distinguish any difference between the CPI model and the PPP model when the models' estimation results were compared. However, the CPI model outperformed the PPP model in the comparison of the models' forecasting accuracy. Therefore the overall comparison implied that the CPI outperformed the PPP and seemed to be a better price index for German tourism demand model for seven European destinations.

Italy

The PPP model outperformed the CPI model both in estimation results and in forecasting accuracy. The only comparison result that was considered indecisive between the two models was from the DW statistics criterion. Therefore, the PPP index may be a better price index for a price variable in the Italian tourism demand.

Spain

The PPP model outperformed the CPI model in estimation results due to its superiority in goodness-of-fit measure. All the estimated equations of the PPP model had higher adjusted R^2 than the CPI model equations. Forecasting accuracy statistics also indicated that the PPP model marginally outperformed the CPI model. Therefore, the PPP index can be considered a better price index for Spanish tourism demand model.

UK

The comparison of the estimation results indicated that neither of the models outperformed the other. However, the CPI model outperformed the PPP model in the comparison of the models' forecasting accuracy. Considering overall results, the CPI outperformed the PPP and seemed to be a better index for a price variable of UK tourism demand model.

CHAPTER V

CONCLUSIONS

The objective of the study was to examine whether the PPP index can be used for the price variable in a tourism demand model established in an AIDS format. In order to achieve this goal, this study appraised the two AIDS models, one with the PPP price variable and the other with conventional CPI, in terms of the two models' estimation results and forecasting accuracy for European tourism demand. The study results provided empirical support regarding the general reliability and applicability of the AIDS method for major tourism destinations in Europe.

As described in more detail in the chapter of data analyses and results, the unrestricted SUR estimation results of the two AIDS models were compared in; (1) number of statistically significant coefficients of the model; (2) magnitude of adjusted R^2 and; (3) DW statistics. The estimation results were mixed and varied across the three criteria used to evaluate the models. The PPP model seemed to be the better choice than the CPI model in estimating the tourism demand of Italy and Spain international tourists, whereas the estimation results for France, Germany and the UK international tourism demand was too similar to make any distinction between the two models' performance in explaining the variation of tourism market shares.

On the other hand, the results of the models' forecasting ability provided a relatively clear and meaningful picture of the difference between the two models. The CPI model outperformed the PPP model in predicting the future international tourism originating from France, Germany, and the UK. For these three major international tourism exporters, only one or two out of seven destination equations produced smaller forecasting error in the PPP model as compared to the CPI model. However, forecasting results of international tourism originating from Italy and Spain were quite different. Overall, the PPP model generated smaller forecasting error than the CPI model in the majority of the destinations for the two origin countries. One obvious conclusion from the estimation and forecasting results was that the PPP performed better in comparison to CPI in Italy and Spain, whereas just the opposite is true for the other three origin countries.

At this point in the study the question still remains what are some of the underlying characteristics of the European international tourism phenomena that may account for the differences in the two models?

In general, Spain and Italy are considered relatively less developed than the countries such as France, Germany and the UK in terms of the country's status of economic development and individual resident's well-being as reflected by the Gross Domestic Product (GDP). The 2004 GDP for these five countries are in the order of Germany ($ 2,741 billion US), UK ($ 2,125 billion US), France ($ 2,047 billion US), Italy ($ 1,678 billion US), and Spain ($ 1,040 billion US) (OECD, 2005b).

As noted earlier in the design of this study, the main reason to include Italy and Spain as origin countries was to investigate whether the AIDS model would produce different results depending on the characteristics of tourist origins. The basic idea behind this assumption was that international tourists from countries that are relatively less developed might be more perceptive of the real price differences between multiple tourism destinations. Research by Eilat and Einav (2004) tend to support the researcher's intuition on this point. Their empirical findings indicated that the tourism from multiple origins that were at different economic development stage showed differences in terms of international tourists' sensitivity to price changes. In that regard, the AIDS model with the PPP variable may be an ideal model to produce better estimation results and accurate forecasting of future international tourism demand from the countries that may have higher sensitivity to the variation of PPP indices across multiple destinations.

Another possible explanation for the differences between the two models may be related to the purposes of international travel from the origin countries. It has been generally accepted that business travelers are considerably less price sensitive than non-business travelers. Therefore, price is expected to play a much smaller role in explaining international business tourism demand than non-business tourism demand (Eilat & Einav, 2004; Kulendran & Witt, 2003).

However, in the current study, all international travelers were included regardless of their purpose (business versus non-business) or motivation for the trip(s). The OECD publications had data sets categorizing international travelers' arrivals at a limited number of tourism destinations by the purpose of trips. However, similar data for the origin country's outbound tourism were not available. According to the OECD data, country such as Spain has had relatively minor portion of business travelers at about 5% - 7% whereas France and the UK hosted 13% - 17% and 20% - 24% of business travelers, respectively. Considering that the business related international travels are closely related to international trade and are consequentially reciprocal by nature, those destination countries might have similar percentage of outbound business travelers as their own inbound business tourism data.

It may also be plausible to consider that Italy had a similar portion of business-related outbound travelers as Spain whereas the data of Germany might be close to those of France and the UK. Therefore, it may be highly likely that the AIDS model with the PPP price variable could be expected to outperform the CPI model in origin countries such as Italy and Spain, where the percentage of non-business outbound travelers might be relatively higher than those of France, Germany or the UK.

Another interesting finding was that most of the origin countries' tourism demand to the UK destination was best forecasted among the seven destinations in both the CPI and the PPP models. The MAPE statistics, which allow comparison between different models and methodologies, showed the smallest forecasting error for the UK equations. The only exception was the Italian model of which the tourism demands to Germany and Switzerland were best predicted by using the CPI model and the PPP model, respectively.

5.1. Implications and contributions of the study

The answer to the study objectives can be summarized as follows.

A PPP price variable facilitates quantitative assessment of relative price competitiveness of different international tourism destinations in Europe. A CPI price variable, on the other hand, has serious limitations in a cross-sectional comparison of different price levels, which is considered to be a significant factor for international travelers to decide travel destinations and tourism expenditures.

The study results indicate there are variations in estimation and forecasting results across five different origin countries' AIDS models in terms of the two rival models' performance.

This study was the first of its kind to examine the role of a PPP index in international tourism demand developed by the AIDS method. An AIDS model's dependent variable was operationalized from the data of each origin country's tourism expenditure shares, which were considered to be affected by price gaps between the destinations. Study results may provide meaningful implications for both tourism policy makers at nation level and international tourism researchers.

The study results would help international tourism researchers understand and recognize the overall applicability of the AIDS method to the analysis of international tourism demand in Europe. To fulfill this goal, this study chose five European origin countries and eight regions of European tourism destinations. The choice of origin countries was based on not only the magnitude of each origin's role in international tourism but also the differences between each individual origin country. The eight regions – seven individual countries and "others" – were expected to represent the European tourism exclusively from other non-European destinations.

Another significance of this study is related to the PPP model's role in forecasting future international tourism demand. The PPP model's forecasting accuracy was compared with the CPI model, which consequently was used as a major criterion for the comparison of the two models.

Essentially, the study dealt with origin-by-origin comparison of the two AIDS models via evaluation of estimation results and forecasting performance. Study results suggest that researchers might need to be more cautious in their choices of price variables. For instance, the tourism demand from the countries that are considered to be relatively less advanced in their economic status (e.g. Italy and Spain) than countries such as France and the UK seemed to be better explained by an AIDS model with a PPP price variable. This may imply that the tourists from the Italy and Spain are more perceptive of the purchasing power parity gaps and/or difference in economic well-being across multiple destination countries.

5.2. Limitations of the study

This study used a relatively small sample size for a model with seven price variables and two or three other explanatory variables. The annual data of 1970 – 1993 were used for the model estimation due to the following reasons. First, the PPP indices for the countries under consideration were not available before 1970. The OECD database had a series of PPP indices for its member countries starting from 1970. Second, the processes to unify many European countries' currencies became accelerated from 1997 – 1998, which led to the establishment of the conversion rates between eleven EU countries' respective national currencies and the euro. Four of the five origin countries and five of the seven individual destination countries of this study are included in those eleven countries. Therefore, the study did not use the data beyond 1996. The data of 1994 – 1996 were reserved for forecasting performance evaluation.

The study calculated the proxy data for the dependent variable using international tourism receipts and arrival data at the destinations. This constraint has been a technical problem in most of the AIDS studies, which might prevent the models from producing more reliable results in estimation or forecasting. Also, this study did not include airfare expenditures to tourism expenditure data even though airfare in general accounts for a significant portion of international travel expenses. As Dwyer et al. (2000) indicated, comparison of airfares across countries is technically very difficult mainly because there is an array of fares in most countries.

Additionally, one needs to be aware of the fact that some factors that might affect the change of international tourism expenditure shares across the multiple destinations couldn't be incorporated into the study. Examples are length of stay and geographic consideration. However, it is impossible for the AIDS method to model international tourism demand from a holistic perspective by including a comprehensive list of factors that might affect the tourism demand.

The study provided relatively poor estimation results specifically in terms of the number of statistically significant coefficients of the models. Even though there were some variations across the origin countries, overall results did not provide strong support to establish any meaningful argument regarding interrelationships among the destinations. The rejection of the two theoretical restrictions on parameters also played a negative role in prohibiting meaningful interpretation of estimated demand parameters, which has also been noted by Divisekera (2003).

Lastly, the data documented the number of entries to a destination without any distinction between a multi-destination and a single destination trips. This constraint might be a major reason why many coefficient estimates for cross-price elasticities were not statistically significant. In other words, possible complementary relationships between two or more tourism destinations especially for single trips to multiple destinations couldn't be detected, as also reported by Eilat and Einav (2004).

5.3. Future studies

The external validity of this study's results can be tested by examining international tourism demand for other tourism destination regions such as North East Asia, South East Asia, the Caribbean or South America. However, caution is strongly advised when interpreting the results, especially when the origin countries are heterogeneous in terms of their social and economic characteristics.

This study involved static AIDS models based on the test conclusion that detected cointegration relationships between the variables. Since the long-run equation can be transformed into an error correction model (ECM) to measure the short-run dynamics (Song & Witt, 2000), in any future research, an analysis of the AIDS model using an ECM format is recommended (Durbarry & Sinclair, 2003; Li et al., 2004). Results from an ECM could be used to capture short-run dynamics of the tourism demand that may have lagged effects from the disequilibrium of the previous periods.

Forecasting accuracy of the AIDS model, regardless of the choice of its price variable, can be compared with other conventional time series techniques. The MAPE, which allows comparison of forecasting error statistics across different models, may be used to further investigate the reliability of the AIDS models in forecasting international tourism demand.

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APPENDIX A

ADF Test Results for Variables

ADF tests results for variables: France – CPI model

Variables	Level data without trend	First differenced without trend
W austria	-1.715041	-5.1966748
W germany	-0.968904	-5.326167*
W itlay	-1.774593	-3.801118*
W spain	-2.404983	-1.844120
W switzerland	-0.724981	-4.762901*
W uk	-1.931789	-4.499476*
W others	-1.689462	-6.018238*
Ln PCPI austria	-1.240147	-3.471235*
Ln PCPI germany	-3.624049*	-5.576666*
Ln PCPI italy	-1.346905	-3.823312*
Ln PCPI spain	-1.833974	-4.025641*
Ln PCPI switzerland	-3.144468*	-4.651768*
Ln PCPI uk	-3.345160*	-2.974392
Ln PCPI others	-2.986498	-6.658652*
Ln RPCTE cpi	-0.846354	-5.200213*

W_i is market share of each destination for French outbound tourism and Ln PCPI's are logarithms of the CPI price variables. For example, W austria represents Austria's market share of French outbound tourism expenditure and Ln PCPI austria represents the logarithm of the Austrian CPI price variable.
Note: The ADF test's lag lengths were automatically selected based on SIC for each variable. * indicates significance at or lower than 5% critical level.

ADF tests results for variables: France – PPP model

Variables	Level data without trend	First differenced without trend
W austria	-1.715041	-5.1966748
W germany	-0.968904	-5.326167*
W itlay	-1.774593	-3.801118*
W spain	-2.404983	-1.844120
W switzerland	-0.724981	-4.762901*
W uk	-1.931789	-4.499476*
W others	-1.689462	-6.018238*
Ln PPPP austria	-1.324689*	-3.949514*
Ln PPPP germany	-3.815105	-5.611481*
Ln PPPP italy	-1.342954*	-3.760230*
Ln PPPP spain	-1.832895*	-4.284854*
Ln PPPP switzerland	-2.383985*	-4.655212*
Ln PPPP uk	-3.265627	-3.005225*
Ln PPPP others	-3.450857	-3.214486*
Ln RPCTE ppp	-0.794436*	-5.112445*

W_i is market share of each destination for French outbound tourism and Ln PPPP's are logarithms of the PPP price variables. For example, W austria represents Austria's market share of French outbound tourism expenditure and Ln PPPP austria represents the logarithm of the Austrian PPP price variable.
Note: The ADF test's lag lengths were automatically selected based on SIC for each variable. * indicates significance at or lower than 5% critical level.

ADF tests results for variables: Germany – CPI model

Variables	Level data without trend	First differenced without trend
W Austria	-0.777131	-5.689668*
W france	-2.203884	-6.985295*
W itlay	-1.835970	-3.639104*
W spain	-0.857764	-4.877032*
W switzerland	-2.209621	-5.004049*
W uk	-3.125916*	-5.988231*
W others	-1.744219	-4.362028*
Ln PCPI austria	-0.898507	-3.667107*
Ln PCPI france	-3.624049*	-5.576666*
Ln PCPI italy	-1.462712	-3.018861*
Ln PCPI spain	-1.595844	-4.085922*
Ln PCPI switzerland	-3.473434*	-4.715218*
Ln PCPI uk	-2.563836	-3.693868*
Ln PCPI others	-2.907256	-6.165240*
Ln RPCTE cpi	-2.352474	-3.811225*

W_i is market share of each destination for German outbound tourism and Ln PCPI's are logarithms of the CPI price variables. For example, W austria represents Austria's market share of German outbound tourism expenditure and Ln PCPI austria represents the logarithm of the Austrian CPI price variable.
Note: The ADF test's lag lengths were automatically selected based on SIC for each variable. * indicates significance at or lower than 5% critical level.

ADF tests results for variables: Germany – PPP model

Variables	Level data without trend	First differenced without trend
W austria	-0.777131	-5.689668*
W france	-2.203884	-6.985295*
W itlay	-1.835970	-3.639104*
W spain	-0.857764	-4.877032*
W switzerland	-2.209621	-5.004049*
W uk	-3.125916*	-5.988231*
W others	-1.744219	-4.362028*
Ln PPPP austria	-1.894526	-3.297996*
Ln PPPP france	-3.815105*	-5.611481*
Ln PPPP italy	-1.496485	-3.039699*
Ln PPPP spain	-2.015477	-4.050933*
Ln PPPP switzerland	-3.556736*	-4.665871*
Ln PPPP uk	-2.581028	-3.705863*
Ln PPPP others	-4.488644*	-4.379139*
Ln RPCTE ppp	-2.267728	-3.787210*

W_i is market share of each destination for German outbound tourism and Ln PPPP's are logarithms of the PPP price variables. For example, W austria represents Austria's market share of German outbound tourism expenditure and Ln PPPP austria represents the logarithm of the Austrian PPP price variable.
Note: The ADF test's lag lengths were automatically selected based on SIC for each variable. * indicates significance at or lower than 5% critical level.

ADF tests results for variables: Italy – CPI model

Variables	Level data without trend	First differenced without trend
W austria	-1.909730	-5.168944*
W france	-2.889828	-6.465282*
W germany	-1.571608	-5.757289*
W spain	-1.173235	-6.894964*
W switzerland	-1.540111	-5.203983*
W uk	-2.600419	-7.141940*
W others	-1.210429	-6.644390*
Ln PCPI austria	-3.696513*	-3.036801*
Ln PCPI france	-1.346905	-3.823312*
Ln PCPI germany	-1.462712	-3.018861*
Ln PCPI spain	-3.664788*	-5.004173*
Ln PCPI switzerland	-2.652642	-4.262340*
Ln PCPI uk	-1.601742	-3.830474*
Ln PCPI others	-1.270087	-3.951819*
Ln RPCTE cpi	-0.437458	-3.207923*

W_i is market share of each destination for Italian outbound tourism and Ln PCPI's are logarithms of the CPI price variables. For example, W austria represents Austria's market share of Italian outbound tourism expenditure and Ln PCPI austria represents the logarithm of the Austrian CPI price variable.
Note: The ADF test's lag lengths were automatically selected based on SIC for each variable. * indicates significance at or lower than 5% critical level.

ADF tests results for variables: Italy – PPP model

Variables	Level data without trend	First differenced without trend
W austria	-1.909730	-5.168944*
W france	-2.889828	-6.465282*
W germany	-1.571608	-5.757289*
W spain	-1.173235	-6.894964*
W switzerland	-1.540111	-5.203983*
W uk	-2.600419	-7.141940*
W others	-1.210429	-6.644390*
Ln PPPP austria	-3.794850*	-3.112879*
Ln PPPP france	-1.342954	-3.760230*
Ln PPPP germany	-1.496485	-3.039699*
Ln PPPP spain	-3.669992*	-4.998575*
Ln PPPP switzerland	-2.668877	-4.255146*
Ln PPPP uk	-1.588997	-3.797957*
Ln PPPP others	-1.291965	-3.142394*
Ln RPCTE ppp	-0.403902	-3.354962*

W_i is market share of each destination for Italian outbound tourism and Ln PPPP's are logarithms of the PPP price variables. For example, W austria represents Austria's market share of Italian outbound tourism expenditure and Ln PPPP austria represents the logarithm of the Austrian PPP price variable.
Note: The ADF test's lag lengths were automatically selected based on SIC for each variable. * indicates significance at or lower than 5% critical level.

ADF tests results for variables: Spain – CPI model

Variables	Level data without trend	First differenced without trend
W austria	-3.335118*	-5.464810*
W france	-3.780355*	-7.528990*
W germany	-1.778769	-6.398215*
W italy	-2.784884	-6.788282*
W switzerland	-1.246412	-6.432545*
W uk	-2.700213	-5.056514*
W others	-1.738775	-4.709547*
Ln PCPI austria	-3.614215*	-4.080731*
Ln PCPI france	-1.833974	-4.025641*
Ln PCPI germany	-1.595844	-4.085922*
Ln PCPI italy	-3.664788*	-5.004173*
Ln PCPI switzerland	-2.703595	-4.830519*
Ln PCPI uk	-2.010136	-4.579752*
Ln PCPI others	-1.499675	-5.112965*
Ln RPCTE cpi	-1.364739	-3.811168*

W_i is market share of each destination for Spanish outbound tourism and Ln PCPI's are logarithms of the CPI price variables. For example, W austria represents Austria's market share of Spanish outbound tourism expenditure and Ln PCPI austria represents the logarithm of the Austrian CPI price variable.
Note: The ADF test's lag lengths were automatically selected based on SIC for each variable. * indicates significance at or lower than 5% critical level.

ADF tests results for variables: Spain – PPP model

Variables	Level data without trend	First differenced without trend
W Austria	-3.335118*	-5.464810*
W france	-3.780355*	-7.528990*
W germany	-1.778769	-6.398215*
W italy	-2.784884	-6.788282*
W switzerland	-1.246412	-6.432545*
W uk	-2.700213	-5.056514*
W others	-1.738775	-4.709547*
Ln PPPP austria	-3.700962*	-3.954559*
Ln PPPP france	-1.832895	-4.284854*
Ln PPPP germany	-2.015477	-4.050933*
Ln PPPP italy	-3.669992*	-4.998575*
Ln PPPP switzerland	-2.710113	-4.825944*
Ln PPPP uk	-1.978757	-4.561999*
Ln PPPP others	-1.517926	-4.603590*
Ln RPCTE ppp	-1.332808	-3.815323*

W_i is market share of each destination for Spanish outbound tourism and Ln PPPP's are logarithms of the PPP price variables. For example, W austria represents Austria's market share of Spanish outbound tourism expenditure and Ln PPPP austria represents the logarithm of the Austrian PPP price variable.
Note: The ADF test's lag lengths were automatically selected based on SIC for each variable. * indicates significance at or lower than 5% critical level.

ADF tests results for variables: UK – CPI model

Variables	Level data without trend	First differenced without trend
W austria	-1.082666	-4.793922*
W france	-1.961987	-4.445016*
W germany	-1.634507	-5.981106*
W italy	-1.966056	-4.751951*
W spain	-1.707409	-5.711596*
W switzerland	-1.568608	-3.806033*
W others	-1.985266	-6.371275*
Ln PCPI austria	-3.014100*	-3.643739*
Ln PCPI france	-3.345160*	-3.045366*
Ln PCPI germany	-2.563836	-3.693868*
Ln PCPI italy	-1.601742	-3.830474*
Ln PCPI spain	-2.010136	-4.579752*
Ln PCPI switzerland	-3.048154*	-3.584584*
Ln PCPI others	-1.748115	-3.429444*
Ln RPCTE cpi	-0.976682	-5.046325*

W_i is market share of each destination for UK outbound tourism and Ln PCPI's are logarithms of the CPI price variables. For example, W austria represents Austria's market share of UK outbound tourism expenditure and Ln PCPI austria represents the logarithm of the Austrian CPI price variable.
Note: The ADF test's lag lengths were automatically selected based on SIC for each variable. * indicates significance at or lower than 5% critical level.

ADF tests results for variables: UK – PPP model

Variables	Level data without trend	First differenced without trend
W Austria	-1.082666	-4.793922*
W france	-1.961987	-4.445016*
W germany	-1.634507	-5.981106*
W italy	-1.966056	-4.751951*
W spain	-1.707409	-5.711596*
W switzerland	-1.568608	-3.806033*
W others	-1.985266	-6.371275*
Ln PPPP austria	-2.989065*	-3.611546*
Ln PPPP france	-3.265627*	-3.005225*
Ln PPPP germany	-2.581028	-3.705863*
Ln PPPP italy	-1.588997	-3.797957*
Ln PPPP spain	-1.978757	-4.561999*
Ln PPPP switzerland	-3.015364*	-3.590740*
Ln PPPP others	-3.128989*	-3.092731*
Ln RPCTE ppp	-0.971264	-4.918864*

W_i is market share of each destination for UK outbound tourism and Ln PPPP's are logarithms of the PPP price variables. For example, W austria represents Austria's market share of UK outbound tourism expenditure and Ln PPPP austria represents the logarithm of the Austrian PPP price variable.
Note: The ADF test's lag lengths were automatically selected based on SIC for each variable. * indicates significance at or lower than 5% critical level.

APPENDIX B

ADF Test Results for Estimation Residuals

ADF test results on estimation residuals: France – CPI model

Residuals	Test statistics without time trend
W austria	-5.0193*
W germany	-5.7189*
W italy	-3.9254*
W spain	-3.3079*
W switzerland	-4.6575*
W uk	-5.0213*
W others	-4.5615*

W_i represents each destination's estimation residuals. For example, W austria represent the residuals from French outbound tourism demand for Austria.
Note: The ADF test's lag lengths were automatically selected based on SIC for each variable. * indicates significance at or lower than 5% critical level.

ADF test results on estimation residuals: France – PPP model

Residuals	Test statistics without time trend
W austria	-5.3271*
W germany	-5.8375*
W italy	-0.9269
W spain	-3.3143*
W switzerland	-4.0287*
W uk	-4.8467*
W others	-5.3403*

W_i represents each destination's estimation residuals. For example, W austria represent the residuals from French outbound tourism demand for Austria.
Note: The ADF test's lag lengths were automatically selected based on SIC for each variable. * indicates significance at or lower than 5% critical level.

ADF test results on estimation residuals: Germany – CPI model

Residuals	Test statistics without time trend
W austria	-4.2288*
W france	-4.6474*
W italy	-4.2788*
W spain	-2.1854
W switzerland	-4.9172*
W uk	-2.7547**
W others	-3.1290*

W_i represents each destination's estimation residuals. For example, W austria represent the residuals from German outbound tourism demand for Austria.
Note: The ADF test's lag lengths were automatically selected based on SIC for each variable. * indicates significance at or below 5% critical level and ** indicates significance at 10% level.

ADF test results on estimation residuals: Germany – PPP model

Residuals	Test statistics without time trend
W austria	-4.2967*
W france	-3.6137*
W italy	-4.7752*
W spain	-2.2062
W switzerland	-5.1667*
W uk	-2.8232**
W others	-2.9560**

W_i represents each destination's estimation residuals. For example, W austria represent the residuals from German outbound tourism demand for Austria.
Note: The ADF test's lag lengths were automatically selected based on SIC for each variable. * indicates significance at or below 5% critical level and ** indicates significance at 10% level.

ADF test results on estimation residuals: Italy – CPI model

Residuals	Test statistics without time trend
W austria	-4.7196*
W france	-4.1484*
W germany	-4.8648*
W spain	-5.9481*
W switzerland	-4.5175*
W uk	-2.3662
W others	-4.2557*

W_i represents each destination's estimation residuals. For example, W austria represent the residuals from Italian outbound tourism demand for Austria.
Note: The ADF test's lag lengths were automatically selected based on SIC for each variable. * indicates significance at or lower than 5% critical level.

ADF test results on estimation residuals: Italy – PPP model

Residuals	Test statistics without time trend
W austria	-4.4512*
W france	-3.7682*
W germany	-5.6724*
W spain	-5.6117*
W switzerland	-5.5967*
W uk	-3.7329*
W others	-5.0924*

W_i represents each destination's estimation residuals. For example, W austria represent the residuals from Italian outbound tourism demand for Austria.
Note: The ADF test's lag lengths were automatically selected based on SIC for each variable. * indicates significance at or lower than 5% critical level.

ADF test results on estimation residuals: Spain – CPI model

Residuals	Test statistics without time trend
W austria	-4.7898*
W france	-3.6799*
W germany	-6.0863*
W italy	-5.7877*
W switzerland	-3.4593*
W uk	-5.5730*
W others	-5.4880*

W_i represents each destination's estimation residuals. For example, W austria represent the residuals from Spanish outbound tourism demand for Austria.
Note: The ADF test's lag lengths were automatically selected based on SIC for each variable. * indicates significance at or lower than 5% critical level.

ADF test results on estimation residuals: Spain – PPP model

Residuals	Test statistics without time trend
W austria	-5.4763*
W france	-6.4635*
W germany	-6.8444*
W italy	-3.8385*
W switzerland	-7.0041*
W uk	-4.1753*
W others	-5.1233*

W_i represents each destination's estimation residuals. For example, W austria represent the residuals from Spanish outbound tourism demand for Austria.
Note: The ADF test's lag lengths were automatically selected based on SIC for each variable. * indicates significance at or lower than 5% critical level.

ADF test results on estimation residuals: UK – CPI model

Residuals	Test statistics without time trend
W austria	-5.4488*
W france	-4.8764*
W germany	-2.5646
W italy	-2.7083**
W spain	-5.1709*
W switzerland	-5.1207*
W others	-4.2044*

W_i represents each destination's estimation residuals. For example, W austria represent the residuals from UK outbound tourism demand for Austria.
Note: The ADF test's lag lengths were automatically selected based on SIC for each variable. * indicates significance at or below 5% critical level and ** indicates significance at 10% level.

ADF test results on estimation residuals: UK – PPP model

Residuals	Test statistics without time trend
W austria	-5.4522*
W france	-6.0209*
W germany	-3.6769*
W italy	-4.2470*
W spain	-4.6003*
W switzerland	-5.4658*
W others	-6.6158*

W_i represents each destination's estimation residuals. For example, W austria represent the residuals from UK outbound tourism demand for Austria.
Note: The ADF test's lag lengths were automatically selected based on SIC for each variable. * indicates significance at or lower than 5% critical level.

APPENDIX C

Test Results of Parameter Restrictions

Test results of homogeneity restriction

County	Price index	Chi-square statistic value	Degree of freedom	Probability
France	CPI	43.475	7	0.0000
	PPP	42.817	7	0.0000
Germany	CPI	28.457	7	0.0002
	PPP	28.266	7	0.0002
Italy	CPI	102.339	7	0.0000
	PPP	92.775	7	0.0000
Spain	CPI	43.901	7	0.0000
	PPP	33.677	7	0.0000
UK	CPI	24.015	7	0.0011
	PPP	44.809	7	0.0000

Test results of symmetry restriction

County	Price index	Chi-square statistic value	Degree of freedom	Probability
France	CPI	186.180	21	0.0000
	PPP	166.083	21	0.0000
Germany	CPI	165.406	21	0.0000
	PPP	135.206	21	0.0000
Italy	CPI	11590.23	21	0.0000
	PPP	8590.74	21	0.0000
Spain	CPI	134.771	21	0.0000
	PPP	55.549	21	0.0001
UK	CPI	77.908	21	0.0000
	PPP	103.118	21	0.0000

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