Inter-Sectorial Structural Linkages in the Turkish Economy: Analysis of the Agriculture Sector via the Input-Output Method

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Abstract: In this study, agricultural sector and its sub-sectors were investigated for the Turkish Economy by use of Input-Output Analysis approach. By calculating the direct-indirect and backward-forward linkages effects of agricultural sector and its sub-sectors, their relation degrees with the other sectors in the economy was analysed. The most important sectors were determined and classified based on their input and output in production process, obtained by input-output analysis. When total linkage effects are considered, it has been identified that manufacturing industry is the key sector for Turkish economy, and, however, that agricultural sector and its sub-sectors which are known to be very important for Turkey are not key sectors.

Key Words: Input-Output Analysis, Agricultural Sector, Turkey

JEL Classification: C39, C67, N75

1. Introduction

Even though different classifications, the major sectors of an economy are agriculture, industries and services. There are direct or indirect interactions among of these sectors. Most sectors rely on agricultural output as input to produce output. On the other hands, agriculture is one of the most important sectors for man's life and it is the basis of food supply of the population of the world. Agriculture has maintained its importance since the existence of mankind. And it will continue to keep its importance. Because of the importance of the agricultural sector, the main objective of this study was to reveal the direct and indirect effects of the changes of sub-agricultural sectors in Turkey on the cross-industries' intermediate input exchanges by years.

With its simplest definition the input-output models are simple mathematical ***general equilibrium models*** that quantitatively analysis the mutual linkages between production and consumption units on the whole economy scale in a multi-sectorial way. Different from micro-economic analysis that focuses on the behaviours of firms and households and macro-economic analysis that analyses the whole economy, the input-output analysis' focus is on sectors and good exchanges between sectors. The input-output models provide an opportunity to quantitatively analyse the production and use of outputs of productive sectors on the whole economical and sectorial basis and fulfil an important gap between partial and total analyses, especially in the analysis of empirical problems (Aydogus, 2010, s.3).

Input-output analyses have often been used recently to explain the production relationships. As an example, Ozdemir and Yuksel (2006) analysed the forward and backward linkage effects of the energy sector in Turkey with Input-Output tables for the years 1985, 1990, 1996 and 1998 and calculated the total linkage effects of the years 1996 and 1998. They found that the manufacturing industry maintained its key sector character in all years and also two different sub-sectors of the energy sector (manufacture of coke furnaces and refined petroleum products and electricity production and distribution) became a key sector in 1998. In their study Tuzunturk and Sezen (2010) calculated the capital and labour intensity by estimating export figures in 2012 for Turkey with Input-Output tables. In their calculation they predict that export will be 184 billion TL and labour intensity will increase. In Ersungur and Kızıltan's (2008) study the

production multipliers for sectors between 1973 and 1998 were calculated using six Input-Output tables and the structural linkages of sectors against the final demand increases in the economy were analysed. In their study it was seen that while the structural linkages in the agricultural sector were high before 1980 in Turkey, the industrial sector stood out after 1980. However, especially after 1990 the development of these sectors' sub-branches broke through mostly as the high structural linkages in the agricultural based industrial sector. Karaca (2007) in his study analysed the manufacturing industry using the table for 1998 with the Input-Output approach and found that the iron and steel sector was the sector with the highest total linkage effect. Dilber (2007) in his study analysed the tourism sector using the Input-Output table for 1998 and expressed that this sector was labour intensive and contributed to employment and it was also a candidate for becoming a locomotive sector in the following years. Tunc (2004) in his study analysed the structural change in the Turkish economy with Input-Output tables for 1985, 1990 and 1996. He expressed that the production increase in 1985-1990 period resulted from the increase in export and domestic demand, although the increase in the 1990-1996 period resulted from the increase in the total domestic demand. Manresa et al. (1988) measured the effect of the new indirect taxes after the delegation of Spain to the EU, McKean and Taylor (1991) used the input-output model to measure how the import prices and the external production costs of sectorial inputs for Pakistan economy. Llop (2006) used this model to analyse the economic effect of alternative water policies on the production system of Spain. Cardenete and Sancho (2002) analysed how the indirect taxation charges and elasticity in the Spanish economy affected the competitiveness of the production structure in its southern region. De Miguel (2003) theorised with this method that the structure of sectorial prices and indirect taxation caused the price changes in Extremadura. Llop and Manresa (2004) used the input-output model to evaluate the import prices and multiplier effect on local prices in Catalonia. Hudson and Jorgenson's (1974) study combining the input-output and econometric model to determine the effect of the policies on energy demand and supply is important as a new methodology suggestion. Forsund (1985) used a widened input-output model to analyse air pollution. Proops (1988) used a widened input-output model to design indicators on direct and indirect energy consumption. Proops et al. (1993) compared England and Germany regarding air pollution using the indicators they suggested in his study in 1988. Hawdon and Pearson (1995) analysed the economy using the input-output model in ten sectors to show how a mutual relationship existed between energy and the environment for England in their study. Alcantara and Roca (1995) used the input-output model to measure the energy demand and carbon dioxide emissions of Spain. Anton et al. (1996) designed different growth scenarios and calculated the carbon dioxide emission level in these cases for the Spanish economy. Morillas et al. (1996) prepared a dynamic study for the effect of the demand structure on growth and air pollution for southern Spain. Manresa and Sancho (2004) estimated the carbon dioxide emission and sectorial energy density for the Catalonian economy. He used the Social Accounts Matrix (SAM) to estimate the energy density.

2. Material and Methods

The main data resource used in this study is the Input-Output Flow Tables for the Turkish Economy prepared by the Turkish Statistical Association (TURKSTAT). The agricultural sector was analysed in this study with the tables obtained using the most recently published data[1] by TurkStat (TUIK, 2004). Input-output analysis was used as an approach in this investigation.

Input-Output Analysis

The Input-Output table is based on the Tableau Economique prepared by a French economist Quesnay in 1758. Russian-born Leontief defined the economical linkages in a new form in his "Input-Output Economics" work in 1966. Through input-output analysis Leontief proved that there were mutual interactions between the sectors in an economy and that different sectors of the economy were depended to each other.

Leontief adopted Walras' mathematical logic. The Walras model deals with the whole economy and expresses the general equilibrium. Leontief divides the economy into two as production and

[1] The year 2002 Input-Output (General) Table of the Turkish Statistics Association (Tukstat) which has officially published last Input-Output Table was used in the study.

final demand. In this analysis there is also an association such as total production, intermediate consumption and final consumption.

For example, providing services of the tourism sector using the construction and furnishing materials and food and beverages is intermediate consumption; total tourism services, total production and the benefits of the tourists from these services are final consumption. Providing equilibrium for all sectors in the economy is possible.

In the input-output relationship context, all sectors affect the economy and may become dependent on each other. In order to produce a certain output, from which sector, the amount of production factor, i.e. the input that will be used can be calculated through this analysis. Also, with the help of this table, sectorial production planning can be carried out. Input-output models are the models considering the relationships between the activity levels of all sectors (Akkaya ve Pazarlioglu, 2000, s.14).

In input-output tables columns show the inputs, i.e. purchases, lines show the outputs, i.e. productions. It is important in the table to calculate how much value each sector takes from the other sectors and how much it transfers to them.

On the basis of input-output tables, the input coefficients (Coefficients of Technology or technical coefficient) matrix is created. This is obtained by proportioning the values in the input-output table to the sector productions through columns. In other words, the input volume of each sector in columns is proportioned to the total input volume at the end of the column it involves with and its added value.

These rates show how many units of input from other goods are required to provide one unit of production (output) from any goods. These rates are called “technical coefficient” (Berger and Saibel, 1957). After calculating the technical coefficients, sectorial production and demands can be planned by regarding these coefficients as data (Afsar, 2006).

Total demand and total supply equality in input-output analysis can be expressed via these equations (Senesen, 1999; Senesen ve Gunluk, 2005):

Total production=Production for intermediate demand+Production for Final demand

$X = Z+D$

D in the equations is the Gross Domestic Product in terms of expenditure.

$D= C + I + CS + G + E - M$

In the equation C shows the private final consumption costs, I shows the formation of gross fixed capital, CS shows stock changes, G shows final consumption costs of the government and E shows export and M shows import. Since the intermediate inputs are consumed in the production process, the evaluations regarding the success of the economy focus on the final demand, i.e. the Gross National Products.

In the input-output model the total demand also is obtained by considering the demand for intermediate goods together with the final demand in the Keynesian model:

$$X_i = \sum_{j=1}^{n} a_{ij} X_j + D_j$$

Here X_i, shows the i. sector’s output, the part shown by the total symbol shows the total intermediate goods demand for the sector’s output, Dj shows the final demand for the sector’s output. The goods and services produced by a sector are demanded for consumption by both the other sectors and final users (Yıldırım vd, 2009, s.103).

While technical the coefficients matrix can be expressed to show in what proportions the total demand consists of the sector’s intermediate demands and of the sector’s final demands, it can be expressed as the production function to show in what proportions the total production consists of intermediate inputs and of labour and capital inputs. In this case

($X_{ij} = a_{ij}X_i$; $0<a_{ij}<1$) a_{ij}'s column totals will give the intermediate input proportion of j sector’s production. This definition of a_{ij} is predicated. The input-output model expressed by the equations can be expressed by the matrix algebra as follows:

$X=AX+D$

Here X is an n lined vector in nxn dimension including n sector’s output. D is an n lined vector in $nx1$ dimension including n sector’s final demand. A is the matrix of intermediate input coefficients in the nxn dimension including the technological (technical) coefficients and n line and n column and it consists of a_{ij} elements. This

is also called the *sectorial dependency matrix*. Matrix *A* shows the direct input intake structure of sectors. This equation is called the input-output matrix equation or input-output equation. When the equation is solved;

$X=(I-A)^{-1}.D$ is obtained. (*I*: a unit matrix)

The $X=(I-A)^{-1}.D$ equation shows the output (production) vector (*X*) corresponding to an exogenously determined total demand vector (*D*) when the production technology is data (*A*).

$(I-A)^{-1}$ matrix is called the Leontief's inverse matrix or technological inverse matrix and this matrix enables calculation of the additional intermediate input demands resulted from the dependency among sectors once and automatically together with the total demands without needing any iteration (Aydogus, 2010. s. 51-52).

The production multiplier to be used in the study is the column total of Leontief's inverse matrix showing the increase in outputs corresponding to a unit increase in final demand belonging to each industry. For instance, the simple production (output) multiplier for j industry is the column total of that industry in Leontief's inverse matrix. We can express this as (Turker, 1999, s.232; Ten Raa, 2005, s.27):

$z_j = \sum_{i=1}^{n} A_{ij}$

Here, z_j: simple production multiplier of j industry,

n: number of industry in input-output flow matrix, for instance the formula for the first sector will be;

$z_1=A_{11}+A_{21}+ \quad A_{n1}$.

A_{ij}**:** shows the elements of Leontief's inverse matrix $(I-A)^{-1}$.

The production multiplier shows the structural linkage level between each industry and the other industries of the economy. According to this, as the numerical value of the production multiplier grows, structural linkage increases.

Hirschman supposes that the effects of forward and backward linkages that reflect sectors' "feeding" and "stimulating" powers on other sectors must be considered in the investment decisions (Hirschman, 1958, s.9). In Hirschman's unbalanced growth model, one of the most important factors that restricts economic growth is the ability of decision making, especially the ability to make an investment decision.

Inferring from Hirschman's ideas, a quadruple grouping can be developed. The categories of this grouping that considers forward and backward linkages together can be summarised as follows:

Category 1: Sectors that have high forward and backward linkage effects influence both the sector they get and take input. The sectors where both effects are high are called the *key sector* or *locomotive sector* (Oney, 1983, s.99).

Category 2: Sectors that have high backward but low forward linkage effects are the sectors effective in the evaluation of natural resources of the country.

Category 3: Sectors that have high forward but low backward linkage effects are the sectors producing intermediate goods and they increase the production of sectors demanding these goods.

Category 4: Sectors that have low backward and forward linkage effects do not influence the other sectors directly, but help to increase the country's income by creating added value (Aydogus, 2010. s. 133).

The above arrangement shows sectorial investment priorities from the lowest to the highest. According to this, the sectors in the first category constitute the key sectors in the economy and have the highest investment priority. The scarce resources should primarily be devoted to these sectors. If there are still unused resources, they should be devoted to the sectors in the second category. Sectors in the III and IV categories come last in terms of investment priorities, that is, these sectors are expected to be stimulated by the key sectors (Aydogus, 1999: 100-101).

3. Results Of Inter-Sectorial Dependency

One of the most important results of input-output analysis is that it enables measurement of the inter-sectorial backward and forward linkage effects numerically. The backward linkage effect concept for a typical j sector is related to the input intake of that sector from the other sectors (i=1 …n) including itself. However, the forward linkage effect concept for a typical i sector is related to the input sale of that sector to the other sectors (j=1 …n) including itself.

This sector will demand input from other sectors including itself to perform a certain production

and all sectors including its sector will produce up to this demand. In Input–Output analysis this initial effect is called the **direct backward linkage effect** and it emphasizes the way that a sector's input affects the other sectors' output. Conversely, the production that all sectors have to perform in order to meet this input demand will again generate inter-sectorial input demand and these demands will again result in production increase (this mechanism is similar to the increasing effect of the investments on income). Out of the direct backward linkage effect this effect is called the **indirect backward linkage effect**, the total of these two effects is called the **total backward linkage effect**.

A part of one unit of a sector's production will meet the intermediate input demand of other sectors, including itself and the other parts will meet the final demand. In input-output analysis the proportion of the total of sector intermediate input sale to the sector production will provide the **direct forward linkage effect** and emphasizes the way in which a sector's output is the other sectors' input. With the exception of this initial effect, the sectors' production (output) using the output of this sector as input will again be the other sectors' input and this mechanism will be repeated. Out of direct forward linkage effect, this effect is called the **indirect forward linkage effect** and the total of these two sectors is called the **total forward linkage effect**.

The sectors using a significant amount of intermediate input from other sectors-having a high backward linkage effect-are expected to stimulate the production increases in the sectors providing intermediate input to this sector and the sectors performing intermediate usage of production rather than final usage–having high forward linkage effect–are expected to stimulate the production increases in the sectors using these sectors' outputs as input. Therefore, the sectors with high backward and forward linkage effect are "locomotive" or "key sectors" in the economy.

To summarize, the total production increase, which is caused by one unit of final demand increase in a certain sector, can be defined as that sector's total backward linkage effect and the increase in a sector's production, which is caused by each unit of final demand increases in all sectors, can be defined as the sector's total forward linkage effect.

Table 1. The First 5 Sectors That Agriculture Sectors Provide Input

Sector	1	2	3	4	5
1	0.1459	0.0346	0.0297	0.0228	0.0185
Agriculture, animal husbandry and related service activities	Agriculture, animal husbandry and related service activities	Manufacture of chemicals and chemical products	Manufacture of food products and beverages	Financial intermediation, with the exception of insurance and pension funding	Wholesale trade and commission trade, with the exception of motor vehicles and motorcycles
2	0.0317	0.0267	0.0145	0.0135	0.0118
Forestry, logging and related service activities	Wholesale trade and commission trade, with the exception of motor vehicles and motorcycles	Sale, maintenance and repair of motor vehicles and motorcycles; retail sale services of automotive fuel	Manufacture of other non-metallic mineral products	Manufacture of coke, refined petroleum products and nuclear fuels	Land transport; transport via pipelines
3	0.0505	0.0340	0.0339	0.0247	0.0182
Fishing, operating of fish hatcheries and fish farms; service activities incidental to fishing	Wholesale trade and commission trade, with the exception of motor vehicles and motorcycles	Manufacture of food products and beverages	Manufacture of other transport equipment	Manufacture of coke, refined petroleum products and nuclear fuels	Fishing, operating of fish hatcheries and fish farms; service activities incidental to fishing

Note: Values in the table were calculated by the writers using the Input-Output table (General) of the Turkish Statistics Institution (TURKSTAT) for 2002.

The direct linkage effect shows the direct trade of a sector with the other sectors. However, the indirect effect shows the chain interaction of the sector with the others. For that reason, direct and indirect linkage effects are involved in the study as total linkage effects (Ozdemir ve Yuksel, 2006, s.12).

3.1. Direct Linkage Effects

From which sectors does the agriculture sector provide their inputs in the order of magnitude? Table 1 presents the first 5 sectors that these sectors provide inputs for one unit of production.

As can be seen in Table 1, when the sub-sectors of the agricultural sector are analysed, the 1st agriculture, animal husbandry and related service activities sector provides the inputs of one unit production from the 1st agriculture, animal husbandry and related service activities sector with 0.1459 unit, the 18th manufacture of chemicals and chemical products sector with 0.0346 unit, the 9th manufacture of food products and beverages sector with 0.0297 unit, the 44th financial intermediation, except insurance and pension funding sector with 0.0228 unit and the 36th wholesale trade and commission trade, with the exception of the motor vehicles and motorcycles sector with 0.0185 unit.

Which sectors providing inputs from agriculture sectors? The first five sector that providing inputs from agriculture sectors is presented Table 2.

How much must the other sectors' production increase in order to increase the one unit total demand on agriculture, hunting and related service activities sector or to increase the production this sector as one unit? 0.3657 unit from the manufacture of food products and beverages sector, 0.2095 unit from the manufacture of tobacco products sector, 0.1459 unit from its own sector, 0.0784 unit from the hotels and restaurants sector and 0.0613 unit from the research and development services sector.

Table 2. The First 5 Sectors Providing Inputs from Agricultural Sectors

Sector	**1**	**2**	**3**	**4**	**5**
1	0.3657	0.2095	0.1459	0.0784	0.0613
Agriculture, hunting and related service activities	Manufacture of food products and beverages	Manufacture of tobacco products	Agriculture, hunting and related service activities	Hotels and restaurants	Research and development services
	0.1200	0.0322	0.0105	0.0103	0.0039
2	Manufacture of wood and of products of wood and cork, with the exception of furniture; manufacture of articles of straw and plaiting materials				
Forestry, logging and related service activities		Manufacture of pulp, paper and paper products	Mining of coal and lignite; extraction of peat	Forestry, logging and related service activities	Mining of metal ores
3	0.0182	0.0079	0.0018	0.0003	0.0002
Fishing, operating of fish hatcheries and fish farms; service activities incidental to fishing	Fishing, operating of fish hatcheries and fish farms; service activities incidental to fishing	Hotels and restaurants	Manufacture of food products and beverages	**Research and development services**	Health and social work

Note: Values the in table were calculated by the writers using the Input-Output table (General) of the Turkish Statistics Institution (TURKSTAT) for 2002.

Table 3: The first 5 Sectors That Agriculture Sector Provide Inputs

Sector	1	2	3	4	5
1	1,1925	0.0695	0.0434	0.0383	0.0342
Agriculture, hunting and related service activities	Agriculture, hunting and related service activities	Manufacture of chemicals and chemical products	Manufacture of food products and beverages	Financial intermediation, except insurance and pension funding	Wholesale trade and commission trade, with the exception of motor vehicles and motorcycles
	1,0108	0.0384	0.0325	0.0208	0.0191
2			Sale, maintenance and repair of motor vehicles and motorcycles; retail sale services of automotive fuel		
Forestry, logging and related service activities	Forestry, logging and related service activities	Wholesale trade and commission trade, with the exception of motor vehicles and motorcycles		Land transport; transport via pipelines	Manufacture of coke, refined petroleum products and nuclear fuels
3	1,0187	0.0629	0.0431	0.0375	0.0332
Fishing, operating of fish hatcheries and fish farms; service activities incidental to fishing	Fishing, operating of fish hatcheries and fish farms; service activities incidental to fishing	Wholesale trade and commission trade, with the exception of motor vehicles and motorcycles	Manufacture of food products and beverages	Manufacture of other transport equipment	Manufacture of coke, refined petroleum products and nuclear fuels

Note: Values in the table were calculated by the writers using the Input-Output table (General) of the Turkish Statistics Institution (TURKSTAT) for 2002.

0.1200 unit of one unit of the total demand on the forestry, logging and related service activities sector from the manufacture of wood and of products of wood and cork, with the exception of furniture; manufacture of articles of straw and plaiting materials sector, 0.0322 unit is from the manufacture of pulp, paper and paper products sector, 0.0105 unit from the mining of coal and lignite; extraction of peat sector, 0.01038 unit is from its own sector, 0.0039 unit from the mining of metal ores sector.

0.0182 unit of one unit of total demand on the fishing, operating of fish hatcheries and fish farms; service activities incidental to fishing sector is from its own sector, 0.00791 unit from the hotels and restaurants sector, 0.0018 unit from the manufacture of food products and beverages sector, 0.0003 unit from the research and development services sector, 0.0002 unit from the health and social work sector.

3.2. Indirect Linkage Effects

The first 5 sectors that the agriculture sector provides inputs for one unit of production are presented in Table 3 (shown in columns in the table).

As can be followed from Table 3, the number 1 sector is agriculture, hunting and related service activities sector with the highest backward linkage effect in agriculture sectors, i.e. mostly stimulating the other sectors by the one unit increase in production provides the inputs of one unit of production from its own sector with 1,1925 units, from the 18th sector manufacture of chemicals and chemical products sector with 0.0695 unit, from the 9th sector manufacture of food products and beverages sector with 0.043471 unit, from the 44th sector financial intermediation, with the exception of insurance and pension funding activities sector with 0.0383 unit and from the 36th sector wholesale trade and

commission trade, with the exception of the motor vehicles and motorcycles sector with 0.0342 unit in order.

The agricultural sectors that give their products as inputs are presented in Table 4.

As can be followed from Table 4, one unit of total demand for the number 1 agriculture, hunting and related service activities sector is from its own sector with 1,1925 units, from the manufacture of food products and beverages sector with 0.5153 unit, from the manufacture of tobacco products sector with 0.2758, from the hotels and restaurants sector with 0.1775 unit and from the tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear sector with 0.1041 unit.

3.3. Total (Direct+Indirect) Linkage Effects

Since the total linkage effects consider the indirect input exchanges as well as the inter-sectorial direct input exchanges, they are the more comprehensive indicators of industrial linkage. However, apart from some exceptions, there is expected to be a large amount of correlation between direct linkage effects and total linkage effects, although this fact is not valid for certain sectors. In these cases considering the indirect linkage effects seems to be a more satisfactory approach (Aydogus, 1999, 2010, s.125-128). In this aspect, a calculation of the total forward and backward linkage effects for 2002 table calculations is included in the study.

Table 4. The First 5 Sectors Providing Input from Agriculture Sectors

Sector	**1**	**2**	**3**	**4**	**5**
1	1,1925	0.5153	0.2758	0.1775	0.1041
Agriculture, hunting and related service activities	Agriculture, hunting and related service activities	Manufacture of food products and beverages	Manufacture of tobacco products	Hotels and restaurants	Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear
2	1,0108	0.1460	0.0473	0.0158	0.0133
Forestry, logging and related service activities	Forestry, logging and related service activities	Manufacture of wood and of products of wood and cork, with the exception of furniture; manufacture of articles of straw and plaiting materials	Manufacture of pulp, paper and paper products	Recycling	Manufacture of furniture; manufacturing n.e.c.
3	1,0187	0.0084	0.0023	0.0004	0.0004
Fishing, operating of fish hatcheries and fish farms; service activities incidental to fishing	Fishing, operating of fish hatcheries and fish farms; service activities incidental to fishing	Hotels and restaurants	Manufacture of food products and beverages	Air transport	Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear

Note: Values in the table were calculated by the writers using the Input-Output table (General) of the Turkish Statistics Institution (TURKSTAT) for 2002.

Table 5. Total (Indirect+Direct) Forward and Backward Linkage Effects of the First 5 Sectors and the Agricultural Sector*

TOTAL FLE			TOTAL BLE		
9,5659	1*	Manufacture of basic metals	3,9281	1	Manufacture of radios, televisions and communication equipment and apparatus
8,3129	2	Manufacture of chemicals and chemical products	3,7515	2	Manufacture of motor vehicles, trailers and semi-trailers
6,5172	3	Electricity, gas, steam and hot water supply	3,7263	3	Recycling
6,2727	4	Land transport; transport via pipelines	3,7164	4	Manufacture of basic metals
6,0628	5	Wholesale trade and commission trade, with the exception of motor vehicles and motorcycles	3,6804	5	Manufacture of furniture; manufacturing n.e.c.
4,0795	12	Agriculture, hunting and related service activities	3,4646	50	Agriculture, hunting and related service activities
1,5646	35	Forestry, logging and related service activities	1,4245	57	Forestry, logging and related service activities
1,0665	55	Fishing, operating of fish hatcheries and fish farms; service activities incidental to fishing	1,7197	53	Fishing, operating of fish hatcheries and fish farms; service activities incidental to fishing

Note: Values in the table were calculated by the writers using the Input-Output table (General) of the Turkish Statistics Institution (TURKSTAT) for 2002.

***:** shows the ranking according to the sector's size.

When Table 5 is analysed, it is seen that the sectors with high total forward linkage effects are very important in the economy because they create supplies to the other sectors using the goods they produce as inputs and reduce the dependency on external resources.

As observed in Table 5, the first 5 sectors with the highest total (indirect and direct) forward linkage effect in 2002 are Manufacture of basic metals, Manufacture of chemicals and chemical products, Electricity, gas, steam and hot water supply, Land transport; transport via pipelines, Wholesale trade and commission trade, with the exception of motor vehicles and motorcycles in order. In 2002 only one sector of sub-sectors of agriculture sector got involved in the first 20 sectors in terms of the highest total forward linkage effects and they had an important role in providing input for the other sectors of the economy.

When we comprehensively look the year 2002, both the forward and backward linkage effects of the sub-sectors of agriculture sector a) Agriculture, hunting and related service activities, b) Forestry, logging and related service activities, c) Fishing, operating of fish hatcheries and fish farms; service activities incidental to fishing are low when the first 20 sectors with high total forward and backward linkage effect. As they are the sectors with low forward and backward linkage, they have less influence on the sectors they take and give inputs to. Although the agriculture, hunting and related service activities sector is in the 12th line in terms of forward linkage effects, it is in the 50th line when the backward linkage effect is considered. These sectors cannot be considered as *key* or *locomotive sectors*.

The sectors with total backward linkage effects are the sectors with an important role in stimulating the production levels of other sectors in economy, i.e. since the sectors with the high backward linkage effect will demand inputs from the other sectors, they cause the stimulation and arouse in economy. When the total backward linkage effects for all sectors in 2002 are analysed, high linkage effect values of sub-sectors of manufacture industry stand out. It is known that the manufacturing industry in developing countries plays an important role in stimulating the production levels of other sectors in the economy.

The first 5 sectors with the highest total (direct and indirect) backward linkage effect for 2002 are Manufacture of radio, television and communication equipment and apparatus, Manufacture of motor vehicles, trailers and semi-

trailers, Manufacture of basic metals, Manufacture of furniture; manufacturing n.e.c. and Manufacture of wearing apparel; dressing and fur dyeing sectors in order.

4. Conclusion

According to Hirschman's categorization, the sectors with high both forward and backward linking effect are defined as locomotive (key) sectors in the economy. When the first 10 sectors with the high total linkage effect in our study are considered, locomotive sectors are Manufacture of basic metals, Manufacture of chemicals and chemical products, Electricity, gas, steam and hot water supply, Manufacture of pulp, paper and paper products, Manufacture of textile products, Manufacture of coke, refined petroleum products and nuclear fuels, Manufacture of plastic and rubber products, Manufacture of radios, televisions and communication equipment and apparatus and the Manufacture of food products and beverages sectors.

Sectorial linkages have been analysed in our study with the help of the Input-Output table of 2002. In addition, the other sectors that the agriculture sector, which is the issue of our study, take in and provide input to are determined in the analyses by use of Leontief's inverse matrix. Because of the fact that forward linkage's effect of agricultural sector higher than backward linkage's effect of it, this sector give input to other sectors is determined. As a result, agricultural sector is not key sector of Turkish economy but it is important sector due to gives input to the key sectors.

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