The Construction of the Jordanian Input-Output Tables for the Year 2010

And

Their Applications and Uses

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List of Abbreviation

DOS	Department of statistics
GDP	Gross Domestic Product
GST	Goods and Services Tax
IO	Input-Output
IOM	Input-Output modelling
IOT	The Input-Output tables
JD	Jordanian Dinar
MOPIC	Ministry of Planning and International Cooperation
SAM	Social Accounting Matrix

Abstract

The main objective of this paper is to share our own practical experience in structuring and in application of the input-output tables for an upper-middle income developing economy. This, however, includes building and updating series of input-output tables, which are detailed set of economic accounts and their uses in modeling for projections, planning and analysis of the Jordanian economy. The tables were to be structured for the year 2010.

The basic assumption on setting up here was that the input-output table would be based, as far as possible, on independent Jordanian data of 2010 together with full use of the existed Jordanian input-output tables for 2006, for deriving such tables from published data.

Building of the Input-Output tables and their transformation into a model of the economy as well as using them as an effective tool for economic analysis and planning was pioneered in America during the 1930's by W. Leontief. Nowadays, this work has been developed extensively both at the national and regional levels.

An input-output tables record the sales or purchases between all sectors in an economy, usually within a particular year. Typical tables identify several dozen of such sectors and show the structure of an economy in a precise and detailed way. There are several types of table each showing a different aspect of the **economy**, e.g. the pattern of purchases, sales, capital investment and imports.

In constructing and examining these tables it is necessary to make a distinction between commodities and industries. A commodity is an artefact, substance or service, while an industry produces various commodities and is defined by its principle commodity, thus the cooking oil and olive oil industry chiefly makes oil. An industry may also make other secondary commodities, for example, the oil industry also makes and repairs small number of plastic products such as bottles and containers. Thus, while the commodity in an absolute concept; an industry may vary in time or from one country to another by virtue of having different secondary commodities.

To reduce this task to manageable proportion the commodities and industries are grouped into sectors of similar types and technologies. Jordanian table would have 81 such groups. Furthermore, the paper would shed a light on the imperative areas and dimensions of uses and applications of the input-output tables and techniques in economic analysis, development planning, impact studies and fiscal management for the economy.

Keywords: *Input-Output Tables, Techniques, Jordan, Macroeconomic Development Planning, Statistics, Fiscal Management, Impacts, Analysis.*

1.Introduction.

The study objectives include the building and updating series of input-output tables, which are detailed set of economic accounts and their use in models for projections, planning and analysis of the Jordanian economy. The tables were to be structured for the year 2010.

The basic assumption on setting up here, was that the input-output table would be based, as far as possible, on independent Jordanian data of 2010 together with full use of the existed Jordanian input-output tables for 2006, for deriving such tables from published data.

The building of Input-Output tables and their transformation into a model of the economy and a tool for its analysis was pioneered in America during the 1930's by W. Leontief. It has developed thereafter extensively both; at the national and regional levels.

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2. The Construction of the Jordanian Input-Output Tables for 2010

In this section of the paper, a full and detailed explanation of how different input-output tables and matrices have been built, their data sources, processing, their characteristics, structures and balances.

2.1 The Total Flows Absorption Table

The basis for such input-output construction is concerned with tables which show either the commodities required to make a particular commodity or the amount bought from different industries required for the output of a particular industry. However, data is most easily collected in term of commodities bought and sold by particular industries.

The commodities bought by companies for consumption or transformations are organized into a table known as the total flows absorption table. These commodities may have either been imported or domestically produced.

However, each industry buys items from each of the other commodity groups. The commodity groups are the principle products of the industry groups. In additions to its commodity inputs any industry also pays out taxes (less any subsidies) and wages, and retains a certain amount (other value-added) to cover depreciation, etc., as well as making profit. Thus it may be noted that as "other value-added" in each industry column is defined as the residual between the gross output for an industry and its material, labour and tax costs, it follows that the total input for that industry is equal to its gross output.

Alternatively, if we consider the rows of the absorption table, they show the destination of the sales of the commodity groups. They are sold to other industries for further processing or are sold to the various categories of "final demand", i.e. households, government and local authority expenditure, stocks, investment and exports. The total sum of the consumption along any commodity row less import of it equals the total domestic output of that commodity.

2.2The Make Matrix

The make matrix shows the commodities (listed down the side) produced by particular Jordanian industry.

The sum of any column shows the total output of that industry and thus the column sums of the absorption and make matrices are equal. Similarly, the sum of the rows of the make matrix gives the total domestic outputs of the particular commodities and thus is equal to the row sums of the absorption matrix.

That said, these two tables form the basis of all later tables and it is their construction which forms the bulk of the work to produce the aimed at input-output tables for the Jordanian economy.

2.3 The Total Commodity x Commodity Table

Given the total flows absorption and make matrices one can create a more useful table –that of the total commodity by commodity flows. The columns of this matrix show the purchases necessary to make the gross domestic production of a particular commodity which also means that its column total will be equal to that of its row. By normalising a column of this table one can see the proportions of different commodities required to produce one unit of that commodity, i.e. the technology of producing that commodity. That such a table can be used to examine and compare the technologies of producing different commodities or producing the same commodity in different countries or at a different time.

To create this table all production of particular commodity must be concentrated into a single sector. Firstly the make matrix is used to identify those cases where an industry makes the commodity as a secondary product. Then any inputs associated with making this secondary product are transferred from the column of purchases of that industry, in the absorption table, to the column of the industry of which that secondary product is the principal product.

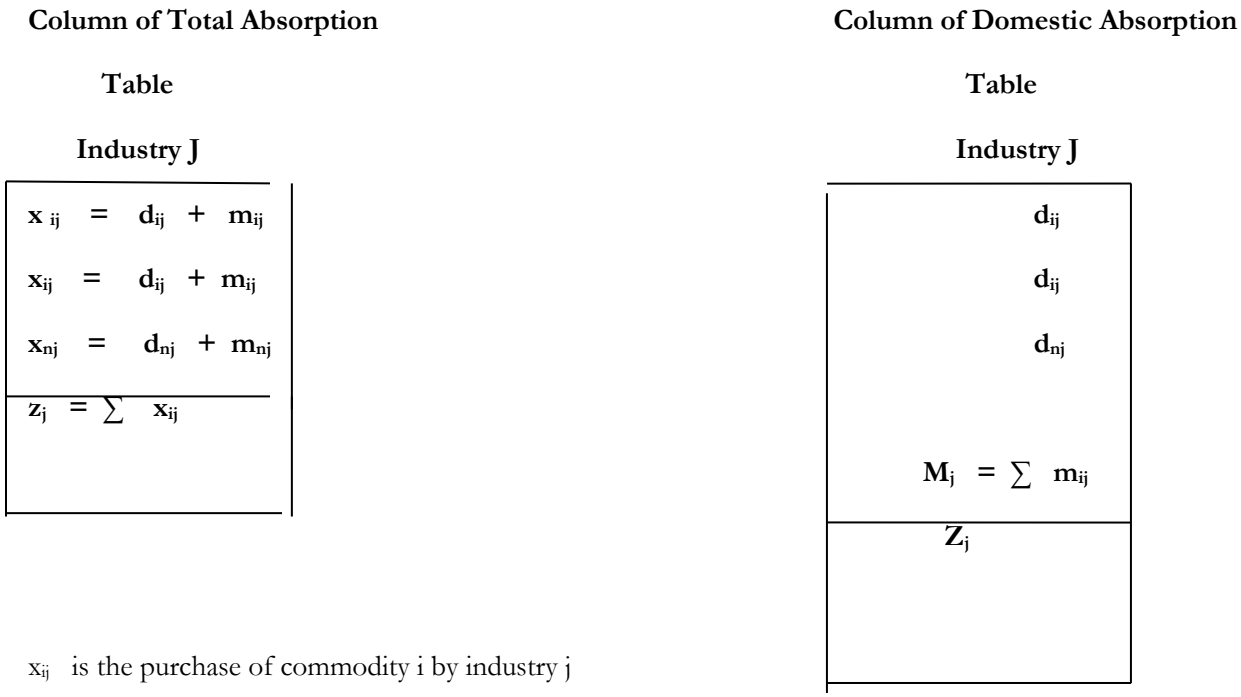
2.4 The Import Matrices

The full total flows absorption table has one import column, which shows the imports of different commodities from the rest of the World. This column is actually the row sum of a matrix whose columns show the amount of different commodities imported by particular industries into Jordan from the rest of the World.

2.5 The Domestic Absorption Table

By subtracting the sum of the import matrix from the total flows absorption matrix we arrive at the domestic absorption matrix whose columns show the amount of domestically produced commodities bought by particular industries. In order that the column totals of this matrix should remain the same as that of the total flows absorption table an extra row is added, which shows the total amount of all commodities imported by each industry. Figure -1 – below illustrates the difference between the total and domestic column of the absorption matrix.

Figure 1: The Total and Domestic Column of Purchases



x_{ij} is the purchase of commodity i by industry j

d_{ij} is the purchase of domestically produced commodity i by industry j

m_{ij} is the purchase of imported commodity i by industry j

M_j is the total of all commodities imported by industry j

Z_j is the total import (=total do0mestic output) of industry j

2.6 Domestic Commodity x Commodity Table

This table shows the amount of domestically produced commodities needed to make a particular commodity. It is produced by an analogous process to that of the total commodity by commodity table, but operating with the domestic absorption table rather than the total absorption table.

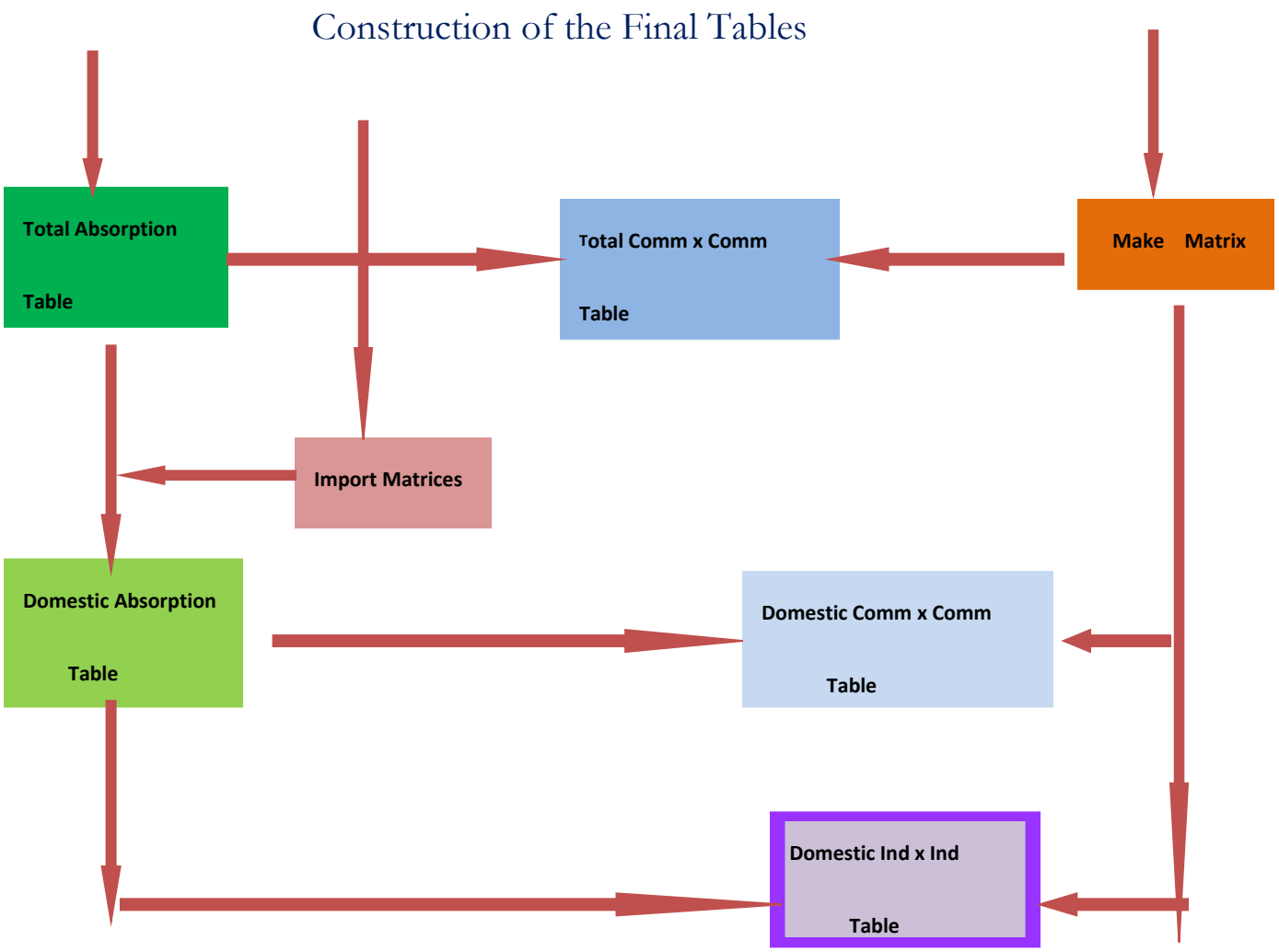
2.7 Domestic Industry x Industry Table

The domestic industry by industry table shows the amount bought from different domestic industries required to produce the output of a particular industry. That is each row shows the distribution of the sales of a particular domestic industry rather than of a particular domestically produced commodity, as in the domestic absorption table.

In order to do this, parts of the commodity rows in the domestic absorption matrix are transferred to other rows in the table so that the overall mix of commodities in any row is that of its respective industry (as found from the make matrix). The total of any row will equal that of the domestic output of the industry, and hence is equal to its equivalent column.

The commodity by commodity and industry by industry tables are sometimes called symmetric tables. The sequence of table construction is shown in the figure below.

Figure 2: Construction of the Final Tables



3. Sectoral Mapping of the Jordanian Input-Output Tables

The following table depicts the industries-commodities mapping of the 2010 Jordanian input-output tables.

Sec No.	IOT Sectors	ISIC 3.1
1	Vegetables	0112
2	Fruits	0113
3	Crops & Other Agriculture	0111, 0200
4	Livestock's & Livestock's Products	0121
5	Poultry and Eggs	0122
6	Fishing	0500
7	Crude Oil and Natural Gas	1110
8	Mining	1421,1422,1429,1010,1030,1320
9	Quarrying	1410
10	Meat and Fish Products	1511, 1512
11	Olive oil and Other Oils	1514
12	Dairy Products	1520
13	Grain Mill Products	1531, 1532
14	Prepared Animal Feeds	1533
15	Bakery Products	1541
16	Sugar & Confectionery	1531, 1542
17	Other Food Products	1549,1513,1544
18	Soft Drink Beverages	1554
19	Alcoholic Drinks	1551,1553,1552
20	Tobacco Products	1600
21	Textile Industry	1711,1721,1729,1730,1723
22	Carpets	1722
23	Clothing	1810,1820
24	Leather products	1911,1912
25	Footwear	1920
26	Wood Products Except Furniture	2010,2021,2022,2023,2029
27	Furniture	3610
28	Paper and Paper Products	2101,2102,2109, 3720
29	Printing and publishing	2212,2221,2222,2211,2213,2219,2230
30	Refinery and Refined products	2320,2310,2330
31	Fertilizers and Insecticide	2412,2421
32	Paint Industry	2422
33	Pharmaceuticals products	2423
34	Soap and Detergents	2424
35	Other Chemical Products	2411,2413,2429,2430
36	Rubber Products	2511,2519
37	Plastics Products	2520
38	Cement Industry	2694
39	Bricks, Articles of Cement Concrete	2695
40	Cutting Shaping Finishing Stone	2696

41	Manufacture of glass and clay	2610,2691,2693,2692
42	Other Non -Metallic Minerals	2699
43	Iron and Steel Industry	2710, 3710
44	Non Ferrous Metal Industry	2720
45	Basic Metals Products	2731,2732
46	Structural Metals Products	2811
47	Fabricated Metal Products	2812,2892,2893,2899,2813,2891
48	Machinery and Equipment	2915,2919,2911,2912,2913,2914
49	Domestic Appliances	2930
50	Electrical Machinery	3110,3120,3130,3140,3150,3220,3230,3000,3190,3210
51	Engineering Equipment	3311,3320,2921,2922,2924,2925,2929,2926,2923,2927,3312,3313,3330
52	Motor Vehicles Bodies, Trailers	3410,3420,3430
53	Other Transport Equipment	3512,3520,3530,3591,3592,3599,3511
54	Jewellery	3691
55	Other Manufacturing Industries	3692,3699,3693,3694
56	Electricity	4010
57	Water Supply	4100
58	Construction	4500
59	Trade	50, 51, 52
60	Hotels and Restaurants	55
61	Road Transport	6021,6022,6023
62	Rail Transport	6010
63	Pipelines Transport	6030
64	Sea Transport and Ports	6110,6120
65	Air Transport	6210,6220
66	Services Incidental to transport	6301,6303,6309
66	Storage and Warehousing	6302
67	Road Transport	6021,6022,6023
68	Travel, Tour Operators Services	6304
69	Postal Services	6411,6412
70	Telecommunication services	6420
71	Information and Computer Technology	7220,7221,7229,7230,7240,7250,7290
72	Banking sector	65
73	Insurance	66, 6720
74	Other Financial Services	6711,6712,6719
75	Business services	71,72,73,741,742,743,7499
76	Real Estate	7010,7020
77	Ownership of dwellings	-
78	Education	80
79	Health Services	85
80	Public administration and defense	75
81	Other Services	7491,7492,7493,7494,7495,91,92,93,95

4.Data Sources and Data Collections

The input-output tables (IOT) for 2010, has been constructed using the economic surveys data for all the sector of the economy, carried out by the Department of Statistics (DOS). These surveys' data have been supplemented with the closing account of the public finance and foreign trade statistics for 2010. This besides using the data obtained from labour market/employment and unemployment survey, to supplement similar data obtained from the main economic surveys for 2010.

The Data Processing Stages:

The statistical data required to construct various tables and matrices needed to derive the IOT for Jordan, have been collected, processed and valuated, in stages and in applicable valuation systems, as shown in the chart -1- and chart -2- below.

Chart -1-: Collecting and Processing the Data for the I/O Tables:

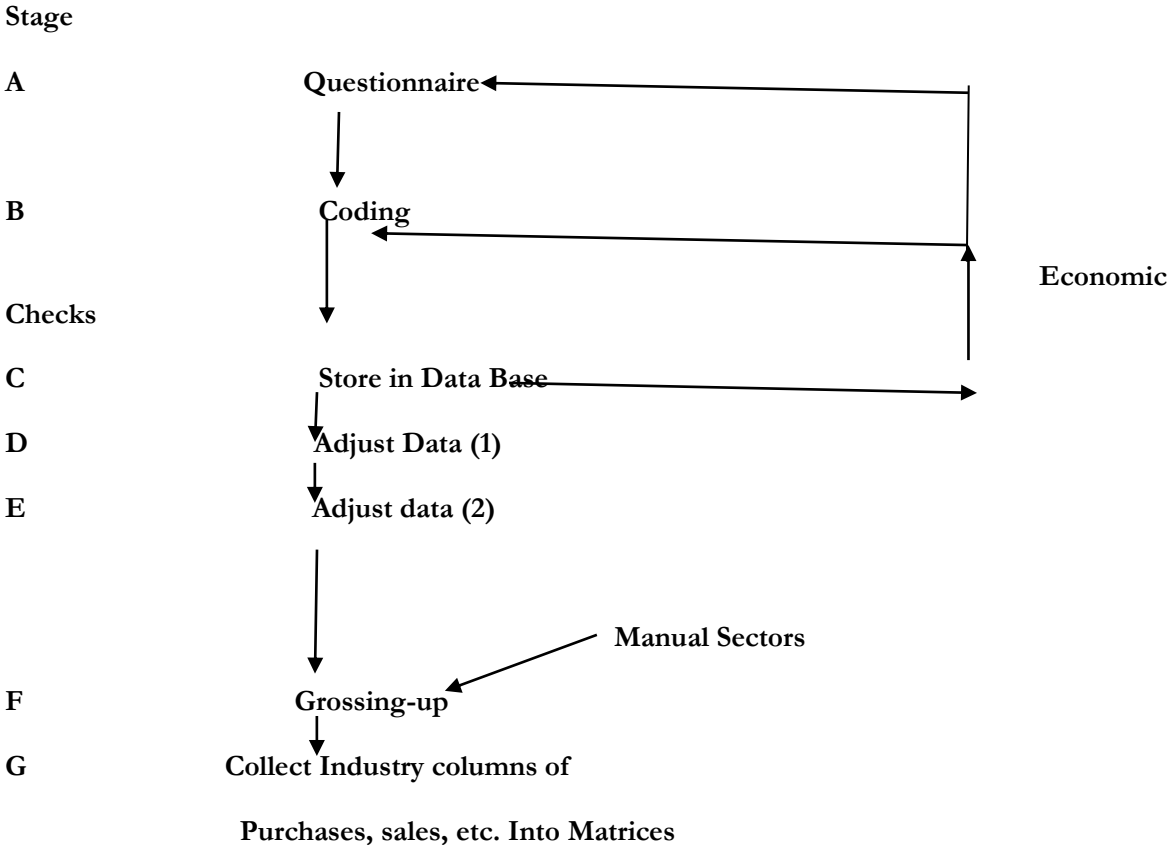
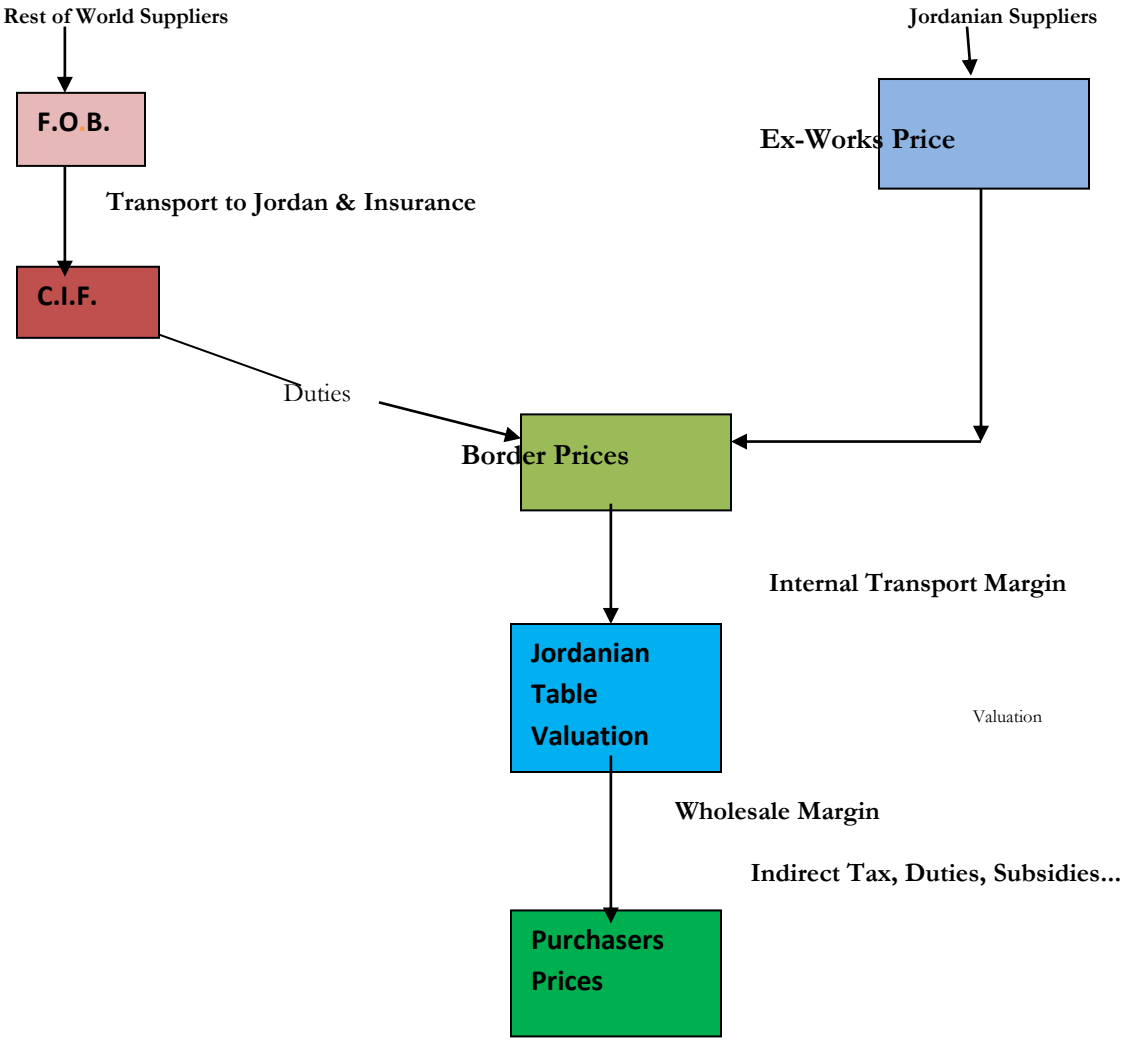


Chart -2-: Valuation of Flows



Then after completing these processes, different tables will be constructed and balancing process would start, as depicted in the two figure below.

5. The Input –Output Tables Balancing Process:

The fact that the 2010 IOT has been constructed using the available and actual statistical data on the intermediate outputs and inputs, drawn and derived from the 2010 economic surveys, carried out by Department of Statistics (DOS) recently. Accordingly, It is a newly build table, reflecting 2010 Jordanian economic conditions rather than, simply, mechanically updating the available 2006 IOT of the economy.

As, from an efficient handling of the data on both final demand components and primary input categories, it has been witnessed that the sum total of these entries are equal, which in turns equal to the GDP of 2010. This is an evident from the Absorption Matrix contents, of these to quadrants entries. Looking into the issue from the output point of view, and particularly into the final Make Matrix which the row-sums of it depicts the sectoral (industrial) total output. This, de facto, includes all the industrial production, regardless of the nature of their uses on the absorption matrix. Accordingly, these row-sums of the make matrix representing the industrial domestic output that produced by each industry in 2010. The issue of the balancing here, is that, these industrial domestic output of 2010 should equal to the total intermediate inputs used by the same sector (industry) adding to it the primary inputs used and gross operating surplus generated by that industry, i.e. the industrial column-sums of the absorption matrix.

With these facts, we have carried out the balancing process, through re-checking and mapping various data, from the all sources and for all entries. Having done that, which has taken quite substantive efforts and time, we have managed to reduce the differences, on average, to less than 5 percentage point, or even less than 2 percentage point in many sectors, between the sectoral output and input, in input-output sense.

To have a full balancing of the final tables of outputs and inputs by industry, we have applied the RAS, biproportional method to balance the leftover discrepancies between the table's totals. The methodological version that we have adopted to apply the RAS method for balancing, is one of the most realistic and based on the actual data of the 2010 surveys derived matrices.

Figure 3: The Emerged Basic Tables

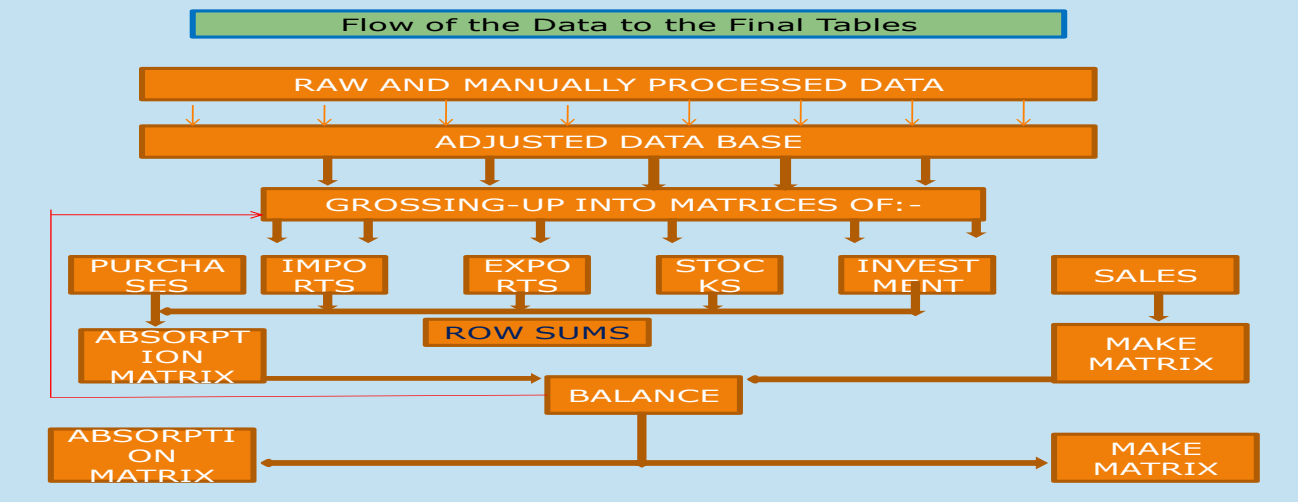
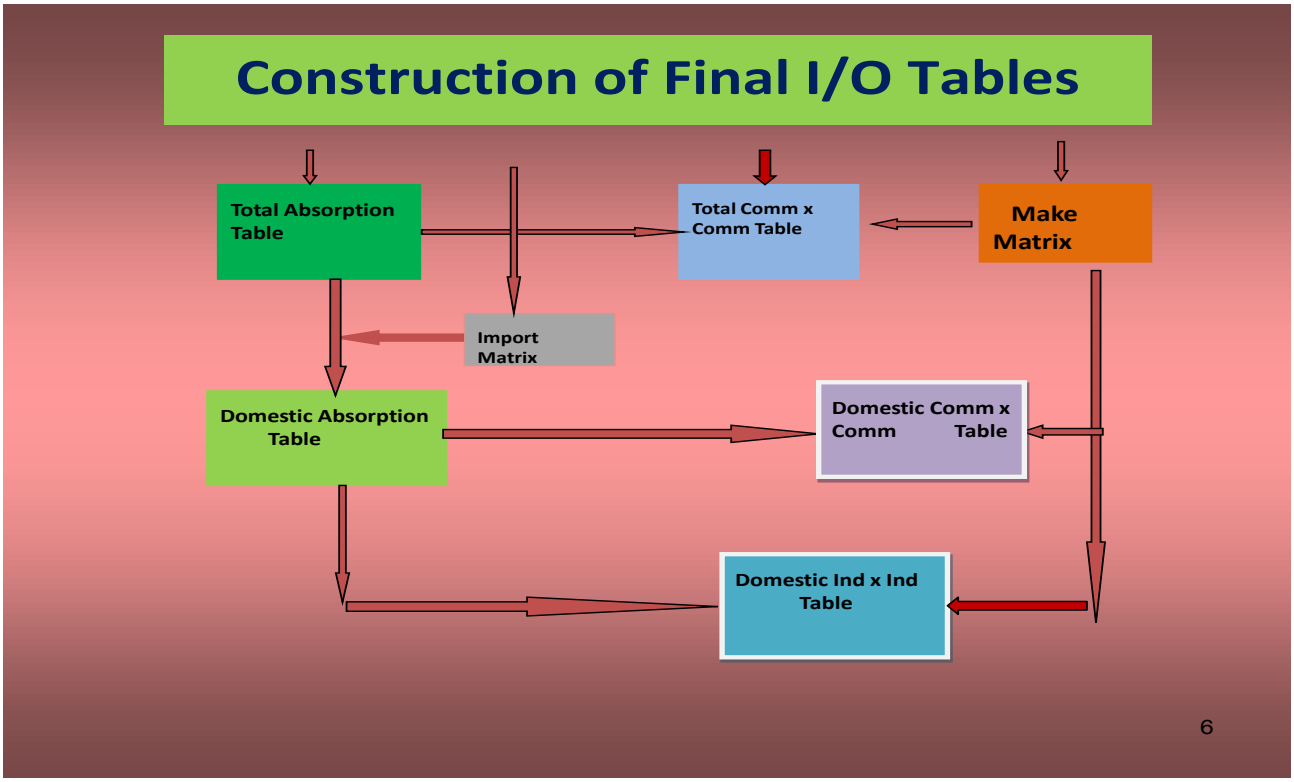


Figure 4: The final Set of Input-Output Tables



Though all the above stated tables and matrices that have been constructed, balanced and produced, specific matrices have been used for operational and application purposes. These are; the total input-

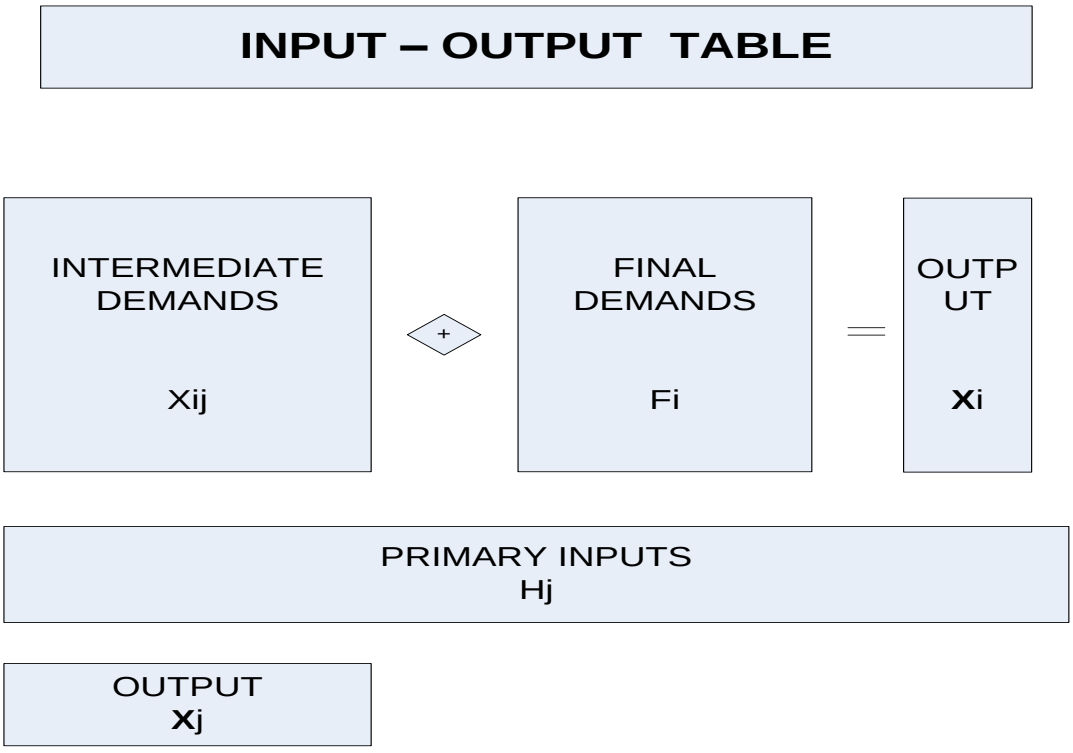
output table, the domestic input-output table (I/O matrix), the import matrix, the technical I/O coefficient matrix and the Leontief inverse matrix.

6. The Input-Output Techniques and Modelling Applications

Input-Output table is recognized as the base for social accounting matrix (SAM) that complementing the national income and flow of funds accounts. Input-Output model is one of the most used tools in analyzing and measuring policy impacts. Accordingly, I-O table and its related modelling techniques have a wide spread use as an effective technique for measuring the impact of changes in the rate of indirect tax in the economy and/or introduce new tax such as Goods and Services Tax (GST) in the economy, removing or reducing the subsidies, particularly, the energy subsidies and so on. The I-O table is recognized as the base for analyzing the change in the output, income, cost and prices of different commodities resulting from introducing new tax, new tax rate, changing the tax policy and/or the subsidies policy. At the same token, I-O table and IOM are effective tools to analyze and measure the effects in changes in interest rate, exchange rate and/or wage rate on the economy and its different variables mix.

The main structure of the input-output modelling (IOM) techniques based on the main quadrant divisions of the input-output matrix. These quadrants are illustrated in the figure below:

Figure 5: Input – Output Matrix Structure and Quadrants



However, such characteristics and quadrants can be shown through the appropriate input-output systems of equations, as:

1) $X_i = \sum_j x_{ij} + \sum_k f_{ik}$

2) $X_j = \sum_i x_{ij} + \sum_h p_{hj}$

The Direct Coefficients are: a_{ij}

Where:

3) $a_{ij} = x_{ij} / X_j$

By Substitution in (1) :

4) $X_i = \sum a_{ij} X_j + \sum f_{ik}$

In Matrix-Vector notations, the Input-Output (I/O) relationships can be rewritten as:

5) $X = AX + F$

6) $F = IX - AX$

Hence:

7) $F = (I - A) X$

X : column-vector of gross output (n by 1)
A : a direct coefficients matrix (n by n)
F : a column-vector of total final demand

$F = \sum_k f_{ik}$ …… **(n by 1)**

and I : is an identity matrix (n by n).
Therefore:

8) $X = (I - A)^{-1} F$

where: $(I - A)^{-1}$ is known as Leontief Inverse

It is de facto that inputs are consisting of domestic produced materials and imported intermediate inputs. Hence:

$x_{ij} = x_{ij}d + x_{ij}m$

where x_{ij}^d is the domestic inputs, and x_{ij}^m is the imported inputs. Accordingly, a_{ij}^d 's are the domestic input coefficients and a_{ij}^m*'s are* the imported input coefficients. In matrices notation:

$$\mathbf{A = A^d + A^m}\text{, } \textit{where;}$$

A^d is the domestic input-output coefficients matrix and A^m is the imported I-O coefficients matrix.

Having such distinctions between domestically produced inputs and imported ones within an I-O framework, would, undoubtedly, be very useful in carrying out variety of impact analysis, amongst other:

- Calculation of the import contents of the national economy
- Measure the import leakages in the economy
- Simulating the import-substitution strategies
- Assess the impact of new tariffs and/or custom duties on import and hence on the economy and its various segments
- Analyzing foreign exchange requirements in the economy
- Evaluating the impact of imported inflation on the domestic price levels
- Identifying the overall development gaps of the national economy vis-à-vis the outside world
- Working out the competitiveness status of the economy

6.1 Input-Output Forecasting Modelling Techniques and Multipliers

Assume a set of final demand (F) has been estimated for a given time period, say year (t), then X_t ; a column-vector of new sectoral production at year (t) can be projected as:
$X_t = (I - A_0)^{-1} F_t$, this can be carried out for variety of impacts of different exogenous F vector(s)

Of the inverse domestic I/O matrix, this can be define as R, where R:
$R = (I - A)^{-1} = \{r_{ij}\}$
This could be worked out for both Domestic Input-Output Matrix (X^d) and Total Input-Output Matrix (X^t), where;
$X^t = X + M$
and M is the imported inputs matrix.
The above formula is for direct and indirect effect multipliers, while another type of multipliers can be calculated, where direct, indirect and induced effects are captured.

6.1.1 The Output Multipliers

The **output multiplier** for sector j measures the total direct and indirect output requirement from all the sectors (industries) in the economy in order to satisfy an increase of one Jordanian Dinar (JD1) in the final demand of sector (industry) j.

The **type I output multiplier** for sector j's, k_j , is defined as:

$$\mathbf{k_j} = \sum_{\mathbf{j}} \mathbf{r_{ij}}$$

The elements, r_{ij}^{s} are the coefficients of the Leontief Inverse of A, i.e. $(I-A)^{-1}$, where A is the matrix of the direct coefficients of the intermediate part of the inter-industrial transaction table.

The **type II output multiplier,** which reflects the direct, indirect and induced effect, is defined similarly except that the intermediate part of the inter-industrial transaction matrix is augmented by the household consumption column and the wages and salaries row. The values of both types of multipliers have been numerically calculated, and few important results have been shown below this section.

6.1.2 The Income Multipliers:

When Final demand component(s) increased and/or decreased, the income generated in the economy due to such change in final demand for industry j would be:

$\sum w_i * r_{ij}$,

where w_i is the labour income coefficient (i.e. wages and salaries coefficient) for the $_i$th sector.

Hence, the Income Multiplier for j sector (h_j) is define as:

$h_j = \sum w_i * r_{ij} / w_j$

This is the type I income multipliers.

As before the coefficients of the Leontief inverse of the augmented matrix are substituted in the above equation in order to obtain the type II income multipliers. Both types of multipliers have been calculated and shown in the results below.

6.1.3 The Employment Multipliers

The repercussions of a change in final demand will generally have some impact on employment in the area, although an increase in output level might be met by increases in labour productivity. Using the ratio of each industry's employment to its gross output in 2010 as a simple employment production function, the impact on employment of a JD1 change in the final demand for industry or sector j is calculated as:

$$\sum_{\mathbf{i}} \mathbf{\iota_i * r_{ij}}$$

Where, $\iota_i = E_i / X_i$ is the labour-output ratio for sector i

E_i is the employment in sector i, and

X_i is the gross output of the i^{th} sector.

The employment figures were based on information provided by the Department of Statistics (DOS), modified and adjusted according to 2010 survey and I/O adopted sectoralization scheme.
As in the case of the income multipliers, the employment multiplier is defined to be the ratio of the total change to the direct change in the Jordanian employment generated by a change of JD1 in the final demand of that sector/industry.

The **type I employment multiplier**, e_j , is defined as:

$$e_j = \sum_i \iota_i * r_{ij} \; / \; \iota_i$$

The coefficients of the Leontief inverse of the augmented matrix are used to derive the **type II multipliers**. The computed values of the employment multipliers are shown in the results below.

Table 1: Number of the Sectors -out of the 81 sectors- with their Different Multipliers Deviated from the Respective National Average Multiplier by Type

No.	Multiplier	Type I		Type II	
		Above Average	Below Average	Above Average	Below Average
1	Output Multiplier	42	39	36	45
2	Income Multiplier	25	56	19	62
3	Employment Multiplier	25	56	26	55

Table 2: The Ranking of the Main Sectors Using Different Multipliers

Type I	Type II	Type I & Type II	Type I	Type II
Travel, Tour Operators Services	Prepared Animal Feed	Refinery & Refined products	Pipelines transport	Prepared Animal Feed
Meat & Fish Products	Public Administration and Defense	Poultry and Eggs	Meat & Fish Products	Pipelines transport
Air Transport	Insurance	Livestock's & Livestock's Products	Air Transport	Meat & Fish Products
Cutting Shaping Finishing Stone	Postal Services	Tobacco Products	Fertilizers & Insecticide	Air Transport
Paper & Paper Products	Education	Cutting Shaping Finishing Stone	Prepared Animal Feed	Fertilizers & Insecticide
Bricks, articles of cement concrete	Rail Transport	Jewellery	Travel, Tour Operators Services	Telecommunicatio n Services
Crops & Other Agriculture	Water Supply	Travel, Tour Operators Services	Telecommunicatio n Services	Sea Transport & Ports
Other Non-Metallic Minerals	Other Non-Metallic Minerals	Pipelines transport	Refinery & Refined products	Travel, Tour Operators Services
Poultry and Eggs	Cutting Shaping Finishing Stone	Bricks, articles of cement concrete	Olive Oil & Other Oils	Cement Industry
Prepared Animal Feed	Travel, Tour Operators Services	Olive Oil & Other Oils	Tobacco Products	Olive Oil & Other Oils
Fertilizers & Insecticide	Others Services	Meat & Fish Products	Dairy products	Dairy products
Other Food Products	Health Services	Paper & Paper Products	Cement Industry	Refinery & Refined products

Nevertheless, as can be seen from the results of the Spearman rank correlation test shown in table (3), there is a fair degree of similarity between the different types of income and employment multipliers. This similarity means that any policy directed at increasing employment through the stimulation of particular industries or sectors should also prove a reasonably effective choice in raising per-capita income, and vice-versa and hence the objectives of raising both employment and income are not conflicted policy objective as is sometimes assumed.

Table 3: Spearman Rank Correlation Matrix

Multiplier	Output I	Output II	Income I & II	Employment I	Employment II
Output I	1				
Output II	0.52	1			
Income I & II	0.52	-0.2	1		
Employment I	0.48	-0.07	0.64	1	
Employment II	0.35	0.06	0.42	0.93	1

6.2 The Industrial Linkages and Leading Sectors in the Jordanian Economy

6.2.1 The Industrial Backward and Forward Linkages

The backward linkage, b_j , is define, in an input-output context, as:

$$b_j = \sum_i r_{ij}$$

Where, r_{ij} , is the elements (cells) of Leontief Inverse matrix $(I-A)^{-1}$. Thus b_j is the total change in the gross output of the economy brought about by one unit change in demand for sector/ industry j output.

The forward linkage, ci , is defined as:

$$c_i = \sum_j r_{ij}$$

This shows the output generated in sector i when final demand in each sector of the economy is increased by one unit.

6.2.2 The Backward and Forward Linkages Index

Having derived the above, an index is constructed to measure the relative strengths of each of the linkages; by dividing each of b_j and ci by their respective average backward and forward linkages for the Jordanian economy as a whole, that is:

$$v_j = \frac{\sum_i r_{ij}}{n} \Big/ \frac{\sum_i \sum_j r_{ij}}{n^2}$$

Or using another methodological setting, this as:

$$v_j = n * b_j \Big/ \left(\sum_j b_j\right)$$

Where n is the number of the sectors in the economy.

While for the forward linkage indices (u_i), the calculation systems are:

$$u_i = \frac{\sum_j r_{ij}}{n} \Big/ \frac{\sum_i \sum_j r_{ij}}{n^2}$$

Or in another way it can be calculated as:

$$u_i = n * c_i / \left(\sum_i c_i\right)$$

Those sectors with a higher than average backward linkage index (i.e. $v_j > 1$) generate an above average response in the other sectors of the economy. These are driven from both; domestic I/O coefficient matrix (A) and total I/O coefficient Matrix (A^T).
A higher than average forward linkage index means that these sectors display above average dependence on the demand from other sector. By increasing the output of such sectors it is hoped that the industries which purchase them will be encouraged by the greater availability of supplies to increase their own output.

The five main sectors out of the eleven leading sectors in the economy are plastic products, air Transport, electricity, iron and steel and telecommunications, all of which are major inputs providers to several other sectors and industries. Still, the remaining leading sectors in this case including; olive oil and other oil, paper and paper products, printing and publishing, and business services, for example; all of which are purchased by virtually every sector in the economy.

6.2.3 They Key (Leading) Sectors in the Jordanian Economy

Key or leading sectors are defined as those sectors for which both backward and forward linkages indices are greater than one. They are, accordingly, the basic industries, whose products are distributed as inputs to many other domestic industries, as well as being sold directly to final demand. At the same time they purchase the products of a considerable number of other industries (sectors) productions in order to produce their outputs. For Jordan the key sectors are:

1. **Poultry and Eggs**
2. **Olive Oil & Other Oils**
3. **Prepared Animal Feed**
4. **Paper & Paper Products**
5. **Printing & Publishing**
6. **Plastics products**
7. **Iron and Steel Industry**
8. **Electricity**
9. **Air Transport**
10. **Telecommunication Services**
11. **Other Financial Sector**
12. **Business Services**

The most interesting aspect of the above list is the appearance of iron and steel industry products and paper and paper products which, compared with the other sectors there, are relatively underdeveloped sectors and thus offers considerable potential in any growth strategy and future investment plans.

Furthermore, it is worth mentioning at this conjuncture, that measuring key sectors in this way may caters inadequately for the capital goods sectors, such as; construction, machinery and equipment, motor vehicles, electrical machinery, transport equipment, and general engineering because these sectors sell their output to investment, which is part of the final demand in input-output tables, and hence do not figure significantly in these measures as they depend on intermediate flows. However, the adopted techniques and the quantitative tool to identify the leading sectors in the economy are quite viable from economic development and strategic planning point of view. Significantly, the measurement of linkages and delineating the leading and potential growth sectors, would, undoubtedly, assist the decision making process in clustering such growth potential activities, and hence prioritizing the related investment projects that connected to these leading sectors' activities, accordingly, in order to direct the country's limited resources and development efforts, and reallocating them, in an optimal and feasible way, to achieve a better coordinated, balanced and sustainable socio-economic development and realistic growth patterns.

6.3 Import Leakages in the Jordanian Economy

When Supply is inelastic in the economy and the economy is open as the case of Jordan, expanding industries will have to look outside the national economy border for additional inputs, thus there is an import leakage of the efforts of national development. In this situation, as output rises so do leakages and some of the impacts on domestic industry and hence the national economy is lost and the linkages neutralized.

Potential linkages may be thwarted by the export of intermediate outputs rather than their sale to domestic industries. Thus, for example, in certain circumstances export of bulk iron ore, may be a leakage in that the potential forward linkages of steel making, processing and fabrication are forfeited with export. The conversion of such leakages into linkages may occur as part of the development process of expanding the domestic industrial base and facilitating import substitution.

To assess some aspects of this within Jordan, the ranking of sectors by their linkages as derived from the domestic I/O coefficients table (A) is compared in table (4) with those derived from the total flows and coefficients (A^T) I/O table (i.e. including imports). These latter results represent the extreme situation in which all imports are replaced by domestically produced goods, which may not be possible, in the short term, due to natural resource and environment constraints.

From examination of the backward linkages in tables (4) one can judge and identify which industry and sector should be encouraged to switch their purchases from outside to Jordanian suppliers in order to generate the greatest effect, and hence real development elsewhere in the national economy. Iron and steel, rubber, painting and paper and paper product industry appear to be such industries; however, this is due to the replacement of large imports of raw iron, rubber, paper and paints, by assumed domestic production which, particularly in the case of iron, and to lesser extent rubber, would not be very feasible. Sectors such as; fabricated metal product, electrical machinery, basic

metal products, paint industry, amongst others, all show significant gains in importance, this suggests for a greater scope of better integration between themselves and with the rest of the economy. The recent growth of a quite few of firms operating in these sectors activities is, no doubt, part of the reason for their present dependence upon imports.

Table 4: The Sectors with Highest Domestic and Total Linkages in Jordan

	Backward			Forward	
Rank	Domestic	Total	Rank	Domestic	Total
1	Travel, Tour Operators Services	Jewellery	1	Refinery & Refined products	Other Chemical Products
2	Meat & Fish Products	Fabricated Metal Products	2	Road Transport	Crude Oil & Natural Gas
3	Air Transport	Prepared Animal Feed	3	Banking Sector	Refinery & Refined products
4	Cutting Shaping Finishing Stone	Electrical Machinery	4	Electricity	Iron and Steel Industry
5	Paper & Paper Products	Air Transport	5	Iron and Steel Industry	Road Transport
6	Bricks, articles of cement concrete	Basic Metals Products	6	Real estate	Non Ferrous Metal Industry
7	Crops & Other Agriculture	Non Ferrous Metal Industry	7	Other Chemical Products	Crops & Other Agriculture
8	Other Non- Metallic Minerals	Paint Industry	8	Trade	Electricity
9	Poultry and Eggs	Paper & Paper Products	9	Services Incidental to Transport	Banking Sector
10	Prepared Animal Feed	Other Manufacturing Industries	10	Quarrying	Textile Industry
11	Fertilizers & Insecticide	Iron and Steel Industry	11	Telecommunication Services	Real estate
12	Other Food Products	Plastics products	12	Plastics products	Paint Industry

The differences between the domestic and total (domestic plus imports) forward linkages volume, indicate those industries with the greatest potential to replace imported goods. As would be expected none (or lightly) traded industries such as construction, distribution, road transport, electricity, etc., have little or no additional sales potential, and are thus demoted in the total forward linkage rankings (see table (4) above) . Refinery and refine product has the highest forward linkage; however, this is a natural phenomenon as it supplying most of the sectors of the economy with its output. Notwithstanding, both crude oil and natural gas and refinery and refined products sectors are fully depending on imports for their inputs which, is highly unlikely and quite infeasible to (contemplate)substitute. Iron and steel, other chemical products, crops and other agriculture and textile industry sector are all shown to have untapped markets, and hence their activities ought to be enhanced, developed and expanded.

Further to its status as a key sector, iron and steel products sector is also seen to have some potential for import substitution.

By and large, the above driven positive effect is resulting from assuming that the economy is pursuing a strategy for selective import substitution of given commodities. This, however, may not be possible for some sectors at present time, but it is an indicative approach where various selective economically viable sectors of the national economy have been identified as feasible potentials, to be used as main ingredients for future strategy of import substitution, particularly, for the competitive imported commodities segment.

6.4 Other Case-Related Applications and Impacts

Quite few additional applications have been carried out in the ministry of planning and international cooperation (MOPIC), where input-output modelling techniques together with the 2010 input-output tables and they have been used and articulated to measure the impact, amongst others, of:

- Introducing Value-Added tax in the economy.
- Reducing the Subsidies on Refined Oil products on inflation, industrial cost and on the livelihood of different income groups.
- Impact of increasing the electricity tariff, by different percentage points on different social and income groups as well as on industrial cost and inflation level.
- Impact of Various other policy alternative scenarios that are likely to be adopted by the decision makers to reform the national economy.

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