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Inter-Sectoral Linkages in Jordan Economy: (Input-Output Analysis)

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"Inter-Sectoral Linkages in Jordan Economy: (Input-Output Analysis)"

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Abstract- The purpose of this study is to investigate the inter-sectoral linkages and the effects of each sector onother sectors in Jordanian economy by using Input and output tables for the years: 1987, 2000, and 2009.To facilitate the comparison process between sectors the researcher assembled and aggregated the each table to 15 sectors. This study applied Input and Output technique to determine the leader sector which has highest backward and forward linkages.

This study found that there is a discrepancyin the values ofthe backward and forward linkages of each sector among the three years. However, the manufacturing and agriculture sectors have had the strongest backward and forward linkages in 2009.

Keywords: input and output tables (iot), jordanian input and output tables (jiot), backward linkages, forward linkages, key (leader) sector.

I. Introduction

Backward and forward linkages are descriptive measures of the economic interdependence of industries in terms of magnitude transactions. Industries with strong backward and forward linkages are termed as key sectors, and play an important role in the development strategy of a country.

Linkages analysis is essential because it shows the importance of each sector within the economy. It used to examine the interdependency of production structures, and it was introduced by Rasmussen (1956), Chenery& Watanabe (1958) and Hirschman (1958). Since that many different methods were improved and expended for measuring linkage coefficients (Bhalla and MA, 1990; Heimler, 1991; Sun, 1998). One of the well-known methods for analysis interdependency between sectors is backward and forward linkage analysis using Input Output Tables.This study will use table for the year 2000 which was built by the researcher using the actual data, and the updated table forthe year 2009 which built by the researcher using RAS method, finally, the table for the year 1987 which built by Jordanian government.

II. Research Problem and Objectives

There are no such studies analyzing inter-sectoral relations by using IOT in Jordanian Economy, which debilitating decision-making process to motivate economic growth. The lack ofanalytical studiesof the Jordanian economy is interested in the role of the economic sectors in stimulating the new investments in other sectors, whether these sectors are using the outputs of other sectors(backward linkages) or by providing what the other sector need from it (forward - inkages).

The aim of this study to analyze the inte sectoral linkages in Jordanian Economy to determine the most influential economic sectors in the economy, which steer the polices toward true decision making to direct investments on leader sectors that most affected according to the economic priorities in Jordan if increasing the economic growth through motivate the investments and production in other sectors.This will stimulate all sectors through the effects of direct and indirect effects generated from the backward and forward linkages of all sectors which encourage economic growth and thus positively impact on income and employment levels in the community.

III. The Importance of Research

Jordanian economic is suffering since the end of eighties in the last century from several economic problems which obstruct its growth and progress; from weakness of output and inability to meet local needs in various forms, to debt burden which absorbsa significant portion oflocal resourcesto meet its obligations.

Linkage analysis can be quite useful to assess the effectiveness of development strategies,which aim to strengthen the supply chain process among industries, and to provide a way to the policy makers to allocate resources for getting the best outcome. Having information about the priority sectors, suitable policies can be navigable towards those sectors for higher growth of the economy, and can be taken careby the weaker sectorsfor further improvement. For these reasons and to highlight the strengthen of every sector, to help the decision makers to betterment the Jordanian Economy.

IV. Methodology

This study was primarily carried out on compiled Input and Output Tables for Jordanian economy to three different years. The table for year1987 was produced by the Jordanian Department of Statistics. The table for the year 2000 built by the researcher depending on the actual data, while the

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table for the year 2009 built by the researcher by updating 2000 table using RAS method.

For analytical purposes, the original Input and Output Tables consisting of different number of sectors are aggregated into 15th sectors based on International Standard Industrial Classification (ISIC3.1).(United Nations, 2002).

The direct input coefficient matrix constructed by dividing each flow shown in the Input and Out put Table on the total of column. Alternatively, when each flow is divided on the total of row, adirect output coefficient matrix obtained. Direct input and output coefficient matrices are used to establish the direct linkages. Direct Input and Output coefficient matrix inverted to obtain the total Input and Output coefficient matrix respectively. The elements of an inverse matrix represent both direct and indirect flows between each sector and other sectors.

V. Theoretical Framework

Jordan represents a small open economy with few naturalr esources and limited manufacturing. If the Jordanian Economic shows growth that means the debt burdens would be reduced, also by improving the economic growth it will effect on reducing the unemployment rates and poverty.

Input and Output analysis has been widely used to assess sectoral economic performance and production interdependence. This paper used compiled Input and Output Tables since 1987s for Jordanian Economy to analyze the significance of inter-sectoral relation and to determine the highest ranking sectors in term of backward and forward linkages. Also itused this technique of Input and Output to explore the structural change of the Jordanian Economy, and to answer both questions: "Who receives from whom?" and "Who gives to whom?".

Moreover it intended to serve three main purposes. First, to analyze the inter-sectoral linkages in Jordanian Economy to determine the most influential economic sectors,and to provides a guide to the construction and interpretation for forecasting purposes. Second, it provides details of the way in which the inter-sectoral linkages tables can be used. Finally, it provides a means of answering some of the questions often requested by input and Output practitioners.

VI. Literature Review

After 1941, when Leontief introduced the first I-O Tables for the Americane conomy, the Input and Output analysis became fundamental means for studying inter-sectoral linkages of sectors of any economy. Consequently, the I-O Tables began to be used quite early by Poul N.Rasmussen (1958) and Chenery and Tsunehiko Watanabe (1958) for establishing the linkages between sectors of the economy. These linkages were studied on the side of inputs (the side of supply) to each sectors (backward linkages)as well as on the side of outputs (the side of sales) of an each sector to other sectors (forward linkages) (Lovrenc Pfajfar and AlenaLotric Dolinar 2000).

Rasmussen (1956) proposed to use the column (or row) totals of the Leontief inverse, (I - A)-1, to measure inter-sectoral linkages. The backward linkage, based on the Leontief inverse matrix, is simply defined as the column totals of inverse matrix. Similarly, the corresponding forward linkage can be defined by reference to the row totals of Leontief inverse matrix.

An empirical study of Input and Output linkage analysis was proposed by Hirschman (1958), who used the Rasmussen linkage indicators to identify "Key or Leader Sectors", in an economy which will promote growth to the follower sectors. The way of linking key sectors and induced sectors is the development of backward and forward linkages between these sectors. These ratios measure the degree of interdependence of different sectors only; to what degree a sector uses inputs from other sectors. Although the linkage is a causal concept and this is the truth, the sector developed strictly as a result of a linkage to a leading sector only, one could also find some sectors with high ratios not due to linkage effects but only due to sectoral interdependence. In this case, the sector did not develop as a result of linkages to another sector but rather in a synonymous with it.

As early as 1958 Hirschman (Hirschman (1958) introduced the analytical concept of the key sector of the economy as a sector with forward and backward linkages above average. In the literature numerous modifications of the basic procedures for establishing the key sectors and their use on data on different economies can be found (Strassert (1968), Hazari (1970), Laumas (1975), Bharadway (1976), Jones (1976), Schultz (1970, 1977), Rao and Harmston (1979), Hewings (1989), Dietzenbacher (1992)). Each of them has its advantages and disadvantages, which mean it has advocates and critics (Lovrenc Pfajfar and AlenaLotric Dolinar 2000).

VII. Backward Linkages

Through these linkages we can estimate the reliance of one sector on other sectors by view production input side, it measures the volume of using one sector to produce the other one, which means increasing the production for the sector affected by high backward linkages will provoke new industries to provide this sector by its input production.

These direct backwards linkages measured by using coefficient matrices (A), it is summation of the elements of the column for the target sector (Chenery, 1958), by using the data of Input Output of the Jordanian economic we have been reached results as

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shown in Table (1), these linkages shows (reflect, express) about the proportion of intermediate inputs (Intermediate Consumption; goods and services) for sector j to the total production for the same sector, which means:

$$Db_j = \sum_{j=1}^{n} \frac{xij}{Xj} = \sum_{j=1}^{n} a_{ij} \quad (1)$$

Whereas $Db_{j:}$ the value of direct backwards linkages, while the relationship $\frac{xij}{Xj}$ is the value of coefficient for sector j.

From Table (1) we see changes in ranks of some sectors, for example, agriculture sector moved from rank 8 to rank 1, this reflects the increasing of agriculture sector dependency on the output of other sectors specially industry, which denotes to technological progress in agriculture sector by using mechanism rather than rely on primitive means in agriculture, while manufacturing and construction sectors rank moved just one step forward, the most important sectors which significantly their ranks moved backward electricity and Retail & wholesale Trade.

But this measure direct backward linkages only without thoughtfulness the indirect effects resulting from expansion in the production of any of the productive sectors,

In the structure of Input and Output, the sales of sector A to sector B recorded as forward linkage for sector A and backward linkage for B but one of these effects which could result in an impact was taken into consideration in this scale. (Jones, 1970)

To measure the direct and indirect effects we should use Leontief inverse matrix [(I-A)-1], we can calculate the direct and indirect effects for backward for any sector through the total of column elements in this matrix, (Yotopoulos and Nagent, 1976), according to the equation:

$$DIB = \sum_{j=1}^{n} (I-A)^{-1} \quad (2)$$

After applying this quotation on the Jordanian economy we can see the results in the table (1).We should notice here that the value of these linkages is the same value of output multipliers. From Table (1) it is noted that the ranks of some sectors have remained pretty much the same except little bit changes, as in construction sector its rank changed in indirect backward linkages from 3 to 2 in direct and indirect backward linkages in the year 2000.

These measures have not been highly accepted among economists, as they thought some of them inaccurate, so some minor adjustments have been involving in the type which is using averages, which is a compared the average of all linkages (direct and indirect) for sector j with overall average for all sectors (Rasmussen, 1957), in following mathematical formula:

$$Ib_i = \frac{1/n}{1/n2} \cdot \frac{\sum (I-A)-1}{\sum \sum (I-A)-1} \quad (3)$$

The numerator represents the average of direct and indirect needs to meet the increased of final demand by one unit from sector j products, whereas the denominator refers to average total needs in macro economy to meet the increased of final demand by one unit, means, the aggregation of increased final demand in all sectors is one unit. (Hajy, 1985)

By applying this quotation on the Jordanian economy data we reached to the direct and indirect backward linkages Index to the Jordanian Economy which is shown in Table (3).

The direct and indirect backwards linkages for sector j are high if the value of index exceed more than one, if it was 1>Ibj, whereas in the revers situation weak, and when the value is more than one it means the sector needs more relatively volume production to cope the increasing in final demand on sector j products by one unit, so sector j will be strong leader for other sectors compared with other sectors.

From Table (3) we can see that the backward linkages in Jordanian economy is weak in general, in 2009 the sectors have linkages are agriculture and manufacturing, however, the manufacturing sector characterized in high stability in backward linkages, we can explain why agriculture sector has been characterized because of depending on using chemical industries products as pesticides and veterinary drugs and treatments more than it was in 1987.

VIII. Forward Linkages

The focal idea for forward linkages is to study the impact of increased output that occurs or may occur in the used sectors when there is a change in its provider sector of production inputs. (Bulmer, Thomas, 1982)

Also it measures the impact of forward linkages sectors dependency to other sectors when production of this sector is used as inputs production in other sectors, high impact of these linkages to a particular sector that includes the expansion in this sector will generate the power stimulate all sectors to enlargement. In other words, the impact of forward linkages happens when particular sector products used as inputs in production one sector or more from other sectors which generate an incentive to do new activity or increase production for specific sector which means these linkages stimulate new investment through creation excess supply. (Zahran, 1968)

We can find the value of direct forward linkages through coefficient production matrix (O) which is a result of dividing each cell in the matrix of intermediate

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demand on total final demand (intermediate and the final which is the total of row), the value of the direct forward linkages for sector i is a total row for this sector in the coefficient matrix production (Yotopoulos and Nugent, 1973), it can be formulated mathematically:

$$Df_j = \sum_{i\,1}^{n} \frac{xij}{Xi} = \sum_{j\,1}^{n} o_{ij} \qquad (4)$$

Where Dfj : the ratio of intermediate demand to total demand Xi for a particular sector, it has been estimated for Jordanian economy and the result shown in Table (2).

Perhaps the most prominent can be seen from this table is the change in rank of some sectors, as example, agriculture sectors which moved from 7th rank to the third rank, and mining and querying from 6th rank to the first rank, but this reflects the only direct forward linkages and doesn't in consider the indirect effects which happened in the economy when the investment increased.

We can measure the traces of direct and in direct forward linkages by using Leontief output matrix (I-O)-1 through using production coefficient (the intermediate demand proportion to total demand including final demand), (Carter & Brody, 1970), the direct and indirect forward linkages equal the total rows of invers Leontief output matrix, it can be formulated mathematically:

$$Tf_i = \sum_{i=1}^{n} (I - O) - 1 \qquad (5)$$

The matrix (I-O)-1 express the increasing in output of i sector to encounter the needs of growing final demand by one unit from products of every sector (Boucher, 1976), after applying this formula on Jordanian economy the result have been shown in Table (2).

From this table we can say that the comments mentioned above with respect to the change of sectors ranks almost remain the same, the forward linkages happens or could happens when sector production i use or maybe use as intermediate output for one sector or more in national economic sector.

As mentioned when talked about backward linkages there are several criticisms for direct and in indirect style, so some modifications have been made to this indicator, new index was calculated using averages and average of averages hosted by the economists Rasumussem (Al-Hammadi & Hannoush, 1992), it might be called the index for direct and indirect forward linkages, it can be formulated mathematically:

$$IF_i = \frac{1/n}{1/n2} \cdot \frac{\sum (I - O) - 1}{\sum \sum (I - O) - 1} \qquad (6)$$

The numerator refers to average of the total of row which belongs to i sector in invers Leontief matrix output, which measures the total impact on sector i when the final demand grows for all sectors by one unit, the increases in investments in sector i it will motivate the production of sectors which used the products of this sector by increasing because it gained the advantage of availability intermediate production (Bulmer-Thomas, 1982).

Whereas the denominator states the average of averages for all sectors. After using above equation and applying it on the Jordanian economy data, the results shown in Table (3), it provides with index for sensitivity of dispersion of forward linkages.

The sectors have a strong forward linkages if the index for any sector greater than one IFi<1, and the vice versa in case IFi>1 (Laumas, 1976). We can notice from Table (3) that the electricity sector and the construction was marked by strong forward linkages in 1987, while they declined in 2000, mining and querying became the stronger forward linkages only, it is a logic reflects the fact after establishing potash factory that relay on basis of main products of this sector from potash and phosphate. With regard to the change in sectors order, ex-analysis about direct forward linkages and indirect forward linkages still largely true.

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Annex

Table 1 : Backward Linkages

NO.	Sector Name	Direct Backward Linkages						Direct and Indirect Backward Linkages					
		1987		2000		2009		1987		2000		2009	
		Value	Rank	Value	Rank	Value	Rank	Value	Rank	Value	Rank	Value	Rank
1	Agriculture, forestry and fishing	0.310	8	0.776	2	0.431	7	1.467	8	3.242	1	3.802	1
2	Mining and Querying	0.318	6	0.455	6	0.390	8	1.475	6	2.022	8	1.734	9
3	Manufacturing	0.350	4	0.726	3	0.717	1	1.525	4	2.854	3	3.427	2
4	Electricity	0.445	1	0.586	4	0.449	5	1.671	1	2.626	4	2.133	5
5	Water	0.312	7	0.449	7	0.440	6	1.474	7	2.135	7	2.058	6
6	Construction	0.362	3	0.788	1	0.610	2	1.584	2	3.023	2	1.771	10
7	Retail & wholesale Trade, and repair maintenance	0.335	5	0.257	12	0.254	11	1.493	5	1.456	13	1.441	13
8	Restaurants&Hotels	0.380	2	0.473	5	0.557	3	1.561	3	2.196	5	2.951	3
9	Transport	0.289	10	0.424	9	0.286	10	1.426	10	1.921	9	1.894	7
10	Communication	0.072	15	0.185	14	0.128	15	1.106	15	1.299	14	0.898	14
11	Financial & insurance	0.192	13	0.290	11	0.159	14	1.273	13	1.493	11	0.818	15
12	Real estate and Business services	0.159	14	0.091	15	0.180	13	1.243	14	1.223	15	2.420	4
13	Education	0.238	11	0.213	13	0.214	12	1.343	11	1.477	12	1.485	12
14	Health and social work	0.194	12	0.446	8	0.471	4	1.276	12	2.149	6	1.769	8
15	Other services	0.305	9	0.360	10	0.326	9	1.443	9	1.809	10	1.638	11

Sources:
1. Al Zoubi, Osama, Construction and Analysis Input–Output Tables for Jordan Economy in 2000, 2009, Baghdad university, PHD thesis, not published.
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Table 2 : Forward Linkages

No.	Sector Name	Direct Forward Linkages						Direct and Indirect Forward Linkages					
		1987		2000		2009		1987		2000		2009	
		Value	Rank	Value	Rank	Value	Rank	Value	Rank	Value	Rank	Value	Rank
1	Agriculture, forestry and fishing	0.221	7	0.705	4	0.827	3	1.376	7	3.036	3	3.561	2
2	Mining and Querying	0.255	6	1.921	1	1.647	1	1.402	6	6.975	1	5.981	1
3	Manufacturing	0.562	3	0.877	2	0.916	2	1.840	3	3.207	2	2.727	5
4	Electricity	1.862	2	0.741	3	0.098	14	4.576	1	2.969	4	2.503	6
5	Water	0.062	13	0.700	5	0.137	12	1.082	13	2.742	5	2.871	4
6	Construction	1.931	1	0.228	10	0.596	6	3.392	2	1.336	13	1.062	12
7	Retail & wholesale Trade, and repair maintenance	0.161	11	0.217	11	0.215	9	1.241	10	1.615	9	1.598	8
8	Restaurants&Hotels	0.028	14	0.208	12	0.189	10	1.043	14	1.349	12	1.774	9
9	Transport	0.183	9	0.254	9	0.771	4	1.259	9	1.624	8	1.694	7
10	Communication	0.358	4	0.352	8	0.243	7	1.464	4	1.565	10	1.082	11
11	Financial & insurance	0.325	5	0.428	6	0.234	8	1.443	5	1.683	7	0.922	15
12	Real estate and Business services	0.177	10	0.385	7	0.762	5	1.237	11	1.702	6	3.368	3
13	Education	0.072	12	0.098	14	0.099	13	1.110	12	1.104	14	1.110	10
14	Health and social work	0.023	15	0.205	13	0.139	11	1.025	15	1.401	11	0.979	13
15	Other services	0.209	8	0.017	15	0.015	15	1.265	8	1.031	15	0.934	14

Sources:

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Table 3 : Index of Power Dispersion of Backward and Forward Linkages

No.	Sector Name	Index of Power Dispersion of Backward Linkages						Index of Power Dispersion of Forward Linkages					
		1987		2000		2009		1987		2000		2009	
		Value	Rank	Value	Rank	Value	Rank	Value	Rank	Value	Rank	Value	Rank
1	Agriculture, forestry and fishing	0.687	8	1.048	1	1.229	2	0.556	7	0.911	3	1.068	4
2	Mining and Querying	0.691	6	0.654	8	0.561	8	0.566	6	2.092	1	1.794	1
3	Manufacturing	0.714	4	0.923	3	1.354	1	0.743	3	0.962	2	1.518	2
4	Electricity	0.782	1	0.849	4	0.216	14	1.848	1	0.891	4	0.961	6
5	Water	0.690	7	0.690	7	0.124	15	0.437	13	0.823	5	1.102	3
6	Construction	0.742	2	0.977	2	0.911	4	1.370	2	0.401	13	0.169	15
7	Retail & wholesale Trade, and repair maintenance	0.699	5	0.471	13	0.466	10	0.501	10	0.484	9	0.479	9
8	Restaurants&Hotels	0.731	3	0.710	5	0.887	5	0.421	14	0.405	12	0.563	8
9	Transport	0.668	10	0.621	9	1.018	3	0.509	9	0.487	8	0.928	7
10	Communication	0.518	15	0.420	14	0.290	11	0.591	4	0.469	10	0.324	12
11	Financial & insurance	0.596	13	0.483	11	0.265	12	0.583	5	0.505	7	0.277	14
12	Real estate and Business services	0.582	14	0.395	15	0.782	6	0.500	11	0.511	6	1.011	5
13	Education	0.629	11	0.478	12	0.481	9	0.448	12	0.331	14	0.333	11
14	Health and social work	0.597	12	0.695	6	0.234	13	0.414	15	0.420	11	0.443	10
15	Other services	0.676	9	0.585	10	0.530	7	0.511	8	0.309	15	0.280	13

Sources:

1. Al Zoubi, Osama, Construction and Analysis Input–Output Tables for Jordan Economy in 2000, 2009, Baghdad university, PHD thesis, not published.

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