TOURISM AND GDP: A meta-analysis of panel data studies

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Abstract

This paper provides a meta-analysis of a selected sample of 87 estimates from studies based on panel data techniques published through until 2012. The purpose is to obtain a summary measure of the effects of tourism on economic growth by applying models for both fixed and random effects. The results show a positive elasticity between GDP and tourism, although the magnitude of the effect varies according to the methodological procedure employed in the original studies for empirical estimates. In this sense, when estimates exclude other explanatory variables of economic growth, elasticities are overvalued.

KEYWORDS: Meta-analysis, Panel data, Economic Growth, Elasticity.

1. INTRODUCTION.

Tourism has attracted relatively little attention in the literature on economic development until the last decade. The main thrust of research on the economic impact of tourism in recent times has been to measure direct and secondary impacts on local and regional economies (Pearce & Butler, 2010). As pointed out in Sinclair (1998), most studies on tourism published during the second half of the 20th century, were not expressly directed towards the topic of tourism's role in economic development. In these studies, it was considered that foreign exchange earnings from tourism could be used to import capital goods to produce goods and services (McKinnon, 1964), that tourism can favor employment or additional tax revenues (Davis et al., 1988; Belisle & Hoy, 1980; Durbarry, 2002; Khan et al., 1990; Uysal & Gitelson, 1994), and that tourism can generate economic growth by enhancing efficiency through competition (Bhagwati & Srinivasan, 1979; Krueger, 1980). Tourism can also facilitate the exploitation of economies of scale at a local level (Helpman & Krugman, 1985).

Theoretical models that consider a causal relationship between tourism and economic growth are a relatively recent phenomenon (Kim et al., 2006). Lanza & Pigliaru (2007) were the first to investigate this relation from an empirical point of view, while Balaguer & Cantavella-Jorda (2002) were the first to analyze the *tourism-led growth hypothesis* (TLG) – i.e. the hypothesis according to which tourism generates economic growth – from an econometric perspective. From the outset, an increasing number of articles with the same objective – although for different countries, using different methodologies and obtaining different results –have been published.

Most of the studies, such as those by Dritsakis (2004), Durbarry (2004), Ongan & Demiroz (2005), Gunduz & Hatemi (2005), Oh (2005), Kim et al. (2006), Katircioglu (2007, 2009, 2010), Lee & Chien (2008), and Brida & Risso (2009), are based on time series and refer to single national economies. Other time series studies, such as those by Brida et al. (2010), Chen & Chiou-Wei (2009), Jin (2011), Lean & Tang (2010) and Arslanturk et al. (2011), for example, provide support for the TLG hypothesis.

The TLG hypothesis has also been investigated using cross-sectional analyses. Among the published reports, those by Lanza & Pigliaru (2007), Singh (2008), Po & Huang (2008) and Figini & Vici (2010) are particularly relevant. Finally, a third group of studies on the TLG hypothesis is based on panel data, this being a method of studying a particular subject at multiple sites, periodically observed over a defined time frame (Hsiao, 2003). The number of studies based on panel data is smaller than that for the time-series approach, although a larger sample of countries is included, thus making these analyses more global (Lee & Chang, 2008).

The TLG hypothesis has thus been analyzed by different quantitative approaches and multiple outcomes have been obtained, although no scientifically rigorous systematic review has yet been made to determine the reason for these differences. In this sense, the meta-analysis proposed in this paper can fill that knowledge gap, because it aims to bring together empirical findings to explain the variation in results and thereby yield some generalizations and directions for future research.

Our objective is to apply quantitative research synthesis –meta- analysis– as a technique for comparative research, by reviewing published empirical studies that analyze the TLG hypothesis using panel data. These studies tend to be more recent and provide global estimates on the basis of large samples of countries as outlined in Lee & Chang (2008).

Therefore, this analysis may extract generic conclusions that are valid at an international level. Further to this, the panel data method examines the relation between GDP and tourism by considering other variables that are also essential for economic growth.

The use of meta-analysis emerged in 1976 (Glass, 1976). In contrast to the traditional narrative review, the basic purpose of meta-analysis is to provide the same methodological rigor to a literature review that is required for experimental research (Rosenthal, 1995). Despite being a relatively recent technique, its use has spread to different scientific disciplines such as social and behavioral sciences (Castillo-Manzano & Castro-Nuño, 2012; Cooper & Hedges, 1994; Lipsey & Wilson, 2001; Petticrew & Roberts, 2006; Schulze, 2004) and particularly health sciences (Eddy et al., 1995; Egger et al., 2001; Sutton et al., 2000).

In the case of economic growth and development studies, the meta-analysis technique has been used to integrate findings on the effects of fiscal policies (Nijkamp & Poot, 2004; Phillips & Goss, 1995), the influence of income inequality conditions or political structures (De Dominicis et al., 2008; Doucouliagos & Ulubaşoğlu, 2008), the contribution of social capital to economic growth (Westlund & Adam, 2010) and population growth (Headey & Hodge, 2009), and the effectiveness of development aid (Doucouliagos & Paldan, 2008).

In the field of tourism, general applications of this technique can be found in tourism research (Dann et al., 1988), tourism forecasting (Calantone et al. 1987), and more specifically on tourist and economic impact studies (Wagner, 2002). Meta-analyses of particular importance in this field concern those performed on tourism income multipliers (Baaijens et al., 1998), regional tourism multipliers (Baaijens & Nijkamp, 2000), and tourism demand (Crouch, 1995; Lim, 1999). More recently, reports have been published concerning specific branches of tourism, such as that by Carlsen & Boksberger (2011) on wine tourism, Weed (2009) on sports tourism, and Sariisik et al. (2011) on sailing tourism.

This paper is divided into six sections: after this introduction, Section 2 explains the meta-analysis technique. Section 3 analyzes and classifies the studies based on panel data to corroborate the TLG hypothesis, explaining how the estimates sample has been selected and organized. Section 4 describes the outputs obtained by meta-analysis. A discussion of the results is presented in Section 5, and conclusions are provided in Section 6.

2. METHODOLOGY.

Following Glass et al. (1981) and Lipsey & Wilson (2001), the meta-analysis method consists of deducing a *summary effect* based on the combination of different estimates (*effect sizes*) from a selected sample of studies by means of different statistical techniques (Chalmers et al., 2002); the most usual are the *fixed-effects model* (FEM) and the *random-effects model* (REM).

Under a FEM, the selected studies are combined on the premise that there is homogeneity among them and that, according to Borenstein et al. (2009), there is one *true effect size* (θ) which underlies all the studies. The inference made is only conditioned by the considered studies, without taking into account the variability among them. The only determinant of the weight of each study in the meta-analysis would be its own variance (*within-study variance*).

The technique to combine studies according to a FEM, known as the *inverse variance weighted method*, was described by Birge (1932) and Cochran (1937). Each effect size is involved in the summary effect in a manner that is inversely weighted by its precision *(statistical weight)*. Assuming a sample of "m" estimates or effect sizes, ($i = 1, 2 \ldots m$), representing a measure of the analyzed effect called T_i, a summary effect $\bar{T}$ may be formulated as in (1) (Borenstein et al., 2009):

$$\bar{T} = \frac{\sum w_i T_i}{\sum w_i} \quad [1]$$

where w_i is the statistical weight of the *i-th* estimate: $w_i = 1/v_i$ [2], and v_i the variance of the *i-th* estimate, so that: $\sum w_i = 1$.

The variance of the summary effect is formulated as:

$$Var(\bar{T}) = \frac{1}{\sum w_i} \quad [3].$$

It is possible that the variability among studies is higher than that expected simply due to pure randomness, which would be detected in the first instance by testing the hypothesis of homogeneity. The most widely used test was originally developed by Cochran (1954); it calculates the parameter Q, where:

$$Q = \sum w_i (T_i - \bar{T})^2 \quad [4]$$

Because of the low power of this test, highlighted by Takkouche et al. (1999), it is recommended that a *subgroup analysis* of studies with similarities to each other be performed, or that additional procedures are used to quantify the possible heterogeneity. Among these alternatives, I^2 is a parameter proposed by Higgins et al. (2003), which indicates the proportion of the variation between studies (*between-studies variance*) in the total variation; that is, the proportion of total variation due to heterogeneity:

$$I^2 = \frac{\tau^2}{\tau^2 + \sigma^2} \quad [5],$$

where τ^2(Tau-Squared) is the *between-studies variance* and σ^2 is the *within-study variance.*

If heterogeneity is detected a REM should be used, which considers that the estimated effects of the included studies are only a random sample of all those possible.

Following Borenstein et al. (2009), the true effect (θ) under a REM could vary from study to study. If it was possible to perform an infinite number of studies, the true effect sizes for them would be distributed about a *mean effect* which would explain two possible sources of variation: within the studies (random error) and between studies (true dispersion), so that: $T_i = \theta_i + e_i$ [6], where e_i is the error when T_i estimates the true effect θ_i.

The variance is given by expression [7]:

$$Var(T_i) = \tau_\theta^2 + v_i \qquad [7],$$

where v_i is the variance due to sampling error in the *i-th* estimate, and τ_θ^2 is the *between-studies variance*.

Applying the *variance weighted method*, expression [2] under the REM is transformed and we have, for each *i-th* estimate, adjusted weights (w_i^*) according to [8]:

$$w_i^* = \frac{1}{\frac{1}{w_i} + \tau^2} \qquad [8],$$

where τ^2 is the between-studies variance and w_i the statistical weight for an *i-th* estimate under a FEM.

With regards to the summary effect $\bar{T}$ (i.e. a *mean effect* obtained from "a distribution of effect sizes") and its variance, from [8] we can calculate, respectively:

$$\bar{T} = \frac{\sum w_i^* T_i}{\sum w_i^*} \quad ; \quad Var(\bar{T}) = \frac{1}{\sum w_i^*} \qquad [9]$$

The possibility of obtaining a biased summary effect must be assessed, which is derived from the presence of *publication biases* as a result of the fact that many completed studies are not actually published because they do not achieve significant effects, because they are unfavorable, or because they have negative outcomes (Sterne et al., 2000; Thornton & Lee, 2000).

Analytically, the publication biases can be detected by the statistical methods of Begg and Egger, which enable testing for the null hypothesis of no bias. *The method of Begg* (*Begg and Mazumdar Rank Correlation Test*: Begg & Mazumba, 1994), suggests an inverse correlation between study size and effect size; the rank order correlation (*Kendall's tau b*) between the treatment effect and the standard error can be determined. *Egger's Test of the Intercept* (Egger, Smith, Schneider & Zinder, 1997) suggests that we assess this same bias by using precision (the inverse of the standard error) to predict the standardized effect (effect size divided by the standard error). The size of the treatment effect is captured by the slope of a regression line (B_1), while bias is captured by the intercept (B_0).

These methods are often supplemented by so-called *funnel plot diagrams,* which are plots of a measure of study size on the vertical axis as a function of effect size on the horizontal axis. Ideally, the cloud of data points resembles an upside-down funnel, indicating no publication bias. A funnel plot that is asymmetric, meaning that one of the tails is missing or is markedly shorter or more thinly populated by data points, indicates the possible presence of publication bias (Borenstein et al. 2009). The main limitation of this graphical method is that the symmetry is defined subjectively by the investigator, as evidenced in the literature (Thornton & Lee, 2000; Macaskil et al., 2001). This limitation requires the application of *Duval & Tweedie's Trim and Fill algorithm* (Duval & Tweedie, 2000), which estimates the number of missing studies and yields an effect size estimate that is adjusted for the funnel plot asymmetry.

Finally, to assess the robustness or stability of the calculated summary effect, a sensitivity analysis is performed based on an iterative repetition of the meta-analysis, omitting in turn each of the studies and including others.

3. PANEL DATA STUDIES AND ESTIMATES.

We have identified 13 studies published through until 2011 which use panel data to analyze the relationship between tourism and GDP (details are given in Table 1). The studies were identified by search techniques using *Scopus, ScienceDirect, Google Scholar* and the main journals in tourism research (see Ryan, 2005). The main search terms were: "*tourism, economic growth and tourism led growth hypothesis"*. References from other studies were also used, which include not only articles in scientific journals listed in Journal Citation Reports (JCR) or other databases, but also working papers (Wpaper) that have achieved a certain scientific recognition on account of their quality or number of citations.

All the studies included are shown with an identification code in Table 1. The last column shows the estimates in each study which may differ depending on the estimation model: whether additional variables were used to explain economic growth, the type of variable used to measure tourism, whether the sample was classified into subsamples and the inclusion or not of instrumental or dummy variables for econometric estimates.

[PLEASE INSERT TABLE 1]

It was found that essentially all the analyses in these studies were carried out to determine the responsiveness of income growth rate to tourism, albeit with two different empirical models of estimation: *dynamic* and *non-dynamic*.

The dynamic model is defined as follows [10], in general terms:

$$y_{it} = \alpha_t + \phi y_{it-1} + \beta T_{it} + \lambda X_{it} + u_i + \varepsilon_{it} \qquad [10].$$

where y is the logarithm of real per capita GDP, T is a measure of tourism development expressed in logarithmic terms, X represents a vector of other explanatory variables, α is a period-specific intercept term to capture changes common to all countries, u is an unobserved country-specific and time-invariant effect, ε is the error term and the subscripts i and t represent country and time period, respectively.

Non-dynamic models are specified similarly, but without the term ϕy_{it-1}. They can be defined in general as follows:

$$y_{it} = \alpha_t + \beta T_{it} + \lambda X_{it} + u_i + \varepsilon_{it} \qquad [11].$$

The value of the parameter β, which reflects the impact of tourism on the GDP, reaches a different interpretation in dynamic and non-dynamic models. In non-dynamic models, β reflects the elasticity of productivity with respect to tourism (expressed in natural logarithm terms); while in dynamic models, it reflects only part of the effect of tourism on productivity (in the same period). The effects of tourism expand in time; that is, tourism has an effect on productivity for various periods thereafter depending on the value of ϕ.

Irrespective of whether the models are dynamic or not, the studies also differ in terms of those that use additional variables such as education, physical capital, etc., to explain the GDP, compared with those that relate only to the tourism growth variable. In other words, do they include (or not) a vector X to account for other explanatory variables? In this sense, as pointed out in Cortés-Jiménez & Pulina (2010), these variables represent a decisive contribution to economic growth and should not be excluded from the analysis if one's aim is to show adequately the manner in which tourism also contributes to such growth.

Other important differences in estimates can be summarized: firstly, whether the temporal effect is included by virtue of the coefficient α. Secondly, the proxy of tourism expansion used to define T (tourism arrivals vs. tourism receipts). Thirdly, whether instrumental variables are used to estimate causal relationships between tourism and GDP. Finally, if the estimates are referred to countries or regions with similar characteristics (i.e. small countries with a traditional specialization in tourism, poor countries or island groups).

Bearing in mind these specifications, Table 2 shows the estimated value of the coefficient β that measures the effect of tourism on GDP, together with the level of significance (Student's *t*-test) and its p-value. A further number has been added to each code, to identify the estimates within each study.

For each record, specifications are provided that show under what basis the estimate was made, indicating whether a dynamic or non-dynamic model was used, if additional explanatory variables of economic growth have been included or not (A or B respectively), if time dummies have been used, depending on the tourism expansion proxy used, if instrumental variables have been used and if they are estimates for a group of specific countries.

The study by Soukiazis & Proenca (2008) uses the accommodation capacity of the tourism sector as a proxy for the tourism. This proxy is not based on tourism arrivals or tourism receipts, and is therefore not classified in Table 2.

[PLEASE INSERT TABLE 2]

Table 2 shows how the coefficients obtained for estimates differ notably with each other, which is logical given the diverse array of specifications for each estimate. Given these differences, the meta-analysis considers different groups of similar estimates, justified on the basis of their high sensitivity to the specific characteristics which are considered. There are two sets of estimates (type 1 scenarios): dynamic and non-dynamic. Within each type 1 scenario, three clusters can in turn be made (type 2 scenarios): those that contemplate the whole sample for each scenario (overall), estimates that include only type A estimates, and type B estimates. Furthermore, within each type 2 scenario, other clusters can be formed (type 3 scenarios): those that contemplate the whole sample of estimates (overall) and which provide only specific, established and differentiated estimates as described in Table 2. For dynamic estimates, unless the time dimension is large, dynamic panels are to be estimated using lagged levels or/and lagged differences as instruments, to be consistent estimates. Therefore, dynamic estimates that do not use instrumental variables and whose temporal dimension is not long have been eliminated. All the eliminated estimates are Type B. These combinations give rise to a total of 46 scenarios.

4. META-ANALYSIS RESULTS.

Thirteen studies were identified in our search, but the estimates for two of them – Sequeira & Campos (2005) and Fayissa et al. (2009) – were excluded from the meta-analysis because the statistical information about the precision of the estimates was insufficient. The final study thus encompassed the empirical results from 11 suitable studies (Table 2) that gave rise to a total of 87 estimates (the sample for our meta-analysis framework) reported in the form of elasticity, which expresses the impact of tourism on GDP.

This sample can be considered large enough to perform the meta-analysis. As O'Mara & Marsh (2008) state, the number of studies considered for identifying a small or large sample of studies depends on the discipline, and we would expect that it would be smaller in the Social Sciences.

Table 3 summarizes the main results of the meta-analysis performed for the 46 scenarios formed by the criteria outlined in Section 3. The sensitivity analysis completed for the sample of 87 estimates (by an iterative repetition of the meta-analysis, omitting in turn each of the studies and including others), provided much more stable results when the 18 estimates from Sequeira & Nunes (2008) were omitted. The meta-analysis without these estimates shows both lower heterogeneity and publication bias for all the scenarios (all sensitivity analyses are available from the authors upon request). Table 3 shows the results of the meta-analysis performed on the remaining sample of 69 estimates.

[PLEASE INSERT TABLE 3]

Independently of the estimation model used for our meta-analyses (FEM or REM), in all the scenarios a weighted mean (summary effect) is obtained with a positive sign, which means that tourism, in a major or minor measure, contributes favorably to GDP in all cases.

With the aim of determining which of the two summary effects (FEM or REM) is more appropriate, the existence of heterogeneity should be analyzed. In the 7th column of Table 3, the statistical significance of the *Q*-test is included. In 23 of the 46 scenarios the null hypothesis of homogeneity is rejected (at the 99 % level in most of the cases). In addition to this test, in the 7th column, the ratio I^2 is added to measure the heterogeneity, due to the fact that the *Q*-test has a limited power (Borenstein et al. 2009; Fleiss, 1993; Takkouche et al. 1999).

According to the classification by Higgins et al. (2003) for the I^2 ratio, 13 of the 46 scenarios (formed by type A estimates from dynamic and non-dynamic studies) show full homogeneity (I^2 = 0%). Nine scenarios show a low heterogeneity (I^2 < 50%), and only three of the 24 remaining scenarios have a moderate heterogeneity (50% < I^2 < 75 %).

The high heterogeneity detected in the 21 remaining scenarios (I^2 > 75 %) seems to be logical, since the estimates from the original studies have been obtained by different methods, variables, data and samples, thus revealing the dispersion between them. As a consequence of this heterogeneity, as stated by Takkouche et al. (1999), the estimates obtained by REM (6th column of Table 3) are more appropriate for further analysis. For this reason we have chosen to focus on the above mentioned column (shaded in Table 3).

To evaluate the possible existence of publication bias, we show in the last column of Table 3 the results of Begg's test (Begg & Mazumbar, 1994) and Egger's test (Egger et al. 1997), which enable testing for the null hypothesis of no bias. The p-value is significant in 24 of the 46 scenarios, so the null hypothesis of absence of bias could be rejected (these methods are only viable with more than two combined estimates).

The detection power of both tests has been questioned (Macaskill et al. 2001; Sterne et al. 2001), and following Palma & Delgado (2006), Walter & Irving (2001), we also consider, in the last column of Table 3, the quantitative interpretation of the funnel plot diagrams (available from the authors upon request). This interpretation is based on the method of Trill and Fill (Duval & Tweedie, 2000) to include the number of missed studies in the scenarios in which the publication bias is detected.

In 31 of the 46 scenarios no study is missed that could potentially modify the summary effect. These scenarios are, in general, related to the non-dynamic models. In the 15 remaining scenarios, the existence of publication bias is detected and the Trim and Fill technique calculates the re-adjusted point estimates. According to the meaning of the publication bias (see Section 2), if other future estimates were added, the summary effect would be modified, so we can conclude that the summary effect obtained for these 15 scenarios with publication bias is overestimating the contribution of tourism to the GDP.

5. RANDOM POINT ESTIMATE VALORATION.

The distinction of studies according to their dynamic or non-dynamic character is crucial, not only from a methodological point of view, but also in terms of the meta-analysis. Considering the results shown in Table 3, the dynamic scenarios show less heterogeneity in general, although they reach lower random point estimates. Even though the non-dynamic scenarios involved lower estimates, they showed a remarkable dispersion or heterogeneity and higher summary random point estimates. Most of the dynamic scenarios in Table 3, exhibited a publication bias, while non-dynamic scenarios did not in general.

The re-adjusted random point estimate in the dynamic models has a value of 0.00063 for the overall sample when all estimates are considered. In the other scenarios of the overall sample, the re-adjusted random point estimate is between 0.01238 (when travel income is taken as a proxy for tourism) and 0.00039 (when tourism arrivals are taken as the proxy).

As shown in Table 3, the random point estimate for non-dynamic models has a value of 0.25800 for the overall sample when all estimates are considered. In the other scenarios of the overall sample, the estimate fluctuates around the same value, with a minimum value of 0.191 and a maximum value of 0.344. With the exception of the estimates that use arrivals as a tourism indicator, none of the estimated values are biased. In this case, the re-adjusted random point estimate is 0.20182.

The random point estimates for non-dynamic models are therefore much higher that those obtained for dynamic models. Nevertheless, one must keep in mind that the small value obtained for dynamic models only reflects the effect of tourism on economic growth for the current period. However, the dynamic nature of the model really means that this effect may persist in time. In order to know what is the full impact of tourism on GDP in these dynamic models, or to determine a representative value of the total tourism-productivity elasticity over time, the value of the long-term cumulative dynamic multiplier (CDM) of tourism must be calculated.

For this, it is necessary to determine the estimated value of the parameter ϕ that relates the current period productivity to the productivity of previous periods. However, to calculate this cumulative effect, the estimated function should be stable. This occurs when ϕ in Equation (10) is less than unity. Otherwise, the trajectory is divergent and the effect tends to multiply with time.

In the case where the dynamic functions are stable with a single time delay, the long-term CDM is equal to:

$$CDM = \frac{\beta}{1-\phi} \qquad [12]$$

The value of this cumulative multiplier is similar to the concept of the tourism-productivity elasticity of non-dynamic studies, which can help to interpret the effect of tourism on economic growth. In Table 4, estimated values of β and ϕ are given along with the value of the CDM calculated when the functions are stable. Parameters whose estimates proved to be not significant in the original studies have been omitted from Table 4, meaning that all estimates included in Table 4 are of type A.

In the last column, it can be seen that the CDM value is substantially higher than the estimated value of β. The last row of Table 4 shows that the average value of the CDM, which summarizes this effect, is 0.0488.

An interval of values for the long term CDM has been calculated, which depends on the diverse specifications of estimates. Extreme values of the re-adjusted random point estimate obtained for dynamic models have been used. The minimum value of the CDM is calculated from the coefficient ϕ of the estimates using tourism arrivals and β equal to 0.00039. The maximum value is calculated from the coefficient ϕ of the estimates using travel income and β equal to 0.01238. This gives a range between 0.002 and 0.11.

It can be seen that the maximum value of long-term CDM (0.11) is significantly lower than the re-adjusted random point estimate in non-dynamic models (0.25), even at the latter's minimum value (0.191). It should be noted here that the choice of the type of panel model used may directly impact on the validity of the results. If the data generating process is best-described as a dynamic panel, then the result from a non-dynamic panel would suffer from biases that come with misspecifications. Therefore, the results of the non-dynamic models should be considered with care.

This difference in values may also be explained when the dynamic and non-dynamic scenarios are divided into two subgroups (A and B). In the dynamic model scenarios, 38 estimates are of type A and only 2 are of type B, while in the non-dynamic model scenarios, 23 estimates are of type B and only 2 are of type A.

In both cases, it is noted that the random point estimates, or the re-adjusted values of the estimates type A, are lower than those obtained in each overall scenario (dynamic overall scenario or non-dynamic overall scenario). On the other hand, the random point estimates of the estimates type B are higher than those obtained in each overall scenario. That is, when additional variables that explain economic growth in the production function are included, in addition to the tourism variable, the impact of tourism on GDP decreases. In this sense, it can be argued that when estimates exclude other explanatory variables of economic growth, elasticities are overvalued. As pointed out in Cortés-Jiménez and Pulina (2010), the variables which represent a decisive contribution to growth should not be excluded from the analysis if we aim to adequately show the way in which tourism also contributes to it. Nevertheless, this conclusion must be considered with care since there are only two estimates type B for dynamic models and two estimates type A for non-dynamic models.

This sub-disaggregation of estimates into A and B does not seem to be sufficient to eliminate the heterogeneity among them, except for type A non-dynamic scenarios. This suggests that other circumstances exist that also affect the value of the random point estimates. Therefore, other classification criteria based on methodological aspects (discussed in Section 3) have been considered and applied to the overall sample for dynamic and non-dynamic scenarios, as well as to their respective A and B subgroups.

It was found that the inclusion of temporal variables and the use of instrumental variables tended to decrease the random point estimates value in all of the type 2 scenarios, and that the random point estimate values obtained for these scenarios were higher when travel income was used to measure tourism than when the number of arrivals was used.

Furthermore, the random point estimate tended to be slightly greater when the estimates that consider only specific samples of countries were used in dynamic models. This sample includes groups of countries considered to be poor, small, specialized in tourism, or from a specific geographic zone. The literature considers that tourism in such groups of countries has a considerably higher impact on economic growth. However, this small difference does not seem to reaffirm that the major effect is true in all groups. In this regard, some studies consider that country size does not affect the relationship between tourism and economic growth (Lanza et al., 2003; Sequeira & Nunes, 2008), but the degree of specialisation in tourism is indeed quite relevant (Adamau & Clerides, 2010; Holzner, 2011; Narayan et al. 2010; Sequeira & Campos, 2005; Sequeira & Nunes, 2008). It also seems that there is evidence in favour of tourism fostering growth to a greater degree in countries with a lower income level (Eugenio-Martín et al. 2004; Lee & Chang, 2008; Seetenah, 2011).

6. CONCLUSIONS.

Theoretical models that consider a causal relationship between economic growth and tourism (namely the TLG hypothesis) are a recent phenomenon. This paper performs a quantitative systematic review (meta-analysis) that synthesizes the findings from the previous panel data empirical evidence.

According to the meta-analysis presented, we can conclude that tourism contributes to economic growth, thereby corroborating the initial hypothesis and suggesting that economic efforts to promote tourism will have a positive effect on the country's overall economic activity. Nevertheless, the magnitude of the effect was found to vary according to the methodological procedure employed in the original studies using empirical estimates. In general, we find that the value of these elasticities is affected by a range of features used in the estimates carried out. We deduce that as a model becomes more specific, the value of elasticity (productivity with respect to tourism) tends to decrease. Thus, the inclusion of explanatory variables for economic growth, in addition to that of tourism, tends to reduce the value of the elasticity. Also, when temporal variables and instrumental variables are considered, the value of the elasticity tends to diminish.The estimates also depend on the proxy used to measure tourism. When the proxy is travel income, the elasticity is higher than when the number of arrivals is used.

We consider essential that future research includes economic growth explanatory variables in estimates carried out and that functions to be estimated, including temporal and instrumental variables, are adequately specified. Also, it may be appropriate that estimations use both proxies of tourism – arrivals and travel income – to enable a range of values to be specified concerning tourism's effect on GDP. If available data are insufficient to calculate these proxies, other variables of a similar magnitude may be used. For example, the sub-items of balance of payments related to tourism as an alternative to the magnitude of travel income.

The sample estimates can be clearly divided into two subsamples. Those based on dynamic models and those based on non-dynamic models. The meta-analysis applied to estimates based on dynamic functions shows that elasticity in the short-term is small, yielding a re-adjusted random point estimate ranging between 0.0004 and 0.0123. The initial effect is extended in time, so that in the long-term the average value of the elasticity is in a range between 0.002 and 0.110. The value of this long-term CDM is obtained from estimates that include variables for economic growth in addition to that of tourism (type A). Hence, although the initial effect of the tourism on GDP is small, it is increased over time. Therefore, policy makers and the tourism industry should plan long-term actions, whether public, private or mixed, in order to optimize the resources invested.

The meta-analysis applied to estimates based on non-dynamic functions shows that the elasticities had an average value of 0.266 for the overall sample. The results of the non-dynamic models should be considered with care because the data generating process is best-described as a dynamic panel. Also, this value may be overestimated because the majority of estimates were type B for non-dynamic scenarios, which do not include other explanatory variables of economic growth. The random point estimate for type A non-dynamic scenarios was only 0.038, which is within the range of values for the long-term CDM.

Finally, the meta-analysis results show that the tourism effect tends to be slightly greater for specific samples of countries. However, there were insufficient panel data studies relating to groups of similar countries for this result to be more precisely stated. Thus, future research focused on specific groups of countries (specialized in tourism, from specific geographic regions, with a similar income level…) would likely extend our findings.

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TABLES

Table 1: Panel data studies showing the relationship between tourism and GDP.

Author	Year of study	Code	Classification of study	Sample	Period	No. of estimates
Eugenio-Martin et al.	2004	Eug	Wpaper	Latin American countries	1985-1998	4
Sequeira & Campos	2005	Seca	Wpaper	72 countries	1980-1999	6
Sequeira & Nunes	2008	Sequ	JCR. Q3	Small, poor and normally developed countries	1980-2002	16
Fayissa et al.	2008	Fayi	JCR. Q3	Sub-Saharan countries	1995-2004	4
Lee & Chang	2008	Lee	JCR. Q1	OCDE, Asia, Latin American and sub-Saharan countries	1990-2002	20
Cortés-Jiménez	2008	Cort	JCR. Q3	Coastal regions of Italy and Spain	1990-2000	12

Proenca & Soukiazis	2008	Sou	JCR. Q4	Portugal regions NUT II and NUT III	1993-2001	6
Fayissa et al.	2009	Fay	Wpaper	Latin American countries	1995-2004	4
Adamau & Clerides	2010	Adam	open journal	162 countries	1980-2005	10
Narayan et al.	2010	Nara	JCR. Q3	4 islands	1988-2004	2
Holzner	2011	Holz	JCR. Q1	99 countries	1970-2007	4
Seetenah	2011	Seet	JCR. Q1	Pacific Islands and developed countries	1995-2007	6
Dritsakis	2011	Drit	JCR. Q3	Mediterranean countries	1980-2007	2

Source: Own elaboration.

Table 2. Tourism led growth: characteristics of the panel data estimates.

Code	Coefficient	Student's t-test or Std Error[*]	p-value	A	B	Dynamic Model		Time dummies		Instrumental variables		Proxy of tourism expansion		Sample of Countries	
						yes	no	yes	no	yes	no	Tourism receipts	Arrivals	Overall	Specific
Adam 1	0.002	0.00056[x]	5%	x		x		x			x	x		x	
Adam 2	0.011	0.0007[x]	no	x		x		x		x		x		x	
Adam 3	0.00018	0.000045[x]	5%	x		x		x			x		x	x	
Adam 4	0.00012	0.00006[x]	10%	x		x		x		x			x	x	
Adam 5	0.00117	0.00071[x]	no	x		x		x			x	x		x	
Adam 6	0.0041	0.00096[x]	5%	x		x		x			x	x		x	
Adam 7	0.0039	0.0012[x]	5%	x		x		x		x		x		x	
Adam 8	0.00048	0.00012[x]	5%	x		x		x			x		x	x	
Adam 9	0.00021	0.00015[x]	no	x		x		x		x			x	x	
Adam 10	0.0027	0.0012[x]	10%	x		x		x			x	x		x	
Cort 1	0.001		5%	x		x			x	x			x		24 Italian & Spanish coastal regions
Cort 2	0.006		1%	x		x			x	x			x		
Cort 3	0.001		5%	x		x			x	x			x		
Cort 4	0.006		1%	x		x			x	x			x		
Cort 5	-0.001		no	x		x			x	x			x		13 Italian & Spanish interior regions
Cort 6	-0.015		10%	x		x			x	x			x		
Cort 7	-0.001		no	x		x			x	x			x		
Cort 8	-0.017		5%	x		x			x	x			x		
Cort 9	0.001		10%	x		x			x	x			x		14 Italian & Spanish Mediterranean coastal regions
Cort 10	0.007		1%	x		x			x	x			x		
Cort 11	0.001		5%	x		x			x	x			x		
Cort 12	0.006		1%	x		x			x	x			x		
Drit 1	1.235		1%		x		x		x		x		x		7 Mediterranean countries
Drit 2	0.077		10%		x		x		x		x		x		

Eug 1	0.00036	1.68	10%	x		x		x		x			x		21 Latin American countries
Eug 2	-0.00019	2.54	10%	x		x		x		x			x		7 Latin American high-income countries
Eug 3	0.00063	1.92	10%	x		x		x		x			x		11 Latin American medium- income countries
Eug 4	0.00062	2.63	10%	x		x		x		x			x		3 Latin American low- income countries
Fayi 1	0.042	0.0082 [x]	1%	x		x					x				17 Latin American countries
Fayi 2	0.021	0.0103 [x]	5%	x		x					x				
Fayi 3	0.0243	0.0071 [x]	1%	x		x				x					
Fayi 4	0.0266	0.0082 [x]	1%	x		x				x					
Fayi 1	0.0378	0.0085 [x]	1%	x			x		x		x	x			42 sub-Saharan countries
Fayi 2	0.0388	0.01 [x]	1%	x			x		x		x	x			
Fayi 3	0.0249	0.0081 [x]	1%	x		x			x	x		x			30 sub-Saharan countries
Fayi 4	0.0256	0.0081 [x]	1%	x		x			x	x		x			
Holz 1	0.011	2	5%	x		x			x	x		x		x	
Holz 2	0.018	2.84	1%	x		x		x		x		x		x	
Holz 3	0.008	2.08	5%	x		x		x		x		x		x	
Holz 4	-0.041	-0.97	no	x		x			x	x		x		x	
Lee 1	0.36	11.84	5%		x		x		x		x	x			23 OECD countries
Lee 2	0.17	14.36	5%		x		x	x			x	x			
Lee 3	0.24	26.41	5%		x		x		x		x		x		
Lee 4	0.13	13.47	5%		x		x	x			x		x		
Lee 5	0,5	52,69	5%		x		x		x		x	x			32 OECD countries
Lee 6	0.5	35.21	5%		x		x	x			x	x			
Lee 7	0.61	5.38	5%		x		x		x		x		x		
Lee 8	0.17	-0.3	no		x		x	x			x		x		
Lee 9	0.13	-0.62	no		x		x		x		x	x			5 Asian countries

Lee 10	0.17	8.98	5%		x		x	x			x	x			
Lee 11	0.32	4.06	5%		x		x		x		x		x		
Lee 12	0.24	6.89	5%		x		x	x			x		x		
Lee 13	0.15	1.1	no		x		x		x		x	x			11 Latin American countries
Lee 14	0.09	8.9	5%		x		x	x			x	x			
Lee 15	0.36	16.36	5%		x		x		x		x		x		
Lee 16	0.23	12.08	5%		x		x	x			x		x		
Lee 17	0.3	8.23	5%		x		x		x		x	x			16 sub-Saharian countries
Lee 18	0.18	6.75	5%		x		x	x			x	x			
Lee 19	0.03	2.44	5%		x		x		x		x		x		
Lee 20	0.08	0.83	no		x		x	x			x		x		
Nara 1	0.24	3.84	1%		x		x		x		x	x			4 islands
Nara 2	0.72	15.29	1%		x		x		x		x	x			
Seet 1	0.12	1.95	10%	x		x		x		x			x		19 Pacific islands
Seet 2	0.06	1.95	10%	x		x		x		x			x		20 developing countries
Seet 3	0.064	1.96	10%	x		x		x		x			x		10 developing countries
Seet 4	0.14	2.04	10%	x		x		x		x		x			19 Pacific islands
Seet 5	0.033	1.87	10%	x		x		x		x		x			20 developing countries
Seet 6	0.08	1.89	10%	x		x		x		x		x			10 developing countries
Sequ1	-14.21	-1.37	no	x		x					x			x	
Sequ2	-0.62	-1.78	10%	x		x					x			x	
Sequ3	-1.89	-1.29	no	x		x					x			x	
Sequ4	1.44	0.39	no	x		x					x			x	
Sequ5	0.329	2.22	5%	x		x					x			x	
Sequ6	1.104	2.26	5%	x		x					x			x	
Sequ 1	0.013	1.05	no	x		x		x		x			x	x	
Sequ 2	0.041	2.42	5%	x		x		x		x		x		x	

Sequ 3	0.026	1.92	10%	x		x		x		x		x		x	
Sequ 4	0.025	1.85	10%	x		x		x		x			x	x	
Sequ 5	0.048	3.77	5%	x		x		x		x		x		x	
Sequ 6	0.041	2.69	5%	x		x		x		x		x		x	
Sequ 7	0.095	4.44	1%	x		x		x			x		x	x	
Sequ 8	0.049	3.89	1%	x		x		x			x	x		x	
Sequ 9	0.042	2.48	1%	x		x		x			x	x		x	
Sequ 10	0.106	4.14	1%	x		x		x			x		x	x	
Sequ 11	0.047	3.32	1%	x		x		x			x	x		x	
Sequ 12	0.041	2.98	1%	x		x		x			x	x		x	
Sequ 13	0.077	2.5	1%	x		x		x			x		x		47 small countries
Sequ 14	0.06	1.79	10%	x		x		x			x	x			
Sequ 15	0.055	1.87	10%	x		x		x			x	x			45 small countries
Sequ 16	0.092	3.45	1%	x		x		x			x		x		
Sequ 17	0.063	3.28	1%	x		x		x			x	x			58 poor countries
Sequ 18	0.055	2.73	1%	x		x		x			x	x			
Sou 1	0.1006	1.55	no		x	x			x		x				
Sou 2	0.1082	1.7	5%		x	x			x		x				7 NUT II Portuguese regions
Sou 3	0.1522	2.05	10%		x	x			x	x					
Sou 4	0.0401	1.54	no		x	x			x		x				
Sou 5	0.0056	2.31	10%		x	x			x		x				30 NUT II Portuguese regions
Sou 6	0.009	2.55	10%		x	x			x	x					

A and *B* are referred to estimates which include or not adding explanatory variables of GDP.

[*] All data for this column are t-student except for those marked with an [x], which signifies std. error according to the original format from each study.

Source: Own elaboration

Table 3: Meta-Analysis Results

Type 1 SCENARIOS	Type 2 SCENARIOS	Type 3 SCENARIOS	No. of Point Estimates	FIXED POINT ESTIMATE / Z-value	RANDOM POINT ESTIMATE / Z-value	HETEROGENEITY MEASURES		PUBLICATION BIAS			
										Duval & Tweedie's Trim and Fill	
						Q test (ρ)	I^2	Begg (Kendall's tau b)	Egger (B0)	No. of missed studies	Re-adjusted Random Point Estimate
DYNAMIC	OVERALL	overall	44	0.000 (4.902)***	0.00089 (2.818)***	0.000***	47.016	(-0.241)	0.833	16	0.00063
		t	22	0.000 (4.706)***	0.0059 (2.055)**	0.000***	57.897	0.112	1.041	10	0.00044
		no t	22	0.00742 (4.738)***	0.00742 (4.738)***	0.968	0.000	(-0.141)	0.279	0	-
		inst	34	0.000 (4.813)***	0.00077 (2.449)**	0.000***	52.562	(-0.327)	0.888	11	0.00073
		no inst	10	0.00576 (2.816)***	0.00576 (2.816)***	0.874	0.000	0.667	0.3505	0	-
		travel income	15	0.01238 (5.139)***	0.01238 (5.139)***	0.639	0.000	0.190	0.301	1	0.01238
		arrivals	23	0.000 (4.591)***	0.00031 (4.591)***	0.710	0.000	(-0.145)	0.387	5	0.00039
		specific countries	30	0.000 (4.775)***	0.0065 (2.339)***	0.002***	48.261	(-0.311)	0.971	12	0.00071
	A	overall	38	0.000 (4.732)***	0.00055 (2.379)**	0.031**	32.272	(-0.263)	0.641	13	0.00044
		t	22	0.000 (4.706)***	0.00059 (2.055)**	0.000***	57.897	0.112	1.048	10	0.00044
		no t	16	0.01047 (2.036)***	0.01047 (2.036)***	1.000	0.000	(-0.284)	(-0.136)	0	-
		inst	32	0.000 (4.731)***	0.0059 (2.242)**	0.006***	43.240	(-0.356)	0.765	10	0.00052
		no inst	6	0.001	0.00128	1.000	0.000	0.667	0.1448	2	0.00076

				(0.099)	(0.099)						
		travel income	15	0.01238 (5.139)***	0.01238 (5.139)***	0.639	0.000	0.190	0.301	1	0.01238
		arrivals	23	0.000 (4.591)***	0.00031 (4.591)***	0.710	0.000	(-0.144)	0.387	5	0.00039
		specific countries	24	0.000 (4.604)***	0.00043 (2.650)***	0.165	21.987	(-0.371)	0.690	8	0.00044
	B (INST)	overall	2	0.009 (3.406)***	0.063 (0.911)	0.042**	75.819	-	-	-	-
		no t	2	0.009 (3.406)***	0.063 (0.911)	0.042**	75.819	-	-	-	-
		specific countries	2	0.009 (3.406)***	0.063 (0.911)	0.042**	75.819	-	-	-	-

Table 3: Meta-Analysis Results (Cont…)

Type 1 SCENARIOS	Type 2 SCENARIOS	Type 3 SCENARIOS	No. of Point Estimates	FIXED POINT ESTIMATE / Z-value	RANDOM POINT ESTIMATE / Z-value	HETEROGENEITY MEASURES		PUBLICATION BIAS			
										Duval & Tweedie´s Trim and Fill	
						Q test (ρ)	I^2	Begg (Kendall's tau b)	Egger (B0)	No. of missed studies	Re-adjusted Random Point Estimate
NO DYNAMIC	OVERALL	overall	25	0.266 (126.649)***	0.258 (6.754)***	0.000***	99.618	0.187	(-0.775)	0	-
		t	10	0.198 (68.873)***	0.208 (4.036)***	0.000***	99.592	0.356	2.662	0	-
		no t	15	0.344 (111.753)***	0.290 (5.375)***	0.000***	99.515	0.000	(-2.606)	0	-
		no inst	25	0.266 (126.649)***	0.258 (6.754)***	0.000***	99.618	0.186	(-0.775)	0	-
		travel income	14	0.321 (116.239)***	0.2783 (4.563)***	0.000***	99.718	0.121	(-3.446)	0	-
		arrivals	11	0.191 (58.894)***	0.309 (6.773)***	0.000***	98.631	(-0.073)	1.918	1	0.202

		specific countries	25	0.266 (126.649)***	0.258 (6.754)***	0.000***	99.618	0.186	(-0.775)	0	-
	A	overall	2	0.038 (1.362)	0.038 (1.362)	0.9860	0.000	-	-	-	-
		no t	2	0.038 (1.362)	0.038 (1.362)	0.9860	0.000	-	-	-	-
		no inst	2	0.038 (1.362)	0.038 (1.362)	0.9860	0.000	-	-	-	-
		travel income	2	0.038 (1.362)	0.038 (1.362)	0.9860	0.000	-	-	-	-
		specific countries	2	0.038 (1.362)	0.038 (1.362)	0.9860	0.000	-	-	-	-
	B	overall	23	0.267 (126.902)***	0.279 (6.993)***	0.000***	99.646	0.221	0.082	0	-
		t	10	0.198 (68.873)***	0.208 (4.036)***	0.000***	99.592	0.355	2.662	0	-
		no t	13	0.344 (112.277)***	0.290 (5.762)***	0.000***	99.150	(-0.012)	(-1.251)	0	-
		no inst	23	0.267 (126.902)***	0.279 (6.993)***	0.000***	99.646	0.221	0.082	0	-
		travel income	12	0.324 (116.669)***	0.313 (4.872)***	0.000***	99.756	0.167	(-1.848)	0	-
		arrivals	11	0.191 (58.894)***	0.240 (6.773)***	0.000***	98.631	(-0.072)	1.917	1	0.202
		specific countries	23	0.267 (126.902)***	0.279 (6.993)***	0.000***	99.646	0.221	0.082	0	-

Note: Significance at ***1%, **5%, *10%, respectively. *Overall* is related to all the estimates; each scenario *A* or *B* is respectively related to estimates with / without added exogenous variables of the economic growth; *t* and *no t* mean estimates with /without time dummies; *Inst* and *no inst* are respectively related to estimates with / without instrumental variables; *Travel income* and *arrivals* refer to estimates based on proxy variables of tourism obtained from data series of travel income or tourist arrivals; *specific countries* are related to estimates obtained for a concrete sample of countries.

Source: Own elaboration.

Table 4. Long-Term cumulative dynamic multipliers of tourism on economic growth.

CODE	Model type	β	ϕ	Cumulative Dynamic Multiplier (CDM)
Adam 1	A	0.002** (0.00056)	-0.1** (0.0077)	0.02[a]
Adam 3	A	0.00018** (0.00045)	-0.01** (0.0073)	0.018[a]
Adam 4	A	0.00012* (0.00006)	-0.09** (0.017)	0.001[a]
Adam 6	A	0.0041** (0.00096)	-0.101** (0.0076)	0.041[a]
Adam 7	A	0.0039** (0.0012)	-0.101** (0.018)	0.038[a]
Adam 8	A	0.00048** (0.00012)	-0.1** (0.0074)	0.004[a]
Holz 1	A	0.011** (2.00)	0.941*** (35.98)	0.186
Holz 2	A	0.018*** (2.84)	0.95*** (35.49)	0.360
Holz 3	A	0.008** (2.08)	0.97*** (52.93)	0.267
Cort 1	A	0.001** (n.a)	0.895*** (n.a)	0.010
Cort 2	A	0.006* (n.a)	0.884 *** (n.a)	0.052
Cort 3	A	0.001** (n.a)	0.919*** (n.a)	0.012
Cort 4	A	0.006*** (n.a)	0.907*** (n.a)	0.065
Cort 6	A	-0.015 (n.a)	0.891*** (n.a)	-0.138
Cort 8	A	-0.017** (n.a)	0.942*** (n.a)	-0.293
Cort 9	A	0.001* (n.a)	0.831*** (n.a)	0.006
Cort 10	A	0.007*** (n.a)	0.830*** (n.a)	0.041
Cort 11	A	0.001** (n.a)	0.869*** (n.a)	0.008
Cort 12	A	0.006*** (n.a)	0.857*** (n.a)	0.042
Eug 1	A	0.00036* (1.68)	0.777* (19.30)	0.007
Eug 2	A	-0.0002* (2.54)	0.765* (12.64)	-0.001
Eug 3	A	0.00063*	0.738*	0.002

		(1.92)	(10.16)	
Eug 4	A	0.00062* (2.63)	0.597* (4.14)	0.002
Fayi 3	A	0.0249*** (0.0081)	0.568*** (0.073)	0.058
Seet 1	A	0.12* (1,95)	0.24** (215)	0.158
Seet 2	A	0.06* (1.95)	0.23*** (2.52)	0.078
Seet 3	A	0.064* (1.96)	0.34*** (2.43)	0.097
Seet 4	A	0.14* (2.04)	0.17* (2.17)	0.169
Seet 5	A	0.033* (1.87)	0.25** (2.15)	0.044
Seet 6	A	0.08* (1.89)	0.37** (2.19)	0.127
Average value of DM	-	-	-	0.0488 0.0527

Note: Significance at ***1%, **5%, *10%, respectively. *n.a.* Not available.

a. The estimated function is $\Delta y_t = \theta y_{t-1} + \beta t_t$. So $y_t = (1+\theta) y_{t-1} + \beta t_t$ and $MD = \beta / \theta$

Source: Own elaboration.