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AN ARDL MODEL OF AGGREGATE TOURISM DEMAND FOR TURKEY[1]

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ABSTRACT

This study empirically examines aggregate tourism demand function for Turkey using the time series data for the period 1960-2002. The total tourist arrivals into Turkey are related to world income, relative prices and transportation cost. We employ bounds testing cointegration procedure proposed by Pesaran *et al.* (2001) to compute the short and long-run elasticities of income, price, and transportation cost variables. We also implement CUSUM and CUSUMSQ stability tests on the aggregate tourism demand function. The empirical results indicate that income is the most significant variable in explaining the total tourist arrivals to Turkey and there exists a stable tourism demand function.

I. INTRODUCTION

The aim of this study is to perform a recent cointegration technique on the international tourist arrivals to Turkey in order to explore the major factors that influence the level of those flows and to reveal the importance of a stable tourism demand equation for economic policy evaluations.

According to the World Tourism Organization (WTO), in 1990 all countries receipts' from international tourism were 264 billion dollars; by 2002 they reached 474 billion dollars; and for the year 2010 they are expected to exceed 1 trillion dollars. But even these numbers do not fully reveal the importance of this industry. Consider also the following facts: international tourism is the world's largest export earner; currently, foreign currency receipts from international tourism are more than petroleum products, motor vehicles, telecommunication equipment and textiles; moreover, it is a labour-intensive industry, employing directly over an estimated 74 million people around the world, as of 2003. Tourism has an important role in stimulating investments in new infrastructure, as well as in generating government revenues through various taxes and fees. Acknowledging these facts and the evidence that tourism comprises a huge portion of gross domestic production (GDP) in some small developing countries such as the Maldives, the Seychelles, Barbados, etc., makes clear the profound importance of tourism for economic development.

In regards to the total tourist arrivals to Turkey, it seems that the number of foreign visitors has accelerated rapidly in the last decade. In 1990, Turkey attracted 4.8 million foreign tourists, which generated an income of $3.4 billion but reached $8.4 billion in 2002 with 10.4 million visitors. The World Travel and Tourism Council (WTTC) predicts that by 2010 the total tourist arrivals to Turkey is estimated to be around 22.4 million resulting in an income of $22.1 billion. As a consequence of this significant increase in the total tourist arrivals to Turkey, the impact of the tourism industry in GDP is going to increase from 5.6% in 2002 to 7% in 2010 and the share of industry in total employment will be 3.5% in 2010 as opposed to 3% in 2002. See figure 1 below for the share of tourism receipts in the GDP over the period of 1960-2002. The WTTC report on Turkey also highlights that the real total demand for Turkish tourism will grow on average by 5.7% per year, well above the world and European Union average expectations for 3.9% and 3.8% per annum respectively, over the next ten years (2001-2010). Turkey's key market for the tourism exports is Europe. The most important single market is Germany, which is closely followed by the former USSR and the UK. For a more detailed descriptive analysis of direct and indirect economic contribution of international tourist flows into the Turkish economy, see also Tosun (1998) and WTTC. Therefore, it is crucial to form a stable tourism demand equation for better economic policy evaluations. However, it is rather difficult to model international tourism demand because international tourism demand involves a number of factors.

In contrast with the important role of the tourist industry in the Turkish economy, little attention has been paid to its quantitative analysis. Existing empirical research of the international tourism demand in Turkey is based on traditional econometric techniques and without examining the stability situation of the estimated regression equations, see for example, Uysal and Crompton (1984), Var *et al*. (1990), Ulengin (1995), Icoz *et al*. (1998), and Akis (1998).

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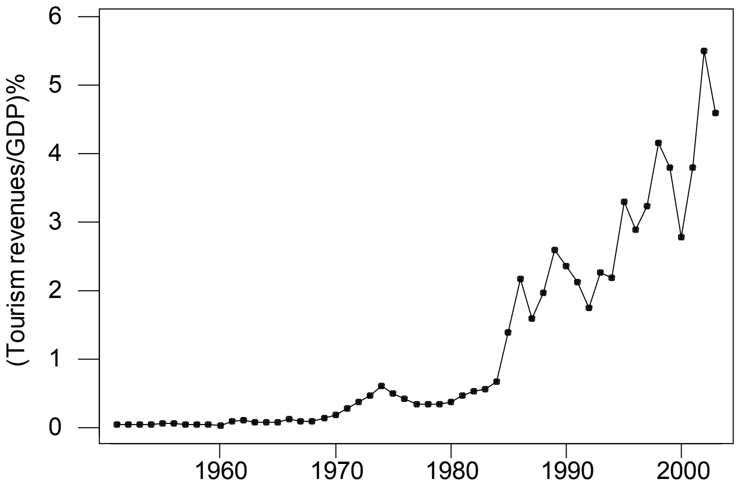
Figure 1: Total tourism revenues as a percentage of GDP over 1960-2002.
Source: own evaluations from Turkish ministry of tourism annual statistics.



This study differs from the previous empirical tourism studies in a way that it employs a very recent single cointegration technique, Auto Regressive Distributed Lag (ARDL) approach as proposed by Pesaran *et al*. (2001) in addition to performing the stability tests on the selected regression equation.

The organization of the rest of this paper is as follows: section II discusses the variables, which are used in empirical studies of international demand along with explaining the data used for this study. Section III outlines the econometric methodology that is employed in this research. Section IV deals with the econometric results and the concluding remarks are given in Section V.

II. TOURISM DEMAND VARIABLES and DATA

There are essentially two measures of volume of foreign tourist demand: tourism flows (arrivals) and tourism expenditure. In regards to determinants of international tourism demand, there is not a clear-cut guide to the type of variables which could be used. Lim (1997) surveys 100 empirical articles on international tourism demand and concludes that the most widely used explanatory variables are income, relative prices and transportation costs.
Fluctuations in the demand for international tourism are influenced by many factors, but most studies focus on the economic factors in estimating a satisfactory explanation.

Crouch (1994) reveals that the income is the most important explanatory variable. However, income elasticity estimates vary a great deal, but generally exceed unity and below 2.0, confirming that international travel is a luxury good.
As for price effects, Crouch (1994:13) argues that “economic theory ensures that price must be included in any demand study, but in the study of tourism, the issue of price is particularly vexatious”. Price includes the price of services for which no single price index is wholly adequate. Price includes the price of reaching the destination (including perhaps an opportunity cost for travel time, yet some receive enjoyment from the travel itself), the cost of local goods and services adjusted for the exchange rate. Moreover, some trips involve multiple destinations. Abstracting from these complexities, theory suggests that the real exchange rate should be an important factor in the demand for international travel. Many studies, however, separated the nominal exchange rate effects from the local price effects. The necessity to include variables that represent tourism prices imposes a big challenge to empirical tourism researchers. The problem stems from the fact that indices for tourism prices are not generally available. Instead, researchers have used exchange rate variables to proxy for tourism prices. Either relative nominal or relative real exchange rates, which are similar to nominal exchange rates but adjusted for inflation in both origin and destination countries, are employed as proxies for the relative prices. The common thread in both versions is that

they are indices that are measured relative to a base year. They can therefore trace changes in costs over time but cannot capture the actual differences between countries in costs of living.
The estimation results found in this literature regarding prices are rather discoursing, since there seems to be no agreement about the appropriate range of this coefficient. Estimated price elasticities vary dramatically both within and across papers. For example, they are in the range of –0.05 to –6.36.

Another component of tourism cost is the price of transportation. Yet, due to the complexities of the price structure of transportation, no consistent data exists on transportation prices. Instead, researchers often included the distance of travel, price of airline tickets, or crude oil prices as a suitable proxy for transportation costs. Crouch (1994) argues that, from the wide variety of results, one cannot adequately reveal that the underlying nature of the relationships between the demand for international tourism and its determinant.

The vast majority of the empirical papers on international tourism in the literature are divided into two main types. The first consists of papers that use modern time series and cointegration techniques in an attempt to model and forecast the dependent variable, between one or several pairs of countries. See for example, Kulendran (1996), Wong (1997), Turner *et al.* (1997), Kim and Song (1998), Vogt and Wittayakorn (1998), Song *et al*. (2000), Kulendran and Witt (2001), Seddighi and Theocharous (2002), Song *et al.* (2003) and Dritsakis (2004). The second type includes papers that estimate the determinants of international tourism demand using classical multivariate regressions. For a detailed survey of this literature, see Crouch (1994), Witt and Witt (1995), and Lim (1997).

Various secondary annual time series data were used in this paper. The data span for this study is selected as 1960-2002 which is the longest available data set to this date. Definitions of variables and data sources are as follows:

TA is the total tourist arrivals into Turkey. Source: Bulletin of Tourism Statistics, Ministry of Tourism of Turkey, Annual Statistics (various issues), Ankara. *WY* is the real world income in billions of USD ($) at 1990 prices. Gross national products of USA, 15 European Union member countries (EU15) and Japan are summed up in order to form this proxy income variable. EU15 and Japan's GDP are converted to USA dollars and are deflated by the USA consumer price index (CPI) of 1990=100. Source: Eurostat, (various issues). *RP* is the exchange rate adjusted relative costs between Turkey and the rest of the world, which is approximated by the CPIs between Turkey and USA; both CPIs are based on 1990=100 in addition to nominal effective exchange rates between Turkish lira and US dollars. Source: IMF International Financial Statistics (various issues). *TC* is the travel cost index. It is based on the per barrel spot oil prices index of 1990=100. Source: www.forecasts.org

III. METHODOLOGY

We form the following aggregate tourism demand model for Turkey which assumes that total tourist flows into Turkey demand is determined by the level of world income, the relative prices as well as the transportation cost:

$$\ln TA_t = a_0 + a_1 \ln WY_t + a_2 \ln RP_t + a_3 \ln TC_t + \varepsilon_t \quad (1)$$

Here, TA is the total tourist arrivals, WY is the real world income, RP is the exchange rate adjusted relative prices between Turkey and the rest of the world and TC is the transportation cost index. All series are in natural logarithmic form (Ln). The expected signs for parameters are as follows: $a_1 > 0,\ \ a_2, a_3 < 0$.

For investigating the long-run equilibrium (cointegration) among time-series variables, several econometric methods are proposed in the last two decades. Univariate cointegration examples include Engle and Granger (1987) and the fully modified OLS procedures of Phillips and Hansen's (1990). With regards to multivariate cointegration, Johansen (1988) and Johansen and Juselius (1990) procedures and Johansen's (1996) full information maximum likelihood procedures are widely used in empirical research.

The so-called autoregressive distributed lag (ARDL) also deals with single cointegration and is introduced originally by Pesaran and Shin (1999) and further extended by Pesaran *et al*. (2001). This method has certain econometric advantages in comparison to other single cointegration procedures. Firstly, endogeneity problems and inability to test hypotheses on the estimated coefficients in the long-run associated with the Engle-Granger method are avoided. Secondly, the long and short-run parameters of the model are estimated simultaneously. Thirdly, all variables are assumed to be endogenous. Fourthly, the econometric methodology is relieved of the burden of establishing the order of integration amongst the variables and of pre-testing for unit roots. In fact, whereas all other methods require that the variables in a time-series regression equation are integrated of order one, i.e., the variables are I(1), only that of Pesaran *et al*. could be implemented regardless of whether the underlying variables are I(0), I(1), or fractionally integrated.

An ARDL representation of Eq. (1) is formulated as follows:

$$\Delta \ln TA_t = a_0 + \sum_{i=1}^{m} a_{1i} \Delta \ln TA_{t-i} + \sum_{i=0}^{m} a_{2i} \Delta \ln WY_{t-i} + \sum_{i=0}^{m} a_{3i} \Delta \ln RP_{t-i} + \sum_{i=0}^{m} a_{4i} \Delta \ln TC_{t-i} + a_5 \ln TA_{t-1} + a_6 \ln WY_{t-1} + a_7 \ln RP_{t-1} + a_8 \ln TC_{t-1} + \varepsilon_t \quad (2)$$

Investigation of the presence of a long-run relationship amongst the variables of Eq. (1) is tested by means of bounds testing procedure of Pesaran *et al.* The bounds testing procedure is based on the F or Wald-statistics and is the first stage of the ARDL cointegration method. Accordingly, a joint significance test that implies no cointegration, (H_0: $a_5 = a_6 = a_7 = a_8 = 0$), should be performed for Eq. (2). The F test used for this procedure has a non-standard distribution. Thus, two sets of critical values are computed by Pesaran *et al.* for a given significance level. One set assumes that all variables are I(0) and the other set assumes they are all I(1). If the computed F-statistic exceeds the upper critical bounds value, then the H_0 is rejected. If the F-statistic falls into the bounds then the test becomes inconclusive. Lastly, if the F-statistic is below the lower critical bounds value, it implies no cointegration. This new approach is similar to the Johansen and Juselius multivariate cointegration procedure, which has five alternative cases for long-run testing too.

Once a long-run relationship is established, then the long-run and error correction estimates of the ARDL model can be obtained from Eq. (2). At the second stage of the ARDL cointegration method, it is also possible to perform a parameter stability test for the appropriately selected ARDL representation of the error correction model.

The stability of coefficients of regression equations are, by and large, tested by means of Chow (1960), Brown *et al*. (1975), Hansen (1992), and Hansen and Johansen (1993). The Chow stability test requires *a priori* knowledge of structural breaks in the estimation period and its shortcomings are well documented (see for example Gujarati, 2003). In Hansen (1992) and Hansen and Johansen (1993) procedures, stability tests require I(1) variables and they check the long-run parameter constancy without incorporating the short-run dynamics of a model into the testing - as discussed in Bahmani-Oskooee and Chomsisengphet (2002). However, it is possible to overcome these shortcomings by employing the Brown *et al*. procedure if we follow Pesaran and Pesaran (1997). The Brown *et al*. stability testing technique, also known as cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) tests, is based on the recursive regression residuals. The CUSUM and CUSUMSQ statistics are updated recursively and plotted against the break points of the model. Providing that the plot of these statistics fall inside the critical bounds of 5% significance then we assume that the coefficients of a given regression are stable. These tests are usually implemented by means of graphical representation.

A general error correction representation of Eq. (2) is formulated as follows:

$$\Delta \ln TA_t = a_0 + \sum_{i=1}^{m} a_{1i} \Delta \ln TA_{t-i} + \sum_{i=0}^{m} a_{2i} \Delta \ln WY_{t-i} + \sum_{i=0}^{m} a_{3i} \Delta \ln RP_{t-i} + \sum_{i=0}^{m} a_{4i} \Delta \ln TC_{t-i} + \lambda EC_{t-1} + u_t \quad (3)$$

where λ is the speed of adjustment parameter and EC is the residuals that are obtained from the estimated cointegration model of Eq. (2).

IV. RESULTS

A two-step ARDL cointegration procedure is implemented in estimating Eq. (1) for Turkey using annual data over the 1960-2002 periods. In the first stage, to ascertain the existence of a long-run relationship among the variables in Eq. (2), we performed the bounds testing approach. In the second stage, we estimated Eq. (2) by the ARDL cointegration method.

In the first stage of the ARDL procedure, the order of lags on the first –differenced variables for Eq. (2) is usually obtained from unrestricted vector autoregression (VAR) by means of Akaike Information Criterion (AIC) and Schwarz Bayesian Criterion (SBC). Bahmani-Oskooee and Bohl (2000) and Bahmani-Oskooee and Ng (2002), however, have shown that the results of this stage are sensitive to the order of VAR. Given that we are using annual observations, we experimented up to 3 lags on the first-difference of each variable and computed F-statistics for the joint significance of lagged levels of variables in Eq. (2). The computed F-test statistic for each order of lags is presented in Table 1 along with the critical values at the bottom of the table. Table 1 indicates that for *i*=1, the computed F-statistic is not significant at 90%. It is significant for *i*=2 at 90% and it is also significant for *i*=3 at 95%. The results appear to provide evidence for the existence of a long-run tourism demand equation. These results also warrant proceeding to the second stage of estimation.

Table 1. F-statistics for testing the existence of a long-run tourism demand equation

Order of Lag	F-statistics
1	F(4, 19)=2.9709
2	F(4, 24)=3.8318*
3	F(4, 29)=4.5115**

Notes: The relevant critical value bounds are obtained from Table C1.iii (with an unrestricted intercept and no trend; with three regressors) in Pesaran *et al.* (2001). They are 2.72-3.77 at 90%, and 3.23- 4.35 at 95%. * denotes that the F-statistic falls above the 90% upper bound and ** denotes above the 95% upper bound.

Given the existence of a long-run relationship, in the next step we used the ARDL cointegration method to estimate the parameters of Eq. (2) with maximum order of lag set to 2. In a search to find the optimal length of the level variables of the long-run coefficients, lag selection criteria of AIC, and SBC were utilized. The long-run results of Eq. (2) based on several lag criteria are reported in Panel A of Table 2 along with their appropriate ARDL models. The diagnostic test results of Eq. (2) for short-run estimations are also displayed in the respective columns of each selection criterion in Panel B of Table 2. As can be seen from Table 2, the long-run results are very similar with regard to coefficient magnitudes and statistical significance. All the estimated models display the expected signs for the regressors and they are highly statistically significant.

Table 2. ARDL Estimations

Panel A: the long-run results Dependent variable $\ln TA$		
	Model Selection Criterion	
Regressors	AIC ARDL (1,0,1,2)	SBC ARDL (1,0,1,1)
$\ln WY$	1.151 (2.332)	0.996 (2.495)
$\ln RP$	-0.901 (3.529)	-0.932 (2.789)
$\ln TC$	-0.419 (2.297)	-0.344 (2.119)
Constant	1.913 (0.952)	-2.334 (0.872)
Panel B: the short-run diagnostic test statistics		
	$\chi^2_{SC}(1)=0.089$	$\chi^2_{SC}(1)=0.085$
	$\chi^2_{FC}(1)=8.469$	$\chi^2_{FC}(1)=2.870$
	$\chi^2_{N}(2)=0.713$	$\chi^2_{N}(2)=1.873$
	$\chi^2_{H}(1)=0.061$	$\chi^2_{H}(1)=0.047$

Notes: The absolute value of t-ratios is in parentheses. χ^2_{SC}, χ^2_{FC}, χ^2_{N}, and χ^2_{H} are Lagrange multiplier statistics for tests of residual correlation, functional form mis-specification, non-normal errors and heteroskedasticity, respectively. These statistics are distributed as Chi-squared variates with degrees of freedom in parentheses.

In order to implement the stability test on the preferred error correction representation of the ARDL method, the ARDL error correction representation of Eq. (3) were estimated as auxiliary models. The estimation results and the respective appropriate optimal lag length selection criteria are displayed in Table 3.

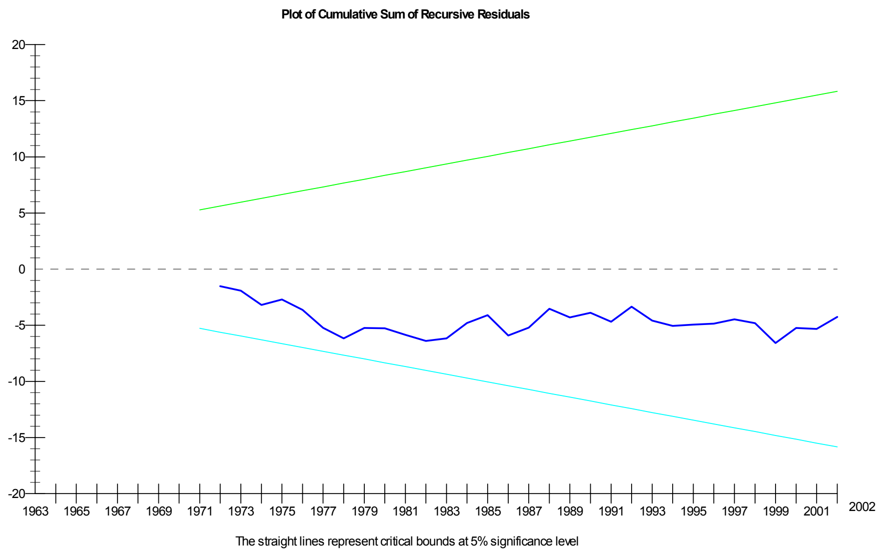
Table 3. Error Correction Representations of ARDL Model
Dependent variable $\ln \Delta TA_t$

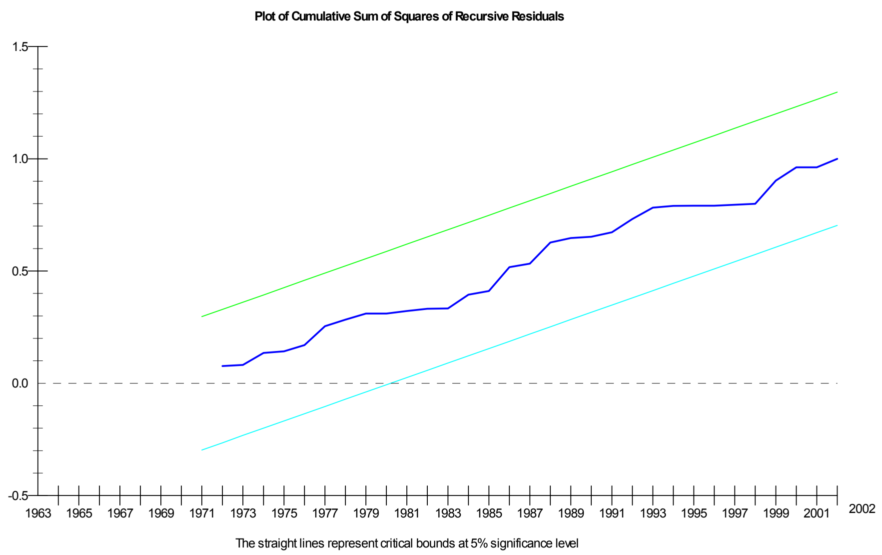
	Model Selection Criterion	
Regressors	AIC ARDL (1,0,1,2)	SBC ARDL (1,0,1,1)
$\ln \Delta TA_{t-1}$	0.749 (2.963)	0.959 (3.545)
$\ln \Delta WY_t$	0.436 (1.968)	0.389 (2.885)
$\ln \Delta RP_t$	0.117 (0.717)	0.145 (0.900)
$\ln \Delta RP_{t-1}$	-0.509 (2.762)	-0.514 (2.821)
$\ln \Delta TC_t$	0.098 (1.349)	0.120 (1.771)
$\ln \Delta TC_{t-1}$	-0.103 (1.376)	-0.092 (1.256)
$\ln \Delta TC_{t-2}$	-0.159 (2.271)	
Constant	-0.109 (0.231)	-0.333 (0.709)
EC_{t-1}	-0.965 (3.093)	-0.869 (3.706)
$\overline{R}^2$	0.532	0.583
F-statistics	3.837	6.116
DW-statistics	1.888	1.809
RSS	0.448	0.342

Notes: The absolute values of t-ratios are in parentheses. RSS stands for residual sum of squares.

Table 3 enables us to select the most appropriate model of implementing the stability test for the tourism demand equation. According to the reported diagnostic tests results, the SBC-based error correction model of Eq. (2) seems to be relatively better fit than the AIC-based error correction model. Therefore, although we also performed the CUSUM and CUSUMSQ stability tests for the AIC-based error correction model, we present only the graph of the SBC-based error correction model. It can be seen from Figure 2, the plots of CUSUM and CUSUMSQ statistics are well within the critical bounds implying that all coefficients in the error correction model are stable.

Figure 2. CUSUM and CUSUMSQ Plots for Stability Tests





V. CONCLUDING REMARKS

In this paper, we attempted to estimate an aggregate tourism demand function for Turkey using a recent single cointegration technique, ARDL. The results from this estimation suggest that the most significant factor in determining the level of tourist arrivals into Turkey is real world income level, which is followed by the relative prices and transportation cost. The estimated income, price and transportation elasticities are in line with the previous empirical studies in the tourism economics literature. We were able to present empirically that the estimated tourism demand function reveals a stable long-run relationship between its dependent and independent variables. To this end, we utilized the CUSUM and CUSUMSQ stability tests and they indicate that there exists a stable tourism demand function. These results indicate that it is possible to use the estimated aggregate tourism demand function as a policy tool in implementing tourism policy in Turkey. As far as the Turkish tourism policy is concerned, we assume that stability of a tourism demand function will reduce the uncertainty associated with the world economic environment and will increase the credibility of its commitment to pursue a sustainable tourism policy.

Turkey has an enormous potential for tourism development due to its cultural and natural attractions and it has the fastest growing tourism industry in Europe. According to the WTTC forecasts, real Turkish visitor exports growth will be 7.5% over the next ten years (2001-2010), which is the highest rate in comparison to the EU countries. The overall number of beds available is estimated around 450,000 in more than 2000 licensed tourism establishments, ranging from 5 star hotels to holiday villages and campsites, which are mainly concentrated on the Aegean and Mediterranean coastline as of 2002. However, the tourism industry is pretty young. Most development occurred over the past 20 years, and is still heavily focused on the sun and the mass market for the summer months; many visitors are still not aware that Turkey has no less than seven UNESCO designated World Heritage sites. But there is scope to extend the season by diversifying products such as thermal spa vacations, heritage tours, and activity based tourism so that the average length of foreign tourist stay can be increased from its current four days. To this end, the Turkish government can play the crucial role it had in the 1980s which provided substantial tourism incentives to the private sector, which financed expansion of bed capacity substantially from 50,000 to 70,000 on the south coast of Turkey. Although, Turkish government tourism expenditures is predicted to grow faster than the EU government tourism expenditures, it still represents only 0.8 % of total government expenditures whereas the corresponding figure in the EU is 4.5% in 2001, as indicated by the WTTC report.

For a sustainable tourism policy and stable tourism demand, the Turkish government should provide more business incentives and develop economic policy tools so that they would stimulate continuous private investment in the sector, better education for the tourism work force, and marketing and promotion of cultural and natural resources.

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