Chapter – 5

Linkages Between Agricultural and Food Processing Sector of India

5.1 Introduction

The inter-dependency between agricultural and non-agricultural sectors has been comprehensively discussed in the literature (Rangarajan, 1982). Agriculture provides food, raw materials to manufacturing sector, and export earnings for the growth of non-agricultural sectors. Hence, it can be said a Forward Linkages (FL) of the agriculture sector with non agriculture sectors. Similarly, non-agriculture sector supports agriculture sectors by supplying inputs such as fertilizers, insecticides, irrigation facilities, infrastructure and markets for agricultural production. This can be said a Backward Linkage (BL) of the agricultural sector with non agriculture sector. Hence, shortage in production of one sector becomes the restrictive factor for the growth of the other sectors. As a result, growth rate of overall economy will be affected. Under such circumstances, it is essential to study the production and consumption linkages of among the sectors to maintain a balance and desire growth rate.[1]

5.2 Sectoral Linkages

Linkages between two sectors or more than two sectors can be categorized into two groups based on the direction of interdependence. One is the BL, which identifies how a sector depends

[1] K.L. Sharma, Department of Economics, University of the South Pacific Suva, Fiji Islands (1975)

on the other sectors for their input supply. The other side is FL, which identifies how the sectors distribute its outputs to the remaining economy. More importantly, these two linkages can indicate a sector's economic pull and push effects, because the direction and level of such linkages present a potential capacity of each sectors to stimulate productivity of other sectors and reflect its role accordingly.

5.3 Methodology

To computation of interdependency, BFL and also for computation of income effect examine Input Output Transaction Table (IOTT) of Indian economy prepared by the Central Statistical Organization (CSO) has been utilized. The most generally used one is based on Input-Output Table (I-O Table) which provide valuable insights in interdependency of various sectors. However, since the provision of these tables occupies voluminous data collection, they are generally not available on annual basis. Although combination of several such tables for different time period could reveal a broad trends in structural shift. The results based on them are generally static and related to the reference period. The sectoral strength of any sector is captured by the computation of BFL. These linkages are described by Hirschman (1958). The I-O model has some distinct advantages over its counterparts.

- Firstly, I-O model captures the FL & BL and interrelationship of any productive sector to the other sector of the economy.
- Secondly, it provides a consistent and systematic approach for understanding the economic impact of any changes in any productive sector on the regional economy.
- Thirdly, it allows analysis of the impact of growth in one or several sectors on the requirements of inputs including labour and capital.

However, the development of I-O model has been used extensively for regional/local area analysis in other economies. It must be mentioned that an I-O flow or co-efficient table may be compiled in three forms viz. Industry x industry table, commodity x industry table or commodity x commodity table. A commodity x commodity table means that rows as well as the columns represent commodities whereas an industry x industry table implies that rows as well as the columns represent industries where each industry may consist of several commodities. To achieve the objectives of the study a co-efficient table of commodity x commodity table is suitable. The computation of these linkages requires the clubbed I-O flow matrix at commodity x commodity by using industry technology assumptions from the absorption matrix and make a matrix. CSO has published I-O table separately. We first computed the clubbed I-O table at commodity x commodity (2006-07) by using industry technology assumptions from the absorption matrix and make a matrix.[2] Having obtained the intermediate flow matrix, the gross value added of each sector is computed. The grouping of table we can see in Appendix-1.

This chapter has examined the inter-dependency and BFL among five sectors of the Indian economy such as AAS, FPI, other than FPI, Mining and Services sectors and also computed income effect, direct income effect as well as direct and indirect effect for all sectors. According to research objectives, the main focus to examine the interdependency and BFL between the agricultural sector and FPI. The five cross five IOTT has been presented in Table: 5.1.

[2] See Appendix 2 of IOTT 203-04 published by CSO, Ministry of Statistics and Programme Implementation, Government of India, for the detailed methodology of construction the commodity x commodity matrix (folw matrix as well as gross value added)

Appendix-1

5.4 The Construction of the Input-Output Transactions Table

It has been constructed a table of five main sectors from the 130 Input-Output flow commodity x commodity table for the present study. The table presents aggregate of five main sectors namely AAS, mining, FPI, other than FPI and service sector. Study has select AAS at the aggregate level from sector one (Paddy) to sector 20 (Others Crops) all are included in agriculture sector, and in the AAS, animal husbandry sector (21), forestry and logging (22), fishing (23). Therefore, in one sector named AAS from sector one paddy to fishing 23. From sector 27 coals and lignite to sector 37 non metallic minerals are included in sector two named Mining sector. All FPIs (24), sugar (25), khan sari boora (26), hydrogenated oil (Vanaspti) (27), Edible oils others than vanaspti (28), tea and coffee processing (29), miscellaneous food products (30), beverages (31) are included in sector three named FPI at the aggregate level. In sector four Manufacturing sector includes all other than FPI. Service sector including all services in sectors five (5).

5.5 Computation of Income Effects

Apart from BFL analysis among the different sectors of the economy, I-O Table has advantages for measuring the income effect. For this purpose, study quantifies the direct income effect as well as direct and indirect effect for all sectors in the present study. The direct effect of one rupee value of the increase in final demand in the sector i is computed through the ratio of the value added (wages, salaries, capital depreciation, and profits) to the sectoral output. The direct and indirect income change per rupee change of final demand in a sector i is estimated by multiplying each figure in the ith row of the inverted (rij) matrix by the appropriate value added

coefficients and then summing the product. The economic rational underlying the direct and indirect income effect is that the increase/decrease in a domestic industrial sector's output due to the change in its demand unleashes forces, which affect the all those local industrial sectors are directly or indirectly supply to this sector. [3]

5.6 Measurement of Sectoral Linkages

The inter-industry linkages have three components: the BL and FL effect, and the total linkages effect. BFL describes the direct effects that results from a unit increase in the gross output of a sector. The total inter-industry linkage effect measures both the direct and indirect repercussions of a unit increase in final demand of a sector which consists of private consumption, government expenditure, gross fixed capital formation, net exports and changes in stock. These linkages can be expressed as follows:

(1) FL

$$LF_i = \frac{\sum_j X_{ij}}{X_i}$$

Where,

LF_i is the FLof ith sector.

X_{ij} represents the amount of commodity I used in the production of commodity j and

X_i is the gross output of ith sector (row vector) which consists of intermediate and final demands.

[3] Pohit Sanjib, "Income and Employment Effects in Mumbai Region: An Input-Output Approach" *National Council of Applied Economic Research*, 11 Indraprastha Estate New Delhi 110 003, INDIA, (1995)

(2) BL

The BL can be presented as follows:

$$LB_j = \frac{\sum_i X_{ij}}{\sum_i} = \sum_i a_{ij}$$

Where,

LB_j is the BL of the jth sector.

X_j stands for the gross output of jth sector (column vector) which consists of total intermediate purchases and gross value added.

a_{ij} represents input-output coefficient which explains the amount of ith commodity used in the per unit production of jth commodity.

(3) Total Inter-industry Linkage

$$PL_j = \sum_i a_{ij}^*$$

Where, a_{ij}^* is the Leontief inverse i.e. $(I-A)^{-1}$ matrix.

I stands for identity matrix and A stands for I-O coefficients matrix.

PL_j is the total inter-industry linkage of jth sector.

5.7 Inter-Industry Linkages

The use of domestic internal inputs (i.e. Sector's output used as input in its own production) per unit of gross output by sectors is given by the diagonal in the input-output coefficient matrix. Table 5.2 shows that the coefficient of internal inputs of the agriculture sector is having highest intermediate linkages 0.1556 and by the FPI coefficients is 0.1274. Other than FPI, mining and service sector use their outputs as inputs followed by 0.4224, 0.0092 and 0.1318 respectively.

AAS used more inputs from other than FPI in compare to other sectors. The coefficient of inputs purchased by agriculture from other than FPI is 0.0933 followed by the inputs purchased from the service sector (0.0749). The coefficient of inputs purchased by AAS from FPI is 0.0037 which very less in compare to the others sector. However an input by AAS from the service sector is (0.0749). The FPI use more inputs (0.3602) from the AAS in comparison to all other sectors of the Indian economy in the present. This indicates that dependency of the FPI on the AAS is more in compare to other sectors for their raw materials/inputs.

Table 5.3 shows the total inter-industry linkage effects of each sector are calculated by summing up the column vector of inverted matrix and is shown by increase one lakh in the final demand for agricultural goods would require an increase of about 0.6724 lakh in aggregate output of the economy. Whereas, an increase of one lakh in the final demand for the output of FPI and other than FPI would require an increase of 0.1786 and 0.1314 lakh in aggregate output respectively. An increase of 1 Lakh in the final demand for the output of Mining and Service Sector would require an increase of 0.7604 and 0.7074 lakh in total output respectively.

5.8 Backward-Forward Linkages

Table: 5.4 has shows BFL effects among five sectors of the Indian economy in the study. FPI is having highest BL with 1.2947 inputs requirement per units of gross output. While the other than FPI has got second position in BL effect 1.2758. The other sector like mining and service sectors are having low BL whose coefficients are less than 1. Again the AAS has got having high FL 0.9333 in compressions to FPI coefficient is 0.6067. FPI has occupied last place in the FL in compression to all five sectors. Other than FPI and service sector FL coefficients are 1.6077 and 1.1828 respectively. This indicates the FPI has having poor FL while it has a strong BL with other industries. The table indicates that the AAS is having strong FL with other sectors in

comparison to FPI. However, the mining sector is having very poor BFL with the other sectors in compression to other sectors.

5.9 Income Effects

To fulfill one another objective, the study has computed income effects i.e., direct as well as direct and indirect income effect. Table 5.5 shows the initial impact of an increase in final demand of a sector is an expansion of output by industry experiencing the change in demand. As a result the income originating in the direct income effects for all five sector are shown in table 3 which indicates Rs one lakh increase in final demand of FPI would result in a rise of Rs 0.1786 income at 2006-007 prices in this sector, because as output increases, a certain proportion of the value of output is paid out to the factors of production and therefore income originating in the industry is effected directly by an increase in output. The direct income effect is found stronger in sectors such as mining and the service sector. The mining sector has a higher income effect 0.7604 followed by service sector 0.7074 respectively for an equivalent change in final demand. AAS has also strong direct income effect (0.6724) in compare to the FPI but less than in compare to the mining and service sector.

The FPI has also weak direct and indirect income effect 0.2234 like direct income effect in comparison to all other sectors. AAS has also better direct and indirect income effect 0.9518 in compare to the FPI but less than service, other than FPI and the mining sector. Other than FPI has highest direct and indirect income effect 1.2565 among all five sectors. The service sector has got second position direct and indirect income effect 1.2555. The mining sector has got the fourth position in direct and indirect income effect 0.8857 by the equivalent change in final demand.

5.10 Conclusion

Finding of this chapter is that the coefficient of internal inputs of the AAS is having highest intermediate linkages 0.1556 and by the FPI coefficients is 0.1274. Other than FPI, mining and service sector use their outputs as inputs followed by 0.4224, 0.0092 and 0.1318 respectively. The total inter-industry linkage effects of each sector are calculated by summing up the column vector of inverted matrix and is shown by increase one lakh in the final demand for agricultural goods would require an increase of about 0.6724 lakh in aggregate output of the economy. Whereas, an increase of one lakh in the final demand for the output of FPI and other than FPI would require an increase of 0.1786 and 0.1314 lakh in aggregate output respectively. An increase of 1 Lakh in the final demand for the output of Mining and Service Sector would require an increase of 0.7604 and 0.7074 lakh in total output respectively.

The FPI has having highest BL in comparison to four other sectors. This shows that FPI highly depend on AAS for their raw materials/inputs. The other than FPI is getting second position in BL 1.2758 AAS has got third position in BL. It means that this sector has the least inputs requirement in compare to FPI and others than FPI. The other industries like mining and service sectors are having low BL whose coefficients are less than 1. Again the AAS is having highest FL, which is 0.9333. However in FPI coefficient is 0.6067 which has occupied last place in all five sectors in FL in the study. The FPI has also weak direct as well as indirect income effect in comparison to all other sectors. AAS has also better direct and indirect income effect with the coefficient of 0.9518 in comparison to the FPI but less than service, other than FPI and the mining sector.

Table 5.1

Input-Output Transactions Table: (2006-07) (Value in Lakhs)

Sector	1	2	3	4	5	Intermediate Demand	Final Demand*	Total output
1. Agriculture and Allied Sector	15630747.8	158.3	11631968.6	7072456.5	5931147.7	40266479	60165328	100431807
2. Mining	3216.9	126720.2	44559.3	33233076.1	58496.0	33466069	-19642349	13823720
3. Food Processing Industries	376316.5	374.0	4114018.2	517427.3	2487029.4	7495165	24801208	32296373
4. Other than FPI	9375113.4	2316859.1	3236447.4	151321522.5	37520101.6	203770044	154460928	358230972
5. Service Sector	7520001.5	868138.3	7500135.1	58128028.1	37682139.5	111698443	174294629	285993072
Total Input	32905396.2	3312249.9	26527128.6	250272510.5	83678914.1			
Value Added	67526410.8	10511469.6	5769244.8	107958461.4	202314157.4			
V. A. Coefficient	0.672360807	0.760393727	0.1786344	0.301365515	0.707409296			

Source: CSO, Govt. of India.

*Final Demand: the use of gross domestic product has been classified into six categories viz., 1. Private Final Consumption Expenditure (PFCE), 2. Government Final Consumption Expenditure. 3. Gross Fixed Capital Formation (GFCF), 4 Change in Stocks (CIS). 5 Exports. 6 Imports. Table : 2

Table 5.2 Coefficient Matrix

Sr. No	Sector	1	2	3	4	5
1	Agriculture and Allied Sector	0.1556	0.0000	0.3602	0.0197	0.0207
2	Mining	0.0000	0.0092	0.0014	0.0928	0.0002
3	Food Processing Industries	0.0037	0.0000	0.1274	0.0014	0.0087
4	Other than Food Processing	0.0933	0.1676	0.1002	0.4224	0.1312
5	Service Sector	0.0749	0.0628	0.2322	0.1623	0.1318

Source: Authors Computation.

Table 5.3 I-A Matrix

Sr. No.		1	2	3	4	5
1	Agriculture and Allied Sector	0.8444	0.0000	-0.3602	-0.0197	-0.0207
2	Mining	0.0000	0.9908	-0.0014	-0.0928	-0.0002
3	Food Processing Industries	-0.0037	0.0000	0.8726	-0.0014	-0.0087
4	Other than food processing	-0.0933	-0.1676	-0.1002	0.5776	-0.1312
5	Service Sector	-0.0749	-0.0628	-0.2322	-0.1623	0.8682

Source: Authors Computation.

Table 5.4 Linkages

Sr. No.	Sector	Forward Linkages	Backward Linkages	Total Inter-industry Linkages	Rank Col. 2	Rank Col. 3
1	Agriculture and Allied Sector	0.93327	0.82711	0.6724	3	3
2	Mining	0.66964	0.78561	0.7604	4	5
3	Food Processing Industries	0.60665	1.29468	0.1786	5	1
4	Other than food processing	1.60766	1.27578	0.1314	1	2
5	Service Sector	1.18277	0.81682	0.7074	2	4

Source: Authors Computation.

Table: 5.5 Income Effects*

Sector	Direct & indirect Income Effect	Direct Income Effect	Rank Col. 2	Rank Col. 3
Agriculture and Allied Sector	0.9518	0.6724	3	3
Mining	0.8857	0.7604	4	1
Food Processing Industries	0.2234	0.1786	5	5
Other than food processing	1.2565	0.3014	1	4
Service Sector	1.2555	0.7074	2	1

Source: Authors Computation, Note: * Change in Rs. For one lakh rupees in final demand.