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Sectoral Interrelatedness and the Iranian Economy During Pre and Post- Revolution Scene: an input-output Analysis*

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1. INTRODUCTION

The primary goal of any economic policy in the production front is, as far as possible to enhance the degree of sectoral interrelatedness (henceforh SI) within the home economy. The focal objective of such policy is not only to increase the sectoral value added of the economy but also to improve the position of the trade balance in the commodity trade front. Iran, being characterized a sole mono- economy with predominance of oil share in the domestic and foreign trade commodity account, has for the past three decades opted to diversity her economy both at home and the foreign trade front (Banouer, and Aruafar, 1990). The past policy package implies that of integration of oil and oil related products to the rest of the domestic economy, i.e. agriculture, industry and sevice sectors and vice- versa in terms of forward and backward linkages on the one hand and the commodity diversification in the foreign trade on the other hand(1). Such laid down development strategy was not only the prime concern of Iran as the other oil producing countries have almost followed the similar exercise right from the late 1973 oil boom (Banouei, 1992).

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1- This paper does not make any attempt to analyze the foreign trade implications vis- a- vis the degree of the sectoral interrelatedness. However, such observation does require a separate investigation.

The main concern of this paper is to operationlise the SI of the Iranian economy at two points of time, i.e., 1974 and 1984 input-output tables. The second part shall highlight the methodology adopted. The third part discusses the nature of the data employed for this study. The fourth part shall exclusively deal with the empirical results. Summary and conclusion shall appear in the last section.

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2. The METHODOLOGY

In this study forward and backward linkages have been worked out in terms on "interrelatedness". Yan and Ames (YA) (Yan and Ames, 1965), has a direct bearing on the row and column elements of a particular matrix. It rather inplies that sector (sectors) which has (have) occupied more cells, i.e., non- zeros values (irrespective of their values being high or low), its (their) SI is (are) higher than the other sectors. The reverse case holds good which is in fact contrary to the corresponding linkage apprach. Because the linkage approach depends on the value of each cell matrix rather than cells themselves. Moreover, unlike the linkage approach can easily be employed for identification of actual and potential linkage analysis vis- a- vis foreign trade implications whereas YA interrelatedness provides an identical result with respect to actual and potential linkages(1).

The essence of the YA method is in fact on the basis of input and output interrelatedness. The input- output interrelatedness can be classified as Direct Forward Interrelatedness (DFI), Direct. Backward Interrelatedness (DBI), Direct and Indirect Forward Interrelatedness (DIFI) and Direct and Indirect Backward Interrelatedness (DIBI)
DFI and DBI are estimated from the following relationships,

1- We have verified this aspect with the Iranian experience (see Banouei, 1991). This is true only if we assume that all imports are competitive which is a customary device followed by most of the constructed input- output tables of the different countries. However, if we relax this assumption and bring into picture the non- competitive imports, then the YA techniques will probably capture the relevance of actual and potential sectoral interrelatedness of the economy. This itself requires further investigation. We are very grateful to Professor K.N. Prasad who has kindly tought us this technical aspect.

$$DFI_i = 1/n \sum_{j=i}^{n} y_{ij} \qquad \text{where} \qquad i = i, 2, \ldots . n \qquad (1)$$

Where DFI_i stand for the Direct Forward Interrelatedness of the ith sector, n shows the number of the sectors and y_{ij} represents the matrix of intersectoral relationship with matrix cells showing either zero or one. Where zero is substituted for empty cell and one is substituted for value in the input- output flow table. The equation (1) says that on average how much of the output of sector i is used as an input in the jth sector for a one unit of production in the ith sector. This is obtained by the averaged row sum of the given input- output matrix.

$$DBI_j = 1/n \sum_{j=i}^{n} y_{ij} \qquad \text{where} \qquad j = i, 2, \ldots . n \qquad (2)$$

Where DBI_j stands for the Direct Backward Interrelatedness of the jth sector. It is obtained by the average column sum of the given input-output matrix. The equation (2) says that how much of sector j is depended on the sector's i inputs to increase an unit output in the jth sector.

For the estimations of DIFI and DIBI, we should know that these are measured by the sum of the reciprocal of row and column elements of an order martix.(1) This involves making use of iteration elements of Leontief inverse matrix comprising successive elements of input- output coefficient matrix in such a way that $(1\text{-}a)^{-1} = 1 + a^2 = a + ...$till they become negligible. In this matrix, elements having non- zero values in a matrix are denoted by number 1 which represents first round of interrelatedness. These values which get non- zero value in a^2 for the first time are denoted by number 2, representing second round order of the interrelatedness and so on. Elements having zero values throughout the iterative procedures are denoted by ∞, representing complete absence of any interrelatedness between the concerned pair of industries. Therefore, an order matrix, say, Y is constructed. The Y matrix comprises only either ∞ or number ranging from 1 to n depending upon the order of the interrelatedness. Then in order to evaluate the interrelatedness of industries on output side, i.e., DIFI, the

1- An order matrix is a matrix which shows the degree of interrelatedness between a pair of industry or the economy as a whole depending on the number of itration it involves (Yan and Ames, 1969).

reciprocal of the elements in a row of the order matrix[3] is averaged. This can be shown from the following equation,

$$DIFI_i = 1/n \sum_{j=i}^{n} 1/y_{ij} \qquad y_{ij} \neq 0 \quad i = 1, 2, \ldots n \qquad (3)$$

Where y_{ij} represents i, jth element of the order matrix. Similarly for the estimation of the interrelatedness of industries on the input side, i.e., $DIBI_j$ we have the following relations,

$$DIBI_j = 1/n \sum_{j=i}^{n} 1/y_{ij} \qquad y_{ij} \neq 0 \quad j = 1, 2, \ldots n \qquad (4)$$

From equation 1 to 4, we can express that the higher DFI and DBI to unity the higher forward and backward interrelatedness and vice versa. Similarly, the higher $DIFI_i$ and $DIBI_j$ to unity, the higher direct and indirect forward and backward interrelatedness and vice versa.

3. THE DATA

For the present exercise, we have used the 1974 and 1984 Iranian input- output tables. The 1974 table has been constructed by the Bank Markazi of Iran (Bank Markazi, no date). This table comprises 101 sectors. The 1984 input- output table has been compiled by the Plan and Budget Organization (Plan and Budget organization, 1989). This table comprises 92 sectors. Therefore, we in order to make them comparable, have initially decided to retain 92 sectors of the 1984 table and adjust the given 101 sectors of the 1974 table in 92 sectors comparable to the 1984 table. However, due to the large size of matrix (92 by 92) and inability of computer for multiplication, we were compelled to reduce the size of both tables to 43 sectors in such a way that oil and oil related sectors have shown separately. Size of both tables to 43 sectors in such a way that oil and oil related sectors have shown separately.

4. EMPIRICAL RESULTS

After having estimated the forward and backward sectoral interrelatedness for the years 1974 and 1984 for 43 sectors, we have then computed the sectoral deviation ratios with the following relaions (see Prasad, Banouei and Swaminathan, 1990).

$$DR_i^{(1)} = \frac{DFI_i(1984) - DFI_i(1974)}{DFI_i(1984)} \times 100$$

$$DR_j^{(2)} = \frac{DBI_j(1984) - DBI_j(1974)}{DBI_j(1984)} \times 100$$

$$DR_i^{(3)} = \frac{DIFI_i(1984) - DIFI_i(1974)}{DIFI_i(1984)} \times 100$$

$$DR_j^{(4)} = \frac{DIFI_j(1984) - DIFI_j(1974)}{DIFI_j(1984)} \times 100$$

Where $DR_i^{[1]}$ shows the ith sectoral deviation ratio for the sectoral direct forward interrelatedness. $DR_j^{[2]}$ stands for the jth sectoral deviation ratio for the sectoral direct backwad interrelatedness. $DR_i^{[3]}$ represents the ith sectoral deviation ratio for the sectoral direct and indirect forward interrelatedness, and $DR_j^{[4]}$ shows the jth sectoral deviation ratio for the sectoral direct and indirect backward interrelatedness. The subsequent results drawn from the above relations have been presented in Table 1, column. 1 to 4.

Considering the col. 1 of the Table 1, i.e., direct forward interrelatedness, it is observed that the deviation ratios for 43 sectors vary between 83% for leather and leather products to- 250% for tobbaco moreover seven sectors have been identified to have high forward interrelatedness with more than 70% and less than 83%. These sectors are: dairy products, edible oil, grain mill, textile excluding. Wearing apparel, other textiles, nonelectrical mach, equipment and transport equipment. 14 sectors have deviation ratios between 50% to more than 60%. These sectors are: agricultural products, live stock, forestry and fishing, other mining, other food, knitted fabric, carpet and rugs, wearing apparel excluding shoes, medicine, other petroleum products and coal, basic metallic procucts, metallic procucts, electrical mach. Equipment, other industrial products and transport and communication. The deviation ratios for sectors between less than 50% to 0 are 15 sectors. However there are other sectors whose deviation ratios are identified to be negative. These sectors are: animal feed, fertilizer & pesticides, construction, trade, restaurant and hotels.

The deviation ratio for DBI ranges between 78% for edible oil to- 2% for other services. Only one sector, i.e., water and electicity has a deviation ratio of more than 70%. 15 sectors have deviation ratio between 50% and more than 60%. These sectors are: agricultural products, live stock, forestry and fishing, other mining, dairy products, wearing apparel excluding shoes, basic chemicals, fertillizer and pesticides, medicine, transport and communication and financial to 0%. However, under DBI category no other sector, except other services whose deviation ratio has been identified as negative.

Coming to the DIFI, it is observed that the ranges of the sectoral deviation ratios vary between 39, i.e., tobacco only. Basides, 7 sectors have been identified to have the deviation ratios of more than 30%. These sectors are: live stock, forestry and fishing, dairy prducts, other food, edible oil, grain mill, other textiles and non- electrical machinery equipment. Eight sectors have shown the deviation ratios between 20 to 30. These sectors are: agricultural products, other mining and synthetic

fibers & paints and vanishes, non- metallic mineral products, basic metallic products, metallic products, other industrial products and transport & communication. The remaining 12 sectors have the deviation ratios between 20 to 0%. However, there are five sectors whose deviation ratios are negative. These sectors are: animal feed, fertilizer and pesticides, construction, trade, restaurant and hotels and other services. With respect to the DIBI, the sectoral deviation ratios vary from 32%, i.e., water and electricity to 5% textile excluding wearing apparel. Two sectors, i.e., carpet & rugs and edible oil have deviation ratio of more than 30% and less than 32%. 18 sectors have idenfified to have deviation ratios of less 30% and 20%. These sectors are: agricultural products, live stock and forestry and fishing, other mining, dairy producs, bread & confectionery, sugar, baverages, tobacco, knitted fabric, other textiles, wearing apparel excluding shoes, basic chemicals, fertilizer & pesticides, medicine, basic metallic procucts construction, transport & communication and financial services. The remaining sector's deviation ratios range between less than 20 and 0. However, no other sector (except textile excluding. wearing apparel) has shown negative signs.

5. CONCLUSION

This study reveals that the overall interrelatedness of the economy has considerably increased in 1984 as compared to 1974. This observation is true not only for DFI and DBI but also for DIFI and DIBI. In terms of the sectoral deviation ratios, it is noticed that the deviation ratios for the primary sectors are higher than secondary and tertiary sectors. This finding supports the prevailing studies in the Iranian context that the impact of the Islamic revolution and then ongoing war with Iraq had direct contribution on the less performance of the secondary and tertiary sectors as compared to the primary sectors.

Table 1
Direct, and Direct and Indirect Deviation Ratios of the Sectoral Forward and Backward Interrelatedness

Name of the Sectors	Direct		Directand Indirect	
	1	2	3	4
1 . Agricultural Prod	50	55	23	23
2 . Live stock, forestry and fishing	60	62	32	26
3 . Crude petroleum	31	16	3	5
4 . Other mining	52	67	26	23
5 . Dairy products	76	51	38	20
6 . Other food	67	27	33	8
7 . Edible oil	71	78	32	31
8 . Grain mill	74	30	36	17
9 . Bread & Confectinery	25	52	0	23
10 . Sugar	30	50	6	23
11 . Animal Feed	-75	41	-2	7
12 . Beverages	24	49	15	22
13 . Tobacco	-250	67	-25	28
14 . Spinning & wearing apparel	31	35	14	11
15 . Textile excluding wearing apparel	78	0	14	-5
16 . Knitted fabric	57	48	12	21
17 . Carpet and rugs	56	64	5	31
18 . Other textiles	78	55	36	25
19 . Wearing apparel excluding shoes	64	52	11	23
20 . Leather and leather products	83	37	39	16
21 . Wood and wook products	35	43	15	15
22 . Paper and paper products	3	41	1	16
23 . Basic cemicals	20	68	9	24

* The deviation ratios have been calculated as follows

$$\text{Col. 1} = \frac{DF_i\ (1984) - DF_i\ (1974)}{DF_i\ (1984)} \times 100 \qquad \text{Col. 2} = \frac{DB_i\ (1984) - DB_i\ (1974)}{DB_i\ (1984)} \times 100$$

$$\text{Col. 3} = \frac{DIF_i\ (1984) - DIF_i\ (1974)}{DIF_i\ (1984)} \times 100 \qquad \text{Col. 4} = \frac{DIB_i\ (1984) - DIB_i\ (1974)}{DIB_i\ (1984)} \times 100$$

DFI- Direct Forward Interrelatedness, DBI- Direct Backware Interrelatedness
DIFI- Direct & Indirect Forward Interrelatedness
DIFI- Direct & Indirect Backward Interrelatedness

Table one cont.

Name of the Sectors	Direct	Directand Indirect		
	1	2	3	4
24 . Fertilizer and pesticides	-125	67	-8	21
25 . Synthetic fibers and paints andvanishes	48	46	25	18
26 . Medicine	61	57	2	22
27 . Soap, detergent & Kindred products	36	46	14	18
28 . Petroleum refineries	0	31	0	13
29 . Other petroleum products and coal	60	45	11	16
30 . Tier, tubes & other rubber products	34	46	13	19
31 . Non- metallic mineral products	45	40	21	16
32 . Basic metallic products	54	45	24	20
33 . Metallic products	55	22	24	8
34 . Non- elect. mach. equipment	71	34	34	14
35 . Electrical mach. equipment	67	37	12	17
36 . Transport equipment	82	39	39	16
37 . Other industrial products	61	32	27	13
38 . Water & elect.	2	73	1	32
39 . Construction	-25	49	-12	22
40 . Transport & Communication	57	51	22	23
41 . Trade, restaurant and hotels	-12	31	-5	15
42 . Financial services	17	63	7	28
43 . Other services	-5	-2	-2	0

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