Export Tourism Input-Output Multipliers for Ireland

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I *Introduction*

This paper focuses on some difficulties involved in the interpretation of earlier studies and goes on to calculate *upper bound* estimates of some of the principal economic effects of Irish export tourism in 1976. The 1976 input-output data of Henry (1980) form the basis for the calculations herein.

II *Review of Earlier Studies*

There is little point in referring to "the" multiplier in empirical studies unless the model under consideration is clearly specified and the multiplier(s) under consideration is (are) defined fairly precisely; otherwise we may be left in ignorance of the terms of reference and may have to guess what researchers mean by their multiplier estimates. Furthermore, little or no meaning can be attached to comparisons of multipliers from the models of different authors unless the models and other assumptions employed are clearly stated.

There have been two recent studies of the economic contribution of Irish export tourism — that by Deane (1980) for the National Economic and Social Council and an article by Byrne and Palmer (1981).

Deane notes that three earlier studies (all unpublished) have been made to measure the size of a Keynesian multiplier arising from export tourism. Deane provides no precise definition of the multipliers involved. However, he reports that the Economist Intelligence Unit calculated that in 1964 the multiplier was 1.9 and that the Economists Advisory Group obtained an estimate of 1.8 in their calculations for 1967. We have no knowledge of the methodologies of those estimates; however, since fairly detailed input-output data for Ireland were not published until 1970, it may be inferred that input-output analysis was not used. The third attempt to measure an export tourism multiplier was by Bord Fáilte in 1974, which related to 1968 and used input-output analysis. As reported by Deane, that study yielded a multiplier of 2.08. But Deane (p. 67) went on to state that "there is some evidence to suggest that during the period since 1968 leakages from the system have increased . . . and that a multiplier of 1.8, therefore, seems more likely".

From the latter estimate, Deane (pp. 67-68) concluded that "on the basis of a multiplier of 1.8, export tourism revenue (excluding carrier receipts) amounted to £184.6 million in 1977 and had a generative effect on incomes of some £332 million, which is equivalent to about 6.1% of GNP. Carrier

*The author, who alone is responsible, thanks several colleagues at the ESRI, TCD and UCD for helpful discussion and comment.

receipts, which amounted to £53.3 million in 1977, are almost certainly subject to a higher leakage rate . . . A multiplier of 1.0 is assumed which suggests a further contribution to GNP of 1%". So "taking both export tourism earnings and carrier receipts, which together amounted to £237.9 million in 1977, it is estimated that an income of £385 million was generated, equivalent to about 7.1% of GNP".

Deane does not explicitly indicate how his estimate of an export tourism multiplier of 1.8 (per £ expenditure by tourists in Ireland) is defined. But it appears from the context in which he arrived at the estimate that it is defined as *the increase in household income, plus the total increase in tax revenue, generated per £ of export tourism expenditure in Ireland, after unspecified leakages have been deducted from that injection, all on that assumption that total tax revenues are automatically spent by government.* This is an unusual way of defining a multiplier in a short-run macroeconomic model. Table 11 of Deane's Chapter 2 indicates that the estimated multiplier of 2.08 in the 1974 Bord Fáilte study was defined along those lines, and his own estimate of 1.8 seems to be an adjustment to that 1974 estimate to take account of an increased marginal propensity to save. (However, the preceding paragraph indicates that when Deane applies the multiplier of 1.8 to export tourism expenditure by tourists in Ireland in 1977, he does *not* deduct direct leakages from that injection along the lines implied by the definition in italics above. Note also that Deane's Table 11 suggests that if it were assumed that government expenditure on goods and services was given, and if the multiplier were defined as otherwise in italics above, then the estimated multiplier in the 1974 Bord Fáilte study would be reduced from 2.08 to 0.8; but Deane does not pursue that consideration.)

We have little basis for making any detailed assessment of Deane's estimates, largely because he does not indicate what assumptions were made in regard to *the structure* of government expenditure induced by increased tax receipts (which is clearly discretionary, as is the decision on whether to spend increased tax receipts in the first instance).

In regard to employment creation generated by total export tourism (including carrier receipts) in 1977, Deane (pp. 70-71) states that on the basis of an estimated 7.1% contribution to GNP in that year, "this percentage of the total employed in 1977 represents some 73,500. It can therefore be tentatively estimated that tourism supported the equivalent of 74,000 full-time jobs"; however, the "method of estimation used assumes a constant relationship between output and employment and will therefore tend to overstate the numbers employed in capital intensive industry and understate the numbers employed in labour intensive industry. Since tourism is generally considered to fall within the latter group the figure derived is, if anything, somewhat of an underestimate."

The study by Byrne and Palmer accepts Deane's estimates but, on one crucial point, seems to misinterpret them. As stated above, Deane, in arriving at an estimate of 1.8, appears to have (implicitly) defined the multiplier in such a manner as to assume that all induced tax revenue was spent by government. However, in settling on an export tourism multiplier of 1.8, Byrne and Palmer apparently do *not* assume that all induced tax receipts are automatically recycled in some (unspecified) form of government expenditure.

That inference follows from their statement (p. 90) that the export tourism multipliers of 1.9, 1.8, 2.08 and 1.8, reported in Deane, "may be compared with studies which suggest government expenditure multipliers which" at most are just over unity. In that context, Byrne and Palmer refer to estimates of fiscal policy multipliers summarised in an article by Colm McCarthy (1979, p. 69) in the Central Bank of Ireland *Quarterly Bulletin,* Summer 1979; however, the studies cited there do *not* regard induced tax revenue as automatically spent. Assuming, then, that Byrne and Palmer have a uniform definition of a national income multiplier in mind, it is apparent that they regard government expenditure on goods and services as exogenous.

Like Deane, Byrne and Palmer suggest that 73,500 full-time jobs can be attributed to export tourism in 1977. They also regard that figure as an underestimate, on the (as we shall argue later, questionable) grounds that export tourism is labour-intensive.

Before proceeding we note that, apart from those reported above, there has been one other published attempt, by O'Connor and Whelan (1973), to estimate a multiplier of relevance to that of Irish export tourism. The O'Connor-Whelan multiplier pertained to total salmon angling export tourism expenditure by sports fishermen in 1970 and was meant by those authors to be no more than a very rough approximation. It seems that this multiplier attempted to represent the coefficient linking Irish value added to export salmon angler expenditure by sportsmen. It was based on the explicit assumption that:

(i) The marginal import content of the first round of anglers' expenditure was 25 per cent.
(ii) The marginal import content of general consumption expenditure was 40 per cent, and
(iii) direct taxes plus savings were 11 per cent of personal income.

Given those assumptions, O'Connor and Whelan (pp. 41-42) suggest that the multiplier is the coefficient 1.6 in the expression $\Delta Y = 1.6E$, where ΔY is the change in national income at factor cost (value added) induced by a level of export tourism angler expenditure E (which includes expenditure by visiting anglers in Ireland and the associated receipts of Irish international carriers, before deduction of either import content or net indirect taxes).

This writer can comment only tentatively on the derivation and interpretation of the O'Connor-Whelan multiplier of 1.6 which, it should be stated, is the earliest, fairly explicit, published estimate of a Keynesian-type multiplier for Ireland known to him. It seems that government expenditure on goods and services was regarded as given (i.e., that it was not made dependent on induced tax receipts), a procedure which we consider appropriate. However, although O'Connor and Whelan clearly state some key assumptions, this writer remains unsure of central features of the economy-wide model which they had in mind; in particular, he cannot grasp how indirect tax leakages were treated (if at all).

At this point the author wishes to indicate that the foregoing discussion has not sought to devalue the work of previous researchers; rather, his central problem has been one of interpretation.

III *The Multiplier Concept in the Present Paper*

In this paper the notion of an export tourism national income multiplier is defined along conventional Keynesian lines; it is the coefficient linking the change in GNP (an endogenous or dependent variable) to export tourism expenditure (an exogenous or independent variable), given the assumptions that government expenditure on goods and services and net investment are unaffected by changes in export tourism expenditure.[1] Since we cannot, on the basis of these assumptions, accept a hypothesis of an export tourism multiplier of close to 2.0, the assumptions are developed in such a manner as to grant the benefit of doubt, and we arrive at an *upper bound estimate* of the total export tourism multiplier of about unity. Apart from its effect on Irish GNP, the net direct and indirect contributions of export tourism to Exchequer revenue and the balance of payments on current account are also estimated. Finally, the conclusions in earlier studies that over 73,500 jobs in 1977 could be attributed to export tourism, and that the sector is labour intensive, are questioned.

We base our estimate on an explicit input-output model of the economy. Their accuracy is therefore contingent on (a) the extent to which the model captures fundamental structural features of the economy and (b) the accuracy of the data fed into the model. In regard to (b), most of the data used was drawn from the 1980 ESRI paper by Henry; it is therefore subject to some of the reservations indicated in that study. The nature of, and the assumptions surrounding, other data used will be clearly stated. In regard to consideration (b) — the realism of the model — we can state the following:

Firstly, simple input-output models fail to distinguish between the marginal and the average values of parameters; for example, they assume that the marginal propensity to import is the same as the calculated average propensity to import, and that marginal tax rates are the same as the calculated average rates. Due to the fact that in Ireland the marginals for some of those leakage parameters exceed the averages, such assumptions would generate overestimates of national income multipliers pertaining to various kinds of exogenous demand. The assumption that the marginal rate of direct tax equalled the average rate of direct tax is dropped in the calculations which follow. However, we do assume equality of marginal and average propensities to import.

Secondly, the model used assumes that non-tourism exports are independent of export tourism expenditure. To the extent that foreign tourist expenditure in Ireland diverts food away from the non-tourism export market, the resulting multiplier calculations will be overestimates.

Thirdly, the input-output model used suppresses much of the supply-side short-run operation of the economy. But it does not do so entirely; the input-output coefficients used as data below reflect *ex post* the interaction of both supply and demand phenomena. However, to the extent that the naïve treatment of supply ignores pressures on capacity, the ensuing multiplier estimates will be overstatements.

The foregoing drawbacks of the input-output method used do not alarm us, given that the objective is to attain safe *upper bound* estimates of export

[1]This is the standard kind of assumption made in macro-economic analysis. We admit that in a longer-term context the assumption may be invalid — to the extent that government expenditure is determined by the revenue available.

tourism multipliers. Any alternative formal method would have its own deficiencies. But the dominant advantage of formal over verbal approaches is that they pinpoint the exact assumptions which are being made and facilitate tractability which would otherwise be lacking.

Before going on to the details of the model used, it might reasonably be asked why anyone would be interested in multipliers associated with exogenous final demands. One answer is that such estimates of income generated per unit of exogenous demand are often deemed relevant to the benefit side in cost-benefit analyses. Depending on the criterion function chosen in such appraisals, the net contributions to the Exchequer finances, savings, the balance of payments on current account and employment may also be of relevance. All of those effects of the export tourism sector are accordingly estimated in Section V below.

IV. *Methodology*

This section outlines the general features of the method used to estimate the effects of export tourism on several endogenous national variables. We first consider a simple input-output model of an economy in the absence of export tourism.

As an accounting identity:

(1) $\sum_j X_{ij} + Y_i \equiv X_i$; i,j = 1,..., n.

X_i: Gross output of domestic producing sector i.

Y_i: Final demand for the output of producing sector i.

X_{ij}: The amount flowing from producing sector i as an input in order to carry on production in sector j.

So (1) simply states that the gross output of sector i consists of interindustry flows plus the output into final demand.

We now assume

(2) $X_{ij} = a_{ij}X_j$

— that the amount flowing from producing sector i to producing sector j is proportional to the gross output of sector j. So if the X_{ij} and the X_j are known for some base year, the a_{ij} can be calculated as $a_{ij} = X_{ij}/X_j$. Each of the a_{ij} is the amount of input from sector i *directly* required per unit of production in sector j.

We assume that the economy is in equilibrium in the accounting period under consideration (the base year); then the a_{ij} denote both actual and equilibrium input-output coefficients, which we assume constant over the period under analysis. Hence we write (1) as $\sum_j a_{ij}X_j + Y_i = X_i$, or, in matrix notation,

(3) $AX + Y = X$

From (3) we can express the gross output vector X as a function of the vector of final demands:

(4) $X = (I - A)^{-1}Y \equiv RY$

where A is the known $n \times n$ matrix of direct input-output coefficients and I is an identity matrix; thus $(I - A)^{-1} \equiv R$ is taken as known.

The elements of the j^{th} column of R in (4), r_{ij}, denote the outputs from each

of the producing sectors directly *and indirectly* required per unit of final demand for the output of sector j. Consider, for example, a hypothetical economy in which sector j is shipbuilding and sector i is steel production. Then a_{ij} denotes the value of steel inputs flowing *directly* into the shipbuilding sector per £ output of ships. However, shipbuilding will also have an *indirect* steel input. For example, since steel must be transported to the shipyards, steel will be required to make transport vehicles, etc.; this steel input into the transport sector would be an output of the steel sector *indirectly* required for shipbuilding. The $(i,j)^{th}$ element of the inverse matrix, r_{ij}, would then denote the direct plus indirect output of steel required per unit of final demand for new ships. Hence, if a final demand vector Y is postulated, (4) enables us to calculate the gross output vector directly and indirectly implied by the postulated Y. For example, the coefficient vector r_j in R would denote the vector of direct and indirect gross output requirements from *each* producing sector implied by a unit of final demand for the output of sector j.

If we now assume that imports, (net) indirect taxes and factor incomes (value added) are linked to gross outputs by proportionality relationships, (4) also provides a basis for determining the values of those variables implied by any vector of final demands. Thus:

$$(5) \quad M = \hat{m}X = \hat{m}(I - A)^{-1}Y \equiv \hat{m}RY$$

$$(6) \quad T^i = \hat{t}^i X = \hat{t}^i RY$$

$$(7) \quad V = \hat{v}X = \hat{v}RY$$

where M, T^i and V are vectors of imports, (net) indirect tax revenues and factor incomes (value added) directly and indirectly generated by the final demand vector Y, and m, t^i and v are vectors of sectoral import-output, (indirect tax)-output, and (value added)-output ratios, assumed constant. The hat (^) over those coefficient vectors indicates that they are written along the main diagonal of matrices otherwise made up of zeros.

If the M, T^i, V and X vectors are known for the base year, we can calculate the matrices of parameters in (5) to (7) by applying equations like (2) — e.g., $M_j = m_j X_j$; so $m_j = M_j/X_j$. Then, assuming that our accounting data represent an approximate equilibrium situation, we can use (5) to (7) to simulate or forecast the direct and indirect effects of any arbitrary final demand vector Y on imports, indirect tax revenues and factor incomes.

We use a variant of the above analytic framework to estimate direct and indirect effects of export tourism expenditure. We also estimate its Keynesian multiplier effects (not dealt with explicitly in the above, since Y was taken as given).

We assume that the parameters of the system, A, m, t^i and v have been calculated *ex post* from base year data; so these are taken as known constants. Suppose now that a vector E of export tourism final demand is exogenously applied to the economy. From (4) this has direct and indirect (excluding Keynesian multiplier) effects on gross outputs as given by

$$(8) \quad X = RE$$

The direct and indirect (excluding Keynesian multiplier) effects on imports, indirect tax revenues and factor incomes are then readily found from equations (5) to (7), with Y replaced by E. Thus

$$(9) \quad M = \hat{m}X = \hat{m}RE$$

$$T^i = \hat{t}^i X = \hat{t}^i RE$$

$$V = \hat{v}X = \hat{v}RE$$

In the remainder of this section we concentrate on how to estimate the effects, including the Keynesian multiplier effects, of export tourism on national income at factor cost; the complete import and indirect tax revenue effects can be, and in Section V are, estimated in analogous manner.

We have already found the immediate (first round of the multiplier) effect of the exogenous final demand vector E on the vector of national incomes, from (9). The immediate increase in direct tax revenue is found as t^dV, where t^d is the marginal rate of direct taxation. But not all of the remaining $(1 - t^d)V$ in disposable income will be spent. If s is the marginal propensity to save, then the sum of the elements in the vector

$$(10) \quad (1 - s)(1 - t^d)V \equiv \alpha V; \quad 0 < \alpha < 1$$

will be spent, thereby initiating the second round of the Keynesian multiplier. The pattern of this expenditure will in general differ from that in E. Since we regard government expenditure on goods and services, and net investment demand, as exogenously given, we assume that the second round of expenditure takes the form of a vector C of household consumption, the weights in which are those of the consumption expenditure vector which prevailed in the absence of export tourism.

From (7) we find that in the second round of the multiplier process

$$(11) \quad M = \hat{m}RC$$

$$T^i = \hat{t}^i RC$$

$$V = \hat{v}RC$$

As before, only $(1 - t^d)$ of (11) is available for spending and a proportion s of the latter available sum will be saved. Hence the increase in spending initiating the third round of the multiplier process is $\alpha\hat{v}RC$, where α is defined as implied by (10). Along the lines of (9) and (11), this generates a third round increase in value added of

$$(12) \quad V = \hat{v}R\alpha\hat{v}RC = \alpha(\hat{v}R)^2C$$

As before, a proportion $(1 - \alpha)$ of the increased income in (12) leaks out in direct taxes and savings. Thus the increase in consumption expenditure

initiating the fourth round of the multiplier is $\alpha^2(\hat{v}R)^2C$, where C is as in (11) and (12), and the resulting fourth round increase in incomes is

$$(13) \qquad V = \hat{v}R\,\alpha^2(\hat{v}R)^2C = \alpha^2(\hat{v}R)^3C$$

The pattern of subsequent rounds of the multiplier process is clear: so summing (9), (11), (12) and (13) and all further rounds, and rearranging terms, we see that the ultimate increase in income (the total multiplier effect) is given by the vector

$$(14) \qquad V = \hat{v}RE + \{I + \alpha\hat{v}R + (\alpha\hat{v}R)^2 + (\alpha\hat{v}R)^3 + \ldots\}\,\hat{v}RC$$

It is not very difficult to show, for the data used in Section V, that the infinite series of matrices in (14) converges. (The author will be happy to provide details, along with a general proof, on request.) It follows that the principal macroeconomic effects of export tourism could be estimated using either equation (14) or,

$$(15) \qquad V = \hat{v}RE + (I - \alpha\hat{v}R)^{-1}\hat{v}RC$$

So as to give insight into the economics involved, we opted for the sequential approach of (14) rather than the instantaneous method in (15). (For example, (15) gives no insight into the nature of the convergence process; (14) does.) However, the interested reader can crosscheck our final solutions (which inevitably involve rounding errors) by applying equation (15).

Some Further Details

The approach actually adopted below is slightly more detailed than that outlined at the beginning of this section:

(i) Some export tourism expenditure bypasses the matrix of X_{ij}'s by leaking directly into imports and net indirect taxes.

(ii) Net indirect taxes are broken down into indirect taxes and subsidies.

(iii) Value added is broken down into factor income accruing to labour and that accruing to capital.

(iv) The employment and capital stock usage per unit of each component of the final demand vector are calculated *ex post* and used in assessing employment creation directly and indirectly due to export tourism, as well as the capital intensity of that sector. Proportionality relationships along the lines of equations (5) to (7) are assumed, thus:

$$(16) \qquad L = \hat{l}X = \hat{l}(I - A)^{-1}Y$$

$$(17) \qquad K = \hat{k}X = \hat{k}(I - A)^{-1}Y$$

where L and K are vectors of labour and capital use entailed by the final demand vector Y, and $\hat{l}$ and $\hat{k}$ are vectors of sectoral labour-output and capital-output ratios (estimated *ex post* and assumed constant for our purposes). The hat over those coefficient vectors indicates that they are written along the main diagonal of matrices otherwise made up of zeros.

V. *Export Tourism: Estimated Effects*

Three sets of calculations are made in this section: (a) The effects on GNP, imports and tax revenues of export tourism expenditure by tourists *in* Ireland. (b) The effects on the same variables of export tourism receipts of Irish-based international carriers (Aer Lingus, B&I Lines and Irish Continental Line). (c) Total export tourism effects, i.e., the sum of those in (a) and (b). We concentrate on 1976 because that is the latest year for which input-output data are available.

Expenditure by Tourists in Ireland

E. W. Henry 1980 (p. 24) has made the following rough estimates (in £ million) of export tourism expenditure by tourists in Ireland in 1976. (Henry's input-output sector numbers are in parentheses.):

Food (1)	23.8	Imports	10.9	
Textiles (2)	2.1	Indirect Taxes	23.5	28.4
Paper (5)	1.4	Subsidies	−6.0	
Other Manufacturing (9)	10.6	TOTAL	137.0	
Agriculture (10)	9.1			
Transport (15)	3.6	137 − 28.4 = 108.6		
Trade Margin, Services (16)	58.0			

Henry's study involves an input-output model of the economy in 1976 in which there are 19 producing sectors. Flows from those sectors are measured at producer prices, and all imports are treated as primary inputs.

In his *Table 2,* Henry calculates the *direct input-output coefficients* for Irish 1976 transactions. This consists of the matrix A in (3) above and the direct import, indirect tax, subsidy, wage and salary, and profits plus depreciation, intensities per unit of gross output in each of the producing sectors. (See the centre element in the equality in equations (5) to (7) above.) Henry's Table 2 also presents the employment and capital intensities per unit of gross output in each of the 19 producing sectors. (See equations (16) and (17) above.)

Henry's *Table 3* presents the $(I-A)^{-1} \equiv R$ matrix for Irish 1976 transactions (equation (4) above). Those coefficients show the *direct plus indirect* outputs from each of the producing sectors generated per unit of final demand for the output of any of the producing sectors. They also show the direct plus indirect imports, indirect taxes, subsidies, wages and salaries, and profits and depreciation, associated with a unit of final demand for the output of each producing sector. (See the right-hand side of equations (5) to (7) above.)

Combined with the analytic framework outlined in Section IV above, Henry's Tables 2 and 3 form the basis of all the calculations which follow. Therefore it might be helpful if the reader referred to Henry's study concurrently with what follows.

It will be noted from the tourism data above that £28.4 m. of export tourism demand bypassed the X_{ij} matrix, spilling directly into imports and net indirect taxes. The remaining (19×1) final demand vector E (with its 7 positive elements summing to £108.6 m.) was applied to Henry's Table 3 (the $(I-A)^{-1}$

matrix, etc.) to calculate the vector of gross outputs, X, directly plus indirectly implied by E. Having obtained X, Henry's Table 2 (the matrix A, etc.) enabled us to calculate a transactions table for the economy associated with the export tourism final demand vector E. This[2] showed the direct plus indirect effects of export tourism expenditure (excluding carrier receipts) *before any induced Keynesian multiplier effects.* Those (first round of the multiplier) effects are as follows:

First Round Effects:		
Imports	£22.0 m.	
Indirect Taxes	£13.9 m.	
Subsidies	−£7.0 m.	
Wages and Salaries	£50.7 m.	£79.7
Profits and Depreciation	£29.0 m.	
(SUM)	(£108.6 m.)	
Employment (man-years)		23,171
Gross Capital Stock Used (£ million)		242.18
Capital Intensity = Gross Cap./Employ.		= £10,450

We now estimate the induced Keynesian multiplier effects. From the above calculations we see that the first round effect of export tourism expenditure in Ireland was to increase GNP at factor cost by £79.7 m. Much of the profits in that figure were incomes of self-employed persons, including farm incomes. However, not all of that £79.7 m. was available for spending to initiate the second round of the multiplier process: some of it accrued to the Exchequer in net direct taxes.

From *National Income and Expenditure 1976* (Central Statistics Office, 1978) we find that GNP at factor cost came to £3,929 m. while £735 m. was raised in direct taxes. However, transfer and national debt interest payments to residents from the Exchequer are negative direct taxes; so to find the average direct tax rate on factor incomes we must take account of such payments. In 1976 these roughly equalled tax revenue; thus the average net direct tax rate was roughly zero. However, we are analysing the *increase* in national income generated by tourism. It is the marginal net tax rate that is relevant here, and that was certainly greater than zero: as income increases transfers such as dole payments fall and more people enter progressive income tax brackets. Thus we estimate the tax rate of relevance as 20 per cent.[3] So applying a rate of net direct taxation of .2 to the £79.7 m. of income generated above we find £15.9 m. added to tax revenue; thus the increase in gross disposable income was £63.8 m.

Before we can estimate the second round of the multiplier process we must also estimate the marginal propensity to spend out of the above £63.8 m. in disposable income plus depreciation. From the national accounts we estimate the average propensity to consume out of disposable income in 1976 as .79. We

[2]This transactions table, and those associated with the further calculations which follow, will be sent by the author to the reader upon request.

[3]Because he did not consider the reaction of transfer payments to changes in national income, Irvine (1974, p. 52), who estimated Irish fiscal multipliers using a model similar to that developed here, used a lower estimate of t^d.

can reasonably assume that the marginal propensity to consume was less than this, say .75. Bearing in mind that depreciation was a fixed sum, it is therefore reasonable to assume that the marginal propensity to spend out of the above £63.8 m. was no greater than .75. However, to be sure that we do not bias the multiplier downwards by choosing too low a marginal propensity to spend, we grant the benefit of doubt and assume a marginal propensity to spend out of gross factor income of 80 per cent.[4]

Thus we estimate the induced increase in expenditure initiating the second round of the multiplier process as £51.0 m., and increased gross saving = £12.8 m. To estimate how the £51.0 m. was spent we find the structure of personal consumption expenditure (excluding that under export tourism) in 1976, from Henry's transactions table for that year. Let z_i be the i^{th} element of that vector. The weight to be applied to the £51.0 m. in estimating the i^{th} component of the induced consumption expenditure vector is $z_i / \sum z_i$. The estimated weights, along with the resulting induced expenditure vector, are as follows:

Sector	*Weights*	*Induced Expenditure (£ m.)*	
1. Food	.127	6.48	
2. Textiles	.011	.56	
3. Clothing	.004	.20	
4. Wood	.007	.36	
5. Paper	.007	.36	
6. Chemicals	.010	.51	
7. Structural Clay	.004	.20	
8. Engineering	.025	1.28	
9. Other Manufacturing	.056	2.86	
10. Agriculture, etc.	.049	2.50	
11. Solid Fuel	.004	.20	
12. Stone, Ores	.000	.00	
13. Construction	.000	.00	
14. Electricity, Gas	.031	1.58	
15. Transport	.019	.97	
16. Services	.310	15.81	
17. Repair	.000	.00	
18. Packaging	.000	.00	
19. Residual	.000	.00	
SUM		33.91	
Imports	.241	12.29	
Indirect Taxes	.126	6.43	17.09
Less Subsidies	−.032	−1.63	
SUMS	.999	51.00	

[4]Irvine (pp. 49, 52, 54) assumed a short-run marginal propensity to consume out of disposable income of 0.6. We assume a higher value of the marginal propensity to consume because we wish to attain safe *upper bound* estimates of the export tourism multiplier.

We note that £17.09 m. of the £51 m. in induced expenditure initiating the second round of the multiplier bypassed the X_{ij} matrix, spilling directly into imports and net indirect taxes. The remaining (19×1) final demand vector above, which we denoted by C in Section IV, was applied to Henry's Table 3 $(I-A)^{-1}$ matrix, etc.) to calculate the vector of gross outputs, X, directly plus indirectly implied by C. Having obtained X, Henry's Table 2 (the matrix A, etc.) enabled us to construct a transaction table associated with the final demand vector C. That transactions table indicated the following (second round of the multiplier) effects.

Second Round Effects:

Imports	£7.27 m.	
Indirect Taxes	£3.35 m.	
Subsidies	−£1.28 m.	
Wages and Salaries	£15.46 m.	£24.53 m.
Profits and Depreciation	£9.07 m.	
(Sum)	(£33.87 m.)	
Employment (man-years)	6753	

We have now estimated the first round effects in the Keynesian income multiplier process and those in the first round of induced expenditure, i.e., we have estimated the first two terms in equation (14), namely,

$$(14') \quad \hat{v}RE + \hat{v}RC$$

We have also estimated, among other things, the effects on imports, tax receipts and employment associated with (14').

Summing the relevant estimates above, we may summarise the effects in and associated with the first two rounds of the multiplier process as (£m.):

Imports:	52.46	Net Ind. Taxes:	31.27
Direct Taxes:	15.90	GNP at Factor Cost:	104.23
Employment (man-years)	29,924		

We have yet to estimate the subsequent rounds in (14) for export tourism expenditure by tourists in Ireland, namely,

$$(14'') \quad \{\alpha\hat{v}R + (\alpha\hat{v}R)^2 + (\alpha\hat{v}R)^3 + \ldots\}\,\hat{v}RC$$

To do so we proceed sequentially exactly as in estimating the second round of the multiplier process above. Thus we have found, in the second round of the multiplier process, that GNP at factor cost increased by £24.53 m. Some £4.91 m. of this was added to direct tax receipts and £19.62 to gross disposable income; of the latter sum, £3.92 went to gross saving and £15.70 went to increased expenditure to initiate the third round of the multiplier process. The structure of that increased expenditure was estimated using the weights listed above. Some £3.79 m., £1.98 m. and £0.50 m. of it bypassed the X_{ij} matrix by spilling directly into imports, indirect taxes and subsidies, respectively; the remaining £10.43 m. worked itself through the interindustry structure,

generating increased imports of £2.23 m., increased indirect taxes of £1.02 m., increased subsidies of £0.39 m., increased gross factor income of £7.57 m., and increased employment of 2,058 man-years. The latter sum in increased factor income was then taken to estimate further increased direct tax revenue and gross savings, and the resulting residual (£4.85 m.) was then applied to initiate the fourth round of the multiplier process. And so went all subsequent iterations in (14") above.

All variables under analysis converged to zero by the tenth iteration. Summing the effects at each round gave estimated macro-economic effects of the £137.0 m. in export tourism expenditure by tourists in Ireland in 1976 (£ million):

Imports	*Indirect Taxes*	*Subsidies*	*Direct Taxes*
61.16	51.53	17.20	22.99

Ind. Taxes less Subs	*Total Net Taxes*	*Wages, Salaries, Profits and Depreciation*
34.33	57.32	115.16

So, adding indirect taxes less subsidies to gross factor income, we find that the increase in GNP at market prices was some £149.49 m. Given that export tourism expenditure by tourists in Ireland came to £137 m. in 1976, this implies that an upper bound estimate of the multiplier applicable to such expenditure — defined as the coefficient linking the change in GNP (at market prices) to export tourism expenditure — was 1.09. We also note that the effect on Exchequer revenue was a gain of some £57.32 m., while the net contribution to the balance of payments on current account was £75.84 m. Finally, the gain in jobs is estimated at 32,902.

Irish Carrier Receipts from Export Tourism

Carrier receipts from export tourism accruing to Irish-based firms came to £46 m. in 1976. On the basis of data on passenger numbers and fare structures we estimate that £34.5 m. of this was earned by Aer Lingus, while the remaining £11.5 m. accrued to B&I Line and Irish Continental Line.

The method used to estimate the direct and indirect effects, including the Keynesian multiplier effects, of the export tourism earnings of Irish carriers, was slightly more *ad hoc* than that adopted in the preceding subsection.

From the 1969 input-output tables (Central Statistics Office, 1978, Table C2) we find that the *direct* import content of air transport in that year was .4052, while that of sea transport was .1688. Because of rising energy costs, we assume that the direct import contents had increased to .55 and .20, respectively, by 1976. These estimates, along with those of the opening paragraph of this subsection, imply that the direct import content of export tourism carrier receipts was .4624 in 1976.

The *direct* import content of Henry's transport sector (which is an amalgam of transport sub-sectors, including CIE) in his 1976 input-output tables is .2334. We note a difference of .2290 (.4624-.2334) between the two estimates of direct import content. So as to be able to continue using Henry's A and $(I-A)^{-1}$ matrices we adopt a somewhat *ad hoc* approach by allocating

£.2290(46)m. = £10.53m. as a direct import leakage; we therefore reckon final demand for carrier services in 1976 as £46m. — £10.53m. = £35.47m.

We have estimated the final demand for transport affecting the interindustry structure as £35.47m. We plug this £35.47m. into the final demand vector and estimate the resulting gross outputs, X, from (4), where Y now has only one positive component (final demand for transport). Having obtained the X vector we go to Henry's matrix A of input-output coefficients and use equations like (2), (5), (6) and (7) to construct a transactions table corresponding to the postulated final demand vector. These calculations led to the following (first round of the multiplier) effects:

First Round Effects:

Imports		£10.48m.	
Indirect Taxes		£1.25m.	
Subsidies		−£0.54m.	
Wages and Salaries		£18.65m.	£24.28m.
Profits and Depreciation		£5.63m.	
	(Sum)	(£35.47 m.)	
Employment (man-years)		2643	
Gross Capital Stock Used		£48.56m.	
Capital Intensity = Gross Cap./ Employ.		£18,370	

In estimating the second and subsequent round multiplier effects we proceed exactly as in estimating the same effects for export tourism expenditure by tourists in Ireland. Thus the above estimates indicate an increase of £24.28m. in gross factor incomes in the first round. Some £4.86m. of that goes in direct taxes and £3.88m. is allocated to gross savings. The residual £15.54m. is spent, thereby initiating the second round of the multiplier process. We assume that the structure of that expenditure is as indicated by the list of weights in the preceding sub-section. Some £3.75m. of the increased expenditure bypasses the interindustry structure by spilling into imports, while the direct leakages into indirect taxes and subsidies are £1.96m., and £.50m., respectively; so expenditure affecting the domestic interindustry structure increases by only £10.33m. This yields the following (second round of the multiplier) effects:

Second Round Effects:

Imports		£2.22m.
Indirect Taxes		£1.02m.
Subsidies		−£0.39m.
Wages and Salaries		£4.72m.
Profits and Depreciation		£2.76m.
	Sum	£10.33m.
Employment		2060

We next manipulated the above increase of £7.48m. in gross factor incomes to generate third and subsequent rounds of the multiplier process. It was found that all relevant variables converged to zero after eight iterations. Summing

the effects at each round gave the following estimated macroeconomic effects of the £46m. in export tourism expenditure on Irish carriers in 1976 (£ million):

Imports	*Indirect Taxes*	*Subsidies*	*Direct Taxes*
29.61	5.57	1.81	7.01

Ind. Taxes less Subs.	*Total Net Taxes*	*Wages, Salaries, Profits and Depreciation*
3.76	10.77	35.06

Adding indirect taxes less subsidies to gross factor income, we find that the increase in GNP was £38.82m. Given that carrier receipts were £46m., this implies that the multiplier applicable to such expenditure was 0.84. We also note that the estimated gain in Exchequer revenue was some £10.77m., while the net contribution to the balance of international payments on current account was £16.39m. Finally, the gain in jobs was estimated as 5620.

Total Efects of Export Tourism, 1976

We now bring together our estimates for 1976 of the effects of export tourism expenditure by tourists in Ireland (£137m.) and those of the effects of export tourism carrier receipts (£46m.); a total of £183m.:

Imports	*Gross Savings*	*Indirect Taxes Less Subsidies*
£90.77m.	£24.88m.	£38.09m.

Direct Taxes	*Total Net Tax Receipts*	*Gross Factor Income*
£30.00m.	£68.09m.	£150.22m.

Adding indirect taxes less subsidies to gross factor income gives an increase in GNP of £188.31m. Hence our upper bound estimate of the overall multiplier — the coefficient linking the change in GNP to total export tourism expenditure — is 188.31/183 = 1.03. The estimated gain in Exchequer revenue was £68.09m. and the net contribution to the balance of payments on current account is reckoned as £92.23m. Finally, the total contribution to employment was some 38,522 jobs (man-years).

We can make a partial cross-check on the accuracy of our calculations by invoking the national accounting identity

$$\Delta S - \Delta I = \Delta G - \Delta T + \Delta X - \Delta M,$$

S: Saving
I: Investment
G: Govt. Exp. on Goods and Services
T: Net Tax Receipts
X: Exports
M: Imports

Substituting our estimates into the identity gives $24.88 \equiv -68.09 + 183.00 - 90.77$, or $24.88 \equiv 24.14$, yielding a satisfactory cumulative rounding error of £0.74 million.

VI. *Conclusions*

Several of our upper bound estimates on the contribution of export tourism to the Irish economy in 1976 have been summarised in the preceding subsection. Our principal conclusions are:

(i) We cannot accept an assumption in some earlier studies that total export tourism is relatively labour intensive. Using Henry's transactions table (his Table 1) we calculate the average capital intensity in the economy as a whole as (Gross Capital Stock)/Employment = (£11,023.9m.)/1,035,000 = £10,651 in 1976. From the calculations at the two stages in Section V we estimate the capital intensity of the total export tourism sector as £(242.18 + 48.56) m./(23,171 + 2,643) = £11,263. Thus total export tourism, according to that estimate, is more capital-intensive, and less labour-intensive, than average economy-wide production. That is because, although export tourism expenditure by tourists in Ireland is of about average capital intensity, the export tourism activity of the international carriers is well above average in capital intensity. We add that our estimate of the capital intensity of total export tourism is an understatement, due to identifiable rounding errors. A major factor accounting for all high capital intensity is seasonality. The advantages of extending tourism outside peak periods is obvious.

(ii) Defining the relevant multiplier as the coefficient linking the change in GNP to total export tourism expenditure in a model in which government expenditure on goods and services and net investment are taken as exogenous, we cannot accept any estimate which places that multiplier anywhere close to 2.0. Our upper bound estimate for the total export tourism multiplier is 1.03; however, because of the assumptions of the model used (recall the discussion in Section III) and because of further assumptions in Section V, it is almost certainly less than unity. Our upper bound estimate of 1.03 is a reflection of the fact that our upper bound calculation of the multiplier applicable to export tourism expenditure by tourists in Ireland is 1.09, while the upper bound calculation applicable to carrier receipts is 0.84. If the author were asked to make a notional adjustment to the estimates from the formal model by mentally "correcting" the assumptions which biased his calculated overall multiplier upwards, he would *guess* that the "true" multiplier was in 1976, and still is, in a neighbourhood of 0.8.

(iii) A recent study by Bradley, Digby, Fitzgerald, Keegan and Kirwan (1981) estimates the export tourism multiplier at a low level of 0.5 in 1977. In that study, which is the latest available revision of the Central Bank/Department of Finance econometric model, the export tourism multiplier was defined as the change in 1977 GNP generated per £ change in exports of tourism services in 1977; carrier receipts were excluded from the calculation. However, it would seem that the multiplier estimate of those researchers is unduly low, and that an appropriate revision of the estimated marginal propensity to import applicable to export tourism, which we believe to be too high in that model, would yield an export tourism multiplier of about 0.7 in that model. Such a finding would not be inconsistent with the conclusions in (ii) above.

(iv) Two earlier studies, discussed in Section II, estimated that total export tourism earnings, at £237.9m. in 1977, generated a GNP increase in 1977 of

£385m., or about 7.1 per cent of GNP. We pointed out difficulties in the interpretation of those studies. Applying our multiplier of 1.03 (estimated from 1976 data) to receipts of £237.9m. in 1977 gives an increase in GNP of £245m., equal to about 4.6 per cent of GNP in that year; however, that is an upper bound estimate.

(v) With government expenditure on goods and services regarded as exogenous, and applying the GNP weight of 4.6 per cent in (iv) above to the figure of 1,036,000 for total employment in that year (Byrne and Palmer, 1981 p.89), would yield an estimate of total export tourism-generated full-time employment in 1977 of some 47,656. However, that would be an overstatement because our multiplier is an upper bound estimate and because the total export tourism sector is, according to our calculations, more capital-intensive than the economy-wide average.

(vi) Since the multiplier and most other calculations in this paper have yielded upper bound estimates, it follows that the calculation of the contribution of export tourism to the balance of payments on current account, reckoned at £92.23m. in 1976, is almost certainly a lower bound estimate.

(vii) The foregoing obsevations on export tourism multipliers should not be construed as implying that further growth of export tourism should not be encouraged. It is now well known that *all* Keynesian income multipliers are quite low for the small open economy of Ireland. Furthermore, the relatively sizeable gains in the balance of payments, in Exchequer receipts and in domestic savings, summarised for 1976 at the end of Section V, are important additional benefits from the export tourism sector.

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