

Fiscal Policy in the Irish Economy: A Leontief Approach to Some Keynesian Objectives

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Introduction

THE objective of this paper is to examine certain aspects of the effectiveness of fiscal policy in the Irish economy within the framework of a mixed Leontief Keynesian system. Primarily, we are concerned with estimating sectoral (and aggregate) impact multipliers for government expenditures.

Initially, we deal with the different methods of estimating multipliers and also the general problems associated with input-output analysis. Having alluded to the deficiencies of the conventional approaches the first section of the paper outlines the model to be used. Section II deals with measurement problems. In the third section we derive the formulations of the required multipliers and then present the results. Following this we compare the estimates with those obtained in other studies examining similar problems. In the final section we carry out some simulations dealing with the effects of tax reductions on the level of income.

The theoretical framework is that developed by Morishima & Nosse (M.N.) [1]. The fundamental data source is Henry's input-output table [2]. In a sense then this paper can be looked upon as utilising the results of existing work in the area in an attempt to examine fiscal effectiveness in the Irish economy.

The approach usually followed in dealing with fiscal policy is to use aggregate macro models, e.g. Hansen [3] or Klein [4]. The advantage in using an input-output approach is that by estimating sectoral multipliers we can assess the effectiveness of government expenditures in generating income in a more precise way. It is clearly more useful to know the degree to which expenditures affect each sector's output than just their overall effect. If there exists a significant

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difference between sectoral multipliers then merely by changing the distribution of exogenous expenditures, while maintaining their level, we can increase or decrease national income. It is not being proposed here that the generation of national income is the sole objective of government expenditures, but it is certainly relevant to know the degree to which, for example, a switch in expenditures from agriculture to education will affect income levels regardless of why such changing patterns come about.

Given then that an input-output approach is the one which will yield the required multipliers we now turn to the problems normally associated with it.

In input-output analysis consumption demand is usually treated as part of the exogenous vector of final demands. Thus this formulation does not incorporate the secondary multiplier effects of the Keynesian type which treats consumption as being endogenous. The M.N. model has the advantage of treating consumption as being endogenous while at the same time is able to estimate the disaggregated effects of fiscal measures.

In a fixed coefficients model of this type certain assumptions are implicit regarding monetary policy. Broadly it is required that sufficient cash be available as transactions balances at a higher income level (if velocity is constant), and that such changes in monetary magnitudes have no significant repercussions on the "real" variables in the system. The conditions under which this holds will depend on the preferences of the units who make up the economy, the degree of international capital mobility and the system of exchange rates [5]. These conditions are not examined here as this would constitute a full study in itself. We assume that it is possible to have the required increase in transactions balances without this having major effects on the system. This assumption is not too unreasonable in view of the fact that we are restricting this analysis to the short run effects of fiscal measures; that is we are estimating impact multipliers, or the effects which a change in Government expenditures will have on the level of income within one year.

I. Framework of Analysis

In this section an outline of the model to be used in evaluating fiscal policy is presented. The objective is to show the connection between national accounts and the input-output table. It follows the M.N. schema.

Table 1 is itself explanatory in that it is the normal representation of a Leontief system. Reading down and across the table two useful identities are established.

$$Y_j = \sum_i a_{ij} Y_j + a_{mj} Y_j + T_j - S_j + W_j + P_j \quad (1.1)$$

$$Y_i = \sum_j a_{ij} Y_j + C_i + G_i + I_i + E_i + D_i, \text{ where } [a_{ij} = Y_{ij}/Y_j] \quad (1.2)$$

The first equation states that the output of any industry plus whatever subsidies it may receive must equal the sum of its inputs plus wages and profits and also cover the taxes on its inputs. The second states that the output of any industry is

consumed by other industries, persons, the government, and the remainder will take the form of investment, exports and stock appreciation.

TABLE I

	Consuming Ind's	Persons	Public Authorities	Gross dam. capital formation	Exports	Stock appreciation	Row Sum
Producing Ind's	$Y_{11} Y_{12} \dots Y_{1n}$ $Y_{21} Y_{22} \dots Y_{2n}$	C_1 C_2	G_1 G_2	I_1 I_2	E_1 E_2	D_1 D_n	Y_1 Y_2
Imports	$Y_{n1} Y_{n2} \dots Y_{nn}$	C_n	G_n	I_n	E_n	D_n	Y_n
Taxes on Exp. (less) subsidies	$M_1 M_2 \dots M_n$ $T_1 T_2 \dots T_n$ $-S_1 -S_2 \dots -S_n$	C_m T_c $-S_c$	G_m	I_m T_I	E_m T_E $-S_E$	D_m T_D	M T S
Employment income	$W_1 W_2 \dots W_n$	—	—	—	W_E	—	W
Gross Profits & other Income	$P_1 P_2 \dots P_n$	—	P_G	—	P_E	P_D	P
Col. Sum	$Y_1 Y_2 \dots Y_n$	C	G	I	E	D	Y

Consider now equation (1.2) in vector notation.

$$Y = AY + C + G + I + E + D \tag{1.3}$$

In the straightforward Leontief model we treat C, G, I, E, D as final demand (F), Thus

$$Y = [I - A]^{-1}F. \tag{1.4}$$

So if we wish to calculate the effect on the output of sector j of a change in final demand originating in sector i we merely take the j, i element of the $[I - A]^{-1}$ matrix. However, as stated above, this approach does not account for secondary consumption-induced effects.

Thus if we could formulate C as a function of Y ; $C = KY$ then to calculate the output multipliers we would require the inverse of the $[I - A - K]$ matrix. Including the K term has the effect of making the inter-sectoral repercussions more vigorous because it takes account of the induced consumption effects. Our major objective then in this section is to outline the model to be used at the estimation stage treating the consumption term in this way.

Total tax on consumption expenditure is defined as the tax rate on each good times the amount of the good purchased

$$T_c = \xi_i t_{ci} C_i + t_{cm} C_m \tag{1.5}$$

Column $n+1$ in table 1 implies

$$C + S_c = \xi_i(1+t_{ci})C_i + (1+t_{im})C_m \quad (1.6)$$

If we assume that each person has a Cobb-Douglas type utility function then we can establish that

$$\frac{c_i}{s} = \frac{c_i}{c} = \beta_i \quad (1.7)$$

where β_i is that proportion of expenditure on good i (Appendix 1). We assume a Cobb-Douglas since this yields constant relative consumption quotas and satisfies the aggregation conditions where individuals have not all got the same income level. If we did not have a function of this type the β_i 's would not be invariant to changes in relative prices. If relative prices remain constant then a Cobb-Douglas would not be necessary and any function with the required homotheticity property would satisfy the aggregation conditions.*

In the input-output framework we must interpret "goods" in a very general manner in that such classifications will always refer to a group of goods or services. Thus the β_i 's will differ if the table is aggregated in a different way. However, it is not unreasonable to suppose that the β_i 's as defined in this exercise will be stable in the medium term, as changes in expenditure patterns develop slowly at this level of aggregation. If we sum the expenditures of both subsidised and unsubsidised persons over all persons (1.7) yields

$$C_i = \beta_i(C + S_c) \quad (1.8)$$

Using this we can rewrite (1.5) by substituting for C_i

$$T_c = t_c(\xi_i\beta_i + \beta_m)(C + S_c) \quad (1.9)$$

where t_c is the average tax rate on consumer expenditure.

$$t_c = \frac{\xi_i t_{ci} \beta_i + t_{cm} \beta_m}{\xi_i \beta_i + \beta_m} \quad (1.10)$$

The issue of determining the amount of consumption in any time period is clearly that of specifying the consumption function. This is distinct from the allocation problem outlined above. Provisionally let us state that the consumption function † for the Irish economy is of the type

$$C_t = a_1 Y_{dt} + a_2 C_{t-1} \quad (1.11)$$

This will be examined more extensively later.

*On this topic see chapter 9 in H. A. John Green, "Consumer Theory", Penguin 1971.

†Note that we do not consider consumption in disaggregated form. It may be the case that short run marginal propensities to consume differ across income groups.

We can define the average excise tax rate for any one industry as

$$t_j = \frac{\xi_i t_{ei} a_{ij} + t_e m a_{mj}}{\xi_i a_{ij} + a_{mj}} \quad (I.12)$$

where c_i is the excise tax rate on industrial outlay on good i .

Using (I.1) we can now define profits for any industry j as

$$P_j = [I - (I + t_j)(\xi_i a_{ij} + a_{mj}) - I_j] Y_j + S_j \quad (I.13)$$

where I_j is the labour input coefficient.

If we assume that a constant proportion of total profits is distributed to persons, then income from profits is

$$\pi = b \xi_j P_j. \quad (I.14)$$

Disposable income is thus defined as

$$Y_d = (I - t_w) \xi_j W_j + (I - t_\pi) \pi \quad (I.15)$$

We are now in a position to derive the equations defining the general elements of the input-output system with endogenous consumption, where the A_{ij} 's are purely in terms of constants or values not determined within the income generating process. Substituting (I.8), (I.11), (I.15), (I.14) and (I.13) into (I.2) we obtain

$$Y_i = \xi_j A_{ij} Y_j + F_i + H_i \quad (I.16)$$

where A_{ij} is the sum of the input coefficient a_{ij} and the consumption coefficient c_{ij} where

$$c_{ij} = a_1 (I - t_w) \beta_i I_j + a_1 b (I - t_\pi) \beta_i [I - (I + t_j)(\xi_i a_{ij} + a_{mj}) - I_j] \quad (I.17)$$

The A_{ij} 's are the transaction coefficients. The F_i 's are the control variables in the system and we define

$$F_i = a_1 b (I - t_\pi) \beta_i \xi_j S_j + \beta_i S_c + G_i + I_i + E_i + D_i \quad (I.18)$$

$$H_i = \beta_i a_2 C_{i-1} \quad (I.19)$$

We are now in a position to see the relevance of the above procedure. We assume the input coefficients—including the labour coefficients—are all constant, that the marginal propensity to consume a_1 and the ratio of personal income from profits to total profits b are constant, and that the consumption quotas are stable. Thus variations in the A_{ij} coefficients depend on changes in the tax rates. The tax rates on personal and industrial expenditures are constant for different levels of expenditure and thus pose no problems. However, in order to be able to treat the

taxes on employment income and on income from profits as being constant it is necessary to assume that the income tax schedule can be approximated by a linear function in the neighbourhood in which we are concerned.

By making the above assumptions equations (1.16) to (1.19) are now expressible in linear terms. Consequently, we can calculate the inverse of the $(I-A)$ matrix. The output vector is thus determined given the vector of exogenous demands.

$$\begin{bmatrix} Y_1 \\ \cdot \\ \cdot \\ \cdot \\ \cdot \\ Y_n \end{bmatrix} = \begin{bmatrix} \cdot \\ \cdot \\ \cdot \\ \cdot \\ \cdot \\ \cdot \end{bmatrix}^{-1} \begin{bmatrix} F_1 + H_1 \\ \cdot \\ \cdot \\ \cdot \\ F_n + H_n \end{bmatrix} \quad (1.20)$$

II. Estimation Procedures

The data used to compute the total transaction coefficients was obtained from Henry's input-output table for the Irish economy [2], the Annual Report of the Revenue Commissioners [6] and the National Income and Expenditure tables [7].

Henry's table is composed of 33 producing sectors. It was decided that this is probably too disaggregated for general policy purposes and the table was thus savaged into 13 sectors.* Different aggregations would yield different transaction coefficients and no attempt has been made to examine the sensitivity of the multipliers to different combinations of sectors. The resulting flows are shown in table 2.

Since most input-output tables are compiled differently it is worth pointing out some of the relevant aspects of the table used here. Firstly, tourist expenditure is included in personal expenditure, not under exports. All new construction, including housing, is treated as being exogenous. The implication of this is that an increase in income will not affect such expenditures (other than repairs) through the consumption coefficients. This will cause the multipliers to be lower than if for example housing expenditure were endogenous. There are various methods of treating imports in an input-output model. Firstly, they could all be lumped together into one category and keep them out of the transactions matrix. Alternatively, we could include non-competitive imports in the transactions matrix through the supply industries and give the competitive imports a separate entry. The table used here follows the former procedure.

*The categories are as follows: (1) Agriculture etc. 1/2/3/4; (2) Fuels & Stone 5/6; (3) Food, Drink & Tobacco 7/8; (4) Textiles and Clothing 9/10; (5) Wood & Paper 11/12; (6) Chemicals & Clay 13/14/16; (7) Metal etc. 15; (8) Electricity, Gas, Water 19; (9) Construction 17/18; (10) Trade margin 20; (11) Services 21/22/23/24/25/26/27/28/29/30/31; (12) Government 32; (13) Artificial sectors & Rent 27/33.

Numbers after each category refer to the category in the original table.

TABLE 3: *Input Coefficients, Consumption Quotas and Outlay tax rates. Ireland 1968*

	1	2	3	4	5	6	7	8	9	10	11	12	13	β_i
1	.2897		.4866	.0064	.0061						.0014	.0118		.0511
2	.0030	.0035	.0010	.0003	.0007	.0154	.1229	.0004	.0307	.0061	.0007	.0022		.0058
3	.0795		.1022	.0020	.0001	.0028					.0013	.0193		.1767
4	.0012			.1458	.0057	.0027		.0008	.0028	.0038	.0006	.0039	.0014	.0547
5		.0003	.0010	.0044	.1900	.0033		.0019	.0113	.0102	.0224	.0144	.0409	.0130
6	.0381	.0139	.0095	.0087	.0218	.0460	.0571	.0411	.0765	.0107	.0083	.0121	.0585	.0155
7	.0027	.0218	.0062	.0087	.0143	.0145	.0211	.0084	.0034	.0122	.0047	.0117		.0259
8	.0111	.0011		.0051	.0087	.0033	.0002	.0065	.0459		.0246	.0074	.1147	.0338
9		.0111							.1453		.0182	.0299	.0077	
10	.0302	.0102	.0049	.0057	.0031	.0035	.0178	.0014	.0365	.0069	.0127	.0042	.0702	.1286
11	.0261	.0160	.0061				.0107	.0052	.0223	.0988	.0970	.1645	.2515	.1497
12											.0004	.0014	.0209	.0134
13	.0002	.1572	.1187	.1343	.1422	.1761	.0677	.1049	.0627	.1101	.0287	.0278	.0063	.0706
Amj	.0297	.0397	.1290	.3260	.1940	.4520	.0580	.4900	.1350	.0160	.0650	.0380	.1470	.1162
tj	.0593	.0474	.0026	.0011	.0039	.0023	.0104	.0699	.0070	.3394	.1406	.0347	.1767	.1450
lj	.0495	.2844	.1292	.2531	.3109	.1496	.2914	.2168	.3668	.3881	.4720	.6343		

The input coefficient a_{ij} is calculated as the amount of output i purchased by industry j divided by the output of industry j . This is also calculated for imports. Labour input coefficients are obtained by dividing the wages of industry j by the total output of that industry. The consumption quotas β_i are obtained by dividing personal expenditure on good i by the total consumption from wages and dividends plus subsidies to consumers (see equation 1.8). The average excise tax rate for each industry t_j was computed by dividing the outlay tax liability of each sector by its total expenditure on inputs. The average tax rate on consumer expenditure was calculated by using (1.9) or (1.10). The resulting coefficients are shown in Table 3.

The effective tax rate on employment income t_w was obtained by dividing the tax payable under Schedule E by income in respect of employment. The effective income and surtax rate on other personal income t_π was obtained by dividing total taxes on personal income minus tax on employment income (Schedules A, B, C, D, and surtax), by other personal income. The data is from the Annual Report of the Revenue Commissioners tables 78, 80, 84. These rates were calculated for several years and the resulting estimates were as follows:

	1966/67	1967/68	1968/69	1969/70
t_w	0.094	0.098	0.101	0.108
t_π	0.126	0.122	0.127	0.122

The only remaining estimates required to calculate the matrix of transaction coefficients are the ratio of personal income from profits b , and the marginal propensity to consume a . The estimate for b was obtained by dividing the sum of self-employment income, dividends and rent (income under Schedules A, B, C, D) by total gross profits (obtained from the input-output table). An adjustment was made for the calendar year. The estimate so obtained was .49.*

The marginal propensity to consume was not estimated in this paper, but was obtained from work in progress on a consumption function in the Central Bank.† It will not be examined in detail here. The form estimated is that of the permanent income type using a Koyck transformation. The short run marginal propensity was estimated to be of the order of 0.6 and the long run 0.92.

All the values required to calculate the elements of the matrix of consumption coefficients (as defined by 1.17) are now available. This enables the A_{ij} 's to be obtained since the A matrix is the sum of the input coefficients a_{ij} and the consumption coefficients c_{ij} . The $(I-A)$ matrix and its inverse are then obtainable.

*E. W. Henry tells me that this method may be a little crude. However, I have found that by varying the ratio by 25 per cent changes the value of the aggregate multipliers by just 2-5 per cent.

†I am grateful to Tom O'Connell at this stage for supplying this preliminary estimate.

TABLE 2: Input-Output Table for Ireland 1968

	1	2	3	4	5	6	7	8	9	10	11	12	13	Total Inter	Personal Exp.	Total Exports	Government	Stocks + Apparent Surplus/Deficit	Gross Fixed K Formation	Total Output
1 Agriculture etc.	123,368		186,110	799	402						574	1,501		311,156	49,900	52,887	626	9,459	7,779	425,807
2 Fuels, etc.	1,273	122	398	39	47	2,353	5,197	65	6,190	1,090	301	917		17,992	5,696	9,953		831		34,472
3 Food, tobacco, drink	33,863		39,085	2,496	6	426					526	2,451		78,851	172,618	125,815		5,221		382,505
4 Textile & clothing	500			18,162	377	417		118	571	690	262	490	345	21,932	53,444	46,057		2,169	985	124,587
5 Wood & paper		12	374	543	12,524	496		292	2,281	1,829	9,028	1,827	9,785	38,991	12,658	10,040		2,066	2,177	65,932
6 Chemicals, clay, etc.	16,212	480	3,616	1,087	1,436	7,024	2,415	6,274	15,448	1,925	3,348	1,541	14,001	74,807	15,112	58,015		3,335	1,269	152,538
7 Metal, eng., vehicle	1,152	753	2,365	1,080	943	2,208	894	1,276	695	2,199	1,890	1,485		16,940	25,308	50				42,298
8 Elect., gas, water	4,745	37		632	572	498	7	681	9,276		9,923	935	27,441	54,748	33,028	37,030		2,137	25,717	152,660
9 Construction		381							29,326		7,330	3,805	1,845	42,687			15,623		143,582	201,892
10 Trade margin	12,880	352	1,889	706	205	533	753	214	7,378	1,248	5,138	540	16,788	48,624	125,611	100		-23	5,757	180,009
11 Services	11,126	550	2,324				451	793	4,500	17,784	39,144	20,904	60,183	157,762	146,195	54,676	39,523		5,400	403,556
12 Government											179	184	5,000	5,363	13,115	2,377	106,257			127,112
13 Artificial & rent	80	5,418	45,422	16,732	9,377	26,866	2,862	16,019	12,667	19,819	11,573	3,539	1,500	171,874	68,911	14,491		-15,248	-730	239,298
Total inter	205,200	8,105	281,583	40,676	25,889	40,821	12,579	25,732	88,332	46,584	89,216	40,122	136,888	1,041,727	721,596	411,491	162,029	9,947	185,936	2,532,726
Total imports	12,629	1,370	49,318	40,560	12,763	68,907	2,459	74,877	27,156	2,836	26,209	4,799	35,077	358,960	113,503	12,164	1,301	21,780	60,970	568,678
Indirect taxes	12,925	449	871	092	151	253	156	7,030	811	16,771	16,226	1,561	30,383	87,679	141,637	1,330		1,282	5,492	237,420
Less subsidies	-9,376		-22,062										-2,550	-33,988	-13,260	-12,262				-59,510
Wages & pensions	21,088	9,803	49,436	31,534	20,501	22,827	12,327	33,094	74,052	69,878	190,479	80,630		615,649		10,519				626,168
Profits & dep.	183,341	14,745	23,359	11,725	6,628	19,730	14,777	11,927	11,541	44,000	81,426		39,500	462,699		75,349	5,500	-16,333		527,215
Total	425,807	34,472	382,505	124,587	65,932	152,538	42,298	152,660	201,892	180,069	403,556	127,112	239,298	2,532,726	963,476	498,591	168,830	16,676	252,398	4,432,697

III. Impact Multipliers

In this section we derive impact multipliers both at the sectoral and aggregate levels. Firstly, we present definitions of the multipliers for (a) income at factor cost, (b) income at market prices and (c) personal disposable income. The estimates corresponding to these follow. We derive explicitly only the definition for income at factor cost. For the derivation of income at market prices and personal disposable income the interested reader is referred to [1].

(a) National Income at Factor Cost

Income at factor cost Y_f is defined as

$$Y_f = \zeta_j(w_j + P_j) = \zeta_j I_j Y_j + \zeta_j (\pi_j Y_j + S_j) \quad (3.1)$$

where S_j represents the subsidies to industry j . We treat these subsidies as being constant. π_j is the marginal profit coefficient of industry j and from (1.13) is defined as

$$\pi_j = [1 - (1 + t_j)(\zeta_i a_{ij} + a_{mj}) - I_j] \quad (3.2)$$

Thus

$$\Delta Y_f = \zeta_j (I_j + \pi_j) \Delta Y_j = \zeta_j f_j \Delta Y_j \quad (3.3)$$

Since the effect of an additional unit of government expenditure in industry i on the output of industry j is given by the (j,i) th element of the inverse matrix, i.e., $\Delta Y_j = L_{ji} \Delta G_i$ where $L = (I - A)^{-1}$ and G is government expenditure.

Thus

$$\Delta Y_f = \zeta_j f_j L_{ji} \Delta G_i \text{ where } f_j = (I_j + \pi_j). \quad (3.4)$$

The sectoral multiplier for an increase in government expenditure directed at sector i is given by (3.4). The aggregate multiplier is the weighted sum of these. Thus if g_i is the proportion of government expenditures on industry i the increase in income is

$$\Delta Y_f = \zeta_i (\zeta_j f_j L_{ji}) g_i \Delta G \quad (3.5)$$

This is the aggregate effect.

(b) National Income at Market Prices

Following a procedure similar to the above we obtain sectoral and aggregate multipliers.

$$\Delta Y_m = \zeta_j m_j L_{ji} \Delta G_i \quad (3.6)$$

$$\Delta Y_m = \zeta_i (\zeta_j m_j L_{ji}) g_i \Delta G \quad (3.7)$$

$$\text{where } m_j = [f_j + t_j (\zeta_i a_{ij} + a_{mj}) + a_1 t_c (\zeta_i \beta_i + \beta_m) \{ (1 - t_w) I_j + b(1 - t_n) \pi_j \}] \quad (3.8)$$

(c) *National Income as Disposable Personal Income*

Again we obtain

$$\Delta Y_d = \zeta_{jj}^d L_{ji} \Delta G_i \quad (3.9)$$

$$\Delta Y_d = \zeta_i (\zeta_j d_j L_{ji}) g_i \Delta G \quad (3.10)$$

$$\text{where } d_j = [(1-t_w)I_j + (1-t_\pi)b\pi_j]. \quad (3.11)$$

Before presenting the results we must distinguish between the impact and total effects of changes in exogenous expenditures. Earlier we stated that a consumption function of the permanent income type using a Koyck transformation is being used in this study. This yields a different marginal propensity to consume in the short run than the long run. This is due to the lagged consumption term. Here we are using the short run estimate only and this is why we refer to the multipliers as being impact multipliers. That is they estimate the effects which may be expected to work their way through the economy within one year. Using a value of the marginal propensity to consume of 0.9 increases the aggregate multipliers by about 15 per cent; but as the model is not considered very suited to longer run analyses this was not pursued.

In Table 4 is presented the estimated impact multipliers at sectoral and aggregate levels for the three definitions of national income.

TABLE 4: *Multipliers due to a unit change in government expenditure*

Industry	Y_t	Y_d	Y_m	Government expenditure weights
1 Agriculture etc.	1.00	0.56	1.13	0.004
2 Fuels etc.	1.07	0.69	1.20	—
3 Food, drink, tobacco	0.86	0.55	0.98	—
4 Textile and clothing	0.68	0.51	0.77	—
5 Wood and paper	0.85	0.63	0.95	—
6 Chemicals, clay	0.55	0.37	0.62	—
7 Metal, eng., vehicles	1.07	0.71	1.18	—
8 Elect., gas, water	0.50	0.37	0.61	—
9 Construction	0.92	0.71	1.03	0.086
10 Trade margin	1.04	0.74	1.25	—
11 Services	1.08	0.80	1.23	0.244
12 Government	1.17	0.95	1.31	0.656
13 Artificial & rent	0.69	0.46	0.90	—
<i>Aggregate Impact Multipliers</i>	1.11	0.88	1.25	

Some comments are in order. The table is interesting for two reasons. Firstly, there is a considerable variation in the sectoral multipliers and thus it is of importance where the exogenous expenditures are initiated if we are concerned with generating income. If this is our objective then sectors (1), (2), (7), (10), (11) and (12) seem to be prime candidates, though for other reasons not all sectors would be considered equally desirable.

The second interesting result is that the multipliers are of such a small magnitude—in many cases less than unity. But there is no reason why this cannot hold in an open economy. It is of interest to note also that the sectors with the smallest multipliers—(4), (6) and (8)—have a considerably higher import content than the other sectors (see row 14 of Table 3). But this is no more than we would expect.

The size of the aggregate multipliers will be disappointing to proponents of aggregate demand theory in that the magnitudes obtained are smaller than is commonly assumed. Indeed it is probably true to say that many economists consider aggregate multipliers as high as two to be realistic estimates, as this is the magnitude often obtained from oversimplified models which have as a consequence very few leakages. In the light of the small estimates found here it seems worthwhile to examine the estimates obtained in other studies which attempt to analyse the same problems as those examined in this paper.

IV. Comparison with Other Studies

Of most immediate interest are the results obtained by Morishima & Nosse using this model. They obtained aggregate impact values between 1.04 and 1.47 for the United Kingdom—using 1954 data. Given the lower propensity to import of the UK economy the results arrived at in this study are of the size which would have been expected *a priori*.

Hansen [3] estimated multipliers for seven OECD countries in the following way. Using a static aggregated model he starts from the standard national income identities

$$Y = C + I + G \qquad dY = dI + dC + dG$$

$$C = a[Y - T] + \beta \qquad \text{Thus} \qquad dC = adY - adT$$

$$T = tY + \gamma \qquad dT = tdY + Ydt$$

where the tax revenue changes are made up of both automatic and discretionary components. The above equations yield

$$dY = \frac{1}{1 - a(1 - t)} \cdot [dI + dG - aYdt]$$

We can now formulate the effect of a discretionary budget change on the level of income as the difference between the *actual* income change and the change which *would* have occurred with no government action. These discretionary effects can then be defined as: $dY = \frac{1}{1-(1-t)} \cdot dI$. Using this kind of framework Hansen builds a more realistic model incorporating direct and indirect taxes, a foreign trading sector, etc. His estimates of discretionary changes in government expenditure on purchases of good and services for the seven countries are given in Table 5.

TABLE 5: *Multipliers for discretionary changes in government expenditures on GNP at market prices*

Belgium	1.42
France	1.94
Germany	1.67
Italy	1.89
Sweden	1.44
UK	1.56
US	2.12

These are all higher than the estimates for Ireland arrived at in this paper. But given that the economies examined by Hansen have in general much lower leakages, the multiplier value of 1.25 for income at market prices estimated for Ireland is in line with what might be expected.

Goldberger [4], using the Klein-Goldberger econometric model of the US economy, estimated an impact multiplier of 1.57 where tax yields are held constant, and a value slightly lower when tax yields are made endogenous. It should be pointed out that in a model of this sort which takes explicit account of lags the "full" multiplier effects will be greater than those suggested by the impact values as it will take more than one year for the initial stimulus to work its way through the economy.

It is not being proposed in this section that strict comparisons of results for different economies is a valid procedure. Clearly we expect different magnitudes for economies with different structures, particularly when the same form of analysis is not being used for each. The main purpose in stating these results is to point out that impact multipliers can in general be expected to lie between one and two and that contrary to conventional beliefs values in the neighbourhood of one are reasonable estimates for economies with high leakages.

V. *Tax Reductions and the Level of Income*

In the previous section we were concerned only with examining the effects of a change in exogenous demand—in the form of government expenditure—on national income at sectoral and aggregate levels. However, we can equally well

affect income levels by changing the value of any of the parameters under our control—specifically the various tax rates. Consider again equations (I.17) and (I.18)

$$C_{ij} = a_1(1-t_w)\beta_i L_j + a_1 b(1-t_\pi)\beta_i [1 - (1+t_j)(\zeta_i a_{ij} + a_{mj}) - I_j] \quad (\text{I.17})$$

$$F_i = a_1 b(1-t_\pi)\beta_i \zeta_j S_j + \beta_i S_c + G_i + I_i + E_i + D_i \quad (\text{I.18})$$

and from Appendix II we have

$$\beta_i = \frac{1}{1+t_{ci}} \cdot \frac{\gamma_i}{\zeta_i \gamma_i + \gamma_m} \quad (\text{S.1})$$

It is clear that a reduction in the various tax rates will affect the level of output in the economy. Changes in any of these rates will increase the value of the consumption coefficients C_{ij} and the consequent intersectoral effects will be stronger for any given change in final demand. Further, changes in the rate of profit tax and consumption taxes will affect the equilibrium level of income since these will cause the vector of "control" variables to shift upwards.

There are various experiments we can carry out at this stage in the form of simulations. It would be interesting for example to estimate the macro effects of changes in the value added tax rates. Unfortunately our model is not sufficiently disaggregated for this purpose, and bias will be introduced if we experiment with changes in average indirect taxes. So we confine ourselves to examining the effects of a change in the rate of tax on earned income.

Assume then that the government decides to cut the standard income tax rate by 5p in the pound in an effort to increase income. We also assume that the government can maintain its level of expenditures even though it may suffer a loss in revenue, and further that individuals are not affected in their willingness to work by this tax cut. This latter assumption of an infinitely elastic supply of labour schedule is a standard one in input-output analysis and is one which we have little evidence to disprove at this stage [8], [9].

Here we are changing only the tax rate on employment income—that is in effect the rate applying to Schedule E—and *not* the general income tax rate applying to all schedules. Earlier we pointed out that the effective rate under Schedule E in 1968/69 was 10 per cent—because we must allow for exemptions, reductions, earned income allowances, etc., before arriving at taxable income. Assuming the 1968/69 rate was cut from 35p to 30p in the pound we find a new effective rate of 8.7 per cent.*

Using this figure we can calculate a new set of government expenditure multipliers. These are given in Table 6. The percentage increase in their value is in parentheses beneath each. As expected, the increase in the multiplier for disposable income exceeds the others by a considerable amount.

*This estimate is obtained by assuming deductions do not change for small changes in income.

However, we must not interpret this result to say that national income will rise by exactly those percentages.

TABLE 6: *Government expenditure multipliers with an effective income tax rate of 8.7 per cent*

	Y_f	Y_d	Y_m
Aggregate values.	1.117	0.895	1.260
Percentage change.	(+0.003)	(+0.016)	(+0.004)

The equilibrium level of income is determined by (I.20). Thus if we cut

$$Y = [I - A]^{-1}[F + H] \quad (\text{I.20})$$

the income tax rate and wish to examine the effect on income then the multiplier we must examine is that which uses weights (k_i) corresponding to the total vector of exogenous demands and not just one component of it (government expenditure). Thus a new set of weights was drawn up and a corresponding set of aggregate multipliers was obtained using the two rates. The percentage changes in these multipliers are given in Table 7.

TABLE 7: *Percentage change in multipliers for total exogenous expenditures with an effective income tax rate of 8.7 per cent*

	Y_f	Y_d	Y_m
Percentage change.	(+0.003)	(+0.014)	(+0.004)

From the table we see that disposable income will rise by about 1.4 per cent. But the effects on income at market prices and factor cost (what we might term the output effect) is less than half of one per cent. This is a rather disappointing result from the policy maker's viewpoint.

VI. Conclusion

This paper has been an attempt to examine certain aspects of fiscal policy in the Irish economy. We pointed out initially that a disaggregated model is preferable for this purpose. The framework used here was that developed by Morishima and Nosse. This has the advantage of taking account of secondary multiplier effects (via consumption) which is not always the case in input-output studies.

Firstly, we calculated a set of government expenditure impact multipliers. We found a considerable difference between the sectoral values and thus concluded

that if income generation is an objective then it is important where exogenous expenditures are initiated. The aggregate multiplier was estimated to be in the neighbourhood of unity—depending on which definition of national income is used. Having compared this with results obtained from other studies it was considered that the estimates were in line with what would be expected *a priori* given the high leakages in the economy.

The final section of the paper dealt with a hypothesised cut in the rate of tax on earned income. The output effect of this was disappointingly low.

The general conclusion then that can be drawn from this study is that fiscal policies of the kinds examined here are of limited efficiency. But given the structure of the economy this should probably not be too surprising.

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