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Input-Output Multipliers in a Small Open Economy: An Application to Tourism

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Abstract: The small open economy model implies short-run supply constraints in traded and partially traded sectors – which could significantly reduce sectoral multiplier values. As an illustration, this paper estimates income multipliers for export tourism in Ireland under different assumptions about the tradedness of supplying sectors. The limited usefulness of such multipliers to long-run policy making is also highlighted.

I INTRODUCTION

The weaknesses of tourism multiplier estimates based on input-output data are well documented (see Bryden and Faber, 1971; Bryden, 1973; Diamond, 1976 and 1977; and Archer, 1977). The purpose of this paper is to extend this discussion to incorporate a consideration of the implications of the small open economy model for these estimates.

Section II considers the issue of supply constraints in estimating multipliers and illustrates by means of a simple example the implications of the small open economy model in this respect. Section III contains various estimates of the income multiplier for export tourism in Ireland under different assumptions concerning the tradedness of, and, therefore, supply constraints in, a few sectors. Section IV concludes the paper.

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II DOMESTIC SUPPLY CONSTRAINTS

The accuracy of the findings from most multiplier studies is reduced by the absence of adequate data and by the need to make certain assumptions which are, to varying degrees, unrealistic.

Rarely is the available data base adequate for accurate estimation of tourism multipliers. This largely arises from the fact that no economic sector produces exclusively for tourism and, as such, no production sector "tourism" actually exists. The demand for tourism is a demand for a diverse "basket" of goods and services and an accurate breakdown of this demand is often not available. The tourist data used in this paper, for example, are based on only "rough estimates" as "more exact details are not available" (Henry, 1980, p. 24).

The most important theoretical issue in using input-output tables is whether average coefficients should be used or whether the coefficients should be refined to suit the requirements of each particular study. Most input-output analyses assume constant coefficients, implying equality of average and marginal values. As multiplier analysis is concerned with the *incremental* effect of additional expenditure, the assumption that marginal coefficients are equal to average coefficients is often essential, given the absence of a reliable matrix of marginal coefficients. However, this is a highly simplifying assumption, which is almost impossible to sustain in the presence of supply constraints in some sectors. In the case of tourism, a number of studies have attempted to tackle this problem, two of which will be discussed.

Diamond (1976) in a study of the Turkish economy noted that the experience there had been one of recurring bottlenecks, particularly those caused by shortages of foreign exchange needed to purchase essential inputs. To depict the Turkish situation with greater realism, and hence gain a more meaningful estimate of tourism's multiplier, he attempted to incorporate such supply constraints into the income-generating process. Using linear programming techniques, a constrained multiplier matrix was derived, with the resulting multiplier estimates substantially less than when the unconstrained matrix was used.

Bryden (1973) in a study of the Caribbean noted that the output of each supplying sector will not grow as final demand grows, especially in the case of domestic agriculture. "One rather crude way of dealing with these problems is to exclude the agricultural sector from the matrix. The inputs which would have been purchased from the domestic agriculture sector – mainly food – are then transferred to imports" (p. 158). A further adjustment to the transactions matrix to allow for increasing capacity utilisation in hotels was made. (The concept of the multiplier is only valid in a situation where resources are idle and have no opportunity cost: as soon as capacity under-

utilisation is admitted, a changing cost structure and changing coefficients have to be admitted.) Crude estimates of marginal coefficients were used for the hotel sector, the resulting multiplier estimate being considerably lower than the earlier estimates.

The adoption of the standard small open economy model has implications for input-output analysis not dissimilar to those outlined above. The model distinguishes commodities according to a criterion of tradedness. For a traded good, a world price P_w prevails and domestic output is determined by the supply conditions, of the good at this price. Any quantity can be sold at P_w on the world market. Clearly, for a traded good, if domestic suppliers can supply more of a commodity at P_w than domestic consumers demand at P_w, the difference will be exported. Conversely, if domestic demand exceeds domestic supply, the shortfall will be imported. The output of a traded good, then, is *not* a function of domestic demand. The analysis of the effect of an incremental injection of tourist demand must allow for the fact that purchases of traded goods translate, if those goods are exported, in a fall of exports and, if imported, to a rise in imports. The small open economy model thus implies an effective domestic supply constraint for traded goods.[1]

Because of the aggregation of commodities in the compilation of statistics into broad categories/sectors, it is likely that different sectors vary from having all component commodities traded, to having some traded, to having none at all traded. For this reason, it is possible to talk about traded, partially traded and non-traded *sectors*.

In the case of a traded sector, if $X = A.X + f$, where X is a vector of outputs, A an input-output average coefficients matrix and f a vector of final demand – then $\Delta X \neq A.\Delta X + \Delta f$, where Δ indicates change. For example, assume a simple two-sector economy, with an A matrix and Δf vector as follows:

$$\Delta f = \begin{bmatrix} 4 \\ 3 \end{bmatrix} \qquad A = \begin{array}{c} \text{Haircuts} \quad \text{Wheat} \\ \begin{bmatrix} 0.1 & 0.5 \\ 0.4 & 0.1 \end{bmatrix} \end{array} \begin{array}{l} \\ \text{Wheat} \\ \text{Haircuts} \end{array}$$

Taking haircuts as non-traded and wheat as fully traded, the Δf vector would translate, given the small open economy model assumptions, into an *effective* change in final demand for domestic output of 4 units of haircuts and zero units of wheat – with 4 units of imported wheat demanded. This is the vector of effective incremental demand and it will always have entries of zeros for traded sectors.

Changes in the A matrix are also necessitated by the tradedness of sectors. Because wheat is fully traded, by assumption, an extra unit, for example, of haircuts demanded will *not* call forth 0.4 units of wheat, but will lead to

1. As consumers are transported to the goods and services (and not vice-versa) in the case of tourism, no good or service consumed by tourists is, strictly speaking, non-traded.

an increase in imports of wheat of 0.4 units. Thus, to reflect this effect at the margin, the second row in the A matrix should be a row of zeros.

The analysis above has been generalised (see John and Mooney, 1982) by the introduction of a diagonal matrix G. The diagonal elements g_{ii} can be thought of as transformation coefficients, which convert the notional demands in the Δf vector and A matrix into effective production changes in the economy – $g_{ii} = 0$ for a traded sector and $g_{ii} = 1$ for a non-traded sector. It is easy to see that the adjustments to Δf and A in the example above can be obtained by premultiplying each by G. Thus, at the margin,

$$\Delta X = G.A.\Delta X + G.\Delta f \qquad \text{or} \qquad \Delta X = (I - G.A)^{-1}\ G.\Delta f.$$

Thus, in calculating the multiplier for tourism in a small open economy, the appropriate vector of final demand to use is $G.\Delta f$, and not Δf, and the appropriate coefficient matrix, even assuming equality of all *ex post* average and *ex ante* marginal coefficients, is G.A, and not A.

III AN ILLUSTRATIVE EXAMPLE

Norton (1982) has calculated a tourist multiplier for Ireland using data from Henry (1980). The same data are used here, as are the assumptions Norton made concerning the marginal rate of direct tax and the marginal propensity to save. The rather cumbersome *iterative* method he used to calculate the income multiplier for tourism was not adopted. A much simpler method is to include wages, profits and depreciation (i.e., gross income) as an extra row in the inter-industry matrix, with household consumption -- less tourist expenditure and multiplied by a factor of 0.64 to account for leakages in the form of direct taxes and savings – as an extra column (see Copeland and Henry, 1975, and Yan, 1969, for a discussion of both methods). Thus, a 20 × 20 A matrix was used and the multiplication of the Leontief inverse $(I-A)^{-1}$ by the vectors of final demand yields estimates of direct, indirect and induced effects of tourist expenditures – if it is assumed that G is a unit diagonal matrix.

This calculation yielded an income multiplier of 0.86 for export tourism, i.e., a unit increase in tourist expenditures added 0.86 units to GDP at factor cost (or, as illustrated in Norton, 1.03 units to GDP at market prices). What is of interest now is to examine the impact on this multiplier value given the varying domestic supply constraints implied by different assumptions concerning tradedness of sectors.

Table 1 outlines the impact on the tourist income multiplier value of 0.86 given various assumptions about the tradedness of sectors. The assumption that agriculture is traded is plausible and, as can be seen, it means a drop of almost one-third in the estimate for the tourism income multiplier

in Ireland. The further assumption that chemicals are traded alters the multiplier estimate very little – from 0.59 to 0.58. The assumption that food is also traded reduces the estimate to 0.51.

It is clear from the above, then, that the assumption of one traded sector, agriculture – a crucial sector in the case of tourism – reduces the tourism income multiplier for Ireland to below 0.6. In view of Norton's (1982) comments and the fact that other traded sectors are also likely to be supply constrained, at least to some extent, then 0.6 must be considered an upper bound estimate for the tourism income multiplier in Ireland. The only factor that might lead to a substantial increase in this estimate is if tax revenue and government expenditure were included in the A matrix, i.e., if government expenditure was assumed to be endogenous. This, however, would be a very debatable assumption to make in a short-run macro-economic model of the Irish economy (see Copeland and Henry, 1975).

It is of interest to note that Bradley *et al.*, (1981) have estimated, by econometric means, a GNP tourism multiplier of 0.5 for Ireland. This is not surprising given that an econometric model is likely to yield a multiplier value closer to that produced by input-output analysis using *ex post* marginal coefficients (as this paper attempts to do), rather than *ex ante* average coefficients.

The tourism income multiplier values above for Ireland are similar to those estimated for other countries/regions, at least where the methods were correctly applied (see Archer, 1977, for references and a useful discussion of the estimates). For example, a value in the range 0.3 to 0.5 was found for the south-west region of England, 0.9 for Missouri in the United States and 0.6 for Antigua in the Caribbean. For smaller regions, such as Greater Tayside and Skye in Scotland and East Anglia in England, values of around 0.3 were found. Another interesting finding in most of these studies was the variation in income multiplier by *category* of tourist, with the values for

Table 1: *Tourism multipliers under different assumptions about supply constraints*

Assumptions	*Tourism multiplier*
All sectors able to meet extra demand	0.86
(i) Agriculture with domestic supply constraint	0.59
(ii) Agriculture and chemicals with domestic supply constraints	0.58
(iii) As in (ii), but food with partial[1] domestic supply constraints	0.54
(iv) Agriculture and food with domestic supply constraints	0.51

1. g_{ii} for food equal to 0.5.

expenditure by hotel guests generally below, and that for expenditure by bed and breakfast guests above, the average.

IV CONCLUSION

Given that the small open economy model implies that effective domestic supply constraints are an important factor in some sectors of the economy, it has been illustrated above how significantly this could reduce the tourism multiplier value for Ireland. The resulting multiplier estimates are, of course, still based on rather crude methods and assumptions, but a figure in the region of 0.5 to 0.6 is likely to be fairly close to the true value for Ireland.

A general concern about the use of multiplier values for policy purposes relates to the rational expectations view that parameter values alter as a result of policy changes – although the views expressed recently by Sims and others (see Sims, 1982) would tend to modify substantially this concern. A further issue is that while the multiplier value above may appear low, it does not imply anything about the benefit from the expansion of tourism to the economy as a whole *in the long run*. As Bryden (1973) notes: "The basic Keynesian multiplier was designed for use in devising short-run policies in situations where all resources, but especially labour and the existing stock of capital, could be assumed to be generally underutilized" (p. 76). (See Copeland and Henry, 1975, for a useful discussion on the applications of input-output multipliers.) The multiplier approach, then, seeks to measure the impact of an *extra* unit of tourism expenditure, and given a certain policy objective function, to compare this with an equivalent increment in the demand for the output of other sectors (Diamond, 1976). Thus, before the role of tourism even in a *short-run* context can be assessed, multiplier values for other sectors of the economy are required.

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