SUPPLY - USE AND INPUT-OUTPUT TABLES, BACKWARD AND FORWARD LINKAGES OF THE TURKISH ECONOMY

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Abstract

Input-output tables provide summary information of the industrial structure of an economy for a given period. They contain information on the flows of goods and services between industries and sectors of the economy.

The compilation of input-output tables has a long-standing tradition in Turkey. The tables compiled and published in generally every five years from 1959 to 2002. Supply-use and input-output tables for 2002 were prepared by Turkish Statistical Institute (TurkStat) fully compliance with ESA'95. After 2002, supply and use tables will be compiled by annually basis at current and constant prices.

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.

The aim of this paper is to give summary information on the compilation of supply-use and input-output tables in Turkey, and to examine the production structure of the Turkish economy by using the results of input-output tables for 2002 applying traditional backward and forward linkage methods developed by Chenery-Watanabe and Rasmussen.

1. Supply-use and input-output tables

1.1. Introduction

The national accounts estimates of GDP in Turkey were compiled by production and expenditure approaches as annual basis according to SNA up to 1987. The GDP compiled by three methods as quarterly basis from 1987 to 2006 was balanced on the level of total aggregates. A new GDP series covering from 1998 to 2007 based on the concepts and definitions of ESA'95 was disseminated at beginning of this year by TurkStat.

The compilation of input-output tables has a long-standing tradition in Turkey. The first input-output table was compiled by State Planning Organization (SPO) for 1959. After this table, eleven tables for different years as input-output or supply-use tables compiled by SPO and TurkStat. Input-output tables (IOTs) from 1959 to 1998 were compiled by the concepts and definitions of SNA. Supply-use and input-output tables for 2002 were compiled by the concept and definitions of the European System of Accounts (ESA-95). The Turkish SUT for 2002 is available only at current prices, so that TurkStat will be compiled by annually SUT at current and constant prices as simultaneously.

1.2. Input-Output Tables

In national accounts and economic analysis two kinds of input-output tables are referred to:

- Supply and use tables (SUT),
- Symmetric input-output table (IOT).

The major differences between a SUT and IOT are:

- The supply and use tables have two tables, supply and use tables, product by industry matrices and both industry and commodity classifications are used. The SUT are often referred to as rectangular input-output tables.

- The input-output tables are converted from supply and use tables as product by product or industry by industry tables. An IOT rearranges both supply and use information in a single table and either a product or an industry classification is used for both rows and columns.

The first official IOT for Turkey were compiled for the years 1959, 1963 and 1967 by the State Planning Organization (SPO). These IOT specifically served as a basis for the Five-Year-Development-Plan.

The first input-output table for 1959 was compiled by15 producer sectors, not services and other tables compiled for 1963 and 1967 were compiled by 37 sectors by SPO.

Turkish Statistical Institute (TurkStat) compiled and published industry by industry IOT for the years 1968, 1973, 1979, 1985 at market prices and 1990 at producer's prices, using the second revision of ISIC, published by United Nations. With the implementation of the 1993 System of National Accounts (SNA-93) in Turkey, TurkStat changed to the compilation of SUTs. The first supply and use tables were compiled for 1996 at producer's prices, the second tables were compiled for 1998 at basic prices, and the third tables were compiled by based on ESA'95 for 2002 at basic prices was published at the beginning of this year. 2003 and 2004 supply and use tables will be finalized at the end of this year.

All IOTs from 1968 to 1990 were prepared and published as six tables (matrices) separately. These tables were the input-output table, output-mix table, table of trade and transportation margins, input-output coefficient matrix, Leontief inverse matrix and imports matrix.

1.3. Supply and Use Tables

The SNA'93 and ESA'95 provide a comprehensive framework on supply and use tables, which are an integral part of the national accounts system and play an important role as an integration framework.

Supply and use framework serves also as a basis for various interconnections with satellite accounts, such as Social Accounting Matrix (SAM), employment statistics, linkages with physical flows (land use, energy) linkages other physical flows related to environmental issues (emissions, waste, sewage) and other forms of satellite systems for tourism, transport, health and education.

Supply and use tables provide an ideal framework for checking the consistency of statistical data on flows of goods and services obtained from different sources. The supply table shows the supply of goods and services by products and by type of supplier. It is comprised of output of domestic industries and total imports by product. The supply table contains the production matrix of domestic industries and the vector of total imports. Primary activities of industries are reported on the diagonal of the production matrix while secondary activities of industries are reported off the diagonal (Eurostat, 2008).

Table 1. Simplified overview of a supply table

	INDUSTRIES (NACE) / PRODUCTS (CPA)	OUTPUT OF INDUSTRIES							IMPORTS		VALUATION		
		Agriculture	Industry	Construction	Trade, hotel, transport	Other services	Government services	Total domestic output at basic price	Imports, cif	Total supply at basic prices	Trade and transport margins	Taxes less subsidies on products	Total supply at purchasers' prices
		1	2	3	4	5	6	7	8	9	10	11	12
1	Products of agriculture	Output by product and by industry (V)						Domestic output	Imports, cif by product	Total supply, at b.p.	Valuation items		Total supply, at p.p. (q)
2	Products of industry												
3	Construction work												
4	Trade, hotel, transport service												
5	Other services												
6	Government services												
7	Total								Imports, cif		Total		
8	Cif/fob adjustments on import												
9	Direct purchases abroad by re												
10	Output at basic prices	Output by industry (g)							Imports, fob		Total		
11	- Market output												
12	- Output for own final use												
13	- Other non-market output												

V- Domestic supply table (product by industry), g- vector of industry output, *q*- vector of product output

The use table shows the use of goods and services by product and by type of use, as intermediate consumption of industries, final use for consumption, gross capital formation and exports. It also contains the components of value added by industry, compensation of employees, other taxes less subsidies on production, consumption of fixed capital and net operating surplus (Eurostat, 2008).

Table 2. Simplified overview of a use table

	INDUSTRIES (NACE) / PRODUCTS (CPA)	INPUT OF INDUSTRIES							FINAL USES							
		Agriculture	Industry	Construction	Trade, hotel, transport	Other services	Government services	Total	Final consumption expenditure by households	Final consumption expenditure by non-profit organizations	Final consumption expenditure by government	Changes in valuables	Changes in inventories	Exports, fob	Total final use	Total use at basic prices
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Products of agriculture	Intermediate consumption by product and by industry (U)							Final uses by product and by category (Y)							(q)
2	Products of industry															
3	Construction work															
4	Trade, hotel, transport services															
5	Other services															
6	Government services															
7	Total															
8	Taxes less subsidies on produc								Adjustment items							
9	Cif/fob adjustments on imports															
10	Direct purchases abroad by resi															
11	Domestic purchases by non-res															
12	Total															
13	Compensation of employees	Value added by component and by industry (W)														(w)
14	Other net taxes on production															
15	Consumption of fixed capital															
16	Operating surplus, net															
17	Gross value added at basic pric															
18	Output at basic prices	(g)							(y)							

U - Use matrix for intermediates (product by industry)
W - Value added components by industry
Y - Final demand matrix (product by category)
q - Column vector of product output
g - Column vector of industry output
y - Vector of final demand
w - Vector of value added

The supply and use framework integrates the supply table and the use table in one matrix. In the framework, the production matrix of the supply table is transposed to the make matrix, and the vector of imports of the supply table is transposed to a row vector of imports.

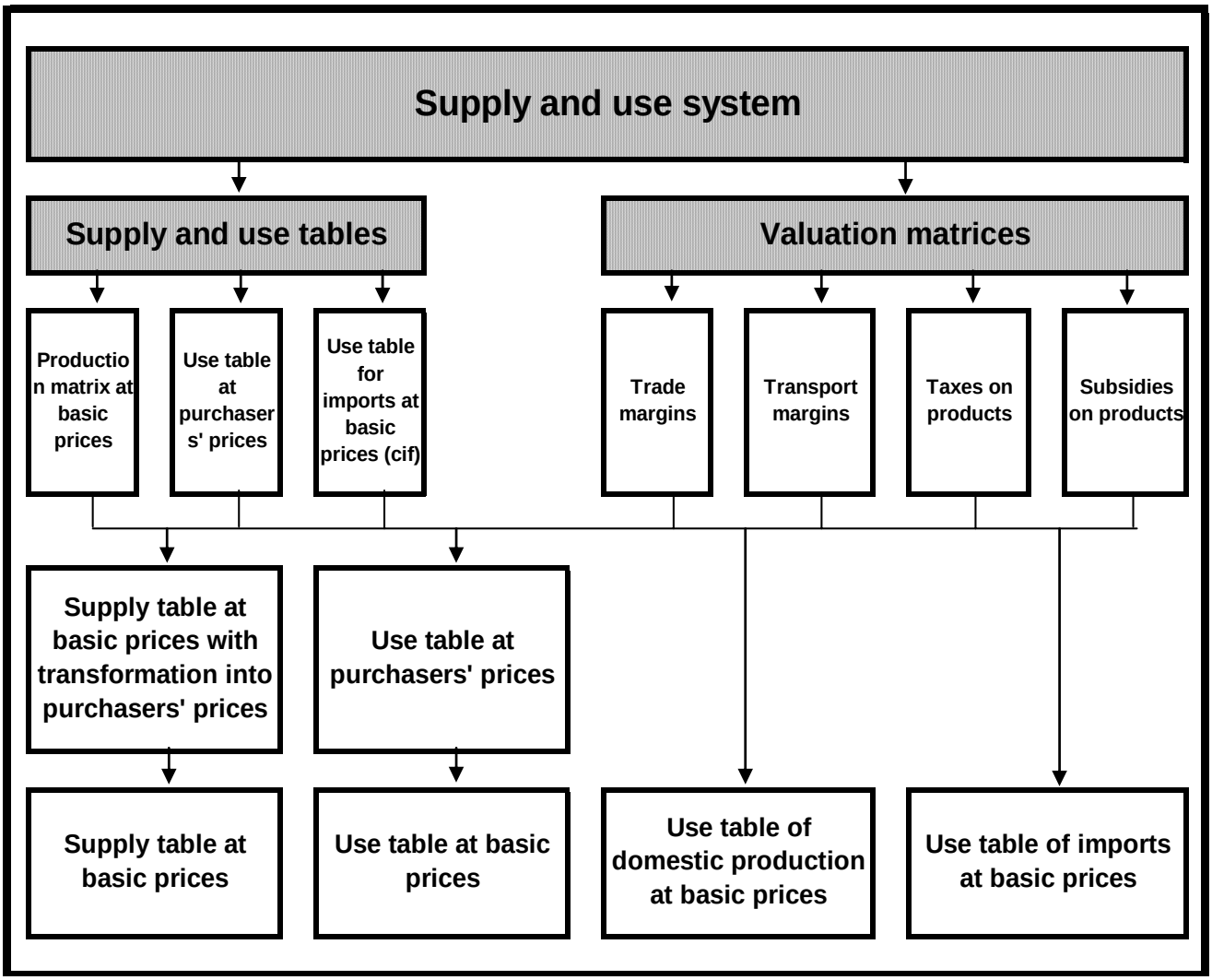
A comprehensive supply and use system incorporates the following tables:

- Supply table at basic prices, including a transformation into purchasers' prices
- Use table at purchasers' prices
- Valuation matrices
- Supply table at basic prices

- Use table of domestic output at basic prices
- Use table of imports at basic prices
- Symmetric input-output table at basic prices
- Symmetric input-output table for domestic output at basic prices
- Symmetric input-output table for imports

The use table for domestic production is derived by subtracting the use table of imports from the total use table. It identifies the input requirements of industries in terms of domestic intermediates; imported intermediates and primary inputs (value added components).

The use table for imports includes information on the use of imported products for intermediate consumption and final uses.



1.3.1. Prices

The SNA-93 and ESA-95 prescribes three ways in which goods and services may be measured namely at basic prices, producer's prices or purchaser's prices. Basic links between prices are as follows:

Basic prices
plus taxes on products (excluding VAT)
less subsidies on products
= *Producers' prices*
plus trade margins
plus transport margins
plus non-deductible VAT
= *Purchasers' prices*

1.3.2. Statistical Unit

The statistical units in the supply and use tables are based on the use of the local kind of activity unit (KAU) as unit of observation. Statistical units used in input-output tables are based on the unit of homogeneous production (UHP) for the product-by-product tables as basic unit.

1.3.3. Classification

TurkStat used the Statistical Classification of Economic Activities in the European Community (NACE Rev. 1.1) to classify the industries in the supply and use tables for 2002 and the Statistical Classification of Products by Activity in the European Economic Community (CPA).

1.3.4. The Supply and Use Tables for 2002

The ESA-95 was implemented in the compilation of the supply and use tables for 2002. The working level of tables was very detailed breakdown by commodity and industry, but published them 59 industry and commodity levels. 2002 SUT and IOTs, fully compliance with ESA'95, are the second tables compiled by at basic prices and current values. These tables are supply table at basic prices, including a transformation into purchasers' prices, use table at purchasers' prices, valuation matrices (table of trade and transports margins, table of taxes less subsidies on products), use table at basic prices, import use matrix, input-output table at basic prices, input-output table for domestic output at basic prices and input-output table for imports.

The supply and use tables for 2002 were compiled by using classifications of NACE and CPA, COFOG and COICOP, etc. All the government expenditures were taken to the intermediate consumption of breakdown by COFOG classification which held by the Ministry of Finance. Three additional rows in the SU tables were added for the cif/fob adjustments on imports/exports, direct purchases abroad by residents and purchases on the domestic territory by non-residents. We add also a new column for the final consumption expenditure by non-profit organizations serving households (NPISH).

1.4. Symmetric Input-Output Tables

The intermediate part of a symmetric input-output table (IOT) is *square*: the number of rows is equal to the number of columns. The dimension can be either product-by-product or industry-by-industry. The square IOT is important for input-output analysis. There are lots of areas used IOT in analysis; well-known examples are the production analysis, cost of structures and productivity analysis, employment analysis, energy analysis, impact analysis and environmental analysis.

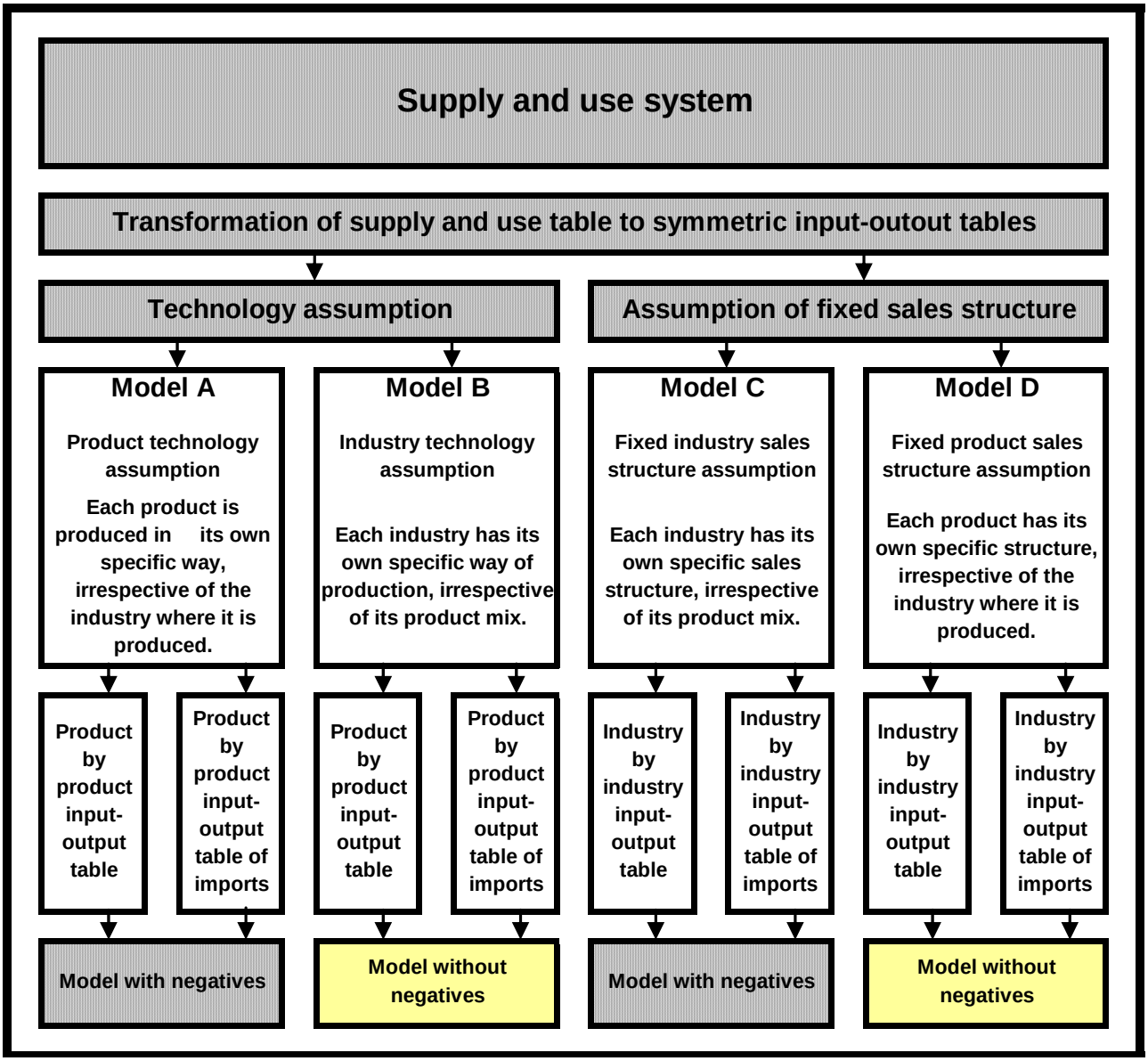
Industry by industry and product by product input-output tables are derived from supply and use tables at basic prices. Compiling input-output tables is an analytical step. For the transformation of supply and use tables into symmetric input-output tables, various assumptions are used and sometimes adjustments are required.

1.4.1. Compilation of the input-output table

There are four basic assumptions for the transformation from supply and use tables into product-by-product input-output tables or industry-by-industry input-output tables (Eurostat, 2008).

- Product technology assumption (Model A)
- Industry technology assumption (Mode B)
- Fixed industry sales structure assumption (Model C)
- Fixed product sales structure assumption (Model D)

The first two assumptions are applied to compile product by product input-output tables. The transformation of SU tables to symmetric industry by industry input-output tables is based on assumptions on the sales structure. All inputs in product by product IO tables are allocated to homogenous units. Product by product IO tables is believed to be more homogenous but further away from statistical sources than industry by industry IO tables. Inputs in industry by industry IO tables are allocated to industries. Industry by industry IO tables is less homogenous but closer to statistical sources and actual observations than product by product IO tables. Model A and Model C have negative values after transformation from supply and use tables to input-output tables. To solve negative problems, hybrid technology and Almon's procedure can be used for removing negative values. But, Model B and Model D do not have negative values.



The construction of the input-output table from the supply and use tables was carried out in several steps. The first step was to transform the supply and use tables into input-output table by applying mathematical methods. The input-output tables for 2002 derived from supply and use tables based on both industry technology assumption and fixed product sales structure assumption, using the Microsoft Visual Basic (VBA) language in EXCEL format (Kula, 2007).

Firstly, use table for domestic production at basic prices was subtracted from use table at basic prices to use table for imports, c.i.f. The input-output table was obtained by application of the fixed product sales structures and the industry technology assumption (Eurostat, 2008).

Table 3. Simplified overview of a symmetric input-output table for domestic output (ind. by ind.)

	HOMOGENEOUS BRANCHES / PRODUCTS (CPA)	HOMOGENEOUS BRANCHES							FINAL USES							
		Agriculture	Industry	Construction	Trade, hotel, transport	Other services	Government services	Total	Final consumption expenditure by households	Final consumption expenditure by non-profit organizations	Final consumption expenditure by government	Changes in valuables	Changes in inventories	Exports, fob	Total final use	Total use at basic prices
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1 2 3 4 5 6	Products of agriculture Products of industry Construction work Trade, hotel, transport services Other services Government services	Domestic products for intermediate consumption at basic prices (B)							Domestic products for final uses at basic prices (F)							(g)
7	Total								Final uses at basic prices							
8	Use of imported products, CIF	Imported products for intermediates							Imported products for final uses							
9	Taxes less subsidies on product	Net taxes on products for intermediate consumption							Net taxes on products for final uses							
10	Total								Final uses at purchasers' prices							
11 12 13 14	Compensation of employees Other net taxes on production Consumption of fixed capital Operating surplus, net	Components of value added (W)														(w)
15	Gross value added at basic price															
16	Output at basic prices	(g)							(y)							

B - Matrix for intermediates (industry by industry)
W - Value added matrix (components by industry)
F - Final demand matrix (industry by category

1.4.2. Calculation of the input-output table by applying of the mathematical methods

The application of fixed product sales structure assumption requires that domestic supply table has to be square as it involves the inverse of the supply table. It can be possible to perform the transformation procedure if intermediate use matrix remains rectangular.

While the original supply table was a rectangular matrix to obtain the square format the aggregation was made. The number of product and industry groups in supply and use tables, use table for domestic production and use table for imports was aggregated to the level of 59 as a square matrix. The transformation from supply and use tables to input-output table was made and calculated the Leontief inverse coefficients.

Calculations were performed using the formulas presented in Input-Output Manual –Compilation and Analysis, published by Eurostat in 2002. The calculation procedures are as follows: firstly, the inversion of domestic supply matrix $(V^T)^{-1}$ was performed. Then the intermediate input-output coefficient matrix *A* was calculated by multiplying the use table *U* with the inverse of the domestic supply table (Eurostat, 2008):

Intermediates and final demand of the industry-by-industry input-output table are:
$B = V(diag(q-m))^{-1} U$
$F = V(diag(q-m))^{-1} Y$

Input coefficient matrix was derived by dividing the columns by the total outputs of industries.
$A = B(diag(g))^{-1} = V(diag(q-m))^{-1} U(diag(g))^{-1} = DZ$
$R = W(diag(g))^{-1}$
With
$Z = U(diag(g))^{-1}$ Matrix of industry intermediate input coefficients
$L = W(diag(g))^{-1}$ Matrix of industry value added coefficients
$D = V(diag(q-m))^{-1}$ Matrix of market shares

The following legend defines the variables which are used in the transformation.

U	Intermediate part of the use table in the dimension product by industry
W	Value added part of the use table in the dimension value added by industry
Y	Final demand part of the use table in the dimension product by final demand
V'	Supply table excluding the columns for imports in the dimension product by industry
B	Transformed intermediate part of use table for symmetric industry-by-industry input-output table
F	Transformed final demand part of use table for symmetric industry-by-industry input-output table
A	Input coefficients matrix for intermediates of the product-by-product input-output table or industry-by-industry input-output table
R	Input coefficients matrix for value added of the industry-by-industry input-output table
q	Vector of total supply of products
m	Vector of imports by product
q-m	Vector of total domestic output of products
diag(q-m)	Matrix with q-m on the diagonal
g	Vector of total output of industries
diag(g)	Matrix with g on the diagonal

2. Backward and forward linkages for the Turkish economy

2.1. Introduction

Linkage analysis is an important analysis for an economy to shows the importance of sectors produced goods and services. Linkage analysis, used to examine the interdependency of production structures, was introduced by the works of Rasmussen (1956), Chenery & Watanabe (1958) and Hirschman (1958). Since that many different methods were improved and expended for the measurement of linkage coefficients. One of the well-known methods for the analysis of interdependency between economic sectors is backward and forward linkage analysis.

Backward linkages are defined as the column sums of the Leontief-inverse from the demand-driven input-output model. Forward linkages are defined as the row sums of the Ghosh-inverse from the supply-driven input-output model. Besides these models, direct input coefficients, and direct output coefficients, and hypothetical extraction of sectors from the demand-driven and supply-driven model are used to define key sectors (see Oosterhaven, 2008).

The objective of this paper is to examine the production structure of the Turkish economy by using the results of input-output tables for 2002 based on two methods developed by Chenery-Watanabe and Rasmussen.

2.2. Linkages based on Chenery-Watanabe method

Traditionally intersectoral linkages are measured by two main categories. One is based on input or output coefficients and Leontief inverse or Ghosian inverse coefficients. The other is the hypothetical extraction method developed by Strassert (1968) mainly measures what happens if intermediate demand goes down, changes in output (see, Andreosso-O'Callaghan B. And Gruogiang Y., 2000)

Backward and forward linkages are descriptive measures of the economic interdependence of industries in terms of the magnitude transactions. Linkages show the estimate of the direct and indirect increase in output following an increase in final demand. Backward and forward linkages, which were first proposed by Rasmussen (1956), are calculated from the Leontief inverse or total requirement matrix.

Linkage analysis is based on both the Leontief demand-driven model and the supply-driven model. the first study on backward linkage and forward linkage were made by Chenery and Watanabe (1958) related to the international comparison of productive structures. The CW backward linkage is the column sums of the input coefficient matrix *A*. The CW backward linkage of sectors *j* is defined as follows:

$$BL^{CW}j = \sum_{i=1}^{n} \frac{x_{ij}}{x_j} = \sum_{i=1}^{n} a_{ij}$$

Where:

$BL^{CW}j$ denotes the backward linkage of sector j for the Chenery-Watanabe

aij denotes the input coefficient matrix.

The CW forward linkage is the sums of rows of matrix of the output coefficient matrix B. The CW forward linkages of sector i is defined as:

$$FL^{CW}i = \sum_{j=1}^{n} \frac{x_{ij}}{x_i} = \sum_{j=1}^{n} b_{ij}$$

Where

$FL^{CW}i$ denotes the forward linkage of sector i,

bij is the output coefficient of sector i to sector j.

The Chenery-Watanabe method based on direct input (or output) coefficients measures only the effects generated by the inter-relationships between sectors. So, these indices can also be called direct backward and forward linkages (see, Andreosso-O'Callaghan B. And Gruogiang Y., 2000; Aydın, 2007). These indices are un-weighted indices which imply that all industries are of equal importance in an input-output table. For that reason, CW method may be corrected if we use weighted input (or output) coefficient instead of un-weighted. The direct input coefficients are weighted in accordance to the importance of each sector in the final demand, and output coefficients are weighted in accordance to the importance of each sector in the total value added. In the demand-driven input-output model final demand is an exogenous variable that is why the share of sectors' final demand to total final demand will be a good weight for identifying the relative strength of backward linkages of various industries in the economy. In the supply-driven input-output model value added components is an exogenous variable, thus a good weighting measure would be the share of a given sector's value added to total value added in the economy.

2.3. Linkages based on Rasmussen method

Rasmussen method is based on the column (or row) sums of the Leontief inverse to measure inter-sectoral linkages. The backward linkage based on the Leontief inverse matrix is defined as the column sums of the inverse matrix.

$$BL^{R}j = \sum_{i=1}^{n} lij$$

Where

lij is the ij'th element of Leontief inverse matrix that is denoted by $L = (I - A)^{-1}$.

$BL^{R}j$ is backward linkage for sector j which reflects the effects of an increase in final demand.

Forward linkage is also defined as the row sums of the Leontief inverse matrix.

$$FL^{R}i = \sum_{j=1}^{n} lij$$

$FL^{R}i$ is forward linkage for sector i. It measures the magnitude of output increase in sector i, if the final demand in each sector were to increase by one unit. It measures the extent to which a unit change in the primary input of sector i causes production increases in all sectors.

2.4. Index of overall intersectoral interdependence

The Leontief inverse is weighted by final demand. Backward linkage measures the impact on supplier industries of a unit increase in final demand. If the Leontief inverse was not weighted, the backward linkage would be an estimate of the direct and indirect increase in output.

Backward and forward linkage indicators are weighted by using the share of sectors in final demand or value added components (Andreosso-O'Callaghan B. And Gruogiang Y., 2000). Indices of overall intersectoral interdependence are defined as:

$$TOL = \sum_{i=1}^{n} \alpha_j BL_j$$

or

$$TOL = \sum_{i=1}^{n} \beta_i FL_i$$

Where

TOL are the index of overall intersectoral interdependence for the Chenery-Watanabe method and the Rasmussen method;

α, is the share of sector j in final demand,

β is the share of sector i in primary inputs.

2.5. Key Sectors

Key sectors for the economic development of a region or a country have been defined as sectors with above average backward and forward linkages. The linkage indicators are normalized and calculated by using following formulas:

NBL =nBLj / ∑BLj
NFL = nFLi / ∑FLi

Where

NBL = {BLj } - vector of normalized values of backward linkages,
NFL = {FLi} - vector of normalized values of forward linkages,
n - Number of sectors in IOT.

Linkage indicators for all sectors are grouped into four categories. If the values of both backward and forward linkages of sectors are above the corresponding average, these sectors are called as key sectors. If only the backward linkages of sector are greater than the average, this sector is called strong backward linkages. If only the forward linkages of sector are greater than the average, this sector is called strong forward linkages. The fourth group refers to the weak linkages category. In this case, the values of sector's backward and forward linkages are less than one.

2.6. Data for 2002 and empirical results

Linkage analysis has been calculated for Turkish economy using the results of 2002 input-output tables which transformed from supply and use tables based on fixed product sales structure assumption. 2002 SU and IO Tables have 59 sector level, aggregated 56 level.

Chenery-Watanabe method (CW) and Rasmussen method (R) are used to calculate backward and forward linkages. Input coefficients and output coefficients matrix as well as weighted input and output coefficient matrix are also used for Chenery-Watanabe method. Leontief inverse matrix, Ghoshian inverse matrix and weighted Leontief inverse and weighted Ghossian inverse are based on Rasmussen method. Normalized values of unweighted and weighted backward and forward linkages are the basic indicators.

2.7. Linkage analysis based on the Chenery-Watanabe and Rasmussen Methods

The CW backward linkage is simply the column sums of input coefficients matrix and the CW forward linkage is the row sums of output coefficients matrix. Table 4 shows the normalized values of backward and forward linkages of 56 sectors. The letters K, B, F and L denote key sector, strong backward linkages, strong forward linkages and weak linkage categories respectively.

There are twenty key sectors in 2002 in Turkey based on the calculation of CW method. These sectors are: agriculture, hunting and related services, food products and beverages, textiles, land transport, wholesale and retail trade, real estate activities, basic metals, chemical and chemical products, petroleum refineries, and paper and printed materials, etc. This means that an increase in the final demand of these industries' output will have a large impact on industries that supply inputs in the production of these industries' output.

Construction, wearing apparel, hotels and restaurants, public administration, motor vehicles, furniture and other manufacturing goods, machinery and equipment, tobacco, leather industry, other services also have large backward linkages in Turkey. The industries with the lowest backward linkages are education, recreational, cultural and sporting services, other transport equipment, fishing, office machinery and computers.

Financial intermediation, other business services, post and telecommunication services, water transports, water supply and distribution, coal and lignite, computer and related services, insurance, renting of machinery and equipment and research and developments have large forward linkages.

Table 5 shows the normalized values of backward and forward linkages and also normalized weighted backward and forward linkages of Turkish economy for 2002 based on Rasmussen method. There are eighteen key sectors in 2002 in Turkey. These sectors are: agriculture, food products and beverages, textiles, construction, land transport, wholesale and retail trade, real estate activities, basic metals, chemical and chemical products, electrical energy, gas and water, post telecommunication, hotel and restaurants, sporting and auxiliary transport activities etc. Strong forward linkages and weak linkages sectors in weighted using by Rasmussen method are the same as strong forward linkages and weak linkages sectors of CW method.

Table 6 shows the summarized the ranking of backward and forward linkages calculated by CW and Rasmussen methods. Agriculture, hunting and related services has the highest weighted forward linkages. The second, third and fourth rankings in weighted forward linkages are land transport, financial intermediation and wholesale trade sectors. Food products and beverages have the highest weighted backward linkages. The second, third and fourth rankings in weighted backward linkages are construction, textiles and wearing apparel.

Table 4. Backward and forward linkages for Chenery-Watanabe Method

			Unweighted linkages		Weighted linkages		Results
			Backward linkages	Forward linkages	Backward linkages	Forward linkages	
1	01	Products of agriculture, hunting and related	0.763	1.085	2.564	8.037	K
2	02	Products of forestry, logging and related ser	0.301	1.192	0.020	0.249	F
3	05	Fish and other fishing products; services inc	0.556	0.598	0.043	0.083	L
4	10	Coal and lignite; peat	0.517	1.110	0.086	0.287	F
5	11	Crude petroleum and natural gas; services i	0.042	1.664	0.009	0.214	F
6	13	Metal ores	0.784	1.645	0.015	0.091	F
7	14	Other mining and quarrying products	0.970	2.760	-0.119	0.725	F
8	15	Food products and beverages	1.769	0.540	7.814	1.177	K
9	16	Tobacco products	1.553	0.134	0.476	0.023	B
10	17	Textiles	1.584	1.126	3.874	2.525	K
11	18	Wearing apparel; furs	1.677	0.253	3.740	0.294	B
12	19	Leather and leather products	1.527	0.865	0.443	0.166	B
13	20	Wood and products of wood and cork (exce	1.625	1.399	0.185	0.203	K
14	21	Pulp, paper and paper products	1.340	1.821	0.109	0.557	K
15	22	Printed matter and recorded media	1.365	1.563	0.165	0.528	K
16	23	Coke, refined petroleum products and nucle	1.397	1.560	0.532	0.413	K
17	24	Chemicals, chemical products and man-mad	0.999	1.416	1.085	1.460	K
18	25	Rubber and plastic products	1.444	1.501	0.494	0.748	K
19	26	Other non-metallic mineral products	1.400	1.639	0.385	1.401	K
20	27	Basic metals	1.153	1.682	0.581	1.297	K
21	28	Fabricated metal products, except machiner	1.335	1.364	0.495	0.627	K
22	29	Machinery and equipment n.e.c.	0.838	0.598	1.592	0.577	B
23	30	Office machinery and computers	0.232	0.636	0.009	0.004	L
24	31	Electrical machinery and apparatus n.e.c.	1.193	0.997	0.617	0.354	B
25	32	Radio, television and communication equipr	1.020	0.756	0.685	0.152	B
26	33	Medical, precision and optical instruments, v	0.542	0.470	0.141	0.025	L
27	34	Motor vehicles, trailers and semi-trailers	1.260	0.711	1.637	0.399	B
28	35	Other transport equipment	0.613	0.953	0.107	0.129	L
29	36	Furniture; other manufactured goods n.e.c.	1.531	0.318	1.484	0.129	B
30	40	Electrical energy, gas, steam and hot water	1.615	1.586	0.854	2.061	K
31	41	Collected and purified water, distribution ser	0.438	1.257	0.056	0.581	F
32	45	Construction work	1.302	0.172	5.051	0.539	B
33	50	Trade, maintenance and repair services of r	1.014	1.144	0.756	1.884	K
34	51	Wholesale trade and commission trade serv	0.914	1.072	1.526	3.987	K
35	52	Retail trade services, except of motor vehic	0.607	0.742	1.206	2.959	K
36	55	Hotel and restaurant services	1.290	0.280	2.438	0.467	B
37	60	Land transport; transport via pipeline service	0.943	0.844	3.649	5.100	K
38	61	Water transport services	0.703	1.284	0.216	0.806	F
39	62	Air transport services	1.464	0.748	0.574	0.214	B
40	63	Supporting and auxiliary transport services;	1.252	1.387	0.656	1.812	K
41	64	Post and telecommunication services	1.058	0.902	0.834	1.196	F
42	65	Financial intermediation services, except ins	0.829	1.290	0.903	3.994	F
43	66	Insurance and pension funding services, ex	0.581	1.040	0.063	0.171	F
44	70	Real estate services	0.372	0.314	1.387	2.004	K
45	71	Renting services of machinery and equipme	0.915	1.399	0.011	0.053	F
46	72	Computer and related services	0.809	1.257	0.049	0.224	F
47	73	Research and development services	0.983	1.991	0.000	0.003	F
48	74	Other business services	0.793	1.643	0.301	3.676	F
49	75	Public administration and defence services;	0.919	0.025	3.119	0.085	B
50	80	Education services	0.479	0.104	0.693	0.216	L
51	85	Health and social work services	1.150	0.174	1.330	0.193	B
52	90	Sewage and refuse disposal services, sanita	1.181	1.241	0.029	0.068	K
53	91	Membership organisation services n.e.c.	1.089	0.522	0.519	0.309	B
54	92	Recreational, cultural and sporting services	0.933	0.838	0.376	0.461	L
55	93	Other services	1.037	0.386	0.135	0.057	B
56	95	Private households with employed persons	0.000	0.000	0.000	0.000	L

Table 5. Backward and forward linkages for Rasmussen Method

			Unweighted linkages		Weighted linkages		Results
			Backward linkages	Forward linkages	Backward linkages	Forward linkages	
1	01	Products of agriculture, hunting and related s	0,877	1,374	1,013	1,053	K
2	02	Products of forestry, logging and related servi	0,694	0,536	0,992	0,994	L
3	05	Fish and other fishing products; services incid	0,803	0,546	0,992	0,993	L
4	10	Coal and lignite; peat	0,790	0,580	0,993	0,995	L
5	11	Crude petroleum and natural gas; services inc	0,590	0,552	0,992	0,994	L
6	13	Metal ores	0,914	0,544	0,992	0,993	L
7	14	Other mining and quarrying products	0,983	0,631	0,991	0,998	L
8	15	Food products and beverages	1,305	2,119	1,056	1,001	K
9	16	Tobacco products	1,223	0,659	0,996	0,993	B
10	17	Textiles	1,329	2,187	1,023	1,011	K
11	18	Wearing apparel; furs	1,439	1,419	1,023	0,995	K
12	19	Leather and leather products	1,326	0,813	0,995	0,994	B
13	20	Wood and products of wood and cork (except	1,252	0,884	0,993	0,994	B
14	21	Pulp, paper and paper products	1,166	0,968	0,993	0,997	B
15	22	Printed matter and recorded media	1,182	0,775	0,993	0,996	B
16	23	Coke, refined petroleum products and nuclear	0,994	0,997	0,996	0,996	L
17	24	Chemicals, chemical products and man-made	0,987	1,580	1,001	1,003	K
18	25	Rubber and plastic products	1,191	0,980	0,996	0,998	B
19	26	Other non-metallic mineral products	1,174	1,366	0,995	1,003	K
20	27	Basic metals	1,079	1,786	0,997	1,002	K
21	28	Fabricated metal products, except machinery	1,157	0,914	0,996	0,997	B
22	29	Machinery and equipment n.e.c.	0,931	1,107	1,005	0,997	F
23	30	Office machinery and computers	0,662	0,529	0,992	0,993	L
24	31	Electrical machinery and apparatus n.e.c.	1,096	0,864	0,997	0,995	B
25	32	Radio, television and communication equipme	1,002	0,909	0,997	0,994	B
26	33	Medical, precision and optical instruments, wa	0,790	0,584	0,993	0,993	L
27	34	Motor vehicles, trailers and semi-trailers	1,143	1,190	1,005	0,996	K
28	35	Other transport equipment	0,831	0,585	0,993	0,994	L
29	36	Furniture; other manufactured goods n.e.c.	1,268	1,047	1,004	0,994	K
30	40	Electrical energy, gas, steam and hot water	1,302	1,611	0,999	1,008	K
31	41	Collected and purified water, distribution servi	0,769	0,557	0,992	0,997	L
32	45	Construction work	1,149	2,310	1,033	0,997	K
33	50	Trade, maintenance and repair services of mo	0,994	1,012	0,998	1,007	F
34	51	Wholesale trade and commission trade servic	0,943	1,411	1,004	1,022	K
35	52	Retail trade services, except of motor vehicle	0,810	1,055	1,002	1,014	K
36	55	Hotel and restaurant services	1,139	1,173	1,012	0,996	K
37	60	Land transport; transport via pipeline services	0,972	2,018	1,021	1,031	K
38	61	Water transport services	0,857	0,701	0,994	0,999	L
39	62	Air transport services	1,178	0,770	0,997	0,994	B
40	63	Supporting and auxiliary transport services; tra	1,117	1,048	0,997	1,006	K
41	64	Post and telecommunication services	1,005	1,005	0,999	1,001	K
42	65	Financial intermediation services, except insu	0,891	1,157	0,999	1,022	F
43	66	Insurance and pension funding services, exce	0,798	0,557	0,992	0,994	L
44	70	Real estate services	0,735	1,234	1,003	1,008	K
45	71	Renting services of machinery and equipment	0,949	0,534	0,992	0,993	L
46	72	Computer and related services	0,896	0,573	0,992	0,994	L
47	73	Research and development services	0,981	0,521	0,992	0,993	L
48	74	Other business services	0,915	1,100	0,994	1,020	F
49	75	Public administration and defence services; c	0,959	1,576	1,017	0,993	F
50	80	Education services	0,775	0,785	0,997	0,994	L
51	85	Health and social work services	1,053	0,959	1,003	0,994	B
52	90	Sewage and refuse disposal services, sanitati	1,080	0,651	0,992	0,993	B
53	91	Membership organisation services n.e.c.	1,019	0,782	0,996	0,995	B
54	92	Recreational, cultural and sporting services	0,954	0,767	0,995	0,996	L
55	93	Other services	1,011	0,589	0,993	0,993	B
56	95	Private households with employed persons	0,571	0,520	0,992	0,993	L

Table 6. Ranking of backward and forward linkages for 2002

			Backward linkages				Forward linkages			
			CW		Rasmussen		CW		Rasmussen	
			UBL	WBL	UBL	WBL	UBL	WBL	UBL	WBL
1	01	Products of agriculture, hunting and related servic	42	7	42	7	27	1	11	1
2	02	Products of forestry, logging and related services	53	49	53	49	23	34	52	34
3	05	Fish and other fishing products; services incidenta	47	47	46	47	41	48	50	48
4	10	Coal and lignite; peat	49	43	48	43	26	33	45	33
5	11	Crude petroleum and natural gas; services inciden	55	53	55	53	5	37	49	38
6	13	Metal ores	41	50	39	50	6	46	51	46
7	14	Other mining and quarrying products	31	56	30	56	1	19	41	19
8	15	Food products and beverages	1	1	4	1	43	16	3	16
9	16	Tobacco products	6	31	8	31	53	53	39	53
10	17	Textiles	5	3	2	3	25	7	2	7
11	18	Wearing apparel; furs	2	4	1	4	50	32	9	32
12	19	Leather and leather products	8	32	3	32	33	42	32	42
13	20	Wood and products of wood and cork (except furn	3	37	7	37	15	39	30	39
14	21	Pulp, paper and paper products	14	41	13	41	3	23	26	23
15	22	Printed matter and recorded media	13	38	10	38	10	25	35	25
16	23	Coke, refined petroleum products and nuclear fuel	12	27	27	27	11	28	24	28
17	24	Chemicals, chemical products and man-made fibr	29	16	29	16	13	12	7	12
18	25	Rubber and plastic products	10	30	9	30	12	18	25	18
19	26	Other non-metallic mineral products	11	33	12	33	8	13	12	13
20	27	Basic metals	22	25	21	25	4	14	5	14
21	28	Fabricated metal products, except machinery and	15	29	14	29	17	20	28	20
22	29	Machinery and equipment n.e.c.	37	10	37	10	42	22	17	22
23	30	Office machinery and computers	54	52	54	52	40	54	54	54
24	31	Electrical machinery and apparatus n.e.c.	20	24	19	24	30	30	31	30
25	32	Radio, television and communication equipment ar	27	22	26	22	36	43	29	43
26	33	Medical, precision and optical instruments, watche	48	39	49	39	45	52	44	52
27	34	Motor vehicles, trailers and semi-trailers	18	9	16	9	39	29	14	29
28	35	Other transport equipment	44	42	44	42	31	44	43	45
29	36	Furniture; other manufactured goods n.e.c.	7	12	6	12	47	45	21	44
30	40	Electrical energy, gas, steam and hot water	4	18	5	18	9	8	6	8
31	41	Collected and purified water, distribution services	51	45	51	45	21	21	48	21
32	45	Construction work	16	2	15	2	52	24	1	24
33	50	Trade, maintenance and repair services of motor v	28	20	28	20	24	10	22	10
34	51	Wholesale trade and commission trade services, e	36	11	36	11	28	4	10	4
35	52	Retail trade services, except of motor vehicles and	45	15	45	15	38	6	19	6
36	55	Hotel and restaurant services	17	8	17	8	49	26	15	26
37	60	Land transport; transport via pipeline services	32	5	32	5	34	2	4	2
38	61	Water transport services	43	36	43	36	19	17	38	17
39	62	Air transport services	9	26	11	26	37	38	36	37
40	63	Supporting and auxiliary transport services; travel	19	23	18	23	16	11	20	11
41	64	Post and telecommunication services	25	19	25	19	32	15	23	15
42	65	Financial intermediation services, except insurance	38	17	41	17	18	3	16	3
43	66	Insurance and pension funding services, except co	46	44	47	44	29	41	47	41
44	70	Real estate services	52	13	52	13	48	9	13	9
45	71	Renting services of machinery and equipment with	35	51	35	51	14	51	53	51
46	72	Computer and related services	39	46	40	46	20	35	46	35
47	73	Research and development services	30	54	31	54	2	55	55	55
48	74	Other business services	40	35	38	35	7	5	18	5
49	75	Public administration and defence services; compu	34	6	33	6	55	47	8	47
50	80	Education services	50	21	50	21	54	36	33	36
51	85	Health and social work services	23	14	22	14	51	40	27	40
52	90	Sewage and refuse disposal services, sanitation a	21	48	20	48	22	49	40	49
53	91	Membership organisation services n.e.c.	24	28	23	28	44	31	34	31
54	92	Recreational, cultural and sporting services	33	34	34	34	35	27	37	27
55	93	Other services	26	40	24	40	46	50	42	50
56	95	Private households with employed persons	56	55	56	55	56	56	56	56

3. Conclusion

This paper gives the information on the compilation of supply-use and input-output tables as methodological and implementations in Turkey. While IOT and SUT are preparing in generally every five years up to 2002, after that date, SUT will be started to prepare as annually basis depends on ESA-95. SU and IO tables for 2002 in Turkey were compiled by very detailed level based on concepts and definitions of ESA'95. The product by product and industry by industry input-output tables are derived from supply and use tables for 2002 based on industry technology assumptions and fixed product sales structure assumptions.

Key sectors were also analysed by using backward and forward linkages of the results of 2002 input-output tables based on the calculation of Chenery-Watanabe and Rasmussen methods. According to findings, there are twelve key sectors in Turkey in 2002 based on both the calculation methods of CW and Rasmussen. These sectors are: agriculture, hunting and related services, food products and beverages, textiles, chemical and chemical products, Other non-metallic mineral products, basic metals, Electrical energy, gas, steam and hot water, wholesale and retail trade, land transport, Supporting and auxiliary transport services; travel agency services, real estate activities.

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