

An Econometric Study of British Tourist Expenditure in Ireland

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THE amount of research devoted to tourism is not commensurate with its economic importance. The reasons for this scarcity of research are numerous and mostly concern the inherent difficulties of the subject [1]. The purpose of this paper is to rectify in part this lack by means of an econometric analysis of the determinants of expenditure by British tourists and recreational tourists in Ireland.¹

The importance of the British market can be shown by looking at the performance of tourist receipts from Britain in relation to total receipts during the period the study covers; namely 1955 to 1969 (Table A1). They averaged somewhat less than 50 per cent of total receipts, grew at a rate of 8.1 per cent, contributed to over 50 per cent of the increase in total receipts and were a stable source of income declining, in absolute terms, only twice.

1. THE DETERMINANTS OF THE DEMAND FOR TOURISM

Traditional economic theory suggests that variables representing income, price and tastes should be taken account of when considering the demand for any product. Modern theory adds a variable representing marketing expenditure. Each of these variables will be treated in turn in the following paragraphs and, in addition, some non-economic factors.

A. *Income*: Travelling abroad constitutes expenditure on a luxury good and hence will be available only to those who have high incomes. More specifically only people who enjoy discretionary income, i.e., income that is left over after expenditure on what are considered necessities, will be able to consider going abroad. This proposition can be illustrated by examining the leading tourist generating countries in 1969 (Table 1). All these countries have high *per capita* incomes. In such countries discretionary income increases at a faster rate than total income since that part of income spent on what people consider necessities increases at a slower rate than total income. One would expect, therefore, that the

1. Throughout this study the terms tourist and recreational tourist refer to the Irish Statistical Bulletin (I.S.B.) definitions of visitor and tourist respectively. Sincere thanks are due to M. J. Harrison for his help throughout the study and to K. Kennedy and B. Dowling for their comments on an earlier draft.

TABLE I

Country	% Share in Total OECD ¹ tourist Receipts 1969
United States	27.4
Germany	15.4
Canada	8.5
France	8.4
United Kingdom	6.3
Netherlands	4.4
Italy	4.0
Belgium/Luxembourg	3.7
Sweden	3.0
Austria	2.4

Source OECD Tourism 1970.

income elasticity of expenditure on tourism based on total or disposable income *per capita* would be greater than unity. This expectation is borne out by the results of other researchers. Artus [2] estimated an elasticity of 1.74 for Germany, the dependent variable being total tourist expenditure. Gray's [3] results gave extremely high elasticities both for Canada (7.01) and the USA (5.64), the dependent variable being tourist expenditure overseas by these countries. His results are rather suspect, however, because of strong negative correlation between the variable representing income and that representing transport costs. Estimates were also made by the OECD for individual countries and some of the results are: France 2.5, Belgium 2.0, USA 1.1 and the UK 1.5. There is some evidence [4] that, after a certain level of *per capita* income has been reached, income elasticity first increases and then for a range of *per capita* income, remains approximately constant. In the very long run it must, of course, decline since tourism is unlikely to indefinitely increase its share of expenditure out of GNP. It may even decline to negligible proportions due to a "saturation effect" similar to that found in the case of motor cars. This is based on the hypothesis that, after a certain point, the utility accruing to an individual from a holiday may decrease as the number of other tourists enjoying utility from the same holiday increases.

As this study deals only with expenditure by Britain in Ireland, an alternative representation of the income variable is total British tourist expenditure. If the hypothesis is accepted that people first decide to go abroad and only then decide which country they will visit, this is the more correct variable to use. The hypothesis implies that there is little substitution between total expenditure on international travel and other products and this implication will receive further attention in the discussion of the price variable. In the case of this variable one would expect an elasticity of unity which is based on the proposition that, other things

being equal, one would expect the market share of a country to stay constant when there is an increase in the total market.

B. *Price*: Economic theory postulates that, when price changes, there will be both income and substitution effects. This study neglects the income effect on the basis that it is very small. Substitution effects will be of three major types: within international tourism the effect between countries of a change in the relative price of the tourist services they offer, the effect of a change in the relative price of international and domestic tourism and the effect of a change in the relative price of tourism (both international and domestic) and other luxury products.

The tourist product is different from other goods in that the consumer has to be transported to the product rather than *vice-versa*. In other respects it is similar to any export and so its price is made up of the following three elements: (i) the price of travel, (ii) the prices of those commodities on which the tourist spends his money after arrival and (iii) the rate of exchange between the currency of the country in which the tourist resides and that of the country to which he is travelling. The three types of substitution effects will be considered in the following discussion of each of these price elements.

(i) Discussion of the price of transport usually centres around the price of air travel due to the extent of the fall in the price of the latter over the past two decades. Between 1960 and 1970 alone the total cost per tonne-kilometre flown was estimated² to have fallen from 28.3 to 15.8 USA cents at 1970 prices. In the context of international tourism the introduction and rapid expansion of charter inclusive tours (CITs) has made an even greater impact on the cost of travel. This has been the result of raising the load factor from around 55 per cent on scheduled flights to nearly 100 per cent on charter flights. Since the variable costs of operating an aircraft are low in relation to the fixed costs, the extra capacity occupied has allowed spectacular reductions in average costs per passenger mile.

Within international tourism this change in the price of travel will have varying substitution effects depending both on the distance of competing destination countries from the major tourist generating countries and on the extent to which they have placed increasing reliance on charter inclusive tours. The distance between Britain and Ireland is small compared to that between Britain and other major tourist destinations and also charter inclusive tours have only had a minor impact on cross-channel tourism. The change in price of travel is expected, therefore, to have resulted in a tendency for the shares in the British market of these other destinations to have increased relative to that of Ireland.

The differentiation between domestic and international tourism is based primarily on travel costs and the secular decline in these costs can be expected to have resulted in substantial substitution between the two. Hence, the strong negative correlation between the post-war upward trend in income and the downward trend in travel costs casts doubt on the validity of using this period to calculate income elasticities. Nearly all previous research has excluded travel cost

2. *The Economist*, June 1971.

as an independent variable and, because of the hypothesised multicollinearity, has resulted in an upward bias in the estimates of these elasticities. (This has led to over-optimistic assessments of the future development of international tourism which are unlikely to be realised unless the previous downward trend in the cost of transport is maintained. Considering the present state of the aircraft industry, both at manufacturing and retail level, this is unlikely to happen.) Estimates of the income elasticity of British tourist expenditure in Ireland will not contain such a bias because of the relative unimportance, previously discussed, of travel costs. However, if the income variable used is total British expenditure on international tourism and if a variable representing relative travel costs is not included, the elasticity in this case will be biased downwards. To remove this bias it would be necessary to use expenditure on tourism, both domestic and foreign. Unfortunately statistics are not available for domestic tourism. Too often this has led to reliance on a somewhat artificial product differentiation between domestic and international tourism which has resulted in neglect of the substitution effects discussed above.

For a given change in the price of travel relative to the prices of other luxury products there are not expected to be relatively large-scale substitution effects between expenditure on the two categories. However, if the absolute change in price is big, as is the case with the price of air travel, substitution effects may be significant in absolute terms. To include this effect in econometric estimation is extremely difficult and its exclusion is expected to result in a slight upward bias in the estimate of income elasticity.

(ii) Two categories can be distinguished, firstly, expenditure on accommodation and sustenance, information on which is generally available in advance. The introduction of CITs has resulted in price reductions due to higher occupancy rates. On this account substitution effects similar to those considered previously are expected, although relative price changes otherwise should not be significant. Secondly, expenditure on purchases, entertainment and inland travel, information on which is generally not available in advance. The effect of these price changes is likely to be more long term. Reputations for expensiveness or cheapness, passed on by word of mouth, are developed over a number of years. Examples of this are the reputed cheapness of Spain and the reputed expensiveness of France and Holland. Gerakis [5] has suggested that there are likely to be short-term effects also in this case. These are mainly based on the hypothesised reaction of a tourist faced with higher than expected prices for purchases etc. However, the long-term substitution effects seem to have a sounder theoretical basis.

(iii) For most of the post-war period changes in exchange rates have been infrequent but large when they have occurred. Since these changes are highly publicised affairs and have a most obvious effect on the cost elements discussed in the previous paragraphs, one would expect large-scale substitution effects.

C. Marketing: Only a small proportion of advertising expenditure can be considered to be performing the function of informing people, although there is probably more real product differentiation in the tourist market than in other mass

consumption markets. Hence, relative marketing expenditure is the more appropriate variable. The substitution effects of this variable will be similar to those discussed in relation to price. However, advertising tourism is a function best carried out by national agencies and, since usually no agency represents the domestic industry, the substitution effects can be expected to be strongest between domestic and international tourism.

D. *Tastes*: There are a great number of non-economic factors, some of which are measurable and others not, which can be considered to influence the decision to travel abroad and the decision as to which foreign country will be visited. These include the following: population increase and changes in the age structure of population; the increase in the degree of urbanisation and the concomitant increase in the desire of people to get into open spaces; the increase in the length of paid holidays; the increase in the level of education giving people a greater interest in travelling abroad and learning about other people first-hand; the climate of a country both in relation to other countries and the kind of climate the traveller is used to; the existence of family ties; and the political situation in a country.

The length of this list might lead one to believe that the attempt to explain trends in tourist expenditure solely by means of economic variables is fruitless. This will be discussed in Section 5.

II. THE REPRESENTATION OF THE VARIABLES

Normally in econometric work a discussion of the data being used to represent the variables would not warrant a major section. However, in the context of international tourism it is felt that an exception must be made if the results are to be interpreted properly.

The dependent variable.

In estimating a demand curve one is concerned with the quantity of the good demanded. The quantity of tourist services sold is not available, and expenditure on these services deflated by the consumer price index is used. Arithmetically expenditure can be broken down into tourist numbers and average expenditure per tourist but the sole use of the former to estimate the demand for tourism is not justified unless the latter remains constant. However, on the basis of statistical criteria the greater reliability of the data on numbers, which will be discussed later, may justify its inclusion in the regressions. The extent of the error involved in doing this will depend on the variation in average expenditure per tourist. Estimation of this variation, of course, is impossible since the justification for using numbers is that the expenditure figures are unreliable.

In theory, therefore, the dependent variable should constitute all expenditure associated with a holiday. In the case of this study it should include British tourist expenditure in Ireland and the associated transport payments both to British and Irish carriers. Payments to British carriers, which should constitute the largest part,

do not enter the balance of payments of either country, since they simply entail domestic transactions, and hence statistics are not available. Data on payments to Irish carriers by all foreign tourists are available but are not disaggregated by country. Hence only tourist exports f.o.b. to Britain are used.

The ISB only provides information on expenditure by those coming *via* Britain. These figures, therefore, include expenditure by other nationals who visit Britain on their way to Ireland and exclude expenditure by British tourists who travel to Ireland *via* the Six Counties. A number of residency estimates could have been used. The ISB provided one but only for the years prior to 1964. In addition, the ISB expresses doubt about the reliability of these figures. Residency figures for tourist expenditure in Ireland are given annually in the breakdown of the UK balance of payments. These data are provided by the CSO in Dublin and, for the years after 1963, are estimated by simple extrapolation of the trends in residency expenditure for the years 1950 to 1963. Bord Fáilte also publish a residency estimate for the years 1960 to 1969. These data are based on four very small sample surveys carried out in alternate years since 1962, figures for the remaining years being estimated by extrapolation and interpolation. Hence, their use in the regressions was not justified despite the fact that they have been used in previous research [6]. Reliance was, therefore, placed solely on the figures for numbers and expenditure by tourists coming *via* Britain. The error involved in using this as representative of British tourists numbers and expenditure is assumed to be incorporated into the error term of the equation.

Recreational tourist numbers and expenditure were also used as dependent variables. In an economic analysis of this type it might be better to concentrate on these variables. The reason is that in almost all cases recreational travellers must bear the cost of travel and the cost of the holiday. Since this is so, the recreational traveller should be much more sensitive to the economic variables of price, income and marketing expenditure than business travellers. Growth in those visiting relatives, although they also bear the cost themselves, would be greatly influenced by additional demographic factors, especially the rate of emigration. Growth of business travellers is largely determined by the trend in trading relations between the two countries, although this is indirectly price and income sensitive.

According to the ISB statistics for tourist and recreational tourist numbers are most reliable when considering year-to-year trends, the latter being slightly less reliable because they are based on a sample. Tourist expenditure figures being based on a sample and on subjective responses are subject to error on two counts. Recreational tourist expenditure figures are based on a smaller sample than the total and, thus, are subject to even larger errors.

In 1959 there was a change in the method of classification by purpose of visit of tourist data and thus regression results for recreational tourist figures must be treated cautiously if any observations prior to 1959 are used.

The independent variables.

(i) *Income:* Discretionary income is a purely subjective variable and thus is not

measurable. Disposable income was used, therefore; UK disposable income being used as a proxy for that of Britain.

The other representation of the income variable was UK foreign tourist expenditure, the figure for Britain not being available. In 1962³ the UK introduced a sample survey to estimate total tourist expenditure. As a result the estimates for this and following years are considered to be much more reliable than those for the years prior to 1962. The figures for these years were revised in the light of the sample survey but results relating to this variable, when any time period other than 1962 onwards is being used, must still be treated cautiously. In this study the original data were used.

(ii) *Price*: The theoretical importance of price, already extensively elaborated upon, necessitated careful treatment of the data to be used to represent this variable. A number of serious problems arose.

The first was deciding which countries constitute Ireland's competitors in the British market since one is concerned with the cost of a holiday in Ireland relative to the cost of a holiday elsewhere. Because substitution both between domestic and international tourism and within international tourism is expected, Britain must be included. Within international tourism the secular decline in travel costs has brought nearly every country into a competitive position. The difficulty was circumvented by assuming that all countries which had an important share of the British market in the period 1964 to 1968 were competitors.

The second problem was to estimate the relative cost of a holiday in Ireland. The construction of the actual ratios used was as follows. The consumer price index (c.p.i.) was assumed to represent the trend of prices facing tourists and was obtained for each country. The c.p.i. of each country was adjusted for any changes in its exchange rate *vis-à-vis* the dollar. (The year in which this adjustment was applied was not necessarily that in which the exchange rate change took place, because the effect of the latter was considered to depend on the month in which it occurred.) Two price variables were constructed using these indices, the first being the ratio of the Irish to the UK price index and the second the ratio of a weighted price index for all other countries to the Irish price index, the weights of each country depending on its average share of British foreign tourist expenditure in the years 1964 to 1968. The UK price index could not have been incorporated into the latter, leaving only one price variable and thus reducing the possibility of multicollinearity and increasing the degrees of freedom, because Britain's share of total British tourist expenditure is unknown.

An index representing tourist prices could differ considerably from the c.p.i. since the expenditure pattern of a tourist (Table A2) is likely to differ from the average expenditure pattern on which a c.p.i. is based. Construction of such a price index was not attempted because what data are available indicated that little improvement over what was actually used could be expected although it would have involved considerable extra work. However, the ratio of the Irish and UK

3. United Kingdom Balance of Payments, 1970.

drink and tobacco price indices was used as an alternative to the c.p.i. ratio for these countries. This was based on the hypothesis that changes in the prices of such goods might correspond more closely to movements in the prices of tourist services.

A serious criticism of the price variables used is that the relative cost of travel is not included in them nor does it appear as a separate price variable. The reason simply is lack of meaningful and worthwhile data. Even if such data existed, one would need a highly sophisticated weighting system to account both for charges on different modes of travel and different charges on similar modes. The exclusion of a travel variable from the regressions is unfortunate although the inclusion of one, from the evidence of other research, would probably lead to such high correlation between it and the income variable that the results would be meaningless.

(iii) *Marketing expenditure.* Bord Fáilte is responsible for advertising Ireland's tourist attractions in Britain and thus expenditure by this body in that country is used as representing Ireland's marketing effort. Some difficulties arise however. Firstly, relative marketing expenditure is the appropriate variable but lack of data precluded the use of such a variable. Secondly, because Bord Fáilte expenditure figures are only disclosed for the financial year, one would expect this variable to influence the dependent variables in two years. A two-year average of Bord Fáilte expenditure was eventually used. Theoretically it is justified and empirically it proved more satisfactory than a current or one-year lagged variable. A third problem was that capital and current expenditure by Bord Fáilte would have different time effects on "sales". Precisely what is current expenditure is difficult to ascertain, but the breakdown of expenditure in recent years indicates that the bulk of it is current, and thus the total figures were used. Finally, it could be argued that some of Aer Lingus's marketing expenditure should be added to that of Bord Fáilte's. However, what part of total Aer Lingus marketing expenditure is devoted to selling Ireland, as opposed to Irish airlines as a means of getting to Ireland, is not ascertainable and thus was not included.

(iv) *The British dock strike of 1966.* Since approximately 50 per cent of tourists coming to Ireland via Britain travel by sea it is to be expected that a dock strike in one of the countries would affect tourist traffic, especially that of recreational tourists, even allowing for substitution between sea and air travel.

(v) *British travel credit restrictions.* In three of the years of the study, 1967 to 1969, travel credit restrictions were in operation in Britain which prohibited nationals from spending more than fifty pounds in non-sterling area countries. Even though this would only affect the higher income tourists, substitution effects both within international tourism and between domestic and international tourism would be expected, Ireland, Britain and other sterling area countries being the benefactors.

(vi) *The introduction of car ferries between Britain and Ireland.* One would expect an increase in tourist traffic due to this factor on two counts. The first is the possible cost reduction for those who would otherwise hire a car in Ireland or transport their own by other means. The second is the increased ease of travel when one

uses a car ferry. Car ferries were introduced in both 1967 and 1968, their effect thus being spread over two years and intermingled with that of the credit restrictions.

The above three variables were represented in the regressions by dummy variables.

(vii) *Weather*. Relative weather conditions don't change but there may be short-term effects based on the hypothesis that good weather on a holiday can be a major factor in one's decision to return to the same place the following year and in influencing one's friends to come in both years. Thus, the inclusion of a two-year average of the Poulter index, an index which takes account of temperature, rainfall and hours of sunshine in the summer months, seems justified.

(viii) *Population*. This variable was accounted for in part, by expressing all appropriate variables in *per capita* terms. No separate variables taking account of changes in age, structure and density were considered.

In expressing all expenditure variables in real terms the UK foreign tourist expenditure variable proved a little more difficult than the rest. To account for the sterling devaluation of 1967 it had to be converted to dollars and then to account for price and exchange rate changes in other countries, it had to be divided by a weighted price index similar to the one mentioned, but this time including Ireland.

III. THE MODEL AND RESULTS

This section is subdivided into three parts, namely (a) the model used together with a discussion of the econometric difficulties involved, (b) the presentation of and comment on the results and (c) the conclusions.

(a) There are four dependent variables,

Y_1 = Real annual expenditure by tourists travelling to Ireland via Britain per head of UK population

Y_2 = Number of tourists travelling to Ireland via Britain per head of UK population, and

Y'_1 and Y'_2 are similar figures for recreational tourists.

There are five independent variables. The income variable can be represented either by

X_1 = real UK disposable income per head of UK population, or

X'_1 = real tourist expenditure abroad by UK residents per head of UK population.

X_2 is real expenditure by Bord Fáilte in Britain per one hundred of UK population. The price variable can be represented either by X_3 as the weighted price ratio discussed in Section 4. or by X'_3 , this price variable lagged one year. X_4 is a dummy representing travel credit restrictions in the UK (= 1 for 1967 to 1969

$= 0$ for all other years). X_5 is the Poulter weather index. U is a stochastic disturbance term. The absence of other variables will be commented on in part (b).

The form of equation used was linear in the logarithms. The time period used was relatively short so that in this study it was not possible to distinguish between the linear and the log linear forms on the basis of statistical criteria. The latter was chosen both on account of *a priori* considerations and the practical advantage of directly yielding elasticity estimates. Thus the basic equation to be tested is of the form:

$$\log Y = b_0 + b_1 \log X_1 + b_2 \log X_2 + b_3 \log X_3 + b_4 X_4 + b_5 \log X_5 + U$$

Some problems arose in the estimation of this equation and these will now be examined. The first was the presence of multicollinearity. This problem arises in nearly all econometric work which deals with the post-war period, because during this time the values of most economic variables have shown a steady upward movement. The introduction of time into the equations to eliminate this trend only added to the multicollinearity problem in this study since $R(X_1, t) = 0.97$ and $R(X_2, t) = 0.99$. The use of deltas of the logs was considered but was rejected for reasons in Geary [7].

Multicollinearity tables are provided in Appendix B to enable the reader to assess the reliability of the results on this count. The value of R at which multicollinearity becomes critical in regression analysis has not been researched to any great extent. In the absence of such research, the fact that some multicollinearity nearly always exists between independent variables would seem to cast doubt on all regression results in cases where theory points to the existence of more than one independent variable.

The second problem was that of simultaneity. In estimating price elasticities, especially those of exports, one encounters this difficulty since price is determined by both supply and demand. However, in the case of tourism, although the price effect in both the supply and demand equations can be considered to be lagged, the time structures of the lags should differ considerably and hence this hypothesis of simultaneity is rejected.

The possibility of simultaneity between the marketing and dependent variables was considered. In recent years marketing surveys of monthly trends in tourist traffic have been carried out. There is every indication that within any one year Bord Fáilte varies sub-categories of its total budget in response to those studies. However, there is little evidence that this occurred for a large section of the time period under study and, because a two-year average of Bord Fáilte expenditure was eventually used, this hypothesis of simultaneity was rejected also.

A third problem arose in accounting for lagged price effects. In an attempt to measure these, it was assumed that the price effect diminishes exponentially over time. This method, however, not only runs into very severe auto-correlation problems [8] but also the lagged dependent variable in this study was highly correlated with the other independent variables. The use of current price or a one-

year lag should not lead to serious underestimation of the price elasticities, however, since the largest price effect is expected from devaluations which have a current or, at most, a one-year lagged effect.

(b) As can be seen from the model, some variables mentioned in Section II are not included at this stage. Two of these are price variables, the ratio of the British and Irish consumer price indices and drink and tobacco price indices respectively. The latter was highly significant, but had the wrong sign, the former insignificant although it had the expected sign. Blackwell's results [6] using a price variable similar to the former were much the same. The main reason for the poor performance of both is that there is likely to be a fairly long term effect associated with them as mentioned in Section I. In addition, the c.p.i. ratio showed very little variation.

Doubt was expressed already about the car ferry dummies. This was verified by the results and they were dropped from the regressions. The dock strike dummy had the wrong sign in all regressions and it also was excluded. Besides, from a breakdown of numbers into sea and air (Table A3), it seems likely that the effect of both was merely that of substitution between sea and air travel.

The method of presentation of the remaining results is designed to highlight the caution with which one must handle empirical findings when any of the problems already mentioned arise, especially that of multicollinearity. Results using tourist expenditure and tourist numbers are looked at in detail first. The time period is 1956 to 1969:

TABLE 2b Simple Regression *t* and *R* values of $\log Y_{1,t}$ on:

	Log X_1	Log X'_1	Log X_2	Log X_3	Log X'_3	X_4	Log X_5
<i>t</i>	7.8	3.74	5.61	0.45	0.024	2.16	1.66
<i>R</i>	0.914	0.733	0.844	0.114	0.004	0.522	0.433

Log X_1 and log X_2 are highly significant⁴ at the 1 per cent level with log X_1 and X_4 significant at the 1 per cent and 5 per cent levels, respectively.

In all multiple regressions an income variable was included because of its overriding *a priori* importance and the reliability of the data used to represent it. This gave five three variable regressions using log X_1

4. When a variable is described as significant, it is the coefficient to which the statement refers.

TABLE 3: *Regression t and R-values of log Y₁ on:*

	Log X ₁ +Log X ₂	Log X ₁ +Log X ₃	Log X ₁ +Log X ₃	Log X ₁ +Log X ₄	Log X ₁ +Log X ₅
t	2.95	-0.54	7.55	-0.59	7.53
R	0.916	0.917	0.915	0.914	0.935

In both the two and three variable regressions neither price variable is significant. Because $R(\log X_1; \log X_2) = 0.94$, the results using these two variables are meaningless. $R(\log X_1; X_4) = 0.58$ and this factor surprisingly would seem to be causing distortion of the estimates as both t values drop. Because of this multicollinearity no regression results using more than three variables are given.

$$\log Y_1 = -2.86 + 1.48 \log X_1 \quad (1)$$

$$R = 0.914, F = 60.9, DW = 1.18$$

Equation (1) is thus the only equation which can be used to derive an income elasticity. Since only 14 observations are used, the DW statistic is not tabulated. However, from those tabulated for 15 observations, the value of 1.18 will lie within or close to the indeterminate region depending on the significance level. For this reason, among others, little reliance will be placed on this equation.

TABLE 4: *Simple Regression t and R values of log Y₂ on:*

	Log X ₁	Log X ₁	Log X ₂	Log X ₃	Log X ₃	X ₄	Log X ₅
t	11.9	2.28	13.41	1.41	0.64	3.55	1.18
R	0.960	0.549	0.968	0.377	0.180	0.715	0.322

A comparison of tables 2 and 4 shows that all of the important variables are much more significant when numbers are used. The t value of $\log X_2$ shows the biggest increase.

TABLE 5: Regression *t* and *R* values of $\log Y_2$ on:

	$\log X_1 + \log X_2$	$\log X_1 + \log X_3$	$\log X_1 + \log X_3 + \log X'_3$	$\log X_1 + X_4$	$\log X_1 + X_4 + \log X'_3$	$\log X_1 + \log X_2 + \log X_3 + \log X'_3 + X_4$
<i>t</i>	2.10	2.88	14.31	2.97	17.76	3.94
<i>R</i>	0.977	0.978	0.983	0.980	0.962	0.81

From table 5 it can be seen that the addition of both $\log X_3$ and $\log X'_3$ raises the *t* values of $\log X_1$ and of themselves. $\log X'_3$ is in fact significant now at the 1 per cent level. $R(\log X_3, \log X_1) = 0.03$, thus these *t* values are no way affected by multicollinearity. From tables 4 and 5 a multiple regression including income, price, marketing expenditure and credit restriction variables would be expected to give excellent results if multicollinearity did not exist. If prediction is the objective, a regression equation including these variables should be used. Table 6, which shows the first difference results, adds some weight to this contention.

TABLE 6: Regression *t* and *R* values of ΔY^2 on:

	ΔX_1	$\Delta X_1 + \Delta X'_3$	$\Delta X_1 + \Delta X'_3 + \Delta X_2$
<i>t</i>	1.24	1.54 1.05	2.31 1.26 1.65
<i>R</i>	0.349	0.458	0.627

X_1 is significant at the 5 per cent level and both the *t* values of X'_3 and X_2 are fairly large and have the correct sign.

Estimates of price and income elasticities will now be presented by producing the most reliable equation found, namely that involving $\log X_1$ and $\log X'_3$.

$$\log Y_2 = -11.40 + 1.66 \log X_1 + 1.12 \log X'_3 \quad (2)$$

(17.67) (3.91)

$$R = 0.983, F = 162. \quad DW = 1.75.$$

The exclusion of theoretically important variables in this equation such as marketing expenditure and credit restrictions may have lead to over-estimation of the income elasticity. This estimate is similar to the OECD estimate of 1.5 for aggregate expenditure by the UK. However, the latter was based on a simple regression using variables expressed in current values and may have suffered from a similar

bias. Furthermore, the exclusion of the price of travel from the OECD regression may have resulted in a greater degree of over-estimation for reasons mentioned in Section I. The exclusion of the price of travel in this study may have led to an underestimatè of the price elasticity. Artus [2] obtained an estimate of 1.6 using a similar equation for aggregate tourist exports by Germany. A downward bias may also have resulted from the sole use of X'_3 to represent the total price effect. The fact that X_3 was also found to be significant is an indication of this and also that the coefficient of X'_3 , when taken to represent the price effect in the year $t+1$, is biased upwards...

$\log X'_1$ is included despite the expected substitution between domestic and international travel discussed in Section I. This is justified, first, because the true coefficient of $\log X'_1$ is known to be unity and the regression estimates should give an indication of the net effect of the exclusion of other variables; second, the problem of multicollinearity seemed to be somewhat reduced (Table B2) and, third, it can be used for prediction purposes. X_4 was always included with it in the regression because $\log X'_1$ unlike $\log X_1$ is determined partly by X_4 . If X_4 is excluded, an overestimate of the coefficient may result. Unfortunately, both $R(\log X_3 \cdot X_4)$ and $R(\log X'_3 \cdot X_4)$ are high and as a result neither could be included. Only equations (3) and (4) were reliable on this count.

$$\log Y_1 = -2.77 + 0.75 \log X'_1 + 0.21 X_4 \quad (3)$$

(7.21) (5.39)

$$F = 37.9, R = 0.934, DW = 2.28$$

$$\log Y_2 = -5.75 + 0.63 \log X'_1 + 0.29 X_4 \quad (4)$$

(5.70) (7.15)

$$R = 0.936, F = 39.0, DW = 2.02$$

The coefficient of $\log X'_1$ is significantly less than the postulated value of unity in both equations. This could be due either to the omission of important variables, especially the price of travel, or the statistical unreliability of X'_1 or, to a lesser extent, Y_1 , or both.

Recreational tourist results will now be looked at. The time period is 1959 to 1969 for reasons mentioned in Section II. Similar and even more marked multicollinearity problems appeared in this time period. The most reliable equations are shown below and the variables found significant are the same as those for tourist data.

$$\log Y_1 = -10.7 + 2.42 \log X_1 + 1.30 \log X_3 \quad (5)$$

(5.87) (1.77)

$$F = 21.2, R = 0.917, DW = 1.55$$

$$\text{Log } Y'_2 = -14.27 + 3.83 \log X_1 + 1.42 \log X'_3 \quad (6)$$

(13.30) (2.77)

$$R = 0.981, \bar{F} = 101, DW = 2.50$$

A comparison of equations (5) and (6) to equations (1) and (2) would indicate that the data are consistent with the hypothesis that recreational tourists are more price and income sensitive than tourists in general. The comments in relation to the price and income elasticities in equation 2 apply here.

In all the regressions a considerably better fit was obtained when data on numbers rather than data on expenditure were used to represent the dependent variable. This is difficult to explain other than by the relatively greater reliability of the data on numbers. Thus, in practice, these data may better represent the quantity of tourist services sold.

(c) Highly significant *F*-values were obtained in every equation and this would seem to indicate that economic factors on their own account for changes in tourist receipts and numbers. However, both X_1 and X_2 are highly correlated with the trend variable and changes in tastes are usually represented by such a variable. Hence, the problem of determining the relative importance of economic and non-economic factors was not satisfactorily resolved. In other respects the regression results are compatible with the theory postulated in Section I.

A number of practical policy suggestions conclude this article.

The agriculture and tourist sectors are broadly similar in economic effects. Both have a low import content in their inputs and, hence, a high multiplier associated with their exports. Agriculture by nature is a non-urban activity and while this is not completely true of tourism, it is true to a considerable extent. However, income elasticities with respect to both products differ substantially with the result that agriculture has been a declining sector of the economy. This would seem to indicate that tourism could constitute an ideal substitute for agriculture by absorbing the resources released without necessitating migration of these resources. The ratio of agriculture's share of GNP to that of tourism is roughly 3 : 1 while the corresponding ratio for Government expenditure on each sector is roughly 20 : 1. Thus, further research might concern itself with the optimum allocation of Government resources between these two sectors.

Marketing surveys to determine the reaction of consumers to changes in economic and other variables should be used to provide further evidence to complement econometric analysis. Such surveys should cover not only the reactions of tourists that actually come but also those that go elsewhere.

The estimation of export functions requires the breakdown of total exports by market area. Therefore, reliable tourist statistics based on residency are needed if estimation of tourist export functions is to be more reliable.

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APPENDIX A

TABLE A1

	% Share of Total Receipts			Other Arriving Direct
	Britain	Six Counties Receipts	Of which Excursionists	
1955-56	46.8	41.0	6.4	12.2
1959-60	54.5	28.4	5.9	17.1
1964-65	43.1	45.3	24.2	11.6
1968-69	48.0	35.8	15.2	16.2

Source: Various Statistical Abstracts and Statistical Bulletins.

TABLE A2: Typical Breakdown of Tourist Expenditure

Item of Expenditure	%
Accommodation	30
Food and Drink	25
Purchases	25
Recreation and Entertainment	10
Local Transportation	5
Other Expenditures	5
TOTAL	100

Source: M. Peters [1], p. 32.

TABLE A3: *Tourist numbers from Britain by Mode of Travel (000's)*

Year	Air	Sea
1955	118	493
1956	143	534
1957	148	509
1958	160	534
1959	196	552
1960	255	529
1961	295	548
1962	302	522
1963	335	497
1964	392	543
1965	415	595
1966	481	523
1967	469	584
1968	492	637
1969	490	673

Sources: Statistical Bulletins.

APPENDIX B

TABLE B1: *Multicollinearity Matrix; Logs*

	X_1	X'_1	X_2	X_3	X'_3	X_4	X_5
X_1	—	0.70	0.94	0.20	-0.03	0.58	0.07
X'_1	—	—	0.53	-0.47	-0.36	-0.07	0.19
X_2	0.93	-0.17	—	0.41	0.16	0.71	0.22
X_3	0.56	-0.64	0.74	—	0.51	0.71	0.10
X'_3	0.17	-0.40	0.42	0.52	—	0.47	0.40
X_4	0.64	-0.55	0.79	0.80	0.54	—	0.36
X_5	-0.03	-0.17	0.07	0.25	0.51	0.33	—

Note: Figures to the left of the diagonal refer to the years 1959-69; those to the right to the years 1956-69.

TABLE B2: *Multicollinearity Matrix; Deltas*

	X_1	X'_1	X_2	X_3	X'_3	X_4	X_5
X_1	—	0.48	-0.58	-0.17	-0.37	0.41	0.36
X'_1		—	-0.49	-0.61	0.11	0.11	0.30
X_2			—	0.51	0.15	-0.47	-0.04
X_3				—	-0.33	-0.30	-0.28
X'_3					—	-0.63	0.25
X_4						—	-0.24
X_5							—

Note: These figures refer to the years 1956 to 1969.

TABLE B₃: *The Data used in the Regressions*

Year	Y ₁	Y ₂	Y' ₁	Y' ₂	X ₁	X' ₁	X ₂	X ₃	X' ₃	X ₅
1956	0.3555	0.0132	0.1400	0.0473	338.50	9.220	0.0782	89.30	90.30	342.50
1957	0.3183	0.0128	0.1190	0.0434	341.80	9.940	0.1057	89.00	89.30	337.50
1958	0.3519	0.0134	0.1280	0.0457	343.80	9.990	0.1334	91.00	89.00	312.00
1959	0.4050	0.0144	0.1780	0.0565	361.80	11.300	0.1528	88.00	91.00	336.50
1960	0.4567	0.0150	0.2080	0.0601	381.10	13.440	0.1547	86.50	88.00	374.50
1961	0.4917	0.0160	0.2210	0.0678	393.60	14.490	0.1612	85.90	86.50	341.50
1962	0.4325	0.0155	0.1940	0.0698	392.20	12.680	0.1933	86.20	85.90	333.00
1963	0.4283	0.0155	0.1880	0.0710	404.80	13.870	0.2148	88.60	86.20	330.50
1964	0.4418	0.0173	0.2270	0.0858	418.00	14.110	0.2352	86.90	88.60	335.50
1965	0.5001	0.0186	0.2670	0.0998	422.90	14.790	0.3052	87.30	86.90	335.00
1966	0.4800	0.0184	0.2580	0.0973	429.40	14.540	0.3468	88.10	87.30	335.50
1967	0.4900	0.0192	0.2600	0.0993	433.20	12.760	0.3833	88.60	88.10	340.00
1968	0.5075	0.0204	0.2930	0.1148	438.40	10.920	0.4487	97.20	88.60	346.00
1969	0.5238	0.0210	0.3000	0.1175	435.00	12.630	0.4880	93.40	97.20	363.50

Sources: Y₁, Y₂; Y'₁ and Y'₂: The various statistical bulletins and abstracts.

X₁: National Income and Expenditure 1970.

X'₁: I.U.O.T.O.

X₂: Bord Fáilte.

X₃: O.E.C.D. Economic indicators.

X₅: Meteorological Office, Dublin.