EXPLANATORY META-ANALYSIS
OF TOURIST INCOME MULTIPLIERS

An application of comparative research to island economies

Sef R. Baaijens
Peter Nijkamp
Kees van Montfort

Faculty of Economics and Econometrics
Vrije Universiteit Amsterdam

De Boelelaan 1105
1081 HV Amsterdam
The Netherlands

telephone: 020-4446090
fax: 020-4446004

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Abstract

This paper aims to demonstrate the potential of quantitative research synthesis, i.e. meta-analysis, as a methodology for comparative and explorative research, with a particular view on tourism research. The attention is focused on regional tourist multipliers which measure the effects of tourist expenditure on the economy of a region. On the basis of a sample of studies on tourist multipliers, differences among tourist income multipliers are ex post examined. The preliminaries of this investigation are discussed in order to show some important issues a meta-analyst is confronted with. Besides, the results of the comparative analysis of previous studies are transferred to the Greek island of Lesvos. This area was estimated to have an average tourist income multiplier falling in between 0.55 and 0.67.

1   INTRODUCTION

Multiplier analysis has been widely used as a method for regional impact assessment of tourism. Especially regional input-output models, from which multipliers can be derived, provide very detailed and relevant information on the consequences of tourist expenditure on regional economies. In the past decades, tourist multipliers have been calculated for several countries and regions, for example for Singapore, Turkey, Alonnisos and Okanagan (Khan et al., 1990; Liu et al., 1984; Pepping and De Bruijn, 1991; Var and Quayson, 1985). Tourist multipliers can not only be used to assess impacts of changes in tourist expenditure, they serve also as indicators of the performance of tourism from the perspective of the local population. A high income multiplier is associated with relatively large benefits for the local population.

Until now researchers using multiplier analysis have mainly focused on the economic impact of tourism. Since a few years the potential of this method has also been recognized for assessing environmental impacts. Pepping and De Bruijn (1991), for example, studied environmental impacts of tourism on the Greek island of Alonnisos using a regional input-output model. Buhalis and Fletcher (1995) stress the usefulness of input-output models in assessing whether tourism development is sustainable or not.

Input-output modelling and multiplier analysis are still seen as useful methods for policy impact assessment. The first part of this article is devoted to the research question why multiplier values found by different researchers for different regions differ from each other. In contrast with the traditional approach of a literature review in which the results of different studies are compared by means of verbal arguments, the approach followed here is a statistical one. Relationships between the regional multiplier and different background characteristics of the tourist area are investigated by regression analysis. An important advantage of a statistical analysis is that its objectivity is expected to be more guaranteed than that of a traditional literature review.

A quantitative analysis of outcomes of studies with a similar research question is usually called meta-analysis (Cooper and Hedges, 1994). Meta-analytical methods are quantitative methods for research synthesis. Until now this type of analysis has mainly been used by medical and social researchers while so far its application to economic issues has been limited. Medical researchers employ meta-analysis for estimating common effect sizes from experiments by means of combining estimates of effect sizes found by individual researchers. Furthermore, if homogeneity of the individual effect sizes is rejected, they try to explain the variations among these.

A topic related to meta-analysis, which is one of its greatest potentials at the same time, is the transferability of research findings. In the case of the tourist multipliers, the issue of the transferability brings us to our second research question: Which lessons can be drawn from a comparative analysis for the average tourist income multiplier of another tourist region? In our case, we will in particular focus the attention on the Greek island of Lesvos.

Transferring existing knowledge to a similar situation which has not been investigated before, is an interesting unexplored research field. Proceeding in this way

enables to make statements about phenomena which would have otherwise required expensive and big research efforts. In this respect, it has to be stressed that for implementing an input-output model an enormous amount of data is necessary. Extensive fieldwork is an important and costly part in most multiplier studies. Although Archer (1971, 1976, 1977) tried to meet this drawback of the input-output model by developing an adjusted input-output-model, calculating multipliers is still an expensive and tedious task.

The structure of this article is as follows. Section 2 will demonstrate the usefulness of calculating tourist income multipliers. For that purpose, it will consider the economic motives for developing a region as a tourist destination. In Section 3 attention will be paid to the two types of models that are used to calculate multiplier values: the input-output model and the ad-hoc multiplier model introduced by Archer. Next, hypotheses will be made about the factors that determine the size of a multiplier value. These hypotheses will be tested by estimating some regression equations that explain the size of the multiplier. Section 4 will describe the data and the method in more detail. It will also operationalize the hypotheses stated in Section 3. Section 5 will give the results of the regression analysis. Finally, Section 6 will employ these results to derive an interval of plausible values for the unknown average tourist income multiplier of the Greek island of Lesvos, using a meta-analytic approach.

2   ECONOMIC MOTIVES FOR TOURISM

Traditionally, the most important motive to develop an area as a tourist destination is the expected economic benefit from this development. From a national perspective, tourism is particularly of importance for the balance of payments (Pearce, 1989). Foreign tourists spend money in tourist areas and in this way a country earns foreign currencies which leads to an improvement of the balance of payments.

Apart from a tool of national economic policy, tourism development is also a tool of regional economic policy. Regional economic policy aims at decreasing regional disparities in life expectations, unemployment and income per capita. These regional disparities are conflicting with national policy objectives such as full employment, balanced economic growth, and a balanced income distribution (Armstrong and Taylor, 1985).

Less prosperous regions which have an attractive environment or cultural heritage, could be developed as a tourist destination. Tourism has a stimulating effect on the regional economy. In this respect two phases of tourism development can be distinguished. First, there is the development phase in which investments in the construction of the tourist industry are stimulating the regional economy. These investments increase the demand for goods and services in the region temporarily. Second, during the operational phase of tourism, expenditures of tourists flow into the economy. These spendings of the tourists have a more permanent stimulating effect. The tourist firms provide the regional economy jobs and as a consequence they pay them wages. In the first place, it has to be mentioned that the tourist sector is a relatively labour intensive industry. This means that a relatively low capital stock is

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required for a certain amount of jobs. In the second place it has to be mentioned that the created demand for labour is fluctuating due to tourist seasons. In addition, the created jobs are often part-time and characterized by a low status and low wages.

The effect of tourism is not limited to these direct effects. Regional companies which deliver to the tourist industry are confronted with an increasing demand. Furthermore, consumer's demand will grow as a consequence of the increase of regional income. Finally, the regional and the national government will benefit, as the revenues from different kind of taxes (such as tourist, income and added value tax) will increase. Besides, the demand for unemployment benefits will decrease as a result of the increased employment.

The phenomenon that the effect of tourist expenditure is not limited to the companies in which this money is spent, is called the multiplier effect of the tourist expenditure. This multiplier effect is the chain of effects which follow after a change in tourist expenditure. Although this multiplier effect can only be described thoroughly by means of a specific model of the regional economy, some general remarks are to be made here. Effects on the regional tourist industry itself are called direct effects. The effects on the regional companies that deliver to the tourist sector and all other consequent changes in intermediate demand are indirect effects. Induced effects are the effects of the increasing demand for consumption goods as a consequence of the increased household income in the region. A chain of effects will come to a stand-still, if products are imported from other regions. From that moment on, this money will not contribute to a growth of regional production growth any more.

Development of a tourist destination does not only lead to benefits, also costs are involved. The private sector has to invest in accommodation, restaurants and so on. Besides, it has to import goods and services which are not available in the region itself. The public sector has to extend the infrastructure of the area. Another public task is the promotion of the area abroad to attract tourists. A second category of costs are the opportunity costs of tourism development. The amounts of capital and labour needed by the tourist sector cannot be used by other industries. If tourism development grows too rapidly, the tourist sector may crowd out other industries. Finally, if the demand of the tourists exceeds the supply of goods and services in the region, inflation will occur. Prices of houses and food will increase which leads to increasing costs of living for the regional population.

3 TOURIST MULTIPLIERS AND MULTIPLIER MODELS

A multiplier value reflects the size of the multiplier effect with respect to a specific feature of the economy such as income, employment or the stock of natural resources. A multiplier value is calculated with the help of a model of the economy. These models belong to the class of equilibrium models. Such models can assess the effects of an exogenous change on the equilibrium levels of the endogenous variables. A normal multiplier shows the change in the level of an endogenous variable in the model as a consequence of the increase of an exogenous variable by one unit. When the normal multiplier is multiplied by the size of the exogenous

shock, the total consequent change of the endogenous variable will be obtained. Thus, multipliers play an important role in policy impact assessment studies in which a current situation is compared with the situation in which a specific policy is pursued (Pleeter, 1980).

It should be noted that apart from normal multipliers sometimes ratio multipliers are calculated. Ratio multipliers measure the size of the secondary effect in proportion to the primary effect. They serve as an indicator of the mutual dependency of the regional firms (Fletcher, 1989; Liu, 1984). A ratio income multiplier of type 1 is the ratio of the income generated indirectly to the income generated directly, while a ratio income multiplier of type 2 is the ratio of the income generated indirectly and induced to the income generated directly.

A first economic model which can be used to derive multiplier values is the input-output model (IO model). An IO model is based on a transactions or input-output table (IO table). An IO table is an overview of the values of the economic interactions between parties in an economy in a year. The idea behind the IO table is that to produce goods and services (i.e. output) raw materials, semi-finished articles and labour (i.e. input) are required (Armstrong and Taylor, 1985; Schaffer, 1976). The IO table divides the firms in an economy into industries. The industries buy goods and services from each other in order to use them for production. Besides, they use resources for their production which cannot be bought from regional firms. These resources are called primary inputs and comprise labour, goods and services from other regions and taxes. The industries do not only produce for each other, but also for the final demand. Final demand comprises various classes, for instance, consumers, investors, government and parties from other regions.

The IO model is the mathematical translation of the IO table. It can be used to assess the effects of a change in the final demand on the economy. The change in final demand is then multiplied by a multiplier which follows from the model. The most important assumption of the IO model is that all industries have linear production technologies which means that for each unit of production the industries use their inputs in the same proportion. The result of solving the model is a matrix with so called detailed sectoral production multipliers (Pleeter, 1980). The entry a_{ij}^{*} of this matrix equals the change in the value of the demand for product i when industry j increases the value of its production by one unit. a_{ij}^{*} reflects the direct requirement of industry j as well as the indirect requirement of other industries as a consequence of the increased production of industry j by one unit.

As the tourist income multiplier is the subject of this study, attention will be focused on income multipliers. If all income earned by the regional population (wage, profit, rent) is treated as one single primary input, the sectoral income multiplier of industry j is equal to the following expression:

$$b_{hj}^{*} = \sum_{l=1}^{m} b_{hl} a_{lj}^{*}.$$

Note:
b_{hl} = the proportion of wage, profit and rent in total value of production of industry l, l=1, ..,m

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b_{hj}^* equals the change in total income earned by the regional population as a consequence of an increase of the final demand for product j by one unit. This multiplier takes account of direct and indirect effects, but does however not take account of induced effects, since an increase of the wages does not lead to an increase of the demand for consumption goods. For investigation of induced effects the IO model has to be slightly adjusted. A possible modification is to treat the household sector as one of the endogenous industries instead of exogenous final demand. In this case the household demand for consumption goods can be seen as the input of this sector, while the income of the household sector can be seen as its output. Increases of production levels do now not only lead to more income for the household sector, but also to a proportional increase of the demand for consumption goods.

Tourists can be seen as a separate class of the final demand. They spend money in the region of destination and demand goods and services supplied by the local or regional firms. When the tourist demand is indeed treated as a separate final demand category, the effect of a change in the level of tourist expenditure can be assessed by the IO model. It is even possible to assess the effect of different groups of tourists, as long as the groups are treated as separate final demand classes. In the IO model different groups of tourists can be distinguished by their different expenditure patterns. When the distinct expenditure patterns are known, tourists could be classified according to their ages, nationalities and the types of accommodation in which they stay (Pepping and De Bruijn, 1989). A tourist income multiplier is a weighted average of the distinct sectoral income multipliers. The expenditure pattern of the tourists serves as the set of weights. If the expenditure of all tourists together is considered, the so called average tourist income multiplier is obtained.

A major drawback of the IO model is that an enormous amount of information is required to construct an IO table. Hence, it is expensive and time consuming to calculate multipliers with the help of IO models. For this reason Archer (1971; 1976; 1977) introduced a method to calculate ad-hoc multipliers. To apply this method less information on the economy is required. Archer distinguishes between tourism-aligned and non-tourism-aligned industries. His method begins with calculating sectoral income multipliers for the most relevant industries. Next, the average tourist income multiplier is calculated by the following formula which takes account of the expenditure patterns of the different groups of tourists, the expenditure pattern of the local households and their preference for foreign goods and services:

$$\left(\sum_{j=1}^{N} Q_j \sum_{i=1}^{n} K_{ji} Y_i\right) * \left(1 + \frac{1}{1 - c\sum_{i=1}^{n} X_i Z_i Y_i}\right).$$

Note:
Y_i = sectoral income multiplier of industry i
$(K_{j1}, K_{j2}, ..., K_{jn})$ = expenditure pattern of the j-th group of tourists
Q_j = portion of group j in total tourist expenditure
$(X_1, X_2, ..., X_n)$ = expenditure pattern of local households

Z_i = portion of the regional industry i in the total demand of local households for products of industry i
c = average consumption quote

Before we will turn to the preliminaries of a comparative analysis of income multipliers on the basis of various reports and articles, it may be useful to offer here already some hypotheses on the size of the multiplier. In the next section, it will be discussed whether these hypotheses can be actually tested on the basis of the information available from various study reports. Factors which influence the size of the income multiplier may be subdivided into four groups:
- the economic model used;
- the behaviour of tourists;
- the behaviour of firms in the region (the regional economic activity);
- the behaviour of regional households.

The first group consists of all features of the economic model from which the multiplier can be derived: the way of modelling, definition of variables and so on. Models, for instance, that take account of induced effects provide higher estimates of the multiplier than models that only take account of direct and indirect effects. A hypothesis is that estimates of the multiplier calculated by the IO model are expected to be higher than those calculated by Archer's ad-hoc method, because the IO model in contrast with Archer's method models the economy in a system-wide way.

The second group of factors consists of features of the tourists who are visiting the region. Their expenditure pattern is, as argued, a very important determining factor of the size of the multiplier. The more the tourists spend their money in industries with a high sectoral multiplier, the larger the tourist multiplier will be. Next, the features of the economic activity also have an important effect on the multiplier (Milne, 1987; 1992). First, there is the diversity of the regional economic activity. If this diversity is small, many goods and services demanded by the tourist industry have to be imported. Indirect employment and income effects in the region are then relatively small. Second, just like the tourists' expenditure pattern the expenditure patterns of the industries influence the size of the multiplier. Firms owned by inhabitants of the region are expected to create relatively more jobs and income indirectly. Because of their more intense bonds with the region, they are expected to be less willing to import goods and services from other regions. Another factor, profit distribution, is related to this. If the profit goes to people who reside in other regions instead of residents of the region, the direct effect is smaller. Fourth, the labour intensity of the firms also plays a role. Firms that employ much labour in proportion to capital, generate more direct employment and income than firms that are more capital-intensive. Features of regional households belong to the fourth group of factors. They receive the income which is created directly, indirectly and induced as a consequence of the tourists' spending. Again, the expenditure pattern is important, in this case for the size of the induced effect. A second factor is the rate of consumption. If savings are modeled as a leakage, we may find that the larger the rate of consumption, the larger the induced effect.

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4 DATA, METHOD AND HYPOTHESES

4.1 Data

Economic models, such as the input-output model, provide many different types of multipliers. The analysis in the next section will concentrate on one specific multiplier value: the average regional tourist income multiplier. That is the ratio of total regional income generated to an average unit of tourist expenditure. The aim of the analysis is to trace factors which could explain the variation in different values of this multiplier found for different regions by different researchers. Instead of a traditional literature review which would compare the distinct multiplier values in a narrative way, a quantitative literature review will be carried out which compares the multiplier values by means of a statistical method.

The data set for the statistical analysis consists of a sample of eleven multiplier values. The source of these multiplier values was formed by a set of nine study reports in total. The first step of the research was the investigation of these reports on the basis of a list of information elements. The following elements were considered:

- source of the study;
- year of collection of data;
- method of research;
- reported multiplier values;
- features of the economy;
- features of tourism;
- features of the environment;
- tourist policy.

In this way information relevant to the analysis was retrieved from the reports. The composition of the list was based on a general equation which is proposed as a framework for quantitative comparative analyses in a meta-analytical context (Button, 1995):

$$Y = f(P,X,R,T,L) + error.$$

This equation states that the effect to be investigated (Y) is a function of background variables. These background variables are subdivided into several groups. In combination with the considerations on the size of the multiplier in the previous section, this division could take place as follows:

- P, the cause of effect Y (tourism);
- X, the systems affected by the effect (the regional economy, i.e. firms and households, and the regional environment);
- R, method of research (IO-model or Archer's ad-hoc method);
- T, time period in which the study took place;
- L, geographical location where the study took place.

The investigation of the nine study reports resulted in an overview table of the relevant information. It appeared that each study report provided different background information, so that quite some information is missing in the overview. This

is a serious problem for literature reviewers who wish to compare different studies. The characteristics that are present in most study reports, are summarized in Table 1.

Table 1: Survey table for meta-analysis

Area	DOC	YEA	ATIM	POP (x 1000)	SUR (x 1000 km²)	GEO	POA	MOD	TOA	LCS	EL
Bahamas	RP	1976	0.7815	189.9	11,401	archipelago	y	A	1388.0	75.8	?
Bermuda	RP	1975	1.0996	56.6	107	archipelago	n	A	511,4	86.6	?
Singapore	JO	1983	0.9393	2501.0	625	island (city)	y	A	2856.6	?	?
Turkey	JO	1981	1.9809	45,529.0	779,425	country	y	IO	1,460.0	?	?
Niue	JO	1987	0.35	2.0	258	island	n	IO	1.8	78.0	70
Cook Islands	JO	1984	0.43	18.0	236	archipelago	n	A	25.6	40.0	38
Kiribati	JO	1987	0.37	66.0	270	archipelago	y	A	2.0	?	99
Tonga	JO	1987	0.42	95.0	699	archipelago	y	A	16.1	24.2	99
Vanuatu	JO	1987	0.56	140.0	12,200	archipelago	y	A	17.5	52.0	10
Alonnisos	BO	1989	0.489	1.55	83	island	n	IO	20.0	35.9	?
Okanagan	JO	1977	0.713	?	21,813	region	n	IO	1,400.0	?	?

Note:
DOC = type of documentation: RP = research paper
                             JO = journal
                             BO = book
YEA = year of data
ATIM = estimated value of the average tourist income multiplier
POP = population size
SUR = surface
GEO = geographic feature of the area
POA = political autonomy
MOD = research method: A = Archer's method
                      IO = input-output model
TOA = number of tourist arrivals
LSC = share of arrivals from most important country of origin in total number of arrivals
EL = share of tourist expenditure in locally owned companies in total tourist expenditure

4.2   Method

A conventional statistical technique appropriate to analyze information which is classified according to the general framework mentioned before is the linear regression model. The type of regression model that would be in agreement with the nature of the data, is the mixed effects model (Cooper and Hedges, 1994). This model explains the actual multiplier value from a linear set of explanatory variables (x_1, …, x_p). This set of variables can however not explain the variation completely, so that an error term (u_i) has to be added. These error terms (u_i, i= 1, …, n) are assumed to be independent and equally normally distributed. They are the random effects in the model, while the coefficients (β_1, …, β_p) are the fixed effects. There is another source of error, as the actual multiplier value is not observed. Each of the study reports only mentions an estimate of the multiplier (m_i). Therefore, a second error term ϵ_i is added which takes account of this estimation error. The regression equation is now equal to:

$$m_i = x_{i1}\beta_1 + x_{i2}\beta_2 + \ldots + x_{ip}\beta_p + u_i + \epsilon_i, \quad i = 1,\ldots,n.$$

The probability distribution of the error term ϵ_i reflects the quality of the studies. The larger the estimated variance of a multiplier, the lower the quality of the study. These variances are however not mentioned by the research reports. The multiplier models employed are deterministic and do not take account of uncertainty in the data. Because of this lack of information it is assumed that the error terms (ϵ_i, i=1, …, n) are independent and equally normally distributed. This means that the studies are assumed to have the same quality. Now, it is possible to estimate the coefficients β_1, .., β_k by means of the ordinary least squares method. The consequence of ignoring the actual nature of the data will be that the estimated variances of the coefficients will not be minimal.

4.3 Hypotheses

The last part of Section 3 made some hypotheses on the size of the tourist multiplier. We will try to test these hypotheses with the help of the ordinary linear regression model. A first problem that complicates an analysis is the remaining data set. It is impossible to test all hypotheses directly, because some necessary information is missing. A second problem is the small number of observations, so that it is impossible to include many explanatory variables in a regression equation. As a consequence of the small number of observations the estimation results should be interpreted with great caution and have only an indicative value.

The regression analysis will be carried out in two steps. First, base equations will be estimated. In these equations the tourist multiplier will be related to geographical characteristics such as surface and population which serve as indicators for the diversity of economic activity in the region. As argued earlier, the hypothesis is that there is a positive relationship between the degree of economic diversity and the multiplier. Here, this comes down to the hypothesis that there is a positive relationship between the multiplier and population size, and between the multiplier and the surface of the area. Another base hypothesis is that politically independent areas have a relatively higher multiplier value than politically dependent regions. Because trade barriers between dependent regions and their mother countries do generally not exist, these regions are relatively less self-sufficient and their degree of economic diversity is relatively low. As a consequence, the indirect effects will be smaller in these regions.

In the second step, base equations will be extended by other variables. A first hypothesis relates to the economic model employed in the study. An input-output model is expected to generate higher multiplier values than Archer's model, as the first one addresses system-wide economic effects more thoroughly. The next models will extend the base models by tourist variables. It seems plausible to assume a positive correlation between the size of the tourist flow and the multiplier effect. The larger the tourist flow, the more the tourist sector will dominate the economy. The other industries will orient themselves to the tourist industry, so that indirect effects

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will be relatively large. On the other hand, it is possible that the tourist sector will crowd out other sectors (with respect to labour and capital) in case of a large tourist demand. The consequence will be that the economic diversity in the region will decline, which leads to lower multiplier values. The number of tourists in comparison with the number of inhabitants could be an indication of the existence of crowding-out effects, unless these numbers are extremely large or extremely small. Furthermore, the tourist income multiplier is expected to be relatively small when one single country has a large share in the tourist flow to the region. Then it is plausible that investors from that country own a large portion of the tourist sector of that region, so that a large portion of the profit made will flow out of the region and the direct effect will be small. The last hypothesis is related to this. The larger the portion of tourist expenditure flowing to locally owned companies, the larger the income multiplier will be.

5   RESULTS OF REGRESSION ANALYSIS

The estimation results of base equations can be found in Table 2. The first regression equation explains the size of the multiplier from the natural logarithm of the population size. The transformation by the natural logarithm can be justified by the law of decreasing returns to scale. The multiplier appears to be positively correlated with population size. An examination of the residuals leads to the finding that Turkey and Bermuda have relatively large residuals. Equations (2) and (3) are estimated to test whether these regions are significant outliers. Only Turkey appears to be a significant outlier. This finding is plausible, because except for Turkey all regions included in the regression are islands or groups of islands. Regression equation (4) in which two dummy variables are included, shows that Bermuda has a large tourist income multiplier compared to the other (groups of) islands included in the analysis.

Table 2:   Results of base models

var	1	2	3	4	5	6	7	8
const	-0.79* (0.40)	-0.11 (0.41)	-0.87* (0.38)	0.87 (0.44)	-0.095 (0.33)	0.49 (0.31)	-1.29** (0.31)	-0.75 (0.39)
ln (POP)	0.13** (0.034)	0.066 (0.037)	0.14** (0.032)	0.064* (0.024)			0.21** (0.032)	0.15** (0.043)
ln (SUR)					0.11** (0.041)	0.019 (0.044)		
BE			0.48 (0.31)	0.55** (0.16)				
TU		0.92** (0.36)				1.24** (0.41)		0.56 (0.30)
GEO				-1.00** (0.23)				
POA							-0.64** (0.19)	-0.48** (0.19)
R^2	0.66	0.82	0.75	0.94	0.45	0.59	0.87	0.92
n	10	10	10	10	11	11	10	10

Note: standard deviations are given between brackets.

**	=	the null hypothesis that this coefficient is zero, is rejected at a significance level of 5%
*	=	the null hypothesis that this coefficient is zero, is not rejected at a significance level of 5%, but is rejected at a significance level of 10%

POP	=	population size		TU	=	1 if the region is Turkey
SUR	=	surface in km^2				0 otherwise
GEO	=	1 if the region is an island or archipelago		BE	=	1 if the region is Bermuda
		0 otherwise				0 otherwise
POA	=	1 if the region is an independent nation		n	=	number of observations
		0 if the region is not independent				

Another indication of the diversity of the economy is the surface of the region. Equation (5) supports the hypothesis that regions with a large surface have relatively high multipliers. Again Turkey and Bermuda appear to have large residuals. Equation (6) in which a dummy variable for Turkey is added, shows that Turkey is responsible for almost all variation in the tourist multiplier due to its surface. Consequently, it can be stated that the geographical size does not influence the multiplier value significantly. A last indication of the diversity of the economy is the degree of political independency of the region. In contrast with our hypothesis, regression models (7) and (8) find that politically independent regions have smaller multiplier values than politically dependent regions.

In conclusion, the base models demonstrate that there is a positive relationship between population size and the tourist income multiplier. Therefore, in the regression equations that will be estimated from now on, population size is chosen as the measure of the economic diversity. In addition it will be examined what happens if a dummy variable of Turkey is added, because Turkey has a special position among the

other regions.

Table 3:   Results of extended models

var	9	10	11	12	13	14	15	16
const	-0.41 (0.51)	0.0025 (0.47)	-1.04** (0.44)	-0.33 (0.25)	-1.25** (0.41)	-0.57 (0.32)	-0.35 (0.48)	0.24 (0.085)
ln(POP)	0.12** (0.037)	0.064 (0.039)	0.092* (0.046)	-0.0051 (0.029)	0.16** (0.031)	0.096** (0.027)	0.056 (0.043)	0.028* (0.0077)
TU		0.84* (0.40)		1.09** (0.22)		0.86** (0.24)		
MO	-0.28 (0.23)	-0.12 (0.20)						
ln(TOA)			0.066 (0.052)	0.092** (0.025)				
TI					0.043* (0.021)	0.039** (0.013)		
LSC							0.0066 (0.0036)	
EL								-0.0016** (0.00034)
R^2	0.71	0.83	0.64	0.95	0.79	0.93	0.58	0.95
n	10	10	10	10	10	10	7	5

Note:
MO   =   1 if Archer's method is used
           0 if an input-output model is used
TOA =   number of tourist arrivals in the year of investigation
TI   =   tourist index: the ratio of the number of arrivals (TOA) to the population size (POP)
LCS =   share of arrivals from most important country of origin in total number of arrivals
EL   =   share of tourist expenditure in locally owned companies in total tourist expenditure

Before paying attention to the effect of tourist variables on the tourist multiplier, the influence of the economic model on the obtained multiplier value will be examined. See Table 3 for the estimation results of the extended models. Multipliers estimated by Archer's model appear to be smaller than those estimated by an input-output model, although a significant difference is not found (equations (9) and (10)).
Equations (11) up to (16) consider the effect of tourist variables on the income multiplier. The first tourist feature is the number of tourist arrivals. Equation (11) shows a positive relationship between the multiplier and the natural logarithm of the number of tourist arrivals, although it is not significant. Adding a dummy variable for Turkey has a striking effect: the positive effect of the population size has faded away, while the number of tourist arrivals has got a significant positive effect (equation (12)). The hypothesis on the influence of the ratio of the total number of tourist arrivals and population size is not supported by the data. Equation (13) as well as equation (14) which takes account of the exceptional position of Turkey, show a

positive coefficient of this ratio instead of the expected negative sign. Equation (15) which examines the effect of the share of tourist flows from the most important country of origin in the total number of tourist arrivals is estimated with only 7 observations. The data of Turkey, Singapore and Kiribati are missing. The effect of this share is positive in contrast with our hypothesis. An explanation of this positive coefficient is that a country that receives relatively many tourists from one single country, will adjust its economy to this type of visitors so that it needs to import less goods and services from abroad. The last equation is estimated on the basis of only 5 observations. These observations comprise the islands and the group of islands in the Pacific. The estimation results do not support the hypothesis that the larger the portion of tourist expenditure flowing to locally owned tourist enterprises, the larger the multiplier values.

It has to be stressed that the results reported above are merely indicative. The number of observations is too small to test the assumptions of the ordinary regression model. As a consequence, it is not justified to come up with solid inferences on the basis of the assumed statistical properties of the model. The small number of observations also did not allow to include more than three explanatory variables in each regression equation.

6   INFERENCES FOR THE GREEK ISLAND OF LESVOS

The results of the comparative analysis in the previous section can give some indications about the size of multiplier values of other regions. The Greek island of Lesvos will serve as a case-study here. Lesvos, located in the eastern part of the Aegean Sea near the Turkish coast, is one of the biggest islands of Greece. Before the second world war it was a relatively prosperous island characterized by a relatively large diversity of economic activity. The island was able to benefit from its geographical location with respect to Thrace, Macedonia and the Black Sea. After the second world war a period of economic decline started. This decline is reflected by the striking fall in the number inhabitants from 127,000 in 1951 to 87,000 in 1991. As the road network on the Greek mainland improved, Lesvos' geographical location changed from an advantage into a disadvantage. At the same time, Greek economic policy was almost exclusively concentrated on stimulating economic activity in the big cities on the main land, while the Greek government was extremely centralized in Athens. That complicated building up economic activities in peripheral areas such as Lesvos.

By far the most important economic activities on Lesvos are still the traditional cultivation of olives and the production of olive oil. Since the mid eighties international tourism has also become an important phenomenon. The tourist development on Lesvos is modest and controlled in comparison to the rapid tourist development of, for instance, the island of Rhodos in the past. To a certain extent, tourism is complementary to the rural economy of Lesvos: many inhabitants work in agriculture during winter time, and in tourism during summer time. The most important natural tourist

attractions of Lesvos are the Mediterranean climate, the beaches and the attractive mountainous landscape characterized by the olive gardens and pine-trees. Besides, there is a rich cultural heritage consisting of picturesque villages, monasteries and remainders of ancient Greek culture.

Table 4:   Background information on Lesvos

Attribute	
Population (in 1991)	86,907
Surface	1630 km^2
"Island"	Lesvos is an island
Political autonomy	Lesvos belongs to Greece
Number of tourists	
- upper estimation	347,545
- lower estimation	47,347+ 31,511 = 78,858
Share	56.4% of the tourists are Greek
Tourist index	
- lower estimation	0.91
- upper estimation	4.00

Note:
Sources: Ethniki statistiki ipiresia tis Ellados,
             Graphio EURISLES Voriou Aigaiou,
             Sourbes (1993)
-    upper estimation of the number of tourists = total number of people that arrived in 1991 by boat or airplane on Lesvos
-    lower estimation of the number of tourists = number of people that arrived in 1991 by charter flight (foreigners) added with the number of Greeks that in 1990 stayed at least one night in a hotel on Lesvos
-    share = quotient of the number of Greeks that stayed in 1990 at least one night in a hotel and the total number of people that stayed in 1990 at least one night in a hotel on Lesvos (x 100%)
-    lower estimation of tourist index = quotient of the lower estimation of the number of tourists and the number of inhabitants
-    upper estimation of tourist index = quotient of the upper estimation of the number of tourists and the number of inhabitants

An indication of the size of tourist flows to Lesvos is the number of passengers arriving by charter flight from a foreign country in a year. These people are almost certainly tourists. The share of these arrivals in the number of total arrivals increased from 1.8% in 1982 to 13.6% in 1991. Apart from the people who arrive by charter flight there are people who arrive by scheduled flight and by regular ferry boat on the island. Nationalities, places of origin and reasons of travelling of these people are however, unknown, so that the exact number of tourists visiting Lesvos cannot be reliably assessed.

Table 4 provides some background information on Lesvos which will be used to assess the unknown tourist income multiplier of Lesvos. As mentioned, the number of tourists is unknown. Therefore, a lower and an upper bound of this number is chosen. The total number of people arriving on Lesvos serves as the upper bound. The lower

bound of the number of tourists is assessed using the fact that the number of Greeks staying in a hotel is known. If they are supposed to be all domestic tourists, this number augmented by the number of people arriving by charter flight can serve as a lower bound of the number of tourists arriving on Lesvos.

Table 5:   Prediction of the average tourist income multiplier of Lesvos by means of regression analysis

no.	prediction	dg	interval	no.	prediction	dg	interval
1	0.73 (0.33)	8	[-0.029; 1.49]	11L	0.75 (0.32)	7	[-0.037; 1.50]
2	0.64 (0.25)	7	[-0.042; 1.24]	11H	0.84 (0.33)	7	[0.066; 1.62]
3	0.68 (0.30)	7	[-0.039; 1.40]	12L	0.65 (0.15)	6	[0.28; 1.02]
4	0.58 (0.16)	6	[0.19; 0.98]	12H	0.79 (0.16)	6	[0.40; 1.17]
5	0.74 (0.39)	9	[-0.14; 1.63]	13L	0.62 (0.28)	7	[-0.043; 1.29]
6	0.63 (0.29)	8	[-0.030; 1.29]	13H	0.76 (0.28)	7	[0.10; 1.41]
7	1.11 (0.26)	7	[0.53; 1.69]	14L	0.55 (0.18)	6	[0.12; 0.98]
8	0.96 (0.23)	6	[0.41; 1.52]	14H	0.67 (0.17)	6	[0.25; 1.10]
				15	0.66 (0.23)	4	[0.16; 1.30]

Note: standard deviations are given between brackets.
no   = number of regression equation (see Table 2 and Table 3)
L   = the number of tourists arriving on Lesvos is underestimated
H   = the number of tourists arriving on Lesvos is overestimated
dg   = number of degrees of freedom of t-statistic

After having discussed some background characteristics of the island of Lesvos we will use the regression equations estimated in Section 5 to derive an interval of plausible values of its unknown tourist income multiplier. Each regression equation generates a prediction of the multiplier of Lesvos when the required background characteristics are filled in. The equations (9), (10) and (16) will be left out of consideration. Equations (9) and (10) investigate the influence of the economic model employed, while the necessary background information for equation (16) is missing. Table 5 shows the predicted multiplier values, but also their standard errors and the corresponding 95% confidence intervals.

The confidence intervals show that the results have to be interpreted with great caution. It appears that all regression experiments predict a multiplier value higher than 0.5, but only two experiments predict a value above 0.9. Since the number of tourists arriving on Lesvos is not exactly known, we have made a high and a low estimate for cases where the number of tourist arrivals plays an explanatory role. Regression models that use the upper estimate of the number of tourists appear to lead to higher predictions of the tourist income multiplier than regression models that use the lower estimate of the number of tourists. The differences between the respective predicted values are 0.09, 0.14, 0.14 and 0.12 for the models (11) up to (15) in Table 5.

Equations (11) to (15) are most informative, because they contain tourist variables. Furthermore, Turkey clearly has a significant influence on the size of the income

multiplier, so that models which take account of the special position of Turkey are preferred. As a consequence, we will focus on regression models (12), (14) and (15). The estimate of the coefficient of population size in model (12), however, is not plausible in view of the findings in the other models, so that the models (14) and (15) are chosen as the most plausible. On the basis of these equations, a value between 0.55 and 0.67 is expected for the average tourist income multiplier of Lesvos.

7   CONCLUSION

This article aims to demonstrate the potential of quantitative comparative research (e.g. meta-analysis), in particular in the field of tourism research. On the basis of a sample of studies on tourist multipliers, it was shown that this type of research has a great potential in explaining differences in existing and available study outcomes. In addition, it was demonstrated that knowledge achieved in the past can be transferred to new situations that have not been investigated before.

The average tourist income multiplier was found to have a positive relationship with population size, the number of tourists visiting the region in a year, the ratio of the number of tourists to the population size and the share of the most important country of origin in the total number of tourists. Multipliers calculated by Archer's method appeared to have smaller values than those computed by input-output models. This is a plausible conclusion, because input-output models map out the economy more completely.

Next, the findings of the comparative analysis were transferred to the Greek island of Lesvos. We constructed an interval with plausible values of the unknown average tourist income multiplier of the Greek island of Lesvos. The lower and the upper bound of this interval are 0.55 and 0.67, respectively.

Although our exercise was limited, it showed that comparative analysis is a promising field of research. It is certainly worthwhile to extend the sample of studies. The arising data-base should contain as much relevant information as possible on the tourist destinations and the studies, including data on tourism policy and the regional environment. This data-base could serve as the basis for a decision support system that provides policy-makers with information on impacts of tourism policy. In this way, they may then investigate possible consequences of their policy proposals in a relatively easy and manageable way.

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