IMPORT DEPENDENCY ON INTERMEDIATE GOODS IN TURKEY: AN INPUT-OUTPUT ANALYSIS

Araştırma Makalesi

Emre ÜNAL[1]

ÜNAL, E., (2020), **Import Dependency on Intermediate Goods in Turkey: An Input-Output Analysis**, Verimlilik Dergisi, Yıl: 2020, Sayı: 4, T. C. Sanayi ve Teknoloji Bakanlığı Yayını.

ABSTRACT

In this study, import dependency on intermediate goods within main manufacturing industries in Turkey was analyzed using World Input-Output Database (WIOD) between 2002 and 2014. Moreover, import dependency on intermediate goods within consumption goods sector was compared to that within export goods sector using a weighted multipliers approach. The analysis shows that Turkey's import dependency on intermediate goods increased significantly in this period. The computer, electronic and optical products and automotive industries showed a markedly high import dependency on intermediate goods. The main reason for the import dependency in the automotive industry was the fact that; almost all goods produced were exported. The computer, electronic and optical products industry experienced high import dependency on intermediate goods, whereas the ratio of export to total output gradually declined and domestic consumption increased. The research reveals that after the 2000-2001 Economic Crisis, a number of institutional factors promoting a liberal economy and thus attracting FDI, stimulated the productivity growth of export goods. Thus, export growth was followed by high import dependency in export goods.

Keywords: *Input-Output Analysis, Import Dependency, Institutional Economics.*

JEL Classification: *B52, C67, D57.*

[1] ***Emre ÜNAL****, Assistant Professor, Fırat University, Department of Economics. ORCID: 0000-0001-9572-8923*

** Makale Gönderim Tarihi: 12.05.2019 Kabul Tarihi: 03.09.2019*

TÜRKİYE'NİN İTHAL GİRDİ BAĞIMLILIĞI: GİRDİ-ÇIKTI ANALİZİ

ÖZET

Bu çalışmada, Türkiye'nin temel sanayi endüstrilerindeki ithal girdi bağımlılığı, Dünya Girdi-Çıktı Veri Tabanı (WIOD) 2002 ve 2014 yılları arasındaki tablolar kullanılarak hesaplanmıştır. Ayrıca yine yurtiçi ve ihracattaki ithal girdi bağımlılığı ağırlıklandırılmış çarpan metodu kullanılarak bulunmuştur. Türkiye'nin endüstriyel ithal girdi bağımlılığının önemli derecede arttığı sonucuna ulaşılmıştır. Bu endüstrilerin başında bilgisayar, elektronik ve optik ürünleri ve otomotiv endüstrisi gelmektedir. Otomotiv endüstrisindeki ithal girdi bağımlılığının en büyük nedeni üretilen ürünlerin büyük kısmının ihraç edilmesidir. Bilgisayar, elektronik ve optik ürünleri endüstrisindeki ithal girdi bağımlılığı artarken ihraç edilen ürünün toplam çıktı içerisindeki payının düştüğü ve yurtiçi tüketimin arttığı sonucuna ulaşılmıştır. Bu çalışma 2000-2001 Ekonomik Krizinden sonra liberal ekonomiyi desteklemek için gerçekleştirilen ve yabancı doğrudan yatırımların artmasına yardımcı olan kurumsal değişimlerin ihracat verimliliğinde artışa neden olduğunu gözlemlemiştir. Bu yüzden ihracat artışı ihraç ürünlerinin ithal girdiye olan bağımlılığındaki artış ile takip edilmiştir.

Anahtar Kelimeler: *Girdi-Çıktı Analizi, İthal Girdi Bağımlılığı, Kurumsal Ekonomi.*

JEL Sınıflandırması: *B52, C67, D57.*

1. INTRODUCTION

Turkey's trade deficit has increased dramatically since 2000. One of the main reasons for this is the import of intermediate goods. Over the years, the trade deficit caused by imported intermediate goods (inputs) became a major problem in the economy. Dependency on intermediate goods had a stimulating effect on the trade deficit. In this work, by using input-output analysis, import dependency on intermediate goods is examined in detail for the main manufacturing industries. Exploration of the causes of the trade deficit can play a role in eliminating the problem. In other words, if the trade deficit caused by intermediate goods can be understood, it should be possible to reduce it. With this in mind, several questions are posed in this research: what is the nature of import dependency on intermediate goods in the main manufacturing industries; in what way did this dependency change between 2002 and 2014; how was this dependency on imported intermediate goods structured in domestic consumption goods and export goods; what kind of institutional factors could have caused rising import dependency?

WIOD PYP input-output tables were used to estimate import dependency between 2002 and 2014. The tables are based on the previous year's prices, which provide reliable results without the problem of a price deflator. This enabled dependency on intermediate goods after the 2000-2001 economic crisis to be analyzed, and its change to the economy to be explained. This research focuses on those manufacturing industries which have sufficient production capacity to dynamically contribute to exports: namely, food, beverages and tobacco products; textiles, wearing apparel and leather products; chemicals and chemical products; rubber and plastic products; computer, electronic and optical products; electrical equipment; machinery and equipment; motor vehicles, trailers and semi-trailers (taken to be indicative of the automotive industry as a whole), and finally transport equipment. These industries together constitute more than 70 % of manufacturing in Turkey. The industries which were chosen for the analysis are not dependent on services, energy or agriculture, and are directly related to manufacturing production. Therefore, to explore import dependency fundamentally is to examine manufacturing industries that are directly related to middle- and high-tech industries that attract foreign direct investment (FDI).[2] In this work, "industry" means a single production group that is described by its characteristic. "Sector" means groups of industries contributing to domestic consumption and exports. The industries that are grouped under domestic consumption are categorized as the domestic consumption goods sector, and similarly those that are grouped under exports are categorized as the export goods sector. This

[2] *For the categorization see OECD (Isic Rev. 3 Technology Intensity Definition).*

categorization serves to identify whether import dependency is largely caused by domestic consumption goods or export goods. If a country is driven by export growth, this causes high import dependency in the export goods sector, and the same holds true for domestic consumption-driven countries and import dependency in the domestic consumption sector.

Import dependency in the Turkish economy has been examined using input-output analysis but import dependency in domestic consumption goods and export goods have not been considered or discussed in detail before. This work is one of the first to look at domestic consumption goods and export goods in order to explore which sector stimulates import dependency in the Turkish economy. An understanding of the differences in configuration between the domestic consumption goods and export goods sectors can serve to indicate in what direction economic policies should be created. In other words, policies should be based on such research. Günlük-Şenesen and Şenesen (2001: 425) analyzed import dependency in the Turkish economy using TurkStat input-output tables, and emphasized the importance of the petroleum industry in import dependency. Ayas (2016: 1-16) used WIOD national input-output tables to examine Turkey's import dependency. In this work, it was found that the import dependency on intermediate goods increased in the textiles industry. Ünal (2017: 15-16) researched import dependency on intermediate goods after 2000, and found that import dependency increased significantly on a sectoral basis, although the research did not consider industrial dependency. The current paper works to combine these two factors, analyzing both industrial and sectoral import dependency. In addition, this research uses a weighted multipliers approach for imported intermediate goods. The weighted multipliers allocate import dependency between the domestic consumption goods and export goods sectors.

In Section 2, the method for calculating import dependency is introduced. Section 3 analyzes both industrial and sectoral import dependency, and in Section 4, institutional reasons for import dependency are discussed. The research is concluded in Section 5. The Appendix gives the method used to calculate productivity in the various sectors.

2. METHOD USED TO CALCULATE IMPORT DEPENDECY AND PRODUCTIVITY

2.1. Method of Import Dependency

Leontief (1986: 65-70) describes direct and indirect input requirements for production. Domestically produced and imported input requirements constitute an important factor in production, but in the case of Turkey, for

input-output analysis research remains limited. Import dependency in the Turkish economy still needs to be researched using input-output analysis. Guo and Planting (2000: 14) used input-output analysis to research import dependency in the US, using a leakages technique between domestic and total output, and found U.S. production to be more dependent on imported intermediate goods. Duman and Özgüzer (2012: 42-44) used a basic calculation method to research industrial import dependency alone, concluding that import dependency is more related to service industries. Kronenberg (2012: 185) points out that the difference between technological or production coefficients calculated by a basic method and a supply method reveals import dependency. Mikulic and Lovrincevic (2012: 2009-2012) investigated the direct and indirect import content of industries and final demand in Croatia, using a basic methodology. They found the highest import content to be recorded for exports, and medium- and high-tech industries to be more integrated into international trade. Ünal (2020) used a weighted multipliers approach with a hypothetical extraction method to estimate productivity growth in each industry. By using a basic input-output analysis, import dependency in each industry could be derived. Moreover, by implementing a weighted multipliers approach, the question of whether domestic consumption goods or export goods stimulated import dependency could be estimated. WIOD PYP input-output tables were used for this analysis (Dietzenbacher et al., 2013: 94). These consist of 56x56 matrix tables, and are based on the previous year's price (PYP). The data covers years between 2001 and 2014. To calculate industrial import dependency, each industry's import price is assumed to be different. However, PYP tables help to reduce this problem. Hence, for one unit of production, the needed amount of direct and indirect imported intermediate goods could be calculated, and also, the level of direct and indirect imported intermediate goods required in both the domestic consumption goods and export goods sectors could be derived. The analysis was conducted using domestic input-output tables separate from imports.

$$Ax + y = x \tag{1}$$

A indicates a technological coefficients matrix, netted of imports. These coefficients were calculated by dividing each industrial input by each industrial output. *y* shows total domestic demand and *x* is a vector that shows total output.

$$y = x - Ax \tag{2}$$

$$x = (I - A)^{-1} y \tag{3}$$

The Leontief inverse matrix is represented as $(I - A)^{-1}$. It is used to derive, directly and indirectly, the level of imported intermediate goods required for one unit of production (Leontief, 1936: 110-111, 1949: 275-280, 1986: 22-27).

$$y = (I - A)\, x \tag{4}$$

$$A^m x = \lambda \tag{5}$$

$$\Sigma_{i=1} \lambda_i = Q \tag{6}$$

A^m shows the coefficients matrix that is derived by imported intermediate goods divided by total industrial output. λ indicates imported intermediate goods in each industry. The total amount of gives λ the entirety of imported intermediate goods. This is represented by Q.

$$A^m (I - A)^{-1} = \beta \tag{7}$$

In Equation (7), β shows the coefficients of imported intermediate goods. In the matrix, j indicates industries in a column and i indicates industries in a row.

$$\beta j = \Sigma_{i=1} \beta ij \quad (j = 1,2,3,...,n) = m \tag{8}$$

m is a row vector. This is derived by the column sum of coefficients of β. m indicates imported intermediate goods directly and indirectly required to produce one unit of production. These coefficients show industrial dependency on imported intermediate goods. It represents the amount of imported intermediate goods required for one unit of production. Pasinetti (1973: 6) implemented vertical integration in input-output analysis, using labor. In the equation, imported intermediate goods were used in the vertical integration.

$$my = m(F + E) = Q \tag{9}$$

Domestic consumption is shown by F and export is shown by E. Superscript f indicates the weight of industrial domestic consumption in total domestic consumption. Superscript e indicates the weight of industrial export in total export. These coefficients are weighted multipliers to allocate import dependency on intermediate goods between the domestic consumption goods and export goods sectors.

$$m^f = \Sigma_{\alpha=1} m_\alpha f_\alpha \qquad \text{and} \qquad m^e = \Sigma_{\alpha=1} m_\alpha e_\alpha \tag{10}$$

In the equation, m^f and m^e show import dependency in domestic consumption goods and export goods, respectively. They indicate imported intermediate goods directly and indirectly required to produce one unit of production in domestic consumption goods or export goods.

2.2. Method of Productivity

To calculate productivity in the domestic consumption goods and export goods sectors, the method explained by Ünal (2018: 32-33) and Ünal and Köse (2019: 165-166) was used. To derive productivity, WIOD national input-output tables were used. To derive productivity,

$$Ax + y = x \tag{11}$$

A represents technological coefficients, y is a vector that shows final demand, and x is a vector that shows output.

$$\begin{aligned} y &= x - Ax \\ x &= (I - A)^{-1} y \end{aligned} \tag{12}$$

$(I - A)^{-1}$ is a Leontief inverse matrix. It is used to derive the direct and indirect labor required for one unit of production.

$$\begin{aligned} y &= (I - A)\, x \\ \text{ø}x &= L \end{aligned} \tag{13}$$

x is a column vector that shows output in each industry. ø is a row vector that indicates the labor required for one unit of production. It is derived by dividing each industrial labor by each industrial output (Pasinetti, 1973: 6). L shows total labor.

$$\text{ø}(I - A)^{-1} = v \tag{14}$$

v represents a row vector. It is the direct and indirect labor required to produce one unit of production in each industry.

$$vy = v(F + E) = L \tag{15}$$

Domestic demand is F and export is E. The weight of each industry in these totals is shown as columns f and e. These are weighted multipliers to allocate labor required between the domestic consumption goods and export goods sectors.

$$v^f = \Sigma_{\alpha=1} v_\alpha f_\alpha \qquad \text{and} \qquad v^e = \Sigma_{\alpha=1} v_\alpha e_\alpha \tag{16}$$

v_f and v_e are the coefficients of domestic consumption goods and export goods. These are coefficients that show the labor directly and indirectly required for one unit of production. The coefficients must be multiplied by price deflators to derieve real values (Goldstein and Officer, 1979: 418-419).[3] The inverse of these coefficients shows productivity. $1/v_f$ is productivity in domestic consumption goods and $1/v_e$ is productivity in export goods (Uni, 2018: 120-121).

3. IMPORT DEPEDENCY ON INTERMEDIATE GOODS

After the 2000-2001 economic crisis, Turkey adopted more open and liberal economic policies in order to reduce its chronic inflation problem and create stability in the exchange rate. With this aim, a deregulation policy was introduced to support privatization and attract FDI. These reforms stimulated economic growth, and produced relatively stability. However, more open and liberal economic policies and intensifying FDI stimulated international trade, so while the Turkish economy enjoyed a prosperous period, its trade deficit was also stimulated to a record level. From 2000, the trade deficit increased significantly, and became a chronic problem.

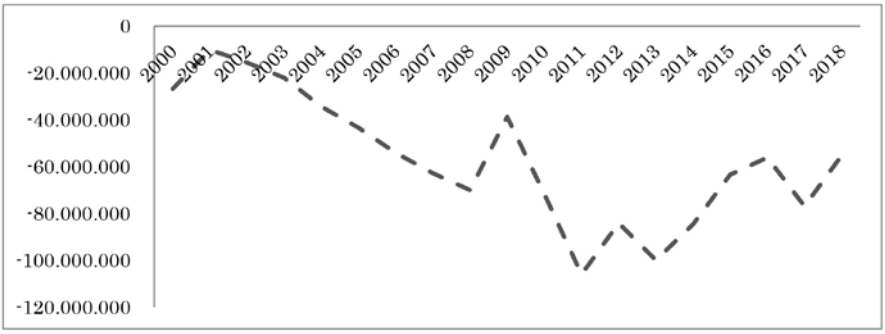

Figure 1. Trade Balance (Annual, Dollar, 2000-2018)

Source: *TurkStat (foreign trade).*

Figure 1 shows Turkey's trade balance after 2000. In the early 2000s, the trade deficit was much lower than in following years. After 2000, the trade deficit dramatically increased and reached a record level in 2011. In 2002, the trade deficit was around 15.5 billion USD, but it rose to 105.9 billion USD in 2011. After this year, although the trade deficit decreased, it remained high. In 2017, the trade deficit was 76.8 billion USD. Although there are many possible explanations for the high trade deficit, one of the main ones is imported intermediate goods. The high level of imported intermediate goods plays a crucial role in stimulating trade deficits.

[3] *Deflators can be derived from the UN database. Deflators were calculated from current prices (USD) divided by constant prices (USD) for domestic consumption goods and export goods.*

Figure 2 shows the trade balance in intermediate goods between 2000 and 2018. In 2002, the trade deficit caused by intermediate goods was approximately 23 billion USD. Whereas imported intermediate goods totaled 37.6 billion USD, exported intermediate goods accounted for only 14.6 billion USD. In 2011, the trade deficit in intermediate goods was 105.2 billion USD. In that year, imported intermediate goods came to approximately 173.1 billion USD in value, but those exported fell far below, at around 67.9 billion USD. In 2017, the trade deficit in intermediate goods decreased to 98.4 billion USD but imported intermediate goods remained almost the same, at around 171.4 billion USD. It is evident that imported intermediate goods are an important factor in stimulating trade deficits in the economy. Hence, if Turkey could come up with economic policies that could reduce its trade deficit in intermediate goods, this could help the economy to cover its total trade deficit.

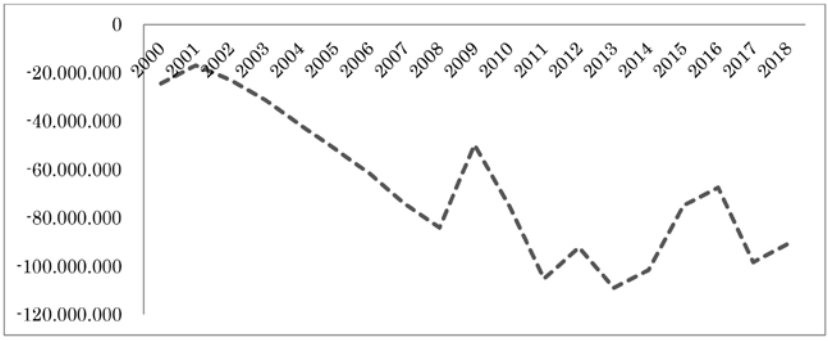

Figure 2. Trade Balance in Intermediate Goods (Annual, Dollar, 2000-2018)
Source: *TurkStat (foreign trade).*

3.1. Import Dependency in Industry

In this section, import dependency in various industries was analyzed. It is clear that medium- and high-tech industries experienced larger import dependency than low- and medium-tech industries. To analyze import dependency in industry, years that do not fall into the business cycles were chosen. The Turkish economy started growing after the 2000-2001 economic crisis; hence, 2002 was chosen as the starting point for import dependency analysis. The world economy experienced an economic crisis in 2008 and 2009, so 2007 – before the global economic crisis– was included in the analysis, as the Turkish economy was negatively influenced by this phenomenon. Finally as a last point, 2014, which furnished the most recent data in WIOD PYP input-output tables, was also included. It is assumed that without experiencing technological transformation or creating a new growth model, it is difficult for a country to revise its economic structure.

Hence, it can be assumed that the analysis of 2014 also represents today's economic problems.

Table 1. Import Dependency on Intermediate Goods in Industries

Industries	Dependency			Change Rate (%)	
	2002	2007	2014	2002-2007	2007-2014
Food, beverages and tobacco	0,1182	0,1592	0,1962	5,9	2,9
Textiles, wearing apparel and leather	0,1883	0,2240	0,2440	3,5	1,2
Chemicals and chemical products	0,2501	0,3343	0,3407	5,8	0,3
Rubber and plastic products	0,2549	0,3448	0,3861	6,0	1,6
Computer, electronic and optical	0,3473	0,3422	0,4344	-0,2	3,4
Electrical equipment	0,2391	0,3283	0,3563	6,3	1,1
Machinery and equipment	0,2272	0,3158	0,3326	6,6	0,7
Motor vehicles, trailers and semi-trailers (automotive)	0,2859	0,4116	0,4161	7,3	0,1
Other transport equipment	0,1543	0,2156	0,2420	6,7	1,6

Source: *WIOD Input-Output Tables. The change rate was calculated as a logarithmic increment.*

Table 1 indicates direct and indirect import dependency on intermediate goods in the listed industries. In 2002, import dependency in these industries was lower than in subsequent periods. The food, beverage and tobacco industries had the lowest dependency on imported intermediate goods. In 2002, for one US dollar of product, the value of imported intermediate goods required was USD 0,1182. In the period 2002-2007 and 2007-2014, they displayed 5,9 % and 2,9 % change rates. Dependency on imported intermediate goods increased to USD 0,1962 in 2014. The textiles, wearing apparel and leather industries' dependency on intermediate goods was USD 0,1883 in 2002. This later increased to USD 0,2440, with an increase in dependency of 1,2 % in the period 2007-2014. The textile and related products industries, with production capacity potential, played a significant role in driving the economy. Hence, although dependency increased in these industries, it was still lower than those of the medium- and high-tech industries. Dependency on imported intermediate goods for the rubber and plastic products industries, again low- and medium-tech, remained high compared with other low- and medium-tech industries. In 2002, for one US dollar of product, the industry needed to import USD 0,2549 of intermediate goods. There was a large increase in import dependency –approximately 6 %– between 2002 and 2007. For the period 2007-2014, the average increase was 1,6 %. Import dependency for one US dollar of product rose to USD 0,3861.

In contrast to the low- and medium-tech industries, import dependency on intermediate goods in medium- and high-tech industries was startlingly high, and rising. In 2002, in the chemical and chemical products industries, for one US dollar of product, USD 0,2501 of imported intermediate goods was required. In 2014, import dependency increased to USD 0,3407. The computer, electronic and optical industries had the highest dependency, around USD 0,3473 in 2002. This dependency reached a record level of USD 0,4344 in 2014. The Turkish economy experienced the highest dependency on imported intermediate goods in the computer, electronic and optical industries. They also showed the highest change in dependency, around 3,4 %, between 2007 and 2014. Import dependency in the electrical equipment industry was USD 0,2391 to produce one US dollar of product. This rose by 6,3 %, to USD 0,3283, between 2002 and 2007, and by 1.1 %, to USD 0,3563, between 2007 and 2011. The machinery and equipment industries followed a similar trend; import dependency climbed from USD 0,2272 to USD 0,3326 between 2002 and 2014.

One of the most dynamic industries in the Turkish economy is the automotive industry, which consists of motor vehicles, trailers and semi-trailers. This industry was developed by import substitution industrialization until the 1980s. The Turkish automotive industry occupies an important position in world automotive production.[4] However, this industry stimulated import dependency on intermediate goods. In 2002, producing one US dollar of product, the value of imported intermediate goods required was USD 0,2859. In the period 2002-2007, the industry experienced a record increase in the level of import dependency, which rose to USD 0,4116, followed by a smaller increase – 0,1 %, to USD 0,4161– between 2007 and 2014. The bulk of transport vehicle production comes from the automotive industry. The rest of the transport equipment industry was less dependent on imported intermediate goods. In 2002, it required USD 0,1543 of imported intermediate goods per one US dollar of product. In 2014, this rose to USD 0,2420.

3.2. Import Dependency in the Domestic Consumption Goods and Export Goods Sectors

Either domestic consumption goods or export goods can be the driving forces behind import dependency. If a country focuses on production for domestic consumption, then import dependency can be stimulated by domestic market. If export growth stimulates imported intermediate goods, then it can be said that import dependency is caused by international trade. If the economy is driven by export growth, this can open the door to imported intermediate goods –in particular, if a country cannot produce

[4] *For additional information about world automobile production see OICA.*

sufficient medium- and high-tech products. Knowing this difference can help to create favorable economic policies.

Table 2. Import Dependency on Intermediate Goods in the Domestic Consumption Goods and Export Goods Sectors

Sectors	Dependency			Change Rate (%)	
	2002	2007	2014	2002-2007	2007-2014
Consumption Goods	0,0976	0,1399	0,1300	7,2	-1,0
Export Goods	0,1728	0,2655	0,2830	8,6	0,9

Source: *WIOD Input-Output Tables. The change rate was calculated as a logarithmic increment.*

Table 2 shows import dependency in the domestic consumption goods and export goods sectors. It shows the level of imported intermediate goods were required in both sectors for one US dollar of product. As seen in the table, in 2002, for every one US dollar production of consumption goods, Turkey needed imports to the tune of USD 0,0976. The dependency had increased by 7,2 % to USD 0,1399 by 2007. Between 2007 and 2014, import dependency in the consumption goods sector decreased slightly to USD 0,13, because towards 2014 economic growth slowed down, and this decreased productivity in the consumption goods sector. When import dependency is compared between the two sectors, it can be seen that dependency was much higher in the export goods sector. Import dependency in the export goods sector was almost two times higher than that in the consumption goods sector. In 2002, exporting one US dollar of product directly and indirectly required imported intermediate goods at a cost of USD 0,1728. Import dependency rose dramatically, by approximately 8,6 %, to USD 0,2655 in the period 2002-2007. Subsequently, dependency rose by 0,9 % to USD 0,2830 between 2007 and 2014. Import dependency in export goods was consistently larger than that in domestic consumption goods. In addition, the change rate of import dependency in export goods remained higher than in consumption goods.

The reason for import dependency being higher in export goods is that the Turkish economy turned towards export growth from 1980 (Ünal, 2018: 23-26). From that year, the economy started to grow by exporting, with Turkey abandoning its policies of import-substitution industrialization (Pamuk, 2010: 27-28). Hence, domestic consumption lost its primacy to export policies. This naturally created higher export growth (Ünal and Köse, 2019: 153-154). Focusing on export growth from 1980, with limited reforms, did not produce favorable trade policies in Turkey. However, from 2000, the Turkish economy adopted more open policies, creating a more favorable production environment for multinational companies, which then stimulated import dependency in the export goods sector.

4. INSTITUTIONAL FACTORS

An institutional approach seeks solutions to economic instability through the implementation of new regulations. According to (Commons, 1934: 317–348), regulating institutional factors work to eliminate conflicts in the economy and create greater stability. As one of these institutional approaches, the *r*égulation theory utilizes institutional forms to analyze an economy in which the discovery of institutional problems requires a lot of effort and research. The theory usually uses five institutional forms – wage-labor relations, bank-credit relations, mode of competition, mode of international insertion and the role of government. (Boyer, 1990: 38-39; 2005), (Boyer and Hollingsworth, 1997: 49-54), (Boyer and Yamada, 2000: 10), (Boyer and Saillard, 2002: 44). Ünal (2020) designed industrial growth models using an institutional approach and input-output analysis, and examined why an industry or a country experiences a trade deficit. In this work, the exchange rate, tax legislation and vertical integration were defined as playing an important role in shaping industrial growth models. Institutional factors usually change significantly when a severe economic crisis emerges. The largest crises have usually transformed growth strategies around the world. If new regulations do not emerge, deepening and chronic economic problems ensue. For instance, in the 1980s, most of the developed countries moved from closed to open economies, thus focusing more on exports. In this context, the Turkish economy suffered a severe crisis in 2000-2001 that changed most of its institutional factors. Hence, one of the main stimuli for trade deficit was the 2000-2001 economic crisis, after which more open, liberal economic policies were implemented. These changes in institutional factors can be seen as a form of international insertion. These policies were designed to develop open trade, decrease inflation and bring stability to the lira via an institutional change to a floating exchange rate system from a managed exchange rate system. The Turkish economy became more integrated into the world economy by increasing trade volume. The new regulations also influenced the productivity structure. After the economic crisis, the productivity of export goods increased significantly. Between 2002 and 2007, productivity growth was 10,3 %.[5] In the 2000s, export productivity became a dynamic force (Ünal, 2016: 65 and 2018: 10-11). In this period, medium- and high-tech industries sucked in large amounts of imported intermediate goods (see Table 1). The multinational automotive industry that was based in Turkey used the country as an export hub. Moreover, the production capacity of the automotive industry increased dramatically. For instance, in 2002, automotive production capacity was 346,565 units. It ranked 21st among producer countries. In 2014, this

[5] *For the method, see Section 2.*

capacity rose to 1,170,445 units and a ranking of 17th.[6] Similarly import dependency on intermediate goods grew in importance in other medium- and high-tech industries, in particular in the computer, electronics and optical industries. Import dependency remained lower in low- and medium-tech industries. This means that the Turkish economy experienced a technological transformation which impacted on productivity and import dependency.

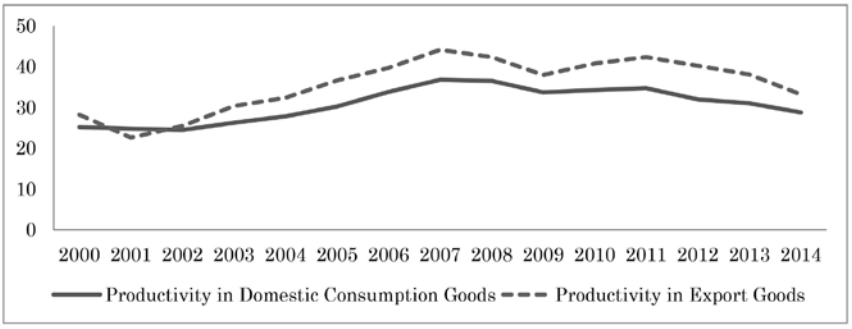

Figure 3. Productivity in Domestic Consumption Goods and Export Goods (Annual, 2000-2014)

Source: *WIOD Input-output tables. For the method, see Section 2.*

Figure 3 outlines productivity in the domestic consumption goods and export goods sectors between 2000 and 2014. It shows the units of production per worker. Clearly, productivity in export goods was higher than in domestic consumption goods. In 2002, a worker could produce 24.5 units of domestic consumption goods, as against 25.5 units of export goods. Productivity in domestic consumption goods rose to 31.95 units and in export goods to 40.2 units in 2012. Notably, in the 2000-2001 economic crisis, productivity in both domestic consumption and export goods was boosted, but more so for export goods. Between 2002 and 2012, the productivity growth of domestic consumption goods was 2,6 % but in export goods was 4,5 %. Turkey attracted a considerable amount of FDI from developed economies and focused on export growth. Hence, import dependency on intermediate goods was higher in export goods (see Table 2). In 2008, productivity declined slightly, then started to increase from 2009. However, after 2011, productivity start to fall, thus slowing the growth of import dependency (Table 1).

Turkey experienced a large increase in FDI after 2000.[7] In particular, the economy attracted investments from developed countries. This can be explained by the *flying geese theory* (Akamatsu, 1962: 11-16). A large

[6] *Data's taken from OICA.*

[7] *Source: Investment and Promotion Agency of Turkey, "FDI in Turkey" and the CBRT, "FDI".*

proportion of these investments moved to the medium- and high-tech industries, particularly to chemicals and chemical products, the computer, electronics and optical industries, and the automotive industry.[8] This process was deepened by an institutional change in the mode of international insertion. The country became more integrated into the world economy and also opened up the economy to privatization and vertical integration. FDI in an economy can work in three ways in an institutional context. First, if investments only move into the domestic consumption goods sector, the input is wholly imported, and import dependency increases. Second, investments can move into both the domestic consumption goods and export goods sectors, stimulating both imported intermediate goods and export goods. Third, if investment is limited to the export goods sector, imported intermediate goods increase therein. This last case is true of the automotive industry, which mainly focuses on exports. In other words, the ratio of export to output remains very high. There are two important institutional factors here. The first is taxation policy and the second is vertical integration. In particular, if taxation is high in the domestic market, the industry will focus on exports (Ünal, 2017: 26-27). For instance, in the automotive industry, special consumption tax is very high for automobiles.[9] This induces the multinational automobile companies to concentrate on the export of goods. Moreover, there is no regulation in capital share, meaning that a multinational company can have 100 % of the capital share without collaborating with a local company.[10] Hence, this institutional form encourages companies to prioritize exports. Table 3 shows the ratio of export to output in the main manufacturing industries. These ratios show whether production focuses on domestic consumption or export. As can be seen, the ratio of export to output was lower in the low- and medium-tech industries than in the medium- and high-tech industries. For instance, in the food, beverages and tobacco industry, the ratio of export to output was 11,3 in 2002, increasing slightly to 16,3 in 2014. This means that a large part of production in food, beverages and tobacco was consumed in the domestic market.

The ratio of export to output in the textiles, wearing apparel and leather industry was 47,1, but the ratio fell slightly to 34,0 in 2014. Medium- and high-tech industries gained in prominence in the export sector. In 2002, the ratio of output for export in the rubber and plastic products industry was low – 29,0 – but this increased to 54,7 in 2014.

The ratio of export to output was high in the medium- and high-tech industries. The computer, electronic and optical industry experienced a 69,1

[8] Source: CBRT, foreign direct invesments in sectors, 2000-2017.

[9] Source: The Department of Revenue, tax lists (Turkey).

[10] Source: Automotive Manufacturers Association (Turkey).

ratio of export to output in 2002. In 2014, this ratio fell to 37,3, the bulk of its output going to the domestic market. In the electrical equipment industry, the ratio of export to output was 41,1, rising to 65,2 in 2014. A considerable amount of its output was exported. A similar situation emeged in the machinery and equipment industries, which focused on producing more for export.

Table 3. Ratio of Export to Output in Industries

Industries	Export/Output (%)		
	2002	2007	2014
Food, beverages and tobacco	11,3	7,0	16,3
Textiles, wearing apparel and leather	47,1	22,8	34,0
Chemicals and chemical products	19,2	12,5	26,7
Rubber and plastic products	29,0	26,5	54,7
Computer, electronic and optical	69,1	34,3	37,3
Electrical equipment	41,1	37,2	65,2
Machinery and equipment	40,0	40,1	73,6
Motor vehicles, trailers and semi-trailers (automotive)	71,9	95,6	97,1
Other transport equipment	89,0	97,8	97,9

Source: *WIOD Input-Output Tables. The change rate was calculated as logarithmic increment.*

One of the driving forces in the Turkish economy is the automotive industry. This industry experienced a high ratio of export to output, with investment focused largely on export. The ratio was approximately 71,9 in 2002, 95,6 in 2007, and 97,1 in 2014. Domestic consumption in the automotive industry was limited, with most of its production focused on export. The other parts of the transport equipment industry showed similar trends. The ratio of export to output was approximately 89,0 in 2002, and reached 97,9 in 2014. The automotive industry exports a large proportion of its production, with companies focusing intensely on exports.

5. CONCLUSION

In this work, WIOD Input-Output Tables were used to determine import dependency on intermediate goods in various industries. Moreover, direct and indirect import dependency was calculated for domestic consumption goods and export goods. After the 2000-2001 economic crisis, import dependency on intermediate goods increased significantly.

Import dependency on intermediate goods increased markedly in medium- and high-tech industries. There are important institutional changes to make the Turkish economy more stabilized and attract FDI. After the 2000-

2001 economic crisis, institutional changes were created in the mode of international insertion. The Turkish economy was transformed into a more open economy. Hence, its attractiveness for FDI increased, with more open economic policies, a floating exchange rate system and privatization. This process stimulated the productivity growth of export goods, and import dependency also increased in the export goods sector. The most important reason for this is that the Turkish economy tended to experience higher productivity growth in export goods than in domestic consumption goods. As the economy started attracting FDI and experiencing larger productivity growth, the dependency of industries on imported intermediate goods also deepened. The most important changes emerged in the computer, electronic and optical industry and the automotive industry. For one unit of production, these two industries experienced highest dependency on imported intermediate goods. However, the direction of dependency headed towards the domestic market in the computer, electronic and optical industry because the ratio of export to output decreased from 69,1 % to 37,3 % between 2002 and 2014. Although import dependency on intermediate goods rose in this industry, the ratio of export to output fell dramatically, as a larger share was absorbed by the domestic market. In some industries, export retained an important position. In other words, the dependency increased for the export because it became a dominant industry. In particular, in the automotive industry, a large proportion of output was created by exports. The ratio of export to output increased from 71,9 % to 97,1 % between 2002 and 2014. There are two important institutional reasons behind this result. First is taxation policy. The taxation implemented for the automobiles is very high in the Turkish economy. Therefore, multinational companies focus more on export. The second is vertical integration policy. In the automotive industry, the multinational automobile companies keeps the largest part of share. This means it is not necessary to collborate with the local companies.

Input-output analysis enables the creation of economic models and the examination of productivity structure and import dependency. However, it has some limitations because it is not easy to collect and release input-output tables every year. Moreover, it is extremely difficult to find input-output tables for every country. The releasing of such tables usually takes some years. WIOD has input-output tables only until 2014. In future, the release of new tables will provide opportunities for further analyses.

REFERENCES

- AKAMATSU, K., (1962), **A Historical Pattern of Economic Growth in Developing Countries**, The Developing Economies, 1 (1), 3–25.
- AYAS, N., (2017), **Import Dependency of Sectors and Major Determinants: An Input Output Analysis**, European Journal of Sustainable Development Research, 2 (1), 1-16.
- BOYER, R., (1990), ***The Regulation School: A Critical Introduction***, C. Charney (trans.), Columbia University Press, New York.
- BOYER, R., (2005), **Coherence, Diversity and the Evolution of Capitalism-The Institutional Complementarity Hypothesis,** *Evolutionary and Institutional Economics Review*, 2 (1): 43-80.
- BOYER, R. & HOLLINGSWORTH, J. R., (1997), **The Variety of Institutional Arrangements and Their Complementarity in Modern Economies**, in R. Boyer and J. R. Hollingsworth (eds.), *Contemporary Capitalism: The Embeddedness of Institutions*, Cambridge University Press, Cambridge, UK, pp. 49–54.
- BOYER, R. & SAILLARD, Y., (2002), **A Summary of Regulation Theory,** in R. Boyer and Y. Saillard (eds.), *Regulation Theory: The State of the Art*, C. Shread (trans.), Routledge, London, pp. 36–44.
- BOYER, R. & YAMADA, T., (2000), **Introduction: A Puzzle for Economic Theories**, in R. Boyer and T. Yamada (eds), *Japanese Capitalism in Crisis: A Regulationist Interpretation,* Routledge, London, pp. 1–16.
- COMMONS, J. R., (1934), ***Institutional Economics***, the Macmillan Company, New York, pp. 317–348.
- DIETZENBACHER, E., LOS, B., STEHRER, R., TIMMER, M. & DE VRIES, G., (2013), **The Construction of World Input-Output Tables in the WIOD Project**, Economic Systems Research, 25 (1), 71-98.
- DUMAN, A. & ÖZGÜZER, G. E., (2012), **An Input-Output Analysis of Rising Imports in Turkey**, Ekonomik Yaklaşım, 23 (84), 39-54.
- GOLDSTEIN, M. & OFFICER, L. H., (1979), **New Measures of Prices and Productivity for Tradable and Nontradable Goods**, The Review of Income and Wealth, 25 (4), 413-427.
- GUO, J. & PLANTING, M. A., (2000), **Using Input-Output Analysis to Measure U.S. Economic Structural Change Over a 24 Year Period**, U.S. Department of Commerce: Bureu of Economic Analysis, WP2000-01.
- GÜNLÜK-ŞENESEN, G. & ŞENESEN, Ü., (2001), **Reconsidering Import Dependency in Turkey: The Breakdown of Sectoral Demands with Respect to Suppliers**, Economic Systems Research, 13 (4), 417-428.
- KRONENBERG, T., (2012), **Regional Input-Output Models and the Treatment of Imports in the European System of Accounts (ESA)**, Jahrbuch für Regionalwissenschaft, 37, 175-191.
- LEONTIEF, W. W., (1936**), Quantitative Input-Output Relations in the Economic System of the United States**, Review of Economics and Statistics, 18 (3), 105-125.

- LEONTIEF, W., (1949), **Structural Matrices of National Economies**, Econometrica, 17, 273-282.
- LEONTIEF, W., (1986), **Input-Output Economics**, New York: Oxford University Press.
- MIKULIC, D. & LOVRINCEVIC, Z., (2012), **The Import Content of Croatian Economic Sectors and Final Demand**, Economic Research, 31 (1), 2003-2023.
- PAMUK, Ş., (2010), **Economic Growth and Institutional Change in Turkey before 1980**, in T. Çetin and F. Yılmaz (eds.) Understanding the Process of Economic Change in Turkey, Nova Science, pp. 15-31.
- PASINETTI, L. L., (1973), **The Notion of Vertical Integration in Economic Analysis**, Metoroeconomica, 25, 1–29.
- UNI, H., (2018), **Comparative Analysis of Regional Trade Imbalances in East Asia and the Eurozone**, in R. Boyer et al. (eds.), Evolving Diversity and Interdependence of Capitalisms, Evolutionary Economics and Social Complexity Science 11, Springer, pp. 93-122.
- ÜNAL, E., (2016), **A Comparative Analysis of Export Growth in Turkey and China through Macroeconomic and Institutional Factors**, Evolutionary and Institutional Economics Review, 13 (1), 57-91.
- ÜNAL, E., (2017), **Turkey's Current Account Deficit Problem and Integration into the Economic and Monetary Union of the European Union**, Kyoto Economic Review, 86 (1-2), 1-49.
- ÜNAL, E., (2018), **An Institutional Approach and Input-Output Analysis for Explaining the Transformation of the Turkish Economy**, Journal of Economic Structures, 7 (3), 1-38.
- ÜNAL, E., (2020), **Industrial Growth Models by Input–Output Analysis and an Institutional Approach to the Automotive Industry in China and Turkey**, Evolutionary and Institutional Economics Review, DOI: 10.1007/s40844-020-00167-0.
- ÜNAL, E. ve KÖSE, N., (2019), **Türkiye ve Birleşik Krallık'ta Grevde Kaybolan İşgünü Sayısının Ücret Üzerindeki Etkisi**, Verimlilik Dergisi, 2019 (2), 143-168.