THE STRUCTURAL ANALYSIS OF AGRICULTURE, FOOD AND ENERGY SECTORS in TURKEY: AN INPUT-OUTPUT MODEL

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ABSTRACT

Energy sector plays a fundamental part (either as a cause or the as a facilitator) in the economic growth process. As known, agricultural sector also plays a strategic role in the process of economic development of a country. Agriculture and energy sector are considered to be important drivers of the economy due to their strong inter-industrial linkages. The purpose of this study is to analyse the structural interdependency of the agriculture, food and energy sectors in Turkey. In this study, it has been discussed whether agriculture, energy and food manufacturing industries can be considered as the drivers of the Turkish economy. For this purpose, the input-output tables constructed by the TurkStat national accounts in 2012 has been employed and several multipliers have been calculated by using input-output tables. According to the multipliers, employment creation capacity of agriculture, energy and food manufacturing sector is relatively weak. However, their income creation impact is remarkably high. Among the others, agriculture is the most income creative sector in case of final demand increase in the economy. Similarly, energy sector has key role in the economy, since it's both direct and indirect income generating effect is quite high. These results ensure useful information for policy makers to stimulate growth via more appropriate investments in the economy.

Key Words: Energy use in agriculture and food sectors, Input–output analysis, Turkey.

TÜRKİYE'DE TARIM, GIDA VE ENERJİ SEKTÖRLERİNİN YAPISAL ANALİZİ: BİR GİRDİ-ÇIKTI MODELİ

ÖZET

Enerji hem bir faktör hem de bir hızlandıran olarak ekonomik büyüme sürecinde temel bir role sahiptir. Bilindiği gibi, tarım sektörü de bir ülkenin ekonomik kalkınmasında stratejik bir rol oynamaktadır. Tarım ve enerji sektörleri güçlü endüstriler arası bağlantıları nedeniyle ekonominin önemli itici faktörleri olarak kabul edilmektedirler. Bu çalışmada tarım, gıda ve enerji sektörlerinin Türkiye ekonomisi için önemli itici sektörler olup olmadığı tartışılmaktadır. Bu amaçla, TÜİK' nun 2012 yılı ulusal hesapları ile oluşturduğu Girdi-Çıktı tabloları kullanılmış ve bu tablolar kullanılarak çeşitli çarpanlar türetilmiştir. Çarpan analizine göre, tarım, enerji ve gıda imalat sanayi sektörlerinin istihdam yaratma etkileri oldukça yüksektir. Tarım sektörü, nihai talep artışı durumunda tüm sektörler içinde en yüksek gelir yaratıcı etkiye sahip sektördür. Benzer şekilde, hem doğrudan hem de dolaylı gelir yaratma etkisi çok yüksek olduğundan, enerji sektörü ekonomide anahtar bir role sahiptir. Bu sonuçlar, uygun yatırımlarla büyümeyi teşvik etmek için politika yapıcılara önemli bilgi sağlamaktadır.

Anahtar Kelimeler: Tarım ve gıda sektörlerinde enerji kullanımı, Girdi-çıktı analizi, Türkiye.

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1.Introduction

Agriculture is both important consumer and producer of energy. Agriculture uses energy directly or indirectly in the form of diesel, electricity, fertilizer, irrigation water, chemicals, machinery etc. (Singh et.al., 2002). Knowledge about energy use in agriculture is important since it can improve the understanding of how to reduce the unstable use of limited energy resources .Moreover, problems with the use of energy in agriculture are concern of researchers and policy makers because fossil energy is limited and has adverse effects on environment (Dalgaard et.al., 2001). As known, environmental pollution and/or environmental degradation are closely linked to energy consumption in the economies. Therefore, efficient use of energy resources supports to achieve increased production and productivity and contributes to economy, profitability and competitiveness of agriculture sustainability to well-being in the rural areas (Singh et.al., 2002).

In fact, energy use in agricultural sector depends on the size of population engaged in agricultural activities, the size of land and the level of mechanization (Ozkanet.al., 2004). Agriculture is of key importance to Turkey both in economic and social terms. Although the share of agriculture has diminished during the recent years, around 20 % of Turkish workforce was still employed in agriculture in 2016, while the sector accounted for 9 % of Turkish GDP (TurkStat, 2016).Turkey is a middle-to high income country and is on an upward trajectory in terms of economic growth. Per capita income levels increased from USD $ 3,000 to nearly $10,000 level over the past 15 years. Turkish economic growth that have been going on have created a strong economy that is based on high demand for energy (IEEFA, 2016). The total primary energy demand is estimated to reach 218 Mtoe by 2023 from the current level of 125 Mtoe (MFA, 2017).The total primary energy demand is estimated to reach 218 Mtoe by 2023 from the current level of 125 Mtoe (MFA, 2017).The demand has reached to such a high extend that energy sector had turned into one of the most important sectors. Turkey's energy sector attracted substantial interest in the investors community thanks to liberalization and markets reforms in electricity sector. During the last decade, market reforms have proceeded in electricity and gas sector. These market reforms triggered a private investment boom (electricity generating capacity doubled between 2007 and 2014). Turkey's energy demand will double during the next decade, which calls for an investment requirement of minimum 100 billion USD (Deloitte, 2016).

There has been many studies analyzing the Turkish economy by using Input-Output (hereafter I-O) model. Türker (1999) analyzed the relative importance of forestry sector and found little contribution of sector to whole economy. Aydın (2001) analyzed the structural change in manufacturing sector by using several I-O tables of Turkish economy. Author found manufacturing and transportation industries were key sectors of the Turkish economy and these sectors mostly produced intermediate goods. Tunç (2004) analyzed the structural change of Turkish economyin a comparative way after 1980 using three I-O models. Author found increase in output was mainly due to increase in final demand and manufacturing sector experienced remarkable increase in the country. Karkacier and Goktolga (2005) analyzed the interdependency of agriculture and energy sector in Turkey and concluded that final demand multiplier of agriculture sector was 1.2778. Çondur and Evlimlioglu (2007) examined the importance of mining

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sector for the Turkish economy by using I-O model. Authors found mining sector has the highest backward linkage coefficient among the others and it's income creating effect is considerably high. Atan (2011),analyzed the effect of intermediate goods on the structure of whole Turkish economy and inter-sectoral linkages by using I-O tables of 2002. Author found energy, transportation and telecommunication sectors were the key industries in Turkish economy. Yılancı (2008), analyzed the key sectors in Turkish economy by using 1998 I-O Table and found agriculture, trade, transportation and communication sectors were the key sectors among the other in the economy. Çalışkan and Aydoğus (2011) analyzed the sources of industrial growth in Turkish economy by using Syrquin Decomposition model for two sub-periods, namely 1985-1990 and 1990-2002. Authors concluded that export-led growth policies implemented after 1980 were mostly ineffective in the short run. Göktolga and Özkan (2011) evaluated the relative importance of transportation sector by comparing two I-O tables (1998-2002) for Turkey. Authors founded that transportation sector grew unstable between 1998 and 2002. Moreover, maritime transportation was key sector in transportation and transportation sector has high potential in terms of indirect effect among the others. Taşçı (2013), provided structural analysis of "information, communication technologies (ICT)" sectors in Turkish economy by using two I-O tables (1998 and 2002) prepared by OECD. Author concluded that ICT sector was growing rapidly and able to create significant amount of job opportunities in spite of the financial crises. Uğurlu and Tuncer (2017), analyzed the relative contributions of manufacturing and service industries employment and growth in the Turkish economy by using two different I-O tables (1995 and 2011). Authors found while manufacturing sector contributed significantly to the economy, service industries ensured limited contributions to country's output. Moreover, manufacturing sector mostly concentrated on the consumer and low to technology goods. Gül (2017) analyzed the construction sector in Turkey by using I-O model and aimed to discuss whether construction sector is a key driver of the economy. Author also analyzed the backward and forward linkages of the construction sector. Author found that contribution of the construction industry in terms of creating inputs for other industries is quite low while the industry has stronger backward linkages.

As summarized by the previous studies, manufacturing and energy sectors come to the fore in the development of the country's economy. These I-O studies, however, mostly have used former I-O tables of TurkStat. As known, TurkStat has recently prepared and published the latest version of I-O tables (2012) of Turkish economy. Therefore, our paper has ensured relatively new structural analysis of the Turkish economy by using latest and updated I-O tables of TurkStat.

The purpose of this study is to analyse the structural interdependency of the agriculture, food and energy sectors in Turkey. An input–output model is useful in analysing the economic relationshipsand linkages among major sectors of an economy. Economists regularly use input–output models to examine the economic interrelationship among the agricultural, food and other sectors of the economy, such as the food, agriculture and energy sectors. Using input–output analysis, it is possible to project output requirements that must be met by the agricultural and food sectors, given a change in output in the energy sector of the economy.

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2. Data and Methodology

Input-Output analysis had their roots in economic theory with Francois Quesney's study entitled "Tableau Economique" in 1758. Quesney's original work was the forerunner of the modern multiplier concept and stressed the interdependence of economic activities (Coon et.al., 1985). However, the first comprehensive study developed by Leon Walras with the "Elements d'economicpolitique pure". Walras showed interdependence among producing sector of the economy and the competing demands of each sector for the factors of production. Walras attempted to explain mathematically the relationbetween producer and consumer sectors by means of simultaneous linear equations (Coon et.al., 1985). These studies served as a source of inspiration for Professor Wassily W. Leontief of Harward University. Leontief developed a general theory of production based on the notion of economic interdependence. The input-output model first developed by Wassily Leontief can be described as a general equilibrium model examining the cross-linking between production and consumption units that constitute economic construction. It focuses on economy, sectoral changes and resulting employment effect (Özdil-Turdalieava, 2014).

Input-Output analysis identifies the linkages or interdependence between various industrial groups within an economy. I-O tabulates and describes the interrelations among different sectors that purchase goods and services from other sectors and which in turn produce goods and services that are sold to other sectors. I-O is especially well suited to assessing how changes in one or more sectors of the economy will impact on the total economy (Atan and Aslanturk, 2012). Input-Output Tables also ensure information about key sectors of the economy for policy evaluation and formulation (Şatıroğlu, 1981).

An I-O table describes the flows among the various sectors of the economic transactions in a given period of time. Transactions of goods and services are broken down by intermediate and final use. Rows describe production sectors outputs, columns represent sectors which use outputs of production as intermediate goods (Aydoğuş, 2010). In other words, the rows refer to the distribution of output from the sector, while columns represent the input composition that the industry needs for output (Miller-Blair, 1985).

In this study, we compiled I-O tables from the last published TurkStat (2012) National Account tables and reduced them to ten sectors.We applied mathematical operations on the matrices obtained from the aggregate I-O Tables to calculate the Matrix of Input Coefficients, Leontief Matrices and Leontief Inverse Matrices, which determine the agriculture, energy and food manufacturing sector's position in the country's economy and their mutual interaction with other sectors. We analyzed the matrices and interpreted our findings as well.

In the aggregated I-O Matrix that we used to compute the Leontief Inverse Matrix, the set of simultaneous equations employed for the solution of the matrix algebra in the simultaneous equations system of each element involved is as follows:

$$x_{11} + x_{12} + x_{13} + Y_1 = X_1$$

$x_{21} + x_{22} + x_{23} + Y_2 = X_2$

$x_{31} + x_{32} + x_{33} + Y_3 = X_3$ (1).

Here;

x_{ij} = sales from i sector (row) to j sector (column)

Y_i = final demand sales from sector i

X_i = total output of the i sector

The elements in the tables $A_{ij} = x_{ij} / X_j$ refers to inter-sector relationships. This equation can be rearranged.

$x_{ij} = a_{ij} . X_j$ here sales from sector *j* to sector *i* depend on the output quantity of sector j, and it is defined as the technical coefficients or input coefficient of sector j's input requirement (Jones, 1997).

When a_{ij}s are placed, equivalence for the following producer sectors can be rewritten as follows:

$$a_{11}X_1 + a_{12}X_2 + a_{13}X_3 + Y_1 = X_1$$

$$a_{21}X_1 + a_{22}X_2 + a_{23}X_3 + Y_2 = X_2$$

$$a_{31}X_1 + a_{32}X_2 + a_{33}X_3 + Y_3 = X_3 \qquad (2).$$

Equality (2) indicates the interconnectivity of each sector over all sectors, since a sector's output level depends on other sectors' output level. For this reason, if the final demand (Y_i) is left on the right part of the equation.

$$X_1 – a_{11}X_1 – a_{12}X_2 – a_{13}X_3 = Y_1$$

$$– a_{21}X_2 + X_2 - a_{22}X_2 – a_{33}X_3 = Y_2$$

$$– a_{31}X_1 + a_{32}X_2 + X_3 – a_{33}X_3 = Y_3 \qquad (3).$$

or,

$$(1-a_{11})X_1 - a_{12}X_2 - a_{13}X_3 = Y_1$$

$$-a_{21}X_1 + (1-a_{22})X_2 – a_{23} Y_3 = Y_2$$

$$-a_{31}X_1 – a_{32}X_2 + (1-a_{33}) X_3 = Y_3 \qquad (4).$$

Matrix notation can be used to simplify the system.

$$\begin{bmatrix} (1-a_{11}) & -a_{12} & -a_{13} \\ -a_{21} & (1-a_{22}) & -a_{23} \\ -a_{31} & -a_{32} & (1-a_{33}) \end{bmatrix} \bullet \begin{bmatrix} X_1 \\ X_2 \\ X_3 \end{bmatrix} = \begin{bmatrix} Y_1 \\ Y_2 \\ Y_3 \end{bmatrix}$$

or it can be simplified further as

$$*A\,X=Y \quad (5).$$

(5) The elements of the matrix *A are similar to those of the Technical Coefficients Matrix calculated from the Industrial Operations Table.This (*A) matrix differs from the Technical Coefficients Matrix: We subtract the diagonal elements of the matrix *A from number 1. The second difference is that the sign of the other elements is negative except for the diagonal elements.Input Coefficients (Technical Coefficients) Matrix is named A Matrix. *A matrix in Equation (5) is the matrix (1-A), which is called the LEONTIEF Matrix. As stated above, Leontief matrix is obtained by subtracting the input coefficient matrix (A) from Unit Matrix (I) (İlhan and Yaman, 2011). The diagonal elements of the Leontief matrix are positive while its other elements are negative (Haeussler- Paul, 1987).

$$(1-A) = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} - \begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix}$$

Thus equation (5) can be written as

$$(1\text{-}A)\,X = Y \quad (6).$$

$$(1\text{-}A) = *A$$

If Equation (6) is solved for equilibrium output level X,

$$X = (1\text{-}A)^{-1}\,Y \quad (7) \text{ is obtained.}$$

The inverse of Leontief Matrix $(I\text{-}A)^{-1}$ is defined as Leontief Inverse Matrix. In order to obtain a sector's output for a specific period, Leontief Inverse Matrix is multiplied with final demand vector as seen Equation (7) (İlhan and Yaman, 2011). Equation (7) also gives the equilibrium solution of the input-output system. We can use this equationto find the necessary amount (in monetary terms) to increase the output of all other sectors when the final demand (Y) changes (for example 1 unit increase).In Equation 7, **(**$1\text{-}A)^{-1}$ Leontief is called as Leontief inverse matrix. This "key matrix (Leontief inverse matrix)" shows output rises in each sector due to the unit increase in final demand. The row and column totals of the elements of this matrix indicate the increase in production in all related sectors as direct (primary impact) and indirect contributions (secondary, tertiary + effects) (Jones, 1997).

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3.Emprical Results

Our main objective is to understand how valid is the argument of "energy and the agriculture are the main driving force of economy especially in developing countries", as mentioned in the previous sections, in case of Turkish economy. The implicit idea behind this argument is that in developing countries investment expenditures in energy and agriculture constitute the main demand that triggers the overall growth in the economy. Therefore, agriculture and energy industry pull investment expenditures and creates strong backward linkages in Turkish economy. If the above argument is valid for Turkey then agriculture and energy industries should be considered strategic and crucial in maintain sustained economic growth of the country.

We start by looking at the linkage coefficients of industries. Table 1 shows the "transaction table for Turkish economy that has been subdivided into 10 sectors: sectors; (1) Agriculture[3], (2) mining and quarrying, (3) food, beverages and tobacco products, (4) other manufacturing, (5) energy[4], (6) Constructions and construction works (7) Trade, (8) Transportation, (9) Tourism and (10) Other Service sectors. The transaction table summarizes the annual TL value of the operations. This table records the flow of goods and services among industries.

Table 1: Transaction Table (Million TL)

Sectors	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Agriculture (1)	29111	116	47477	6540	8	101	130	11	2346	1439
Mining (2)	446	1530	280	13909	1734	4584	757	252	95	468
Food Manufacturing (3)	6229	33	19064	910	48	94	1515	197	15085	2831
Other Manufacturing (4)	6163	2583	7850	181390	1797	73703	14962	20059	2085	33189
Energy (5)	1447	981	1994	28352	64014	576	4606	815	2350	11906
Construction (6)	359	92	350	1501	2584	46730	2850	444	474	10751
Trade (7)	5064	1181	12379	39504	1326	13907	7271	14127	4116	12099
Transportation(8)	2641	1935	7625	25684	1226	6024	18094	55120	1252	14094
Tourism (9)	20	61	174	1288	101	336	2060	529	650	7661
Other Services (10)	1367	1682	5687	29194	6316	14697	46558	13960	7182	108918
Output at basic prices	***178745***	***32739***	***173280***	***730662***	***154721***	***297839***	***288644***	***272994***	***85422***	***741717***

Table 1 shows the basic structure of the I-O table (also called transaction matrix). Basically, the rows represent the outputs (suppliers) and the columns the destination of inputs (users) (D'Hernoncourtet.al., 2011). The columns in this table show the value of the inputs absorbed by the industries and the payment to primary inputs.

[3] Agriculture sector consists of i) products of agriculture, hunting and related services, ii) products of forestry logging and related services, iii) fish and other fishing products;aquaculture products;support services to fishing (TURKSTAT, 2017).

[4] Energy sector consists of electricity, gas, steam and air conditioning, natural water;water treatment and supply services, iii) sewerage services, sewage sludge;waste collection, treatment and disposal services;materials recovery services;remediation services and other waste (TURKSTAT, 2017).

Along the rows, the distribution of products into various industries and final demand categories are shown.

The matrix of technical coefficient (A matrix) is shown in Table 2. This matrix is obtainedby dividing each entry in the transaction table by its column total, i.e. the total output of the respective industry. Thus, an element in this matrix, expressed as a percentage, shows the direct requirement from the supply to the industry.

Table 2: A matrix: Technical Coefficient

Sectors	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Agriculture (1)	0,16	0	0,27	0,01	0	0	0	0	0,03	0
Mining (2)	0	0,05	0	0,02	0,01	0,02	0	0	0	0
Food Manufacturing (3)	0,04	0	0,11	0	0	0	0,01	0	0,18	0
Other Manufacturing (4)	0,03	0,08	0,05	0,25	0,01	0,25	0,05	0,07	0,02	0
Energy (5)	0,01	0,03	0,01	0,04	0,41	0	0,02	0	0,03	0,05
Construction (6)	0	0	0	0	0,02	0,16	0,01	0	0,01	0,02
Trade (7)	0,03	0,04	0,07	0,05	0,01	0,05	0,03	0,05	0,05	0,01
Transportation(8)	0,02	0,06	0,04	0,04	0,01	0,02	0,06	0,2	0,02	0,02
Tourism (9)	0	0	0	0	0	0	0,01	0	0,01	0,02
Other Services (10)	0,01	0,05	0,03	0,04	0,04	0,05	0,16	0,05	0,08	0,01

That is, for each million TL of output produced by the agricultural sector, the agricultural sector must purchase from the mining and quarrying sector 0.002 million TL, from food, beverages and tobacco 0.035 million TL, from other manufacture 0.0034million TL, from energy 0,008 million TL , from construction 0,002 million TL , from trade 0,028 million TL, from transportation 0,015 million TL, from tourism 0,000 million TL and from other services 0,008 million TL. These coefficients show the direct effects in all sectors due to a one TL change in output in a particular sector. Direct effects are simply the production changes equal to the immediate final demand changes.

If we compare the magnitude of co-efficients for agriculture, energy and food manufacturing sectors in Table 2, while agriculture gives the highest amount of the input to food manufacturing sector (row1, cell 4), it's input contribution to energy sector is limited. Following the food manufacturing sector, agriculture ensures the second highest input contribution to tourism sector. While energy sector gives the highest input amount to other services sector and food manufacturing sector, respectively, it's input contribution to agriculture is low. Food manufacturing ensures the highest input contribution to tourism sector, followed by the agriculture sector.

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On the other hand, if we look at input demand side, agriculture sector demands the highest input from food manufacturing and other manufacturing sector. Naturally, food manufacturing sector demands the highest input from agriculture sector, followed by the trade sector. Energy sector demands highest input from service sector followed by the constructionsector.

Table 3: Key Matrix; $(1\text{-}A)^{-1}$ Matrix

Sectors	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Agriculture (1)	1,21	0,01	0,37	0,02	0,00	0,01	0,01	0,00	0,10	0,00
Mining (2)	0,01	1,05	0,01	0,03	0,02	0,03	0,01	0,00	0,00	0,00
Food Manufacturing (3)	0,05	0,00	1,14	0,00	0,00	0,00	0,01	0,00	0,21	0,01
Other Manufacturing (4)	0,07	0,13	0,11	1,35	0,05	0,41	0,09	0,13	0,07	0,02
Energy (5)	0,03	0,07	0,04	0,10	1,72	0,04	0,05	0,02	0,07	0,08
Construction (6)	0,00	0,01	0,01	0,01	0,04	1,19	0,02	0,01	0,01	0,02
Trade (7)	0,05	0,05	0,11	0,08	0,02	0,09	1,04	0,08	0,08	0,02
Transportation(8)	0,03	0,09	0,09	0,07	0,03	0,06	0,09	1,27	0,04	0,03
Tourism (9)	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,00	1,01	0,02
Other Services (10)	0,02	0,08	0,07	0,08	0,08	0,10	0,18	0,09	0,11	1,02

Each coefficient in the $(1\text{-}A)^{-1}$ matrix (Table 3), reveals the linkage between the industries. Each $\{x_{ij}\}$ reveals by what factor in row sector i sells goods and services to column sector j because of a change in final demand-forward linkage. Moreover, each $\{x_{ij}\}$ also reveals by what factor column sector j purchases goods and services from row sector i because of a change in final demand-backward linkage (Karkacier-Goktolga, 2005).

The I-Otable poses the starting point in estimating the output, earnings and employment multipliers and of other multipliers used frequently in analyzing the economic impacts. I-O multipliers are summary measures used for predicting the total impact on all industries in an economy of changes in the demand for the output of any one industry. The multipliers are derived from the input-output tables (Surugiu, 2009).

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Table 4: First Round-Second Round Economic Effects

Sectors	Direct Input Production Multipliers		
	Total Effect Sum of column of $(1\text{-}A)^{-1}$ matrix	First-Round Effect Sum of column of (A) matrix	Second-Round Effect Difference between $(1\text{-}A)^{-1}$ and (A)
Agriculture	1,466112	0,29566	1,170452
Mining	1,49428	0,311418	1,182861
Food Manufacturing	1,943575	0,593721	1,349855
Other Manufacturing	1,747355	0,449279	1,298077
Energy	1,955789	0,511596	1,444193
Construction	1,927784	0,539725	1,388059
Trade	1,503788	0,342302	1,161486
Transportation	1,608696	0,386511	1,222185
Tourism	1,70414	0,417158	1,286982
Other Services	1,223198	0,127956	1,095242

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In general, it can be seen that the second-round effect (indirect effect) is greater than the first-round effects in all sectors. This results is in the line with the increase in the concentration of interaction between the sectors in the economy. As seen in Table 4, it can be said that among the others, the energy sector has the highest indirect impact in terms of economic contribution.Therefore, energy sector has key role in the economy, since it's both direct and indirect income generating effect is quite high. Following the energy sector, construction and food manufacturing ensures the highest indirect impact in the economy, respectively. Similar to energy sector, food manufacturing has also important sector since it high second round and total income generating effect in the economy.

Economists and policy makers often wish to know the number of jobs that will be created because of an increased final demand. The employment multiplier (LM) measures the total change in employment due to a one-unit change in the employed labour force of a particular sector. The additional employment in the new activity multiplied by the employment multiplier for the industry provides an estimation of the total new jobs created in the area of study (Surugiu, 2009).

The LM is obtained using the total requirement table and direct employment coefficients as: $E= L * (I-A)^{-1}$

where: E is the employment multiplier matrix, L is n×n matrix containing the *i* th sector's direct employment coefficient in its i *th* diagonal and zeros elsewhere. Table 5 gives the employment multipliers.

Table 5: Employment Multipliers

Sectors	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Agriculture (1)	0,0216	0,0001	0,0067	0,0003	0,0000	0,0001	0,0001	0,0001	0,0018	0,0001
Mining (2)	0,0008	0,1699	0,0010	0,0046	0,0035	0,0046	0,0009	0,0007	0,0007	0,0004
Food Manufacturing (3)	0,0037	0,0002	0,0882	0,0003	0,0001	0,0002	0,0007	0,0002	0,0159	0,0004
Other Manufacturing (4)	0,0069	0,0130	0,0108	0,1374	0,0046	0,0415	0,0091	0,0135	0,0067	0,0019
Energy (5)	0,0013	0,0035	0,0022	0,0050	0,0861	0,0021	0,0025	0,0012	0,0034	0,0041
Construction (6)	0,0005	0,0007	0,0007	0,0008	0,0034	0,1137	0,0016	0,0006	0,0012	0,0021

Trade (7)	0,0086	0,0102	0,0204	0,0159	0,0044	0,0165	0,1986	0,0147	0,0147	0,0040
Transportation(8)	0,0028	0,0078	0,0074	0,0062	0,0022	0,0052	0,0079	0,1095	0,0038	0,0022
Tourism (9)	0,0002	0,0009	0,0008	0,0010	0,0006	0,0010	0,0024	0,0010	0,2105	0,0041
Other Services (10)	0,0069	0,0218	0,0197	0,0222	0,0229	0,0274	0,0516	0,0242	0,0324	0,2892
Sum of columns (Employment Effect)	***0,0534***	***0,2282***	***0,1578***	***0,1937***	***0,1280***	***0,2123***	***0,2756***	***0,1657***	***0,2912***	***0,3085***

The relative place of energy, agriculture industries in terms of employment multipliers is 9th and 10th out of 10 industries. The employment multipliers means that other sectors' employment creation capacities in order to satisfy one person employment in the agriculture and energy sector are overwhelmingly weak. This can be interpreted that the employment can be served easily to satisfy the final demand of agriculture and energy industry, but no need to create such a big value added by the other sectors to generate employment in the agriculture and energy industries.

Table 6: Income Multipliers

Sectors	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	Sum of Rows
Agriculture (1)	0,776	0,005	0,240	0,010	0,001	0,004	0,003	0,002	0,065	0,003	1,109
Mining (2)	0,003	0,608	0,004	0,017	0,013	0,016	0,003	0,003	0,003	0,001	0,670
Food Manufacturing (3)	0,014	0,001	0,332	0,001	0,000	0,001	0,003	0,001	0,060	0,001	0,414
Other Manufacturing (4)	0,019	0,035	0,029	0,376	0,013	0,114	0,025	0,037	0,018	0,005	0,671

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Energy (5)	0,006	0,018	0,011	0,025	0,430	0,011	0,012	0,006	0,017	0,020	0,557
Construction (6)	0,002	0,003	0,003	0,003	0,013	0,445	0,006	0,002	0,005	0,008	0,490
Trade (7)	0,027	0,032	0,064	0,050	0,014	0,052	0,627	0,046	0,046	0,013	0,973
Transportation(8)	0,016	0,043	0,040	0,034	0,012	0,028	0,043	0,601	0,021	0,012	0,851
Tourism (9)	0,001	0,002	0,002	0,002	0,002	0,002	0,006	0,002	0,507	0,010	0,536
Other Services (10)	0,017	0,052	0,047	0,053	0,055	0,066	0,124	0,058	0,078	0,693	1,242
Sum of columns ***(Income Effect***	***0,880***	0,799	0,772	0,572	0,552	0,739	0,853	0,758	0,819	0,767	1,109

The statistic (sum of columns) shows the impact upon income from employment (IfE) -or compensation of employees- throughout the studied economy arising from a unit increase in final demand for industry j's output. It also includes induced effects in the economy (D'Hernoncourtet.al., 2011). As seen in the Table 6, among the others,agriculture is the most income creative sector in case of demand increase in the economy. For example, for each 1 million TL increase of final demand, gross value added would increase 0,8795007 million TL in the economy. Food manufacturing sector ranks fifth in income creating in the economy with the 0.772 million TL.

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CONCLUSION

The main aim of this study is to reveal whether energy and agriculture sectors are the important drivers of the economy like in many developing countries. Moreover, the structural interdependency of the agriculture, food manufacturing and the energy sector in Turkey has been analyzed using the input-output analysis.

The input-output analysis gives important objective insights about relative place of energy, agriculture and food manufacturing sectors among all industries in the economy. According to the multipliers, employment creation capacity of agriculture, energy and food manufacturing sector is relatively weak. However, their income creation impact is remarkably high. Among the others, agriculture is the most income creative sector in case of demand increase in the economy. For example, for each 1 million TL increase of final demand, gross value added would increase 0,8795007 million TL in the economy.

Food manufacturing sector ranks fifth in income creating in the economy with the 0.772 million TL. Moreover, it can be said that among the others, the energy sector has the highest indirect impact in terms of economic contribution. Similarly, energy sector has key role in the economy, since it's both direct and indirect income generating effect is quite high. Following the energy sector, construction and food manufacturing ensures the highest indirect impact in the economy, respectively. Finally, food manufacturing is also important sector since it has high second round and total income generating effect on the economy.

These results ensure useful information for policy makers to stimulate growth via more appropriate investments and mitigate unemployment issues in the Turkish economy. As a result, energy, agriculture and food manufacturing sectors play key role in the overall economy.

REFERENCES

Atan S. (2011). Türkiye'deki Sektörel Bağlantı Yapısının Girdi-Çıktı Yaklaşımı ile İncelenmesi: Yurtiçi Üretim ve İthal Ara Girdi Araştırması. *Ekonomik Yaklaşım*, 22(8): 59-78.

Atan S. and Aslanturk Y. (2012). Tourism and economic growth nexus: an input-output analysis in Turkey.*Procedia - Social and Behavioral Sciences* 62: 952 – 956.

Aydın S. (2001), Türk İmalat Sanayinin Üretim Yapısı (1973-1990): Girdi-Çıktı Analizi, İstanbul Teknik Üniversitesi, Yüksek Lisans Tezi, https://polen.itu.edu.tr/xmlui/bitstream/handle/11527/11169/935.pdf?sequence=1&isAllowed=y, (Access date 04/11/2017).

Aydoğuş, O. (2010).*Girdi Çıktı Modellerine Giriş*. Gazi Kitapevi. Ankara.

Çalışkan E.T. and Aydogus O. (2011).Türkiye Ekonomisinde Endüstriyel Büyümenin Kaynakları:Girdi-ÇıktıModeli İle Ampirik Bir Analiz (1985-2002).*Ege Akademik Bakış*, 11(4): 499-510.

Çondur F. and Evlimlioğlu U. (2007).Türkiye'de Madencilik Sektörünün Girdi-Çıktı Analizi Yöntemiyle İncelenmesi. *Sosyal Bilimler Dergisi*, 17: 25-41.

Coon R.C., Leistritz F.L., Hertsgaard T.A., and Leholm A.G., (1985). The North Dakota Input-Output Model: A Tool for Analyzing Economic Linkages, North Dakota State University, Agricultural Economics Report, No:187, http://ageconsearch.umn.edu/record/23304/files/aer187.pdf, (Access date 07/11/2017).

Dalgaard T., Halberg N., and Porter J.R. (2001).A Model for Fossil Energy Use in Danish Agriculture Used to Compare Organicand Conventional Farming..*AgricultureEcosystems&Environment*, 87: 51-65.

D'Hernoncourt J., Cordier M., and Hadley D. (2011). Input-Output Multipliers Specification Sheet and Supporting Material, Science Policy Integration for Coastal Systems Assessment (SPICOSA), Project No:036992, http://www.coastal-saf.eu/output-step/pdf/Specification %20sheet% 20I_O _final. pdf, (Access date15/04/2017).

Deloitte. (2016). Turkish Energy Market Outlook, Achievement, Overview and Opportunities, http://dektmk.org.tr/upresimler/turkish-energy-market-outlook.pdf, (Access date 5/04/2017).

Goktolga Z.G. and Özkan M.(2011). 1998-2002 Yılları Türkiye Taşımacılık Sektörü Kilit Sektörlerinin Girdi-Çıktı Analizi.*Sosyal Bilimler Araştırmaları Dergisi*, II: 65-8.

Gul Z.B. (2017). Construction Industry in Turkey:An Input-Output Analysis Using the World Input-Output Database (WIOD) for the 2002-2011 Periods. *Atatürk Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, 31(1): 157-174.

Haeussler , F.F., and Paul R.S. (1987).*Introductory Mathematical Analysis for Business Economics and the Life and Social Sciences*. Prentice-Hall International Inc., London,UK.

IEEFA. (2016). Turkey at a Crossroads:Invest in the Old Energy Economy or the New?, Institute for Energy Economics and Financial Analysis (IEEFA), http://ieefa.org/wp-content/uploads/2016/09/Turkey-Crossroads-Invest-in-the-Old-Energy-Economy-or-the-New_June-2016-v2.pdf, (Access date: 11/04/2017).

Ilhan B. and Yaman H. (2011). A Comparative Input-Output Analysis of the Construction sector in Turkey and EU Countries.*Engineering, Construction and Architectural Management*, 18(3): 248-265.

Jones L.L.(1997). Input-Output Modeling and Resource Use Projection. Faculty Paper Series, Department of Agricultural Economics, Texas A&M University, College Station, TX.http://ageconsearch.umn.edu/record/23993/files/fp97-10.pdf, (Access date 04.04.2017).

Karkacier O. and Goktolga Z.G. (2005). Input-output Analysis of Energy Use in Agriculture. Energy *Conversion&Management*, 46: 1513-1521.

MFA.(2017). Turkey's Energy Profile and Strategy, Republic of Turkey Ministry of Foreign Affairs (MFA), htt://www.mfa.gov.tr/turkeys-energy-strategy.en.mfa, (Access date:5/04/2017).

Miller R.E. and Blair P.D. (1985).*Input-Output Analysis:Foundations and Extensions*. Prentice-Hall Inc.Englewood Cliffs, New Jersey, USA.

Ozkan B., Akcaoz H., and Fert C. (2004). Energy Input-Output Analysis in Turkish Agriculture. *Renewable Energy*, 29:39-51.

Özdil T. Turdalieva A. (2014). Girdi-Çıktı Analizi Yaklaşımıyla Türkiye ve Kazakistan Ekonomilerinin Karşılaştırılması, *Ege Akademik Bakış,*14(3):383-393.

Singh H., Mishra D. and Nahar N.M. (2002).Energy Use Pattern in Production Agriculture of a Typical Village in Arid Zone, India—part I.*Energy Conversion&Management*, 46: 1513-1521.

Surugiu C. (2009). The Economic Impact of Tourism. An Input-Output Analysis, National Institute for Research and Development in Tourism, http://www.revecon.ro/articles/2009-2/2009-2-8.pdf, (Access date15/04/2017).

Şatıroğlu K. (1981). *Planlama ve Programlama Teknikleri*, Ankara Üniversitesi, SBF Yayını, No:492, Ankara.

Tasci K. (2013). Bilgi ve İletişim Teknolojileri Sektörünün Girdi-Çıktı Analizi Yöntemiyle Türkiye Ekonomisi Açısından Önemi, *Akademik Bakış Dergisi*, 34:1-20.

Tunç G.İ. (2004).Türkiye Ekonomisinde Yapısal Değişim: Bir Girdi-Çıktı Analizi, Economic Research Center, ERC Working Paper in Economic 04/07, http://erc.metu.edu/menu/series04/0407.pdf, (Access date 10/09/2017).

TurkStat.(2016). Main Statistics, Agriculture, www.turkstat.gov.tr, (Access date:10/04/2017).

TurkStat. (2017). National Accounts, Input-Output Tables(2012), www.turkstat.gov.tr, (Access date: 5/04/2017).

Türker M.F. (1999).Girdi-Çıktı Analizi Yardımıyla Ormancılık SektörününÜlke Ekonomisi İçindeki Öneminin Belirlenmesi,Tr. *Journal of Agriculture and Forestry,* 23(1): 229-237.

Ugurlu A.A. and Tuncer I. (2017).Türkiye'de Sanayi ve Hizmet Sektörlerinin Büyüme ve İstihdama Katkıları:Girdi-ÇıktıAnalizi, *Dokuz Eylül Üniversitesi, İktisadi ve İdari Bilimler Fakültesi Dergisi,* 32(1): 131-165.

Yılancı V. (2008).Türkiye Ekonomisi İçin Kilit Sektörlerin Belirlenmesi:Girdi-Çıktı AnaliziYaklaşımı, *İstanbul Üniversitesi İktisat Fakültesi Mecmuası*, 58(2): 75-86.