SECTORAL INTERDEPENDENCE AND GROWTH OF ORISSAN ECONOMY: An Input-Output Analysis

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Orissa continues to be one of the most backward states of India in spite of its rich natural physical resource endowment. The state's effort to achieve the transformation of the economy from a primary-producing one to an industrialized one has not been achieved due to deficiency in the planning procedure. The state's economy is characterized by low per capita income, low capital formation, inadequate exploitation of potential natural resources and inadequate development of socio-economic infrastructure. The urgent necessity of the state is to build up an infrastructure base and to create conducive environment to boost investment in the state economy.

The amount of investment flowing to an economy normally depends on the rate of return it is likely to generate. Sectoral pattern of investment depends on the income generating capacity of the different sectors of the economy. A backward economy characterized by capital deficiency has to carry out its investment programme in a careful manner and this requires a detailed understanding of the inter-sectoral dependence in the economy. The present paper is an attempt to identify the inter-sectoral interdependence in the state economy and to link it with the growth strategy adopted in the state economy. There is also an attempt to link the sectoral origin of state income to the multiplier values of the sectors to estimate the likely multiplier impact of any investment programme in the economy. The scheme of the paper is as follows, Section-I briefly presents the important features of the state economy. Section-II depicts the theoretical background of the total linkage index, defines the multiplier concept and the Hirschman Compliance Test. Section-III presents the empirical results and section-IV concludes the paper.

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SECTION-I

The economy of Orissa is mainly agrarian in character. 87 percent of the state's total population of 31.66 million depends on agriculture for their livelihood. The state has significant percentage of SC (16 %) and ST (22 %) population. The scheduled area of the state comprises of 45 percent of its total geographical area.

State Income:

The Gross State Domestic Product (GSDP) of the state has increased from Rs. 18, 213 crores, in 1993-94 to Rs. 23,004 crores in 1999-00, showing a compound annual growth rate of 3.97 percent over the period. The NSDP increased from Rs. 15861 crores to Rs. 32728 crores during the same period. The sectoral division of NSDP at factor cost at 1993-94 prices is given in table-1

Table-1: Sectoral Division of NSDP at factor Cost in 1993-94 prices.

Sector	1994-95	1995-96	1998-97	1997-98	1998-99	1999-00
Primary Sector	9175.88	11817.06	10678.12	13865.59	14584.46	15344.65
	(48.40)	(50.77)	(48.12)	(50.54)	(48.86)	(46.88)
Secondary Sector	3443.63	3941.03	3301.97	3771.13	3664.45	4310.23
	(18.16)	(16.93)	(14.88)	(13.74	(12.28)	(13.17)
Tertiary Sector	3002.67	3652.9	3686.89	4607.24	5058.27	5540.23
	(15.84)	(15.69)	(16.62)	(16.79)	(16.95)	(16.93)
Service Sector	3338.07	3895.56	4522.32	5193.53	6543.12	7533.69
	(17.61)	(16.74)	(20.38)	(18.93)	(21.92)	(23.02)
NSDP At Factor Cost	18960.25	23276.55	22189.3	27437.49	29850.3	32728.8

Source: Economic Survey, 2000-01; Directorate of Economics and Statistics, Orissa, Bhubaneswar.

The above table clearly reveals marginal decline in the share of primary sector in NSDP from 48.4 percent in 1994-95 to 46.88 percent in 1999-00. It is surprising to note that the share of the secondary sector in the NSDP has gone down from 18 percent in 1994-95 to 13 percent in the year 1999-00. The tertiary and service sector has shown significant upsurge and responsible for 40 percent of NSDP in 1999-00 as compared with 34 percent in 1994-95. Going by the type of economic activity and their percentage change in GSDP over the previous year it is observed that in 1998-99, the contribution of forestry, fishing, registered manufacturing, electricity, gas and water supply, construction and storage are negative whereas it is positive for all other sectors.

Primary Sector:

The agriculture sector continues to be in a very low level due to lack of adequate modernization of agricultural practices. The food production of the state has shown a declining trend in nineties. It was 72.3 lakh tones in 1991-92, but fall to 55.6 lakh tones during 1999-00. The main deficiency in agriculture is the absence of irrigation facilities in the state. By 1999-00, the state could provide irrigation facilities to 24.85 lakh hectre lands, which is 42.12 percent of the total cultivable areas of the state. The activities allied to agriculture like fishery, animal resources, forestry etc. have also not developed significantly over the years. The state has vast mineral resources like coal, iron ore, manganese ore, bauxite, chromites etc. However, the rate of exploitation of different mineral resources of the state is much below the potential. In 1999-00 the mineral production of the state was 694.8-lakh ton valued at Rs.2805 crores.

Secondary Sector:

Major industries in the state are Rourkela Steel Plant, National Aluminum Company, Indian Charge Chrome, Paradip Phosphate and coal based power plants at Talcher, Koniha and Banharpali. By the end of 1999-00, Orissa had 339 large and medium industries with an investment of Rs. 1880.36 crores providing employment to 82533 persons. There were 62552 small-scale industries operating in the state by the end of 1999-00 with an investment of 1396.02 crores providing employment to 4.18 lakh persons. Besides 15.11 lakh cottage industries had been set up with an investment of Rs. 556.96 crores providing employment to 26.37 lakh persons at the end of 1999-00.

Tertiary and Service Sector:

The state could achieve some progress in the tertiary and service sector. The number of Commercial Bank branches in the state was 2048 in 1990-91 and it rose to 2219 in 1999-00. However, Credit Deposit Ratio in the state has fallen from 80.59 to 39.75 during the same period indicating declining private sector investment in the state. Education development in the state indicates that there were 65552 primary schools, 12406 upper primary schools, 6094 high schools, 1367 general colleges and 7 universities by the end of 1999-00. Similarly in the field of health, there were 180 hospitals, 157 community health centers, 1188 primary health centers and 14 mobile health units operating in the state by the end of 1999-00. The transport and communication network in the state

consists of 2317 km. of railways, 2782 km. of national highways, 4816 state highways, 3727 major district roads, 4598 other district roads and 4670, C.V. roads, 24852 km of village roads, 20380 km Panchayat Samit roads, 139973 km Gram Panchayat roads, 7030 km of forest roads and 13777 km of municipal roads by the end of March 2000.

SECTION-II

The original Keynesian multiplier examines the impact of level of investment on total income. Here it assumes that the entire economy as a single sector. On the contrary the Leontief Input-Output Model enables us to analyze the impact of change in investment in one sector upon the output of the other individual (concerned) sectors. The value of multiplier differs from sector to sector and depends on where the initial impact is directed (Richardshon, 1972).

The input-output analysis thus provides us a clear strategy for the allocation of government investment among different sectors of the economy. This exercise is of immense help to the planning authority to manipulate the impact in desired direction.

The input-output flow table explains the way in which the activities of different sectors are linked with each other in a network of interdependence. Because of the interrelations among various sectors any increase in final demand from a sector sets off the process of chain reaction on output, employment and income, not only in that particular sector but also in all other sectors. With the help of multiplier index we can measure these changes. Under Input-output framework it is possible to derive a set of multipliers that describes summary measures of the total repercussions in terms of adjustment in output, employment, wage and income generated by a given change in final demand vector (Sexena, 1986). Manipulation of the Input-output table allows us to estimate different types of multipliers viz. output, income, employment and wage for the economy.

Regional growth is often defined in terms of regional production, income or employment. The three multipliers-output, income and employment, translate the impact of final demand changes into these three measures of regional growth.

Output Multiplier

The output multiplier for industry **j** measures the sum of direct and indirect requirements from all sectors needed to deliver one additional rupees of output **j** to final demand

(Richardson, 1972). This is nothing but the summation of the entries in the column under industry j in the Leontief inverse matrix.

$$O_j = \sum_{i=1}^{n} a_{ij} \quad \text{..... (1.1)}$$

Where O_j represents the output multiplier and a_{ij} 's are the elements of the Leontief inverse matrix $(I-A)^{-1}$.

The output multiplier represents the total requirements per unit of final output. The structural interdependence between each sector and the rest of the economy is quantified by the index. The output multiplier is also interpreted as total linkage index by Yotopolos and Nugent (1973).

Income Multiplier:

The income multiplier states the variation of income on account of change in final demand or output in any one of the given sectors. The first step in calculating the income multiplier is to calculate the direct income generated per unit of output in each sector. This is obtained from the household row of the input coefficient matrix. The direct income per unit of output in each sector gives us an idea about the structure of the economy. But for a complete analysis it should be supplemented with indirect incomes generated by each sector. The input-output coefficient table exhibits the fact that the production of a unit of output in each sector requires several inputs from different sectors; let the final demand increases by one unit. At the first instance, the demand for the inputs of the concerned commodity will rise. In the second round these inputs themselves have to be produced by the respective sectors by using inputs from various other sectors. In the same way the third round inputs must be produced and so on. This is a series of events, in the process the income of all sectors will rise. The direct and indirect income effects measures the total incomes generated in several sectors as a result of a unit change of final demand or of output of a particular sector.

The Leontief inverse matrix $(I-A)^{-1}$ captures both the direct and indirect effects of any change in the exogenous vector say, final demand (Bulmer-Thomas, 1982). The elements in each of the columns in the inverse matrix give the direct and indirect input requirements from the various sectors in the row to produce a unit increase in the final demand of the sector at the top. Since the income associated with a unit of output in each

sector are known, the total direct and indirect incomes associated with one unit of final demand can be easily calculated by summing up.

“The direct and indirect income change is obtained by multiplying each column entry in the standard inverse matrix (households excluded) by the supplying industry’s corresponding household row coefficient from the direct coefficient table (Richardson, 1972).

Therefore, the direct and indirect income change for sector j is given by the formula

$$\sum_{i=1}^{n} a_{ij}\, h_i \text{……..} \quad (1.2)$$

Where, a_{ij} represents an element of the Leontief inverse and h_i is the entry in the row vector of household coefficients.

In the above discussion it is assumed that, a part from postulated change in the final demand of the given sector, all other final demands remain unchanged. However, practically a change in final demand has an expansionary effect on total demand. Two different events occur simultaneously. First, it ensures greater output and generates additional income. Secondly, it includes additional consumption expenditure, which in turn cause change in production, income and so on for successive rounds. Let us describe the total income thus generated due to a change in final demand as ‘direct, indirect and induced income’.

To calculate this, let us assume that the consumption function for each commodity is linear and homogeneous i.e., there exists a direct and proportional relationship between income and consumption. Now the standard input coefficient matrix be expanded by making the household sector endogenous. We then compute the inverse of expanded matrix. “The last row in the extended inverse matrix gives the direct, indirect and induced income associated with a unit increase in the final demand of the respective sectors” (Bhall, 1971).

On the basis of foregoing discussion two types of income multipliers are formulated: type-I income multiplier and type-II income multiplier.

Type-I income multiplier is expressed as the ratio of the direct plus indirect income change to the direct income change resulting from a unit increase in the final demand for any given sector.

Type-II income multiplier is obtained by taking the ratio of the direct, indirect and induced income change to the direct income change occur an account of a unit increase in final demand.

Employment Multiplier:

Analogous to the income multiplier, employment multiplier has two variants such as type-I employment multiplier and type-II employment multiplier. The former express the relation between direct plus indirect employment change to the direct employment change and the later measures the ratio of direct, indirect and induced employment change to the direct employment change on account of a unit change in final demand. The direct employment change for sector j is the slope of its employment production line **Ij.** Where, **I** is the physical labour input coefficient and is derived as $\mathbf{I= E_m/X}$, $\mathbf{E_m}$ is the employment and X is the gross output of the concerned sector.

The direct plus indirect employment change for sector **j** is calculated by summing the results so obtained from the multiplication of the physical labour coefficient for each **i** (*h*) With the total direct and indirect requirements from each **i** for one unit of final demand to **j** (a_{ij}). Symbolically,

$$\sum_{i=1}^{n} i_i \; a_{ij} \text{ …….. (1.3)}$$

Likewise, the direct, indirect and induced employment change for sector j is given by

$$\sum_{i=1}^{n} i_i \; a^*_{ij} \text{ …… (1.4)}$$

Where, a^*_{ij} represents an entry in the expanded inverse matrix with households endogenous.

Hirschman Compliance Test:

In a developing economy Hirschman advocated that the development strategy ought to proceed in a manner where it will generate greater induced decision-making. Deliberate unbalanced growth of the economy is required to promote overall growth. It is also required to encourage activities that have the strongest linkage effects in input-output terms so as to maximize induced decision-making.

For this purpose it is necessary to identify the industries with high linkage and to encourage the growth of sectors with high linkages. The correlation between the two i.e.

linkage effect of a sector and growth rate of a sector is known as the Hirschman Compliance Test.

SECTION-III

Empirical Analysis:

The present work is an analysis to examine as to whether the sectoral growth of the Orissan economy satisfied the Hirschman Compliance Test. For this purpose the paper divides the economy into seven sectors. These are:

1. Agriculture and Animal husbandry
2. Forestry
3. Fishing
4. Mining
5. Construction
6. Manufacturing
7. Electricity

This division is purposefully done to facilitate our analysis in the face of acute data constraints. Data on the industry sector of Orissa is not published sector wise and this creates difficulty in knowing the growth of different sector. The Gross State Domestic Product (GSDP) data of Orissa have these seven sectoral divisions. The services sector data is available but the input-output table on which this work is dependent has excluded the service sector. So the effort of this paper is to estimate the growth rate of these seven sectors for which data is available and correlate it with their total linkage index. To compute the growth rate of different sectors we have used the time series data of GSDP at current prices pertaining to seven sector classification for the period 198081 to 2001-02. For calculation of total linkage index we have used a snapshoot view of Orissan economy from the Input-output table constructed for the year 1994-95 as per the same sectorisation scheme.

The following table depicts the total linkage index of different sectors as exhibited by Orissan economy for the year 1994-95.

Table-2

Total Linkage Index of Orissan Economy

Sl. No.	Sectors	Total Linkage	Rank
1	Agriculture	1.315	6
2	Forestry	1.055	7
3	Fishing	1.134	5
4	Mining	1.345	4
5	Manufacturing	1.713	1
6	Electricity	1.487	3
7	Construction	1.520	2

Source: Patra, A.K., 2002

The present study shows that manufacturing (1.713) sector is having highest total linkage order followed by construction (1.520) and electricity (1.487).

So far as growth of Orissan economy during the period 1980-81 to 2001-02 is concerned, the study reveals that mining sector achieved higher growth (18.45), followed by electricity (18.32) and fishing (1.77). Following table reveals the growth rates of different sectors of Orissan economy during the period 1980-81 to 2001-02.

Table-3

Growth rates of Sectors in Orissan economy during 1980-81 to 2001-02

Sl. No.	Sectors	Growth rate	Rank
1	Agriculture	9.65	7
2	Forestry	9.71	8
3	Fishing	15.77	3
4	Mining	18.45	1
5	Manufacturing	13.56	5
6	Electricity	18.32	2
7	Construction	14.83	4

SECTION-IV

Conclusion:

The Hirschman Compliance Index, which represents the correlation between sectoral growth rates and their total linkage index, is very low in Orissa. It is only + 0.3111, Hirschman compliance test failed to build up a strong correlation between the total linkage and growths of the sectors. The sector having highest total linkage (manufacturing 1.713, ranks first) is not able to grow adequately during the given time

frame. On the contrary the sector having low potential of total linkage (mining 1.345, ranks fourth) performs highest growth during the period.

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