MEASUREMENT OF SECTORAL INCOME AND EMPLOYMENT MULTIPLIERS FOR THE ECONOMY OF UTTAR PRADESH : AN APPLICATION OF SEMI-CLOSED INPUT-OUTPUT MODEL

NIRANKAR SRIVASTAV AND R. R. BARTHWAL*

(I) Introduction

The input-output (*I-O*) approach is widely used in estimating the inter sectoral linkages in an economy. This helps in identifying the key sectors of the economy. Most of the studies (See Karunaratne (1976), Bulmer (1978), Beyers (1976), Augustonovics (1972), Boucher (1976), Diamond (1974), Hewings (1974), Laumas (1975-76, May'76) and Yotopoulos & Nugent (1973)) conducted abroad and in India, Kashyap (1979), Hazari (1970), Mehta (1980), Alagh *et al.* (1980) used standard open Leontief *I-O* model for this purpose. But the open system is capable of evaluating only the direct and indirect effects on output, income and employment requirements, when final demand for sectoral output changes. In this paper, we are extending this approach to study the economy of Uttar Pradesh. We will use semi-closed input-output model for this purpose along with the open input-output model. The semi-closed *I-O* model is an improvement of the open model since this is capable of capturing the overall effect i.e., the aggregate of direct, indirect and induced effects on production, income and employment requirements for given changes in final demand of sectoral outputs. This will helps in estimating quantitatively the different types of multipliers for the various sectors of the state economy.

(II) Methodology

We can define the *I-O* model from the transactions as shown in Table 1. There are n producing sectors, sector : $n+1$ is the household sector; of is exogenous final demand (other than household consumption) : Q is the payment to exogenous factors (other than value-added i.e., direct

* I. I. T. Kanpur-208016. This paper is a part of the first author's Ph. D. research undertaken at the Indian Institute of Technology, Kanpur.

payment to labour). Assuming that each production sector has fixed coefficient technology and is subject to constant returns to scale, one can then define A (the matrix of input coefficients), v (the vector of value added coefficients), c (the vector of direct household consumption coefficient) and l (the vector of direct labour coefficients). Expressing the *I-O* model as :

Table 1

INTER-INDUSTRY TRANSACTIONS

Sector	Sector							
From/To	1	2	. . .	n	$n+1$	OF	Total
1	X_{11}	X_{12}	. . .	X_{1n}	C_1	OF_1	X_1
2	X_{21}	X_{22}	. . .	X_{2n}	C_2	OF_2	X^2
.							
.							
.							
n	X_{n1}	X_{n2}	. . .	X_{nn}	C_n		
$n+1$	V_1	V_2		V_n	C_{n+1}	OF_n	X_n
Q	Q_1	Q_2	. . .	Q_n	Q_{n+1}	OF_{n+1}	X_{n+1}
Total	X_1	X_2	. . .	X_n	C	OF	

In matrix form we can write the open Leontief *I-O* model (for exogenous household sector) as :

$$X=[I-A]^{-1}F \qquad \ldots \quad (1)$$

Where as X, F are output and Final demand vectors

$$X=\begin{bmatrix} X_1 \\ X_2 \\ \vdots \\ X_n \end{bmatrix} \qquad F=\begin{bmatrix} OF_1+C_1 \\ OF_2+C_2 \\ \vdots \\ OF_n+C_n \end{bmatrix}$$

$$A = [x_{ij}/x_j] \qquad i=1, 2.....n, j=1, 2.....n$$

$$v = [V_1/X_1, V_2/X_2.....V_n/X_n]$$

$$= [v_1, v_2, ...v_n] \qquad ... \quad (2)$$

$$l=[L_1/X_1, L_2/X_2.....L_n/X_n] = (l_1, l_2...l_n) \qquad ... \quad (3)$$

The direct and indirect changes in income due to a unit change in sectoral final demand would be given by

$$Y=v[I-A]^{-1} \qquad ... \quad (4)$$

Whereas the element of $[I-A]^{-1}$ provides the direct and indirect effects on output from the unit change in sectoral final demand. Similarly, the direct and indirect change in employment potential due to a unit change in a sectoral final demand would be given by

$$L=l[I-A]^{-1} \qquad ... \quad (5)$$

Let Type 1 multiplier=(Direct effect+Indirect effects)/direct effect
We then express

Type 1 Income multiplier $(M^I_Y)=v\ (I-A)^{-1}v^*$ ... (6)

where

$$v^* = \begin{bmatrix} 1/v_1 & \dots & 0 \\ \vdots & & \vdots \\ 0 & \dots & 1/v_n \end{bmatrix}$$

and ;

Type 1 Employment multiplier

$$M^I_L = l(I-A)^{-1}l^* \qquad ... \quad (7)$$

where

$$l^* = \begin{bmatrix} 1/l_1 & \dots & 0 \\ \vdots & & \vdots \\ 0 & \dots & 1/l_n \end{bmatrix}$$

In a semi-closed *I-O* model household sector is treated as endogenous i. e., it is taken within the technology matrix which can be expressed as :

$$A^* = \begin{bmatrix} A & C \\ v & C_n+1 \end{bmatrix} \qquad ... \quad (8)$$

Now define

$$H=[I-A^*]^{-1}$$

if elements of H are h_{ij}, then vector $(h_{n+1,j})$ represents the overall income i.e., direct, indirect and induced income effects (See Yan (1969) for detail).

Let, Type 2 multiplier = (Direct effect+Indirect effect+Induced effect)/Direct effect)

So, the Type 2 Income multiplier would now be

$$M_Y^{II} = \begin{bmatrix} h_{n+1,j} & \cdots & h_{n+1,n} \end{bmatrix} v^* \qquad \ldots \quad (9)$$

Similarly, the Type 2 Employment multiplier would be

$$M_L^{II} = l \begin{bmatrix} h_{11} & \cdots & h_{1n} \\ \vdots & & \vdots \\ h_{n1} & \cdots & h_{nn} \end{bmatrix} l^* \qquad \ldots \quad (10)$$

(III) Theoretical Aspects of the Direct, Indirect and Induced Effects

Initially, the income and employment potentials generated in producing one unit of final demand of a particular sector could be express in terms of sectoral value added and labour coefficients, respectively. But, the repurcussions of the expansion of any sector's economic activity due to a change in final demand of it's output is not confined to the direct effect alone. Due to intersectoral linkages, some indirect effect would also be felt by the sectors which are supplying inputs directly or indirectly to that particular sector. The chain process will go on in backward direction till it peters out. The degree of direct and indirect effect depends upon the nature of the sector and the extent to which it is integrated with other sectors.

When output changes due to a change in final demand, value added by each sector also changes. This leads to a change in sectoral production and personal income in the second round. Since consumption is closely related to personal income, so the changes in personal income will induce changes in consumption. This process generates another round of repurcussions on output, personal income and consumption. To evaluate the equilibrium output, income and employment levels, the semi closed *I-O* model is used, in which household consumption is not exogenous but simultaneously determined with

the other supply variables. This gives us not only the output required to meet a given final demand but also the outputs required to meet the change in final demand which is induced by the changes in production and income. Thus, the semiclosed system evaluates the overall effect, i.e., direct, indirect and induced effects on production, income and employment requirements, where as open *I-O* system estimates only a part of overall effect, i.e., direct and indirect effects only.

(IV) Data Sources

The input-output table of the state economy has been used in this study. There are sixty four various economic sectors in the table, which has been prepared at 1970-71 prices, by the State Planning Institute (1978), Lucknow. The labour coefficients used in this study are based on the estimates of Srivastava *et. al* (1978). A list of sixty four sectors with their code numbers is given in Appendix.

(V) The Empirical Results

Sectoral income effects and multipliers are shown in Table 2. The numbers in bracket are the sectoral ranks. The highest multiplier value among the sixty four sectors receives rank 1 and so on. As mentioned earlier, direct income effect reflects the contribution to income (value-added) per unit of output. There exists a considerable degree of variations in the range of direct income changes (see column 1, of the table 2). By-products of Agriculture (28)[1], other Agricultural Products (35), Fruit-Vegetable & Spices (36), Fisheries (38) and Forestry (39), sectors are showing higher direct income changes, on the other hand there are sectors like Grain-mill Products (16), Vanaspati (21), Drugs & Pharmaceuticals (53), Soaps & Glycerine (54) and Petroleum Products (63) showing lower magnitudes of direct income changes. Sectors which are showing larger direct income effect (higher value added coefficients) are usually primary sectors, which have relatively higher demand for labour and low use of intermediate inputs. In thirty seven sectors out of sixty four, direct income effect is larger than the indirect income effect. It is interesting to note that induced effects are generally larger in magnitude than corresponding direct and indirect income effects (see column 6 Table 2). The size of the original direct effect or the proportion of sectoral cost devoted to wages. The significantly large induced income effect due

[1] Figures in brackets are the sector's code number assigned in Table 1 in Appendix.

Table 2

INCOME MULTIPLIERS : U. P. ECONOMY, 1970-71

Sector No.	Direct Income change	Direct & Indirect Income change	Indirect Income change	Type I Income multiplier	Direct & Indirect Induced Income change	Induced Income change	Indirect & Induces Income change	Type II Income multipliers
	1	2	3	4	5	6	7	8
(a)			(b)	(i) (c) & (d)	(e)	(f)	(g	(h) (i) (c)
1	0·3318	0·6239	0·2921	1·8802(27)	1·4209	0·7970	1·0891	4·2820(27)
2	0·1688	0·4180	0·2492	2·4761(14)	0·9519	0·5339	0·7831	5·6383(14)
3	0·4523	0·6188	0·1665	1·3681(42)	1·4092	0·7905	0·9569	3·1157(42)
4	0·2661	0·5023	0·2362	1·8878(25)	1·1440	0·6417	0·8779	4.2993(25)
5	0·2920	0·5146	0·2226	1·7623(31)	1·1720	0·6574	0·8800	4·0137(31)
6	0·2380	0·4421	0·2041	1·8574(28)	1·0068	0·5647	0·7688	4·2304(28)
7	0·2444	0·4833	0·2389	1·9774(24)	1·006	0·6173	0·8562	4·5035(24)
8	0·4176	0·6027	0·1852	1·4434(37)	1·3728	0·7701	0·9552	3·2873(37)
9	0·7841	0·8537	0.0696	1·0997(54)	1·9442	1·0905	1·1601	2·4795(54)
10	0·3669	0·8069	0·4400	2·1992(17)	1·8377	1·0308	1·4708	5·0087(17)
11	0·3644	0.5287	0·1643	1·4510(36)	1·2042	0·6754	0·8398	3·3047(36)
12	0·3894	0·8260	0·4366	2·1212(21)	1·8811	1·0552	1·4917	4·8309(21)
13	0·4786	0·7065	0·2279	1·4761(33)	1·6089	0·9025	1 1304	3·3618(33)
14	0·1293	0·6861	0·5568	5·3061(06)	1·5625	0·8764	1 4332	12·0845(6)

1	2	3	4	5	6	7	8
(a)		(b)	(i) (c) & (d)	(e)	(f)	(g)	(h) (i) (c)
15	—	0·4494	0·4494	— (61)	1·0235	0·5741	1·0235	— (61)
16	0·0834	0·8320	0·7486	9·9760(02)	1·8949	1·0628	1·8115	22·7201(2)
17	0·1212	0·6268	0·5056	5·1715(07)	1·4275	0·8007	1·3063	11·7780(7)
18	0·2678	0·6417	0·3739	2·3961(15)	1·4614	0·8197	1·1936	5·4571(15)
19	0·1668	0·7852	0·6185	4·7079(08)	1·7884	1·0032	1·6216	10·7221(8)
20	0·2008	0·9161	0·7152	4·5611(09)	2·0864	1·1703	1·8855	10·3877(9)
21	0·0129	0·7763	0·7634	60·1800(01)	1·7680	0·9917	1·7551	137·0583(1)
22	0·1459	0·9151	0·7692	6·2736(05)	2·0842	1·1691	1·9383	14·2·80(5)
23	0·4180	0·5869	0·1685	1·4028(41)	1·3367	0·7498	0·9183	3·1948(41)
24	0·3127	0·56197	0·2493	1·7971(29)	1·2799	0·7 79	0·9672	4·0930(29)
25	0·3477	0·6528	0·3080	1·8860(26)	1·4935	0·8377	1·1458	4·2953(26)
26	0·7359	0·8967	0·1608	1·2186(43)	0·2042	1·1455	1·3064	2·7752(43)
27	0·7519	0·9145	0·1626	1·2162(44)	2·0826	1·1682	1·3308	2·7699(44)
28	0·9979	0·9990	0·0015	1·0015(59)	2·2751(1)	1·2761	1·2778	2·2808(59)
29	0·8065	0·9229	0·1164	1·1443(49)	2·1019	1·1790	1·2955	2·6063(49)
30	0·8356	0 9206	0·1150	1·1376(50)	2·1649	1·2143	1·3293	2·5908(50)
31	0·7938	0·9187	0·1249	1·1573(47)	2·0922	1·1173	1 2984	2·6357(47)
32	0·8522	0·9487	0·0965	1·1133(52)	2·1607	1·2120	1·3085	2·5355(52)
33	0·8163	0·9190	0.1027	1·1258(51)	2·0999	1 1740	1·2767	2·5640(51)
34	0·8142	0·9685	0·1543	1·1895(45)	2·2058(3)	1·2373	1·3916	2·7091(45)
35	0·8906	0·9586	0·0679	1·0763(55)	2·1831	1·2245	1·2925	2·4513(55)
36	0 9424	0·9765	0·0341	1·0362(57)	2·2239(4)	1·2474	1·2815	2·3599(57)

1	2	3	4	5	6	7	8
(*a*)		(*b*)	(*i*) (*c*) & (*a*)	(*e*)	(*f*)	(*g*)	(*h*) (*i*) (*c*)
37	0·6937	0·9788	0·2851	1·4110(39)	2·2292(3)	1·2504	1·5355	3·2135(39)
38	0·9077	0·9685	0·0608	1·0669(56)	2·2057	1·2372	1·2980	2·4300(56)
39	9·9499	2·9828	0·0330	1·0347(58)	2·2385(2)	1·2556	1·2886	2·3565(58)
40	0·2880	0·7376	0·4496	2·5614(13)	1·6799	0·9423	1·3919	5·8335(13)
41	0·3462	0·7576	0·4114	2·1883(18)	1·7254	0·9678	1·3792	4·9839(18)
42	0·3294	0·6588	0·3294	2·0001(23)	1·5005	0·8416	1·1711	4·5553(23)
43	0·5294	0.7753	0.24589	1.4645(34)	1.7657	0.9904	1.2363	3.3353(34)
44	0.1884	0.3355	0.1471	1.7807(30)	0.7640	0.4286	0.5756	4.0554(30)
45	—	0.7023	0.7033	— (61)	1.5996	0.8972	1.5996	—(61)
46	—	—	—	— (61)	—	—	—	— (6)
47	0.1859	0.6153	0.4294	3.3100(10)	1.4014	0·7861	1.2155	7.5385(10)
48	0.2467	0.5187	0.2720	2.1026(22)	1·1814	0.6626	0·9347	4.7887(22)
49	0.4145	0.6026	0.1880	1.4538(35)	1.3724	0.7680	0.9579	3.3109(35)
50	0.2181	0.6005	0.3824	2.7533(12)	1.3676	0.7671	1.1495	6.2706(12)
51	0.2834	0.4002	0.1168	1.4120(38)	0.9114	0.5112	0.6280	3.2159(38)
52	0.1559	0.4913	0.3354	3.1504(11)	1.1190	0.6277	0.9630	7.1750(11)
53	0.0636	0.4204	0·3568	6.6108(04)	0.9575	0.5371	0.8939	15.0559(4)
54	0.0875	0.7170	0.6295	8.1963(03)	1.6330	0.9159	1.5455	18.6668(3)
55	0.2803	0.6121	0.3318	0.2184(19)	1.3941	0.7819	1.1138	4.9737(19)
56	0.3410	0,3792	0.0383	1.1122(53)	0.8637	0.4845	0.5227	2.53306(53)
57	—	—	—	— (61)	—	—	—	—(61)
58	0.6279	0.7197	0.0918	1.1462(48)	1.6392	0.9194	1.0113	2.6105(48)
59	0.6745	0.7896	0.1151	1.1707(46)	1.7983	1.0087	1.1238	2.6662(46)

1	2	3	4	5	6	7	8
(a)		(b)	(c) (i) (d)		(f)	(g)	(h) (i) (c)
60	0.2844	0.4424	0.1580	1.5555(32)	1.0075	0.5651	0.7231	3.5425(32)
61	0.5789	0.8131	0.2342	1.4046(40)	1.8519	1.0388	1.2730	3.1991(40)
62	0.2182	0.4863	0.2681	2.2284(16)	1.1075	0.6212	0.8893	5.0753(16)
63	0.0355	0.0355	—	1.0000(60)	0.0808	0.0453	0.0453	2.2775(60)
64	0.3098	0.6600	0.3502	2.1304(20)	1.5031	0.8431	1.1933	4.852(20)

Note : (*a*) Sector no. as assigned in appendix Table 1.

(*b*) column (2) less column (1). (*c*) per Re. of direct income change (*d*) column (2) divided by column (1). (*f*) column (5) less column (2) (*g*) column (3) plus column (6). (*h*) column (5) divided by column (2) Bracket numbers are rankings with in columns.

Sources: Srivastav N. (1985).

to given change in final demand itself enhances the importance of overall income effect derived from the semi-closed *I-O* model. In terms of overall income effect due to a unit change in final demand (column 5, Table 2), By-products of Agriculture (28), Tobacco (34), Fruit-Vegetable & Spices (36), Animal Husbandry (37) and Forestry (39) sectors occupy the higher ranks. On the other hand, Electrical Equipments (2), Paints & Varnishes (50), Drugs and Pharmaceuticals (53), Power (56) and Petroleum Products (63) show very low overall income effects.

The Type 1 and Type 2 income multiplires for the sectors with their ranks are shown respectively in the column 4 & column 8 of Table 2. Top five ranked sectors showing higher Type 1 & Type 2 multipliers are : Vanaspati (21), Grain-mill products (16), Soaps & Glycerine (54), Drugs & Pharmaceuticals (53) and Oils (22) in the state economy. As mentioned earlier, Type 1 multiplier for a sector is associated with direct and indirect generation of income when there is one Rupee change in households payments as a result of a change in final demand for the output of the sector, whereas Type 2 multiplier includes induced effect along with direct and indirect effects. The larger direct income change of any sector shows higher share of wages in inputs, i.e. labour intensiveness of that sector, whereas smaller direct income change of a sector shows larger amount of intermediate inputs i.e., capital intensiveness of the sector. For example, Agricultural by-product sector (28) is quite labour intensive, while Grain-mill Products Sector (16) is quite capital intensive (see entries in column 1 Table 2) relatively. It is clear from Table 2 that capital intensive sectors are having higher Type 1 multipliers than labour intensive sectors. The reason for this is fairly clear. A sector which uses a great deal of labour but not many other intermediate inputs from the economy will probably have fewer interactions with other sectors than the one which utilizes a considerable amount of intermediate inputs. Hence, when a sector which uses a great deal of intermediate inputs expands it's output the 'chain reaction' of which will spread through out the many other sectors of the economy. Thus, high Type 1 multipliers are associated with sectors which show high indirect income effects relative to direct effects and high Type 2 multiplier with the sectors having high indirect and induced effects relative to direct effects.

This is also found in the case of the economy of Uttar-Pradesh that there is a tendency for a negative relationship between the size of the overall income effect and the magnitudes of Type 1 & Type 2 multiplier. For example, By Products of Agriculture (28), Forestry (39),

Animal husbandry (37), Tobacco (34) and Fruit-Vegetable & Spices (36) are the sectors which show higher ranks corresponding to the size of the over all income effect, but these sectors are showing very low Type 1 & Type 2 multipliers. Similarly the sectors which are showing higher ranks due to high Type 1 & Type 2 multipliers are having very low magnitudes of overall income effects (compare column 5 with column 4 & 8 of Table 2). This is so because sectors which are having larger magnitudes of overall income effects as a result of larger direct income effect, with a relatively small indirect effect, hence exhibiting fairly small multiplier. Considering the overall income effect the top five sectors in the state economy are ; By-Products of Agriculture (8), Forestry (39), Animal Husbandry (37), Fruit-Vegetable & Spices (36) and Tobacco (34). On the other hand, the sectors Vanaspati (21), Grain-mill products (16), Soaps & Glycerine (54), Drugs and Pharmaceuticals (53) and Oils (22) are exhibiting highest income multiplier in the state economy.

Table 3 show the direct, indirect and induced employment effects and corresponding Type 1 & Type 2 multipliers for the various sectors of the state economy. We have defined Labour coefficients as the number of workers per Rs. one lakh of output for each sector (column 1, Table 3) which are recorded as the direct employment change. A significant variation exists in the magnitudes of the direct employment coefficients. By-products of Agriculture (28), Cotton and Cotton seeds (31), Cereals (26), Forestry (39) and Sugar cane (30) are among few sectors which are showing higher direct employment changes. These sectors are usually primary sectors, which have relatively higher demand for labour. On the other hand, there are the sectors Vanaspati (21), Water supply (58), Tea & Coffee processing (17), Non ferrous metals (07), Nitrogeneous fertilizers (44) and misc. Chemicals (5) showing lower magnitudes of direct employment effects. Obviously, these sectors are highly capital intensive, hence least employment generating. There are thirty sectors out of sixty four in the state economy which are showing larger direct than indirect employment effect. As in the case of income effects, it is also seen here that induced employment effects are significantly high. This suggests that for designing employment policies the induced employment effects should be considered along with the direct and indirect employment effects.

The first five ranked sectors which are having higher overall employment effects are : other Agricultural products (35), By-products of agriculture (28), Cotton & Cotton seeds (31), Cereals (26), Forestry

Table 3

EMPLOYMENT MULTIPLIERS: U. P. ECONOMY 1970-71

Sector No.	Direct Employment change	Direct & Indirect Employment change	Indirect Employment change	Type I Employment multiplier	Direct Indirect & Induce Employment change	Induced Employment change	Indirect & induced Employment change	Type II Employment multiplier
	1	2	3	4	5	6	7	8
	(*a*)		(*b*)	(*c*) (*i*) (*d*)		(*f*)	(*g*)	(*h*) (*i*) (*c*)
1	5.2577	13.2602	8.0025	2.5220 (24)	43.0561	29.7959	3.7798	8.1891(22)
2	3.6789	9.3885	5.5096	2.4204(27)	29.3492	19.9606	25.4703	7.5664(24)
3	9.9301	14.1233	4.1932	1.4223(42)	43.6737	29.5504	33.7436	4.3181(39)
4	5.8787	10.7002	4.8215	1.8202(34)	34.6899	23.9897	28.8112	5.9009(34)
5	10.3942	13.5100	3.1158	1.2998(45)	38.0858	24.5759	27.6917	3.66415(47)
6	3.9783	8.0239	4.0457	2 0169(31)	29.1362	21.1122	25.1579	7.3238(28)
7	0.9911	4.1205	3.1294	4.1575(14)	27.2000	23.0795	26.2090	27.4443(7)
8	2.6462	6.2447	3.5985	2.3598(28)	35.0307	28.7860	32.3845	13.2381(17)
9	10.1902	11.8283	1.6382	1.1608(53)	52.5965	40.7681	42.4063	5.1615(38)
10	10.1170	21.9987	11.8817	2.1744(30)	60.5337	38.5350	50.4167	5.9834(33)
11	19.3017	24.2386	4.9369	1.2558(48)	49.4899	25.2514	30.1883	2.5640(54)
12	19.0506	35.9973	16.9467	1.8896(33)	75.4434	39.4461	56.3928	3.9602(44)
13	16 9705	20.9070	3.9365	1.2316(50)	54.6459	33.7388	37.6754	3.2200(49)
14	1.9683	15.3967	13.4284	7.8223(7)	48.1616	32.7648	46.1933	24.4686(8)

	1	2	3	4	5	6	7	8
	(*a*)		(*b*)	(*c*) (*i*) (*d*)		(*f*)	(*g*)	(*h*) (*i*) (*c*)
15	5.5906	18.4539	12.8633	3.3008(20)	39.9163	21.4623	34.3257	7.1398(29)
16	2.1979	36.1955	33.9976	16.4682(3)	75.9290	39.7334	73.7311	34.5461(5)
17	0.7939	31.0138	30.2199	39.065(2)	60.9470	29.9332	60.1531	76.7692(3)
18	9.4220	22.8142	13.3922	2.4213(26)	53.4588	30.8445	44.0368	5.6038(36)
19	3.1334	28.5853	25.4519	9.1227(5)	66.0873	37.5020	62.9593	21.0912(12)
20	9.3193	8.6871	29.3678	4.1512(15)	82.4363	93.7491	73.1169	8.8457(23)
21	0.2780	20.5893	20.3113	74.0624(1)	57.6637	37.0744	57.3857	207.4237(1)
22	1.6894	24.1718	22.4824	14.3079(4)	67.8754	43.7036	66.1860	40.1772(4)
23	2.4884	8.8282	6.3398	3.5477(17)	36.8575	28.0292	34.3691	14.8117(15)
24	1.2106	6.6949	5.4843	5.5302(10)	33.5326	26.8367	32.3220	27.6991(6)
25	14.3060	21.0307	6.7247	1.4706(40)	52.3478	31.3171	38.0418	3.6591(48)
26	39.9483	46.6244	6.6761	1.1671(52)	89.4494[4]	42.8249	49.5011	2.2391(59)
27	22.8146	28.7934	5.9788	1·2620(47)	72.4654	43.6719	49.6508	3.1764(50)
28	50.00	50.0318	0.03183	1.0006(61)	97.7390[2]	47.7072	47.7390	31.9547(57)
29	22.4960	26.6868	4.3708	1.1942(51)	70.9437	44.0769	48.4477	3.1536(51)
30	35.0583	39.1884	4.1357	1.1180(55)	84.5795	45.3955	49.5312	2.4132(55)
31	45.5444	50.5281	4.9837	1.1094(56)	94.4001[3]	43.8720	48.8557	2.0727(58)
32	29.5326	32.7250	3.1924	1.1080(57)	78.0336	45.3085	48.5010	2.6422(53)
33	10.2558	14.2323	3.9765	1.3877(43)	58.1200	43.8876	47.8642	5.6670(37)
34	7.1859	9.2574	2.0715	1.2882(46)	55.5117	46.2543	48.3258	7.7251(23)
35	54.6756	57.6319	2.9563	1.0540(59)	103.4100[1]	45.7780	48.7344	1.8913(60)
36	5.5700	16.5219	0.9519	1.0611(58)	63.1560	46.6341	47.5860	4.0562(42)

	1	2	3	4	5	6	7	8
	(a)		(b)	(c) (i) (d)		(f)	(g)	(h) (i) (c)
37	7 3128	20.6652	13.3524	2.8258(21)	67.4102	46 6749	60.6974	9.2181(20)
38	15.3235	17.5409	2.2184	1.1447(54)	63.7929	46.2519	48.4704	4.1633(40)
39	38.2184	39.4225	1.2041	1.0315(60)	86.3623[6]	46 9398	48.1439	2.2597(56)
40	11.4765	37.5771	20.1026	2.7519(22)	66.8024	35.2253	55.3279	5.8218(35)
41	7.9695	18.2531	10.2836	2.2903(29)	54.4339	36.1808	46.4644	6.8203(30)
42	25.3139	42.0688	16.7549	1.6618(37)	73 5332	31.4644	48.2193	2.9048(52)
43	15.8201	23.4039	7.5838	1.4793(39)	60.4292	37.0252	44.6091	3.8197(46)
44	0.9170	5.5089	4.4919	5.8985(8)	21.4303	16.0214	20.5133	23.3700(10)
45	3.6425	18.5621	14.9196	5.0959(11)	52.1040	33.5419	48.4615	14.3044(16)
46	—	—	—	—(62)	—	—	—	—(61)
47	7.4707	26.2740	18.8033	3.5169(18)	55.6603	29.3863	48.1896	7.5404(27)
48	6.3659	15.8307	9.4648	2.4867(29)	40.6028	24.7721	34.2369	6.3781(31)
49	12.0294	17.8771	5.8377	1.4848(38)	46.6546	28.7775	34.6152	3.8751(45)
50	2.7625	73.2380	10.4755	4.7920(12)	41.9157	28.6777	39.1532	15.1731(14)
51	0.9748	3.7730	2.7982	3.8706(16)	22.8837	19.1106	21.9089	23,4753(9)
52	1.7940	9.9681	8.1841	5.5563(9)	33.4328	23.4646	31.6388	18.6359(13)
53	4.8002	15.9807	11.1805	3.3291(19)	36.0597	20.0790	31.2595	7.5121(25)
54	2.3221	18.8547	16.5326	8.1196(6)	53.0927	34.2419	50.7746	22.8658(11)
55	3.4790	14.7310	11.2570	4.2342(13)	43.9649	29.2338	40.4859	12.6372(18)
56	1.7786	2.5750	0.7964	1.4477(41)	20.6859	18.1109	18.9073	11.6304(19)
57	—	—	—	— (62)	—	—	—	—(61)
58	0.4604	1.1797	0.7193	2.5623(23)	35.5520	34.3723	35.0916	77.2200(2)
59	13.4422	16.6307	3.1885	1.2372(49)	54.3402	37.7055	40 8980	4.0425(41)

	1	2	3	4	5	6	7	8
(*a*)			(*b*)	(*c*) (*i*) (*d*)		(*f*)	(*g*)	(*h*) (*i*) (*c*)
60	4.8909	9.3929	4.4520	1.9205(32)	30 5192	21.1262	25.6283	6.2400(32)
61	6.7053	11.5801	4.8756	1.7272(35)	50.4135	38.8334	43.7090	7.5193(26)
62	24.3642	31.6735	7.3039	1.3000(44)	54.8965	23.2229	30.5323	2.2531(57)
63	—	—	—	— (62)	—	—	—	— (61)
64	93.9464	24.0835	10.1371	1.7268(36)	55.6027	31.5191	41.6563	3.9868(43)

(*b*) Column (2) less column (1). (*c*) per Re. of direct Employment change (*d*) column (2) divided by column (1). (*f*) column (5) less column (2) (*g*) column (3) plus column (6). (*h*) column (5) divided by column (1). (*i*) Brackets numbers are rankings with in columns. (*a*) sector no. as assigned in appendix Table 1.

Sources : Srivastav, N. (1985).

(39) (See column 5, Table 3). These sectors must give priority in the state economy in order to have highest overall employment effect. On the other hand, Power (56), Nitrogeneous fertilizer (44), Synthetic rubber (51), Non-ferrous metals (07). Iron & Steel (06) and electrical equipments (02) are the sectors which are having least overall employment effets.

As we have seen eartier, the Type 1 & Type 2 employment multipliers represent respectively the ratio of direct and indirect, and overall changes in employment changes to direct employment changes for a sector. These are shown with ranking orders in Table 3 column 4 & 8 respectively for the sixty four sectors of the state economy. This reveals that Grain Mill products, Tea & Coffee processing, Vanaspati, oils and Sugar are among the few sectors which are showing higher Type 1 & Type 2 employment multipliers in the state economy.

Conclusions

Income and employment multipliers have been computed for sixty four economic sectors of Uttar-Pradesh within the inter-industry framework. The open and semiclosed Leontief's input-output models have been used for this purpose. Apart from direct and indirect effects on income & employment as a result of a change in final demand for sectoral output we also take into account the sectoral induced effect of a change in household income. Our results have shown that the induced effect is quite significant & hence, important in the state economy. Such effect, should not be ignored while selecting the key sectors for development.

The sectors exhibiting high income and employment multipliers include Dairy products, Grain-mill products, Tea & Coffee processing, Vanaspati, Oils and Soaps & Glycerine. The sectors which are showing lower rankings for both multipliers include Potassic-fertilizer, Coals and and Coke and Petroleum products. Such type of classification based on sectoral rankings may be useful in development planning of the state economy.

Appendix

Table 1

THE LIST OF SIXTYFOUR SECTORS OF THE INPUT-OUTPUT TABLE OF THE STATE ECONOMY : 1970-71

Sector No.	Name of the Sector	Sector No.	Name of the Sector
1.	Construction	33.	Fibers
2.	Electrical equipment	34.	Tobacco
3.	Transport equipments	35.	Other agri. products
4.	Non-electrical equipments	36.	Fruit vegetable and spices
5.	Metal products	37.	Animal husbandry
6.	Iron and steel	38.	Fisheries
7.	Nonferrous metals	39.	Foresty
8.	Cement	40.	Cotton textiles
9.	Mining	41.	Woollen textiles
10.	Leather and leather products	42.	Silk industry
11.	Glass and glass products	43.	Other textiles
12.	Wooden products	44.	Nitrogeneous fertilizer
13.	Nonmetallic products	45.	Phosphatic fertilizer
14.	Dairy products	46.	Potassic fertilizer
15.	Canning and preservation	47.	Rubber products
16.	Grain mill products	48.	Paper and paper products
17.	Tea and coffee processing	49.	Printing and publishing
18.	Misc. food preservation	50.	Paints and vanishes
19.	Sugar	51.	Synthetic rubber
20.	Gur and Khandsari	52.	Insecticides and pesticides
21.	Vanaspati	53.	Drugs and pharmaceuticals
22.	Oils	54.	Soaps and glycerine
23.	Beverages industries	55.	Misc. chemicals
24.	Cigar and Cigarattes	56.	Power
25.	Other tobacco manufacturers	57.	Coal and coke
		58.	Water supply
26.	Cereals	59.	Railway transport
27.	Pulses	60.	Motor and other transport
28.	By products of agriculture	61.	Trades and commerce
29.	Oils seeds	62.	Services
30.	Sugar cane	63.	Petroleum products
31.	Cotton and cotton seeds	64.	Wrapping, packing, filling and plastic materials
32.	Potato		

References

1. Alagh, Y. K., Bhalla, G. S. and Kashyap, S. P. (1980), Structural Analysis of Gujrat, Punjab and Haryana Economies : An I—O Study (Allied Publishers, New Delhi).
2. Augustinovics, M. (1972), 'Methods of international and inter-temporal comparision of structure', in Carter, A. P. and Broody, A. (ed.), Contributions to Input-Output Analysis (Amsterdam : North Holland).
3. Beyers, W. B. (1976), 'Empirical Identification of Key-sectors : Some Further Evidence', Environment & Planning, Vol. 8.
4. Boucher, M. (1976), 'Some further Results on Linkage' Hypothesis', *Quaterly Journal of Economics*, Vol. 90, No. 2.
5. Bulmer, T. V. (1978), 'Trade, Structure and Linkages in Cost Rica : An I—O approach', *Journal of Development Economics*, 5, pp. 73-86.
6. Diamond, J. (1974), 'The Analysis of Structural Constraints in Developing Economies : A Case Study', *Oxford Bulletia of Economics and Statistics*, Vol. 36.
7. Hazari, B. R. (1970), 'Empirical Identification of Key sectors in the Indian Economy', *Review of Economics and Statistics*, Vol. 52, No. 3, August.
8. Hewings, G. J. D. (1970), 'The Effect of Aggregation on Empirical Identification of Key sectors in a Regional Economy : A partial Evaluation of Alternative Techniques', *Environment and Planning*, Vol. 6.
9. Karunaratna, N.D. (1976), 'Quantification of Sectoral Development Prospects in Papua New Guinea Using Tinbergen & Rasmussan Criteria', *Developing economies*, Vol. 14, No. 3, September.
10. Kashyap, S. P. (1979), Regional Planning in a consistency frame work : A study of Gujrat, SPISR, Ahmedabad, pp. 44-68.
11. Laumas, P. S. (1975), 'Key Sectors in some under developed countries : Kyklos, Vol. 28, No. 1.
12. Laumas, P. S., (1976), 'The weighting problem in testing the linkage Hypothesis', *Quaterly Journal of Economics*, Vol. 90, No. 2, May.
13. Laumas, P. S. (1976), 'Key Sectors in Some underdeveloped countries : A reply', Kyklos, Vol. 29, No. 4.

14. Mehta, B. C. (1980), Structure of Rajasthan Economy (Raj Book & Subscriber, Jaipur).

15. Srivastav, N. (1985), Sectoral Interdependency and Effects of Income Redistribution in the economy of Uttar Pradesh : A Study in I-O Framework, Ph. D. Thesis submitted to I. I. T. Kanpur, Degree awarded.

16. Srivastava, S. C. & Lal, B. (1978), Computation of Labour Coefficients for 64 sectors of the I-O table 1970-71, PPD, SPI, Lucknow.

17. State Planning Institute (1975), Structure of the economy of Uttar Pradesh, PPD, SPI, Govt, of U. P., Lucknow.

18. Yan, C. S. (1969), Introduction to Input-Output Economics (Holt, Rinehar and Winston, New York).

19. Yo to Poulos, R. A. and Nugent, J. B. (1973), 'A Balanced Growth Version of the Linkage Hypothesis', *The Quarterly Journal of Economics*, Vol. 87, No. 2, May, pp. 157-175.