A Meta-Analysis of International Tourism Demand

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Abstract: The purpose of the paper is to review the major published empirical studies on modelling international tourism demand, and to integrate their findings according to the effect sizes of the important explanatory variables used, namely income, transportation costs and tourism prices. A meta-analysis of seventy papers is provided, with the papers being selected on the basis of their t-statistics, standard errors, F-statistics, and sample sizes. The primary purpose of the meta-analysis is to enable general conclusions to be drawn from the major published empirical studies regarding the relationship between international tourism demand and income, transportation costs and tourism prices.

1. Introduction

In tourism studies, as in other social and behavioural sciences, conflicts and variations in interpretations of findings that address common research questions are not uncommon. This has not always led to an improved scientific understanding of the problem under study because "human behaviour is often difficult and complex to explain, ... common definitions are not always available ... methods, techniques, and sampling characteristics vary from study to study" (Wolf, 1986, p. 9). With the proliferation of studies in the relationship between international tourism demand and its determinants, Crouch (1994, p. 21) argued that "more scientific and rigorous meta-analytical methods for integrating findings has the potential to explain the variation in results and thereby yield some generalizations".

Glass (1976, p.3) introduced the term 'meta-analysis' to denote the statistical summary of the results of various studies on a common research problem, such as the determinants of international tourism demand, "for purpose of integrating the findings". Since meta-analysis relies on the summary statistics obtained from the original studies as data, meta-analysis is "an analysis of the results of statistical analyses" (Hedges and Olkin, 1985, p. 13). The aim of an integrative research review and the use of meta-analysis, which allows statistical generalizations to be made with respect to the combined evidence across studies, is to draw overall conclusions from the many studies in areas such as international tourism demand, and to direct future research to yield new knowledge in the field.

The purpose of the paper is to use test statistic data derived from numerous published empirical studies on international tourism demand to illustrate what can be learned from a meta-analytic review. One hundred empirical studies from 1961 to 1994 have been located as a result of a computerised literature search and a manual search of tourism journals. The paper is organised as follows. Section 2 is devoted to a discussion of effect size of the findings of the three most frequently used explanatory variables, namely income, transportation costs and tourism prices, from selected studies, followed by some concluding remarks in Section 3. Unlike earlier extensive meta-analytical research to integrate the estimated elasticities of the determinants of international tourism demand, this paper extracts the primary results (namely, the test statistics) provided by researchers in published international tourism demand studies and reports the derived summary statistics of effect sizes.

In general, the meta-analytical approach provides a range of quantitative techniques that permits the cumulative results of common characteristics across a range of comparable studies to be summarized statistically. In the framework of microeconomic consumption theory, 70 studies of the 100 have been selected for an integrative review. Each of these studies is, in effect, testing the same directional hypothesis that the demand for international travel in a particular destination is positively related to income in the origin, and negatively related to both transportation costs and relative tourism prices. The remaining 30 studies are excluded from the review for the following reasons: the t-statistics are not provided in 16 studies (which include studies that used systems of equations); the sample sizes are not disclosed in 8 studies; 5 studies have not incorporated the variables of interest in the models used (namely the income, transportation cost and tourism price variables, which are the three most prominent and frequently used explanatory variables in international tourism demand studies); and one study used the probit model. Of the total of 70 studies under review, 65, 42 and 48 studies included the income, transportation cost and tourism price variables, respectively.

2. Effect Size

Although different studies may measure the same variables, using different proxies complicates the process of combining statistical evidence from the different studies. One solution proposed by Glass (1976) is to estimate an index of effect magnitude known as the effect size, or standardised difference between the group means, usually denoted by *d*. Effect size is used to determine the strength of the relationship between variables. Cohen (1988, pp. 9-10) defines an effect size as "the degree to which the phenomenon is present in the population or the degree to which the null hypothesis is false ..., the effect size is some specific nonzero value in the population. The larger this value, the greater the degree to which the phenomenon under study is manifested". Factors that could influence the size of effects include the reliability of the measurements used in the study, sample size and the number of additional variables included in the model. The test of significance and the size of the effect of an independent variable on a dependent variable, are related such that:

Test of significance
= size of effect * size of study.

From the different studies, the estimates of effect size are standardised and treated as raw data for statistical analyses so as to enable these estimates to be combined across studies. The most straightforward way to compute *d* is to use the formula $2t/\sqrt{df}$, and $\sqrt{df}/2$ is an index of the size of the study. In addition to the effect size for each model, an average effect size for each study is computed for the income variable. An overall mean effect for the 65 studies under review is $\Sigma d/65$ = 206.09/65 = 3.17. Of the 65 studies that reported income findings, 25 were conducted without including the transportation cost variable in their models. The average effect size for the 25 studies is 4.15, whereas the remaining 40 studies with the transportation cost variable included have an average effect size of 2.56. Effect sizes vary across studies and the most popular measure of variability is the standard deviation, which is computed as s = $\sqrt{\sum(d-\bar{d})^2/n-1}$, to yield 3.85. In other words, the average effect size is 0.82 of a standard deviation. At the 5% level of significance, (that is, $3.17 \pm 1.96 * \frac{3.85}{\sqrt{65}}$), the obtained effect sizes range between 2.23 and 4.11, assuming that the effect sizes are normally distributed. If the mean effect size of 3.17 obtained from the 65 studies is tested for statistical significance at the 5% level, the calculated t value of 6.64 is very high.

The overall mean effect for the 42 studies is $\Sigma d/42$ = -0.88 and the standard deviation for the effect size of transportation costs is 3.74. This shows that the average effect size is about one-quarter of a standard deviation. At the 5% level of significance, the calculated effect sizes range between -2.01 and -0.25 ($-0.88 \pm 1.96 * \frac{3.74}{\sqrt{42}}$), and the mean effect size of -0.88 turns out not to be significant, with t = -1.52. The overall mean effect size for the 48 studies that included tourism prices as an explanatory variable is $\Sigma d/48$ = -0.73. The standard deviation for the effect size of tourism prices is 1.16 and the mean effect size is 0.63 of a standard deviation, with the confidence interval at the 5% level ranges between -1.06 and -0.40. At the 5% level of significance, the mean effect size of -0.73 for tourism prices is significant, with t = -4.36.

Previous studies on international tourism demand examined the effect of income, transportation costs and tourism prices (as well as other factors) on tourist arrivals or departures, tourist expenditures or receipts, travel exports or imports, number of nights spent at tourist accommodation, and tourist length of stay. The effect size of income on each category of dependent variable is computed to examine the differential effects for the alternative dependent variables used. Some studies used more than one dependent variable. All in all, 38 of the 65 studies used tourist arrivals or departures, 24 used tourist expenditures or receipts, 7 used travel exports or imports, and 2 used tourist length of stay, as their dependent variables. The average effect size of income on tourist arrivals or departures, tourist expenditures or receipts, travel exports or imports and tourist length of stay are 2.49, 4.12, 4.14 and 0.56, respectively. In comparison, the results for tourist expenditures or receipts and travel exports or imports exceed the overall mean effect of 3.17 for the 65 studies.

The average effect size of transportation costs on tourist arrivals or departures (30 studies), tourist expenditures or receipts (11 studies) and travel exports or imports (3 studies) are -1.58, -0.61 and 4.62, respectively. Besides contradicting theory that international tourism demand is inversely related to transportation costs, but the result for travel exports or imports far exceeds the overall average effect of -0.88 for the 42 studies that have included the transportation cost variable in their models. As for tourism prices, the average effect sizes on tourist arrivals or departures (26 studies), tourist expenditures or receipts (20 studies) and travel exports or imports (6 studies) are -0.69, -0.47 and -1.17, respectively. Results for the various dependent variables have the same sign as the overall average effect size of -0.73 for all the 48 studies that included tourism prices in their models.

It is also useful to analyse variation in effect size estimates within and between the groups of studies. In Table 1, the effect sizes of the income variable in the 65 studies are separated into 5 groups. Besides the income variable, Group 1 consists of 25 studies which also include both the transportation cost and tourism price variables; Group 2 consists of 15 studies which also include the transportation cost variable; Group 3 consists of 19 studies which also include the tourism price variable; Group 4 consists of 6 studies which do not include both the transportation cost and tourism price variables; and Group 5 consists of all the 65 studies.

Hedges and Olkin (1985) show that an efficient way of combining results involves a weighted average that takes into account the variance of each study effect size. The effect size estimate for each study (that is, mean effect size), its variance and the weight are computed. There are 5 groups and m1 denotes effect size estimates in group 1, m2 effects in group 2, m3 effects in group 3, m4 effects in group 4, and m5 effects in group 5. The weighted mean effect sizes for the 5 groups in Table 6 are given by:

$$\bar{d}_i = \frac{\sum_{j=1}^{mi} w_{ij} d_{ij}}{\sum_{j=1}^{mi} w_{ij}}, \qquad i = 1, \dots, 5,$$

where

d_{ij} is the jth study effect size estimate in the ith group;

w_{ij} is the weight (or the reciprocal of the variance, v_{ij}) of d_{ij}: $w_{ij} = 1 / v_{ij}$.

The sampling variances $v_1, \dots, v_5$ of the group mean effect estimates $\bar{d}_1, \dots, \bar{d}_5$ are given by the reciprocal of the sum of the weights in each group:

$$v_i = \frac{1}{\sum_{j=1}^{mi} w_{ij}}, \qquad i = 1, \dots, 5.$$

The overall groups weight is the sum of the weights for the five groups:

$W = w_1 + w_2 + w_3 + w_4 + w_5$.

The overall weighted mean effect size is:

$$\tilde{d} = \frac{\sum_{i=1}^{5} \sum_{j=1}^{mi} w_{ij} d_{ij}}{\sum_{i=1}^{5} \sum_{j=1}^{mi} w_{ij}},$$

and the variance of $\tilde{d}$ is:

$$\tilde{v} = \frac{1}{\sum_{i=1}^{5} \sum_{j=1}^{mi} w_{ij}}.$$

Although Table 1 shows that the weighted effect sizes are all smaller than the unweighted effect size of 3.17, they are still statistically significant at the 5% level. The weighted average effect size of 0.51 for all studies is 0.13 of a standard deviation, as compared with 0.82 of a standard deviation reported earlier for the income variable. Suppose the group means $\bar{d}_1, \ldots, \bar{d}_5$ are normally distributed, with variances v_1, ... , v_5, respectively, and are tested for statistical significance at the 5% level. The calculated z value for all 5 groups exceeds 1.96. In addition, at the 5% level of significance, confidence intervals for the group mean effect in Table 1 show that the effect size for all groups is significantly greater than zero. Group 3 (that is, studies that include income and tourism prices) has the largest mean effect size range of 0.92, whereas group 5 (which includes all studies) has the smallest range of 0.16. In contrast to the latter, the unweighted effect size of the income variable has a range of 1.88.

As shown in Table 2, the effect sizes of the transportation cost variable in the 42 studies are also separated into 5 groups. 60% of the studies are in Group 1 (which includes transportation costs, income and tourism prices); 36% of the studies are in Group 2 (which includes transportation costs and income); 2% of the studies are in Group 3 (which includes transportation costs and tourism prices); 2% of the studies are in Group 4 (which only includes transportation costs); and Group 5 includes all 42 studies. Groups 3 and 4 consist of only 1 study each. All weighted effect sizes, apart from that of Group 3 (which is statistically insignificant at the 5% level), are smaller than the unweighted effect size of -0.88. The weighted average effect size of -0.498 for all studies is about one-seventh of a standard deviation, in contrast to the one-quarter of a standard deviation mentioned earlier for the unweighted transportation cost variable. At the 5% level, the calculated z value is significant for all groups, except Group 3 which has a z value of -0.55. Furthermore, Group 3 has the largest range of 13.73 at the 95% confidence intervals, with the mean effect size estimate ranging from -8.78 to a positive upper confidence interval limit of 4.95. The mean effect size for all studies has a range of 0.004, whereas the same for the unweighted effect size for transportation costs is 1.96.

Similarly, the effect sizes of the tourism price variable in the 48 studies are separated into 5 groups. Table 3 shows that 52% of the studies in Group 1 includes tourism price, income and transportation cost variables; 40% of the studies in Group 2 includes tourism prices and income; 2% of the studies in Group 3 includes tourism prices and transportation costs; 6% of the studies in Group 4 includes only tourism prices, and Group 5 consists of all 48 studies. Besides the effect sizes of -2.37 and -0.99 for Groups 2 and 4, respectively, the other weighted effect sizes are smaller than the unweighted effect size of -0.73. Nonetheless, all weighted effect sizes are statistically significant at the 5% level. The weighted average effect size of -0.219 for all studies is 0.19 of a standard deviation rather than 0.63 of a standard deviation reported earlier for the unweighted tourism prices. The calculated z value for all the groups is statistically significant at the 5% level. Group 4 has the largest mean effect size range of 1.26. Group 5, which includes all studies, has a mean effect size range of 0.006. However, the same for the unweighted mean effect size of tourism prices is 0.66.

3. Conclusion

A sensible use of meta-analysis techniques enables an identification of the direction and strength of the relationships between international tourism demand and the explanatory variables of income, transportation costs and tourism prices. The synthesis of the paper aims to derive summary statistics for effect sizes, and to undertake within and between group comparisons for effect sizes. The average effect sizes of the 65 and 48 studies which reported income and tourism price findings, respectively, support the proposition that international tourism demand is positively related to income and negatively related to tourism prices. However, the results for transportation costs do not entirely support the view that international tourism demand is inversely related to this explanatory variable, especially those studies that have used travel exports or imports as the dependent variable.

Analysis of the variations between group effect size estimates in which the studies are arbitrarily categorised into groups having common number and type of explanatory variables (namely, income, transportation cost and tourism price variables), supports earlier findings of the paper. Examination of effect size shows that there are substantial differences in the weighted and unweighted average effect sizes of income, transportation cost and tourism price variables. Furthermore, the weighted average masks substantial variability in effect sizes between studies. To what extent substantive factors (that is, factors which characterize the circumstances of each study, such as the decade of publication) and methodological factors (that is, factors which characterize the different research procedures used, such as the type of functional form used) explain differences between studies and the estimates of effect size, is the subject of further research.

Although meta-analysis can be a powerful analytical tool in comparative studies of international tourism demand, its limitations include the lack of benefit of controlled experimental conditions, homogeneous measurement scales and statistical independence. An ideal meta-analysis would examine all studies undertaken in the area, including those that are currently unpublished. However, this makes it difficult to incorporate legitimate negative results, which have a tendency not to appear in publications, in any overview analysis. Since meta-analysis relies on the data reported in primary studies, it is inevitable that the aggregated results can only be as good as the studies themselves.

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Table 1

Data for the Income Variable Studies

	$\sum w$	$\sum wd$	$\bar{d}$	v	Z	Confidence Interval
Group 1 (38% studies)	411.040	151.095	0.37	0.002	8.27	$0.282 < \bar{d} < 0.458$
Group 2 (23% studies)	146.824	80.294	0.55	0.007	6.66	$0.386 < \bar{d} < 0.714$
Group 3 (29% studies)	18.053	52.765	2.92	0.055	12.41	$2.46 < \bar{d} < 3.38$
Group 4 (9% studies)	9.979	14.022	1.41	0.1002	4.45	$1.094 < \bar{d} < 1.727$
Group 5 (100% studies)	585.895	298.176	0.51	0.0017	12.37	$0.429 < \bar{d} < 0.591$
Overall groups	1171.791	596.352	0.51	0.00085	17.49	$0.453 < \bar{d} < 0.567$

Note: $\bar{d}$ denotes the weighted mean effect size and v denotes the sampling variance of the group.

Table 2

Data for the Transportation Cost Studies

	$\sum w$	$\sum wd$	$\bar{d}$	v	Z	Confidence Interval
Group 1 (60% studies)	15345	-955.41	-0.062	0.0000651	-7.68	$-0.078 < \bar{d} < -0.046$
Group 2 (36% studies)	68578	-40801	-0.595	0.0000145	-156.26	$-0.602 < \bar{d} < -0.588$
Group 3 (2% studies)	0.0815	-0.1564	-1.919	12.27	-0.55	$-8.78 < \bar{d} < 4.95$
Group 4 (2% studies)	17.9889	-9.4754	-0.527	0.0556	-2.23	$-0.99 < \bar{d} < -0.065$
Group 5 (100% studies)	83942	-41766	-0.498	0.0000119	-144.36	$-0.505 < \bar{d} < -0.491$
Overall groups	167883	-83532	-0.498	0.0000059	-205.03	$-0.503 < \bar{d} < -0.493$

Note: $\bar{d}$ denotes the weighted mean effect size and v denotes the sampling variance of the group.

Table 3

Data for the Tourism Price Variable Studies

	$\sum w$	$\sum wd$	$\bar{d}$	v	Z	Confidence Interval
Group 1 (52% studies)	532584	-115307	-0.217	0.0000018	-161.75	$-0.22 < \bar{d} < -0.21$
Group 2 (40% studies)	574.43	-1361.18	-2.37	0.0017408	-56.8	$-2.45 < \bar{d} < -2.29$
Group 3 (2% studies)	525000	-115278	-0.22	0.0000019	-159.61	$-0.223 < \bar{d} < -0.217$
Group 4 (6% studies)	9.77	-9.66	-0.99	0.1023541	-3.09	$-1.62 < \bar{d} < -0.36$
Group 5 (100% studies)	533159	-116668	-0.219	0.0000018	-163.24	$-0.222 < \bar{d} < -0.216$
Overall groups	1066327	-233346	-0.219	0.0000009	-230.87	$-0.221 < \bar{d} < -0.219$

Note: $\bar{d}$ denotes the weighted mean effect size and v denotes the sampling variance of the group.