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The Relationship Between Efficiency, Rantability and Export Competitiveness: An Implementation on Turkish Automotive Sector

Etkinlik, Rantabilite ve İhracat Rekabet Gücü Arasındaki İlişki: Türk Otomotiv Sektörü Üzerine Bir Uygulama

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ÖZ

Bu çalışmada, Türkiye'de Borsa İstanbul'da (BIST) yer alan Otomotiv şirketlerinin/sektörünün ekonomik ve finansal rantabilite, etkinlik ve verimlilik düzeylerindeki ve ihracat rekabet gücündeki değişikliklerin değerlendirilmesi amaçlanmıştır. 2007-2017 dönemini kapsayan analizlerde, Oran Analizi, Veri Zarflama Analizi (VZA), Malmquist Toplam Faktör Verimliliği (TFV) ve açıklanmış karşılaştırmalı üstünlük endeksleri gibi çeşitli teknikler kullanılmıştır. Verimlilik ve ihracat rekabet gücü skorlarının birlikte hareket ettiği ve ekonomik ve finansal rantabilitenin bu hareketi güçlendirdiği sonucuna varılmıştır. Ayrıca, finansal etkinlik ve ihracat rekabet gücü arasında doğrudan bir ilişki vardır.

ABSTRACT

This study aims to assess the economical and financial rantability, changes in efficiency and productivity levels and export competitiveness of the automotive companies/sector which are dealt in Borsa İstanbul (BIST) within Turkey. In the analyzes covering the 2007-2017 period, we used various techniques such as the Ratio Analysis, the Data Envelopment Analysis (DEA), the Malmquist Total Factor Productivity (TFP) and the revealed comparative advantage indices. It is concluded that the scores of the productivity and export competitiveness move together and economical and financial rantability strengthen this moving. Also, there is a direct relationship between financial efficiency and export competitiveness.

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GENİŞLETİLMİŞ ÖZET

Otomotiv sektörü, etki alanının genişliği, diğer sektörlerle olan geri ve ileri bağlantı katsayılarının yüksekliği ile ekonominin gelişiminde geniş ve önemli bir yere sahiptir. Otomotiv endüstrisi, demir-çelik, plastik, kauçuk, cam, tekstil ve elektronik sektörlerinden girdi kullanan; buna karşılık inşaat, turizm, savunma, ulaştırma ve altyapı gibi birçok stratejik sektörün gelişimine katkı sağlayan lokomotif sektörler arasında yer almaktadır. Otomotiv sektörü, üretimde bulunduğu ekonomiye yüksek katma değer sağlayan, teknolojik gelişmeleri hızlandıran, ihracat kanalıyla döviz geliri kazandıran ve önemli oranda istihdam artışı sağlayan bir sektör olma özelliği taşımaktadır. Bununla birlikte, otomotiv sektörünün yüksek istihdam oranına sahip olması sebebiyle, sektörde yaşanan dalgalanmalar istihdama olumsuz yönde yansımaktadır.

Teknoloji şirketlerinin sektöre girişi ile otomotiv sektörü Ar-Ge faaliyetlerinin merkezi haline dönüştürmüştür. Teknoloji ve ilaç endüstrisinin hemen ardından dünya Ar-Ge yatırımlarının büyük bir bölümü otomotiv sektöründe yapılmaktadır. Dünya otomotiv sektörü teknolojinin ve çevresel koşulların etkisi ile sürekli bir değişim sürecindedir. Giderek sıkılaştıran çevresel regülasyonlar, otomotiv sektöründe hibrit ve elektrikli araçların gelişimine hız kazandırmıştır.

Türk otomotiv endüstrisi, Türkiye imalat sanayinin ana itici sektörlerinden birisi konumundadır. AB ile Gümrük Birliği Anlaşması ve Türkiye'nin AB adaylık süreci, Türk otomotiv endüstrisinde AB ürün ve çevre standartlarının kabul edilmesine yol açmıştır. Türk şirketlerinin pek çoğu AB mevzuatına uygun olarak kalite sistem sertifikalarını almışlar ve Dünya standartlarında kalifikasyon seviyesine ulaşmışlardır.

Dünyada otomotiv sektörüne olan talebin giderek artması, sektörün üretim kalitesiyle birlikte, sektördeki rantabilite ve etkinlik kavramlarını ön plana çıkarmıştır. Zira, sektör ürünlerine artan taleple birlikte küresel rekabet hız kazanmıştır. Bu perspektifte, otomobil ihracatı gerçekleştiren ülkelerin sektördeki küresel payları bağlamında ihracat rekabet gücü kilit bir kavram olarak ortaya çıkmıştır.

Bu çalışmada, otomotiv sektörü ve otomotiv sektörünün diğer sektörlerle ilişkisi, Türkiye'de otomotiv sektörünün gelişimi, sektörün ekonomik ve mali rantabilite, etkinlik ve ihracat rekabet gücü düzeyleri analiz edilmiştir. Bununla birlikte, ele alınan değişkenler arasındaki etkileşim düzeyi de incelenmiştir. Otomotiv sektörünün öneminden hareketle çalışmanın amacı, Türk otomotiv endüstrisini çok yönlü analiz (finansal etkinlik, ekonomik ve mali rantabilite ve ihracat rekabet gücü) ederek sektörün gelişimine katkı sağlayacak uygulanabilir politik öneriler geliştirmektir. Çalışmada, Borsa İstanbul'da işlem gören sekiz otomotiv firmasının (toplam endüstrinin % 60'ından fazlasını temsil etmektedir) 2007-2017 dönemine ilişkin finansal etkinlik, ekonomik ve mali rantabilite ve ihracat rekabet gücü ilişkisi üç farklı yöntem kullanılarak analiz edilmiştir. Farklı yöntemlerden elde edilen sonuçların bir bütün olarak değerlendirilerek sektörün durumu ve geleceği daha geniş bir çerçevede ele alınmıştır.

Çalışmada ilk olarak BIST'de işlem gören otomotiv firmalarının son 11 yıldaki (2007-2017) finansal, ekonomik ve mali durumları rasyo analizleri kullanılarak incelenmiştir. İkinci aşamada elde edilen rasyolardan hareketle sektörün finansal etkinlik analizi ve etkinlikteki zaman içerisindeki değişim süreci Veri Zarflama Analizi ve Malmquist Toplam Faktör Verimliliği (TFV) metodolojisinden hareketle elde edilmiştir. Üçüncü aşamada ise sektörün ihracat rekabet gücü derecesi Balassa Endeksi, Vollrath Endeksi, İhracat-İthalat Oranı Endeksi ve Net Ticaret Endeksi ve Lafay Endeksi kullanılarak elde edilmiştir.

Türkiye'nin otomotiv ihracat rekabet gücüne ilişkin skorlar incelendiğinde, yüksek seviyede olmasa da, rekabet avantajının olduğu görülmektedir. Bununla birlikte, açıklanmış karşılaştırmalı üstünlük endeksleri incelendiğinde, söz konusu rekabet avantajı özellikle 2009 yılından sonra genel olarak azalmıştır. Bununla birlikte, endeks skorlarının ortalama değerleri incelendiğinde, Balassa Endeksi ve Vollrath Endeksi değerlerinin zayıf derecede rekabet gücünü gösterdiği görülmektedir. Ayrıca, Net Ticaret Endeksi ortalaması rekabet gücünün varlığını işaret etmektedir. İhracat-İthalat oranı endeksi ise rekabet gücünün marjinal sınırdan olduğunu göstermektedir. Genel olarak yorumlandığında, Türkiye'nin otomotiv ihracatında istikrarlı ve kararlı bir ihracat rekabet gücü bulunmaktadır.

Elde edilen tüm sonuçlar birlikte değerlendirildiğinde sektörün verimliliğindeki (Malmquist TFV Skorları) ile ihracat rekabet gücünün 2010-2011 yılları hariç ele alınan dönemde birlikte hareket ettikleri sonucuna ulaşılmıştır. Diğer bir ifadeyle, sektörün finansal etkinliği ile açıklanmış karşılaştırmalı üstünlüğü arasında doğru yönlü bir ilişki olduğu sonucuna ulaşılmıştır.

Introduction

Automotive sector has an extensive and important situation in development of economy with its width of influence area, and its height of back and forward correlation coefficient with other sectors. Automotive sector that generates approximately 5% of the world economy takes a part in leading sectors that use inputs in iron-steel, plastic, rubber, glass, textile and electronic sectors and, in return, contribute to improvement of many strategic sectors such as construction, tourism, defence, transportation and infrastructure. Automotive sector has the characteristics of providing high added value to the economy that it exists in production, accelerating technological development, bringing in foreign exchange via export, and proving considerably employment increase. However, fluctuations in the automotive sector are reflected in employment negatively because of its high employment rate (Pişkin, 2017).

Since 2000's, automotive sector has been one of the most changing sectors. With the entering of technology companies into the sector, automotive sector turned into the centre of R&D activities. As the leading countries in automotive sector began to prefer contemporary production methods while leaving traditional production style, Taylorist production and lean manufacturing were started to be adopt. Also, gradually stringent environmental regulations has accelerated the development of hybrid and electric cars in automotive sector.

The increasing demand for automotive sector in the world has brought production quality of the sector with the concepts of rantability and efficiency in sector to forefront. Therefore, global competition has gained pace by increasing demand for sector products. In this perspective, export competitiveness in the context of global stakes' in sector of countries which exports automotive comes out as key concept. Turkey is a rapidly developing country in the case of the automobile sector. Turkish automotive industry has a position as one of the main driving sector in Turkish manufacturing industry. Customs Union and candidacy of Turkey for the European Union (EU) led to acceptance of the EU production and environment standards in Turkish Automotive Industry. Many Turkish companies received a quality system certification in accordance with the EU legislation and reached world-class qualification level.

In this study, based on the period of 2007-2017, with reference to 8 companies samples which are dealt in BIST and represent a large part (over the 60% of industry) of the sector, Turkish automotive sector was analysed as multi-dimensional. The sector was analysed by economical and financial rantability ratios. Technic efficiency and productivity change of sector were researched in time with the help of the data obtained from the ratio analysis. Efficiency and productivity levels of the sector were associated with international competitiveness.

Automotive sector takes a part in leading sectors that providing high added value to the economy, accelerating technological development, bringing in foreign exchange via export, contributing the development of many sectors that it is a customer, supporting manufacturing industry that it supplies such as construction and tourism and improving strategic area such as defence, transportation, and infrastructure (Pişkin, 2017). In all industrialized countries, automotive industry with sub-industry is defined as locomotive of economy, can be influenced substantially fluctuations in economy, and can cause fluctuations (Katip, Karaer, & Özengin, 2014).

Automotive sector has a high multiplier effect and added value on economic growth in strong connection with other sectors. As automotive sector is traditionally related to iron-steel, petrochemical, glass, textile sector, it is receiver of some product which are produced by sectors such as plastic and electronic because of its necessity for tools produced by developing technologies and lightweight materials. At the same time, automotive sector is closely

associated with raw material and sub-industry except for own structure and marketing, retailer, after-sales service, fuel, finance and insurance sectors enabling final products to reach consumers (Pişkin, 2017).

Automotive sector has made many important contributions to developing defence industry, demand increase for technological equipment by farmers in agricultural sector, tourism sector within more convenient, faster and cheaper transportation and many more. Turkey has carried on its activities with 12 companies and 18 factory in automotive sector. Of these 12 companies of which four has produced exclusively automobiles, 6 has produced only commercial vehicles and 2 has produced both of them. Ford Otosan, Oyak Renault and Tofaş companies has ranked top ten among 500 industrial enterprise that was declared by İstanbul chamber of industry (KPMG, 2018).

Turkish automotive sector is a sector which ranges in increase trend in world market with new product and capacity investment in its production and export increased year by year. According to data of 2016, Turkey was one of the countries that increased its production performance by 16.1%. Besides, it outdistanced Japan, South Korea, and USA in motor vehicle export race to the EU. This growth continued in 2017 (KPMG, 2018).

As automotive production was 1.48 million pieces in 2016, it went up 1.7 million pieces in 2017. Industrial exports reached their highest level in 2017 by \$ 28.5 billion. In the first half of 2018, the exports of automotive sector increased by 14.5 percent to 16 billion 434 million dollars. The data of 2017 demonstrated that fell 180 vehicles average per thousand people in the world while this numbers were at a level of 189 in Turkey, 569 in West Europe, and 808 in the USA.

Table 1: Turkish Automotive Sector (1000 pieces)

<i>Year</i>	<i>Production</i>	<i>Export</i>	<i>Import</i>	<i>Employment (per)</i>	<i>Capacity Utilization Rate (%)</i>
2015	1.359	992	659	48.748	80
2016	1.486	1.141	681	53.377	86
2017	1.7	1.36	720	59.212	88

Source: It was compiled from Automotive Sector Report (2017) and prepared by the authors.

China that manufactures 30% of the world production, took place on the top in 2016 automotive production ranking by 28 million 119 thousand pieces of production. In the same ranking, America took the second place by 12 million 198 thousand (Yılmaz, Taştan, Ecek, & Çınar, 2017). Turkey took the 14th place in automotive production in the world. Sector is on 17th in automobile production and 8th in commercial vehicle production. Also, Turkish automotive supply industry has an ability to product almost all components and pieces which are needed by sector. 10 billion US \$ reaching supply industry export figures in 2017 are equal to 34 percent of total automotive exports. Turkish automotive sector is the largest sector in the exports area of Turkey with 17% export size on sectorial basis by exporting 77% of automotive its own products (Yılmaz, Taştan, Ecek, & Çınar, 2017). It has seen that automotive industry has a quietly high stake in the list of 250 companies which make Turkey's highest R&D expenditure. The largest 10 automotive main industry companies in R&D 250 list compose of 40% of total expenditures made by 250 companies.

Literature Review

When the literature is reviewed, the studies on the competitive structure of the automotive sector can be grouped into two groups. The first is the micro-based studies on the

competitive structure of the automotive sector. In these studies, the competitive structure of the sector was examined mostly from the concentration indices. However, in some studies, the competitive structure of the automotive sector was handled on a macro basis and the competitiveness of the automotive sector was studied. In these studies, the export competitiveness of the sector was generally tried to be calculated and interpreted with the revealed comparative advantage (RCA) indices such as the Balassa index.

Ülengin et al. (2010), Avcu (2016), Ildırar and Kıral (2018) approached the competitive structure of the automotive sector in terms of micro base and concentration analyses. In this context, Ülengin et al. (2010) analysed Turkish automotive competitiveness with Bayes causal networks method in their study. In the result of the study, it was underlined that sector had a weak competitiveness and its future extremely depended on local supplier quality, the scope and impact of taxation, ease of access to credit, innovation capacity, R&D expenditures of company, prevalence of the latest technologies and university-industry cooperation in R&D. Avcu (2016) analysed the market structure and competitiveness of automotive sector with the help of the concentration ratio (CR4, CR8), the EI and the Herfindahl-Hirschman index. According to the calculated indices, it was emphasized that the competitive level in the market of domestic passenger car and domestic light commercial vehicle was low. However, there was a monopolistic competition in the imported passenger car market. Just like Avcu (2016), Ildırar and Kıral (2016) also analyzed the subject by using the concentration indices. They examined the market competitive structure by using the concentration ratio (CR4, CR8) and Herfindahl-Hirschman index with sales data of automobile and light commercial vehicle in Turkey in the period of 2004-2017. In reference to the CR4 and the CR8, domestic passenger car and light commercial vehicle in the market were high concentration, in other words, there was low competition. On the other hand, the concentration ratio of imported passenger cars and imported light commercial vehicles was relatively low. According to the results of the Herfindahl-Hirschman index, it was concluded that the market was close to monopolistic competition.

Başkol (2008, 2011), Özdamar and Albeni (2011), Bozdağ and Saraçoğlu (2013), Terregrossa and Gönel (2014) and Vošta and Kocourek (2016) conducted studies on the competitiveness (export competitiveness) of the automotive sector on a macro basis and used predominantly the RCA indices. Başkol (2008, 2011) calculated the competitiveness of Turkish automotive sector. In the study, the BI, import infiltration rate and specialization coefficient indices were used for the years 1996-2007. In the result of the study, it was reached that the country had no competitiveness in the automotive sector. When Başkol re-examined the same study in 2011 for 1996-2010 period with the same indexes, he concluded that the sector had a weak competitiveness. Özdamar and Albeni (2011) also analysed to foreign trade competitiveness of Turkish automotive industry using three different dimension of revealed comparative advantage (RCA) index for the years 1998-2008. According to the results of the analysis, Turkey had competitiveness in the product group of personal auto since 2002 in world market but it was emphasized that the competition coefficient is not high enough. It was concluded that Turkey had competitiveness in the product group of lorry-van after 2002 and of minibus-midibus-bus after 1990. Bozdağ and Saraçoğlu (2013) examined automotive exports competitiveness of Turkey and Commonwealth of Independent States in 1995-2011 period by using the BI. It was concluded that only Uzbekistan, Belarus and Turkey among the countries in question had competitiveness in the export of the sector. In a study conducted by Terregrossa and Gönel (2014), Turkey's automotive export competitiveness in the EU-15 were compared with China and Western European countries in 2001-2013 period. According to the results obtained using the VI, it was emphasized that Turkey decreased gradually export competitiveness in the relevant market. Vošta and Kocourek (2016) analysed the global

competitiveness of the EU in automobile export for the years 1995-2015. According to the results calculated using the BI, it was concluded that Germany and England had relatively high export competitiveness in the last 20 years.

In the literature, there are studies that use economic and financial rentability ratios. In addition, there is no study in which the economic and financial profitability ratios are correlated with competitiveness indices and efficiency ratios.

Erkuş (2003) determined that the costs tend to decrease as enterprises grow. In addition, Semerci, Parlakay and Çelik (2015) also revealed that examined enterprises firstly needed to affiliate with organizations serving the input supply and milk marketing of manufacturers to carry out dairy cattle activities at a higher rentability level. Erman and Küçük (2016) determined that the largest share in the gross product was the sale of seed fish in the land enterprises and the sale of table (portion sized) fish in the cage enterprises. Feed cost had the largest share in operating and production costs of all enterprises. Rentability ratios were set down as 11% in cage enterprises and 4,1% in land enterprises.

There are many national and international implementation for automotive sector's competitive structure and competitiveness analysis. As some part of these studies used concentration index, others used predominately international comparative advantages index. In some studies, it is observed that sectoral efficiency and rentability were examined. In some studies, factors affecting efficiency, rentability or competitiveness were analyzed by econometric analysis. However, when the literature samples are examined, it is not found any study examining the relationship between efficiency, rentability and export competitiveness scores of any sector. These studies examined sectors with only one of these variables. The main differences of this study from other studies are to associate with sectoral efficiency, rentability changes and revealed comparative advantages' (export competitiveness) degree. In this context, in the study, effectiveness, rentability and export competitiveness in Turkey's automotive sector have been analyzed for a period of 11 years (2007-2017). Considering these indicators, methods and time period, it is thought that this study brings a new perspective and makes a contribution into literature.

Methodology and Data

In this study that aims multi-dimensional (efficiency-rentability- export competitiveness) analysis of Turkish automotive industry is used three different methods. The results obtained from each method are correlated with each other and, thus the automotive industry has been analysed in many ways. The variables chosen as representing the automotive industry are financial parameters (indicators) of automotive companies to be dealt in BIST in last 11 years (2007-2017) and is gained by financial reports of relevant companies, statistical of Public Disclosure Platform (PDP), statistical of BIST, and UN Comtrade Database. The variables and the definition of variables used in each analysis method are shown in Table 2.

In this study where the automotive sector was analyzed in a multidimensional manner, efficiency, rentability and export competitiveness of the 8 automotive companies (represents more than 60% of the total industry) dealt in BIST and interaction of these variables were examined in the period of 2007-2017. Three different methods were used for the analysis. First of all, in the last 11 years, monetary, economic, and financial structure of the automotive companies were researched by using rentability ratios. Secondly, by means of obtained ratios, financial efficiency analysis and period of change in efficiency were gained by the DEA and Malmquist TFP. In third and last phase, export competitiveness level of the sector was calculated by the BI, the VI, the EIRI, the NTI and the LI. All results obtained were associated with each other. The theoretical framework of each method used in the study is briefly discussed below.

Table 2: The Definition of Variables

<i>Variables Used in Ratio Analysis</i>		
Output Variable	Input Variable	Data Source
Economic Rantability	Profit Before Tax and Interest/Total Passive	Public Disclosure Platform (PDP)
Financial Rantability	Net Profit/Equity Capital	Public Disclosure Platform (PDP)
Stock Exchange Value	Year-end closing value	Borsa İstanbul (BIST)
<i>Variables Used in Efficiency Analysis</i>		
Output Variable	Input Variable	Data Source
	Fixed Assets/Total Assets	Compiled from Annual Reports of Companies
Net Profit/Net Sales	Equity Capital/Total Assets	Compiled from Annual Reports of Companies
	Current Ratio	Compiled from Annual Reports of Companies
<i>Variables Used in the Revealed Comparative Advantage Analysis</i>		
Output Variable	Input Variable	Data Source
Balassa Index	Automotive export in the country, total export in the country, automotive export in the world, total export in the world	UN Comtrade Database
Vollrath Index	Automotive export in the country, total export in the country, automotive export in the world, total export in the world	UN Comtrade Database
Export-Import Ratio Index	Automotive export in the country, automotive import in the country	UN Comtrade Database
Net Trade Index	Automotive export in the country, automotive import in the country	UN Comtrade Database
Lafay Index	Automotive export in the country, automotive import in the country	UN Comtrade Database

The one of the methods for measuring manufacturing efficiency is ratio analysis. The monitoring of the movement of a single input and the ratio of a single output to each other over time constitutes the essence of the ratio analysis. This method enables to examine only one dimension on performance because of applying ratio of single input to single output (Yeşilyurt & Alan, 2003). The economic rantability ratio is a preferred ratio to expose whether resources

are used efficiently or not. On the other hand, financial rantability ratio is an important indicator that shows the relationship between the company's equity and net profit. The high level of efficiency in both ratios indicates that the profitability of the enterprise is satisfactory. The rantability factor expresses the ratio of net product to gross product. In other words, the rantability factor shows net yield as a percentage of the gross product. The rantability factor is not only a ratio to measure gross income of a company but also to support comments about assets' income generation skills. Among liquidity ratios, the most commonly used current ratio is a ratio that demonstrates the ability of the current assets to meet its short-term liabilities that need to be paid within one year by company. The affirmed ratio as security limit for companies is commonly 2 points. However, not to be under 1 point can be accepted in implementation. The presence of stocks within the current assets reveals the necessity of not interpreting the current rate alone. When all rates used in ratio analysis are interpreted, they must be evaluated with the relevant other rates. Besides, considering sector and macroeconomic conditions will provide more consistent on analyses. In our study, parametric and non-parametric methods of measuring efficiency levels are used together with obtained data results of ratio analysis.

$$\text{Economic Rantability} = \frac{\text{Profit before tax and interest}}{\text{Total Liabilities}}$$

$$\text{Financial Rantability} = \frac{\text{Net Profit}}{\text{Equity Capital}}$$

$$\text{Rantability Factor} = \frac{\text{Net Product}}{\text{Gross Product}} * 100$$

$$\text{Current Ratio} = \frac{\text{Current Assets}}{\text{Short-term Liabilities}}$$

In the cases of higher financial rantability than economic rantability, it is possible to state that equity capital is used efficiently. It is considered that the ratio analysis will be insufficient to measure the degree of effectiveness in cases where the number of inputs and outputs is high (Yolalan, 1993). In these cases, parametric and non-parametric methods are used to measure efficiency levels. Parametric methods assume that there is an existence of production/output function related to be measured Short-term Liabilities (STL) and has an analytical structure of this function. In parametric methods, the boundary parameters that are known before its functional form are estimated and then the distance of each observation unit to this limit is measured (Aydin, 2010). The effort to measure production efficiency began with the studies of Debreu (1951) and Koopmans (1951) and, then, gained significant momentum with the study of Farrell (1957). Non-parametric methods developed as an alternative to parametric methods are based on linear programming and aims at determining the efficiency limit and measuring the distance of units to this limit like parametric methods. On the contrary to parametric methods, it doesn't make any assumptions about the structure of the production function. The DEA and Malmquist TFP are non-parametric methods.

The DEA used in the second phase of the study, developed by Charnes, Cooper, Rhodes (CCR). The DEA enables to examine the relative performance of the decision-making units within the framework of Farrell's approach. In the DEA, the inputs and outputs of the selected units are examined. Furthermore, an activity limit is created by selecting the best rates among these inputs and outputs (Duranay, 2017). The original form of the DEA is known as "CCR Model". The next models built on the CCR Model. While the CCR Model calculated the total

efficiency value of the decision units under the assumption of constant return to scale, the BCC Model calculated the technic efficiency of decision units under the assumption of variable return to scale. Which type of model or assumptions will be used is evaluated according to the purpose and scope of the research (Özek, 2015).

The CCR Model is the model that examines the amount of input compounds to reduce in order to achieve the most efficient output level when the output amounts of the decision-making units are stable. The CRR Model shows the amount of output produced by the decision-making unit under the assumption, $x_{ij} \geq 0, y_{ij} \geq 0$, that all input and output levels have a non-negative value. The variables in the model are the given weights by the k decision unit for the i inputs and r outputs. These weights, in turn, are shown as v_{ik} or u_{rk} . The aim of this model maximizes ratio of weighted output to total weighted inputs (Ramanathan, 2003). The “rational shape” of the CCR model can be shown as follows:

$$\max h_k = \frac{\sum_{r=1}^s u_{rk} Y_{rk}}{\sum_{i=1}^m v_{rk} X_{jk}}$$

Fractional programming model can be converted to linear programming model. This conversion is made by equalling to 1 of denominator of objective function while it is to be a restriction. The result of this conversion, model can be defined as below:

$$\begin{aligned} \max h_k &= \sum_{r=1}^s u_{rk} Y_{rk} \\ \sum_{r=1}^s u_{rk} Y_{rj} - \sum_{i=1}^m v_{ik} X_{ij} &\leq 0; \quad j = 1, \dots, n \\ \sum_{i=1}^m v_{jk} X_{ik} &= 1 \\ u_{rk} &\geq 0; \quad r = 1, \dots, s \\ v_{ik} &\geq 0; \quad r = 1, \dots, m \end{aligned}$$

While it converts to linear form, h_k refers to the efficiency level; u_{rk} and v_{jk} refer to weights assigned to outputs and inputs, respectively. The non-parametric DEA method is a static analysis and analyses by the data of the STLs in a single period. In the process of evaluating efficiency, in order to examine the change that may occur over time, methods such as the Fisher and Tornqvist indices, and the Malmquist TFP developed (Kirikal, 2005).

The TFP calculated the change on total factor productivity between two data points with calculating the ratio of the distance of each data point according to common technology. Distance function $d(x,y)$ values that is equal to 1 if y vector is line on the S boundary, is less than 1 if y vector defines a point of technical ineffectiveness, or is more than 1 if y vector defines a point out of the S boundary.

$$d(x,y) = \text{Enk.} \left\{ \delta: \left(\frac{y}{\delta} \right) \in S \right\}$$

In Malmquist index, distance functions can be considered as basis of input and output. The input based distance function takes into account the minimum proportional contraction of

the input vector while the output vector is stable and it also takes into account the maximum proportional increase of the output vector when the input vector is stable. In the output based distance function, the production technology is defined using the output set R^t . Production technology R^t for every term ($t=1, \dots, T$) show the conversion from inputs ($x^t \in R_+^M$) to outputs ($y^t \in R_+^M$). Therefore, $x_t = (x_1, \dots, x_K)$, produced outputs by using input vector become output $y_t = (y_1, \dots, y_M)$.

$$R^t = \{ (x_t, y_t) : x_t \rightarrow y_t \}$$

Following Färe et al. (1994), this methodology can be expressed as follows:

$$d_0^t(x_t, y_t) = \min \{ \theta : (x_t, \frac{y_t}{\theta}) \in R^t \}$$

$$\min \{ \theta : (x^t, \theta y^t) \in R^t \}^{-1}$$

If data of (x_t, y_t) is on t period production line, distance will be $d_0^t(x_t, y_t) = 1$ and full efficiency (activity) for production. If distance is $d_0^t(x_t, y_t) \leq 1$, its production will not be efficient during the (t) period.

For the technical efficiency and change in efficiency in the different period, the distance function can be written as follows:

$$d_0^t(x_{t+1}, y_{t+1}) = \min \{ \theta : (x_{t+1}, y_{t+1}/\theta) \in R^t \}$$

This index measures the maximum rational change that comes up with data x^{t+1} input and y^{t+1} output under t period technology and also the maximum rational change that comes up with, relatively ($t+1$) technology, data x^t input set and y^t output (Mao & Koo, 1996).

$$M_0^t = \frac{d_0^t(y^{t+1}, x^{t+1})}{d_0^t(y^t, x^t)}$$

This index measures the productivity changes caused by changes in technical efficiency from ($t+1$) period to t period. Technical activity changes from ($t+1$) period to t period can also be measured under ($t+1$) period technology:

$$M_1^{t+1} = \frac{d_0^t(y^{t+1}, x^{t+1})}{d_0^{t+1}(y^t, x^t)}$$

Färe et al. (1994) described the geometric mean of the two indices as follows:

$$m_0(y^t, x^t, y^{t+1}, x^{t+1}) = \left[\left(\frac{d_0^t(y^{t+1}, x^{t+1})}{d_0^t(y^t, x^t)} \right) \times \left(\frac{d_0^{t+1}(y^{t+1}, x^{t+1})}{d_0^t(y^t, x^t)} \right) \right]^{\frac{1}{2}}$$

In this equation $d_0^t(y^{t+1}, x^{t+1})$ notation represents the distance from ($t+1$) observation to technology of (t) period. This equation can be shown in the following pattern.

$$m_0(y^t, x^t, y^{t+1}, x^{t+1}) \frac{d_0^{t+1}(y^{t+1}, x^{t+1})}{d_0^t(y^t, x^t)} \left[\left(\frac{d_0^t(y^{t+1}, x^{t+1})}{d_0^{t+1}(y^{t+1}, x^{t+1})} \right) \times \left(\frac{d_0^t(y^t, x^t)}{d_0^{t+1}(y^t, x^t)} \right) \right]^{\frac{1}{2}}$$

In the equation, out of the parenthesis measures the change in output-axis technical efficiency between (t) and (t + 1) years (Kök and Deliktaş, 2003). More than 1 of m_0 index shows that total factor productivity increases (gets well) while less than 1 of this value shows that productivity reduces.

The export competitiveness and specialization level of countries on a specific sector were indicated through calculation of comparative superiority coefficients. Especially, explicated foreign trade performance index were used frequently for empirically measuring the foreign trade competitiveness. In the export competitiveness index used as the third method of the study, it was preferred to use the BI, the VI, the NTI, the EIRI and the LI.

Through the use of revealed comparative superiority coefficients, it is possible to detect which sectors have a potential competitive advantages and disadvantages (Ramirez, 2002). In addition to that, degree of specialization in sectoral export can be indicated. If degree of the export competitiveness and specialization in specific sectors in the country was not alter or ruin by government policies, the country's revealed comparative advantage index value in relevant sectors compared to the rest of the world would realized the advantages/disadvantages of sectors in realistic way (Zhi Wang, 2000).

The most common measure about revealed comparative advantages is the BI. The index is the ratio of the share of any product in national exports to its share in the world's total exports. The BI is formulated as $\left(\frac{X_{ij}}{X_j}\right)/\left(\frac{X_{iw}}{X_w}\right)$ (j: the country, i: the product group, w: world). Values more than 1 refers to the export competitiveness (Balassa, 1965).

After the BI, the most common export competitiveness criterion (index) is the VI. Unlike the BI, the VI prevents double accounts of the country and the product. The index formulizes as $\left(\frac{X_{ij}}{X_{-ij}}\right)/\left(\frac{X_{i-jw}}{X_{-i-jw}}\right)$. (X_{ij} : country j's export for the good "i", X_{-ij} : country j's total export except the good "i", X_{-jw} : world export for the good "i" except X_{ij} , X_{-i-jw} : total world export except X_{ij} and X_{-jw} . Vollrath Index is the ratio of the share of the product in national export (the export of the goods to the total export of the country is ignored) to the share of the world's total export (the country is not calculated one more in the numerator, both the goods and the country are not calculated once again in the denominator) (Vollrath, 1991). Values more than 1 shows the export competitiveness. If a sector (product) in a country has a significant share in world total exports, the VI is higher than the BI (Kara & Necla Erdoğan, 2018).

In order to demonstrate the power of export competitiveness, the BI and the VI can be classified into four stages. If the values of the indices are between 1 and 2, it has weak competitiveness, between 2 and 4 it has competitiveness at medium level, and at 4 and above it has strong competitiveness (Hinloopen, 2001).

In addition to export competitiveness, measurement of the degree of specialization of the country's exported product (sector) is also important. In this context, the EIRI, the NTI and the LI can be used. The EIRI formulizes as $\ln \left[\left(\frac{X_{ij}}{X_j}\right) / \left(\frac{M_{ij}}{M_j}\right) \right] * 100$. While the fractional share represents the ratio of product export to total export, the denominator also shows the ratio of product import to total import (Mikic, 2005). Values more than 50 show specialization and high

competitiveness. If the index values are between -50 and 50, specialization is on the marginal level.

The NTI is obtained by dividing the difference of product exports and imports by their total. The index formulizes as $\left(\frac{X_{ij}-M_{ij}}{X_{ij}+M_{ij}}\right)$ (Balassa and Noland 1989) and is between -1 and +1 (Saboniene 2009). Positive values refers to importance of export and specialization.

The LI formulizes as $\left[\frac{X_{ij}-M_{ij}}{X_{ij}+M_{ij}} - \frac{\sum X_{ij}-M_{ij}}{\sum X_{ij}+M_{ij}}\right] \frac{X_{ij}+M_{ij}}{\sum X_{ij}+M_{ij}}$ (Desai, 2012). The index by taking into account imports, allows controlling for intra-industry trade and re-exporting flows. $LI > 0$ indicates that the country has a comparative advantage in the industry. Conversely, if the $LI < 0$, the country has a comparative disadvantage in the said industry (Reyes 2014). In addition, the index is between -50 (full despecialization) and +50 (full specialization) (Desai, 2012).

Empirical Results and Discussion

The results of the economic and financial rantability ratios, which are calculated by using the data in the financial reports of the companies operating in the automotive sector, for the years 2007-2017, are converted into average values on the basis of companies and sector and are given in Table 3.

Table 3: Average of Economic and Financial Rantability Ratios of the Automotive Sector

<i>Companies</i>	<i>Time Period</i>	<i>Average of Economic Rantability Ratio (%)</i>	<i>Average of Financial Rantability Ratio (%)</i>	<i>Rantability Factor (Average)</i>	<i>Current Ratio (Average)</i>
Isuzu	2007-2017	2.8	4.6	8.53	2.9
Tofaş	2007-2017	2.5	4.2	0.78	1.1
Doğuş	2007-2017	2.5	3.8	0.53	1
Otokar	2007-2017	2.3	3.5	-0.5	2.8
Ford	2007-2017	1.4	2.9	0.53	1.5
Karsan	2007-2017	-0.8	-0.2	-2.64	1.2
Tümosan	2009-2017	1.2	1.6	1.31	3.8
T.Traktör	2007-2017	1.8	3.6	-0.8	2
Sector Average	2007-2017	1.71	3	0.97	2.03

Source: It was calculated by using data from the companies' financial reports.

The high rate of economic and financial rantability are interpreted as positive. Although there is no standard figure determined in the interpretation of these ratios, if these ratios are close to 100%, the operating rantability is satisfactory, vice versa. As a result of the average of the sector (all companies) studied, economic rantability and financial rantability were calculated as 1.71% and 3%, respectively. This situation clearly show that sectorial rantability was not the satisfactory level. However, to evaluate comparatively financial and economic rantability ratio provided to speculate additionally. In this respect, it is seen that financial rantability ratio is higher than economic rantability ratio, in other words, usage of equity capital is productive. Between the years 2007 and 2017, the 8 companies that were examined within the scope of the study has a productive usage of equity capital. When it is seen that the average of economic and financial rantability ratios examined in the basis of enterprise, the average of the financial rantability ratios of the enterprises are higher than the average of the economic

rantability ratios except for Karsan. Ford Otosan which has a competitive position in the sector also uses its equity capital more efficiently than other companies in terms of economic and financial rantability ratios. In the table, it is understood that the main reason why Karsan has low scores in terms of economic and financial rantability is due to the company's loss statement between 2008-2010 and 2012-2016.

Companies which were under the examination made a profit about 3 TL in each of 100 TL in equity capital. Rantability factor giving the rate of net product to gross net product was found 9.7% in the average of companies. Thus, in examined companies 9.70 TL in each of 100 TL of gross net product was net product. The current rate average of companies was to be 2.30. This situation indicated that examined companies in the scope of the study could pay their current debts with selling their current assets, easily. The reflection of 2008 Global Financial Crisis showed itself the decreasing numbers in manufacturing and foreign trade in 2009 but it had not commonly negative effects all of the sector.

The relative performances (financial efficiency) and the process of change over time of the 8 companies in the automotive sector in the period of 2007-2017 were calculated by using the DEA and the Malmquist TFP methodology. Table 4 shows the output-oriented Technical Efficiency scores of the companies. According to Table 4, the most achievement company in the terms of financial efficiency is Otokar (Technical Efficiency Average is 1). Then, the followings are Tofaş (0.95), Doğuş (0.92) ve T.Traktör (0.88), respectively. It is seen that the highest technical efficiency performance in the year is 2009 and 2014.

In the evaluation process of the efficiency, the Malmquist TFP index were calculated in order to examine the process of change over time and showed in Table 5. The Malmquist TFP index measures the productivity changes caused by altering in technical efficiency. Since the sector average was less than 1 (TFP=0.972) in the period 2007-2017, there was a decreasing return in the sector. As evaluated on the basis of companies, it is seen that companies increasing their productivity during the examination were Tümosan (TFP=1.116) and Anatolia (TFP=1.069), respectively. These companies benefit from scale economy. On the other hand, when the TFP average of the other 6 companies was below 1 (TFP < 1), the efficiency of these companies decreased over time. In the terms of year, it was seen that the highest score of the TFP were in 2006, 2013 and 2008, and the lowest scores of productivity were in 2017, 2015, and 2010, respectively.

Table 4: Technical Analysis of the Automotive Sector

	<i>2007</i>	<i>2008</i>	<i>2009</i>	<i>2010</i>	<i>2011</i>	<i>2012</i>	<i>2013</i>	<i>2014</i>	<i>2015</i>	<i>2016</i>	<i>2017</i>	<i>Average</i>
Anadolu	0.512	0.815	1	0.912	1	0.931	0.868	0.839	0.668	1	1	0.867727
Tofaş	1	1	1	0.944	1	0.906	0.857	0.886	1	0.862	1	0.950455
Doğuş	0.737	0.846	1	1	0.797	1	1	1	0.913	1	0.861	0.923091
Otokar	1	1	1	1	1	1	1	1	1	1	1	1
Ford	0.686	0.65	1	1	1	0.841	0.786	0.758	0.651	0.502	0.772	0.786
Karsan	0.752	0.703	0.964	0.441	0.877	0.696	0.975	1	0.87	0.713	0.573	0.778545
Tümosan	0.441	0.628	0.755	0.726	0.904	0.995	0.702	0.963	1	1	1	0.828545
T.Traktör	0.786	0.732	0.968	0.998	0.784	1	1	1	1	1	0.482	0.886364
Average	0.739	0.797	0.961	0.878	0.92	0.921	0.898	0.931	0.888	0.885	0.836	0.877636

Source: It was calculated by using data from the companies' financial reports and the UN Comtrade Database.

Table 5: Total Factor Productivity Analysis of the Automotive Sector

	<i>2007-2008</i>	<i>2008-2009</i>	<i>2009-2010</i>	<i>2010-2011</i>	<i>2011-2012</i>	<i>2012-2013</i>	<i>2013-2014</i>	<i>2014-2015</i>	<i>2015-2016</i>	<i>2016-2017</i>	<i>Efficiency Changing</i>	<i>Technology Changing</i>	<i>TFP</i>
Anadolu	1.529	1.203	0.951	1.491	0.622	1.056	0.926	0.742	1.572	1.05	1.069	0.999	1.069
Tofaş	0.941	0.469	1.013	0.895	0.961	1.1	0.892	1.11	0.993	0.887	1	0.905	0.905
Doğuş	1.079	0.865	1.375	0.799	1.167	1.043	1.014	0.884	1.352	0.6	1.016	0.975	0.99
Otokar	1.008	0.784	0.938	0.816	1.072	1.064	0.889	1.052	1.102	0.811	1	0.947	0.947
Ford	0.89	0.997	1.056	1.005	0.789	1.092	0.915	0.859	0.893	1.167	1.012	0.949	0.96
Karsan	0.962	1.087	0.402	1.405	0.929	1.596	1.214	0.731	1.063	0.595	0.973	0.957	0.932
Tümosan	1.422	1.016	1.175	1.427	0.815	0.831	1.244	1.056	1.406	0.989	1.085	1.028	1.116
T.Traktör	0.943	1.028	0.985	0.847	1.137	1.134	0.934	0.708	1.092	0.372	0.952	0.925	0.88
Average	1.076	0.901	0.94	1.051	0.919	1.098	0.995	0.88	1.165	0.764	1.013	0.96	0.972

Source: It was calculated by using data from the companies' financial reports and the UN Comtrade Database.

When Turkey's BI and VI scores in associated with automotive export competitiveness is examined in 2000-2016 period, it is observed that there is a low global competitive advantage. However, this competitive advantage has decreased in general after 2009. In addition, the NTI and the LI scores indicating the level of export specialization shows that Turkey could not provide specialization in automotive exports. The EIRI indicates that the level of specialization is at the marginal level. In generally interpretation, although not specialized in automobile exports, Turkey has a weak degree of competitiveness in the global automotive exports.

Table 6: Export Competitiveness of the Turkish Automotive Sector (2000-2016)

(Revealed Comparative Advantage (Export Competitiveness) Coefficients)

<i>Years</i>					
	<i>BI</i>	<i>VI</i>	<i>NTI</i>	<i>EIRI</i>	<i>LI</i>
2000	0.6067	0.5829	-0.6371	-88.6717	-0.0502
2001	0.7866	0.769	0.056	34.0164	-0.0501
2002	0.9051	0.8958	0.0823	49.6435	-0.0369
2003	1.0747	1.0849	-0.097	16.8593	-0.0227
2004	1.3687	1.4291	-0.159	10.6588	-0.0134
2005	1.417	1.4852	-0.1036	22.3197	-0.0119
2006	1.5942	1.6989	-0.0392	34.8095	-0.0098
2007	1.6728	1.8015	0.0822	57.5847	-0.0071
2008	1.7272	1.8572	0.1168	57.0199	-0.0064
2009	1.6922	1.7971	0.107	53.9974	-0.0092
2010	1.6333	1.7298	-0.0448	40.9522	-0.0084
2011	1.6021	1.6902	-0.1015	39.8807	-0.0073
2012	1.3179	1.3572	-0.0524	38.0813	-0.0079
2013	1.4887	1.5571	-0.0617	44.8396	-0.007
2014	1.4502	1.5145	0.0119	48.8624	-0.0065
2015	1.4102	1.4727	-0.0374	30.6725	-0.0064
2016	1.5362	1.6317	0.0285	42.7633	-0.0055
Average	1.3696	1.4327	-0.0499	31.4288	-0.01568

Source: It was calculated by using data from the UN Comtrade Database.

When all the results are evaluated together, the productivity (the Malmquist TFP) scores and export competitiveness scores of the Turkish automotive sector acted together in the examined period except for the years 2010-2011. In other words, it is concluded that there was a correct relationship between the financial efficiency and the revealed comparative advantages (export competitiveness) in the sector. For instance, in 2007 and 2008, the Total Factor Productivity scores increased from 1.010 to 1.076, indicating an increase in productivity growth in industry. In the same period, the BI and VI also increased (from 1.6728 to 1.7272 in the BI and from 1.8015 to 1.8572 in the VI). Industrial efficiency resulted in increased competitiveness. Similarly, a decrease in the average TFP of the industry in 2014 and 2015 which were announced in the same years led to a decrease in competitiveness scores (BI, VI). These relationship is not seen in 2009 and 2012. This reason why not having the same direction

of movement in 2009 and 2011 can be explained by the fact that these years (the 2008 Global Crisis and the 2011 European Debt Crisis) represent the post-crisis years.

Table 7: Efficiency-Competitiveness Relationship

<i>Years</i>	<i>Balassa Index</i>	<i>Vollrath Index</i>	<i>Total Factor Productivity</i>
2007	1.6728	1.8015	1.01
2008	1.7272	1.8572	1.076
2009	1.6922	1.7971	0.901
2010	1.6333	1.7298	0.94
2011	1.6021	1.6902	1.051
2012	1.3179	1.3572	0.919
2013	1.4887	1.5571	1.098
2014	1.4502	1.5145	0.995
2015	1.4102	1.4727	0.88
2016	1.5362	1.6317	1.165

Source: It was calculated by using data from the companies' financial reports and the UN Comtrade Database.

Notes: The light grey color represents the increase in the scores while the dark grey color represents the decrease in the scores. The TFP scores are the yearly average and are obtained from Table 5. The BI and the VI are obtained from Table 6.

Conclusions

With its strong forward and backward links to other sectors of the economy, the automotive sector has a large multiplier effect and added value on economic growth and development. On the other hand, the automotive sector is one of the leading sectors that adopt and implement the Industry 4.0 processes. Following the technology and pharmaceutical industry, most of the world's R&D investments are carried out in the automotive sector. In parallel with revenue growth in developing countries and rising consumption demand, the manufacturing in automotive sector with the effects of low cost has changed its direction from developed countries to developing countries. This changing has affected directly Turkish automotive sector. In the recent years, Turkish automotive sector has sustained its sectorial growth through integration with the EU. It has thought that the strong steps to accomplish long-planned competitive Turkish brand will make significant contributions to increase international competitiveness of the sector.

The Turkish automotive sector ranks 14th in the world in terms of size, and in the 6th place on the back of Europe, Germany, Spain, France, the United Kingdom and Russia. As of the end of November 2017, more than 77% of the total automotive sector exports are made to the EU countries. The Turkish automotive sector operates its activities in 12 companies and 18 factories. Of these 12 companies, four has produced exclusively automobiles, 6 has produced commercial vehicles and 2 has produced both of them.

In the study, the structure of the automotive sector in the period of 2007-2017 is considered as multidimensional. When the literature samples are examined, it is not found any study examining the relationship between efficiency, rantability and export competitiveness scores of any sector. These studies examined sectors with only one of these variables. The main differences of this study from other studies are to associate with sectorial efficiency, rantability changes and revealed comparative advantages' (export competitiveness) degree. Considering

these indicators, methods and time period, it is thought that this study brings a new perspective and makes a contribution into literature.

According to sectorial economic and financial rantability ratio, the economic rantability were calculated as 1.71% and the financial rantability were calculated as 3%. The fact that the financial profitability ratio is higher than the economic profitability ratio shows that the use of equity capital in the sector is efficient. The presence of low or high ratio of financial and economic rantability affect the interpretation about whether sources are used efficiently. The high ratio indicates that the resources are not used effectively and the low ratio indicates that the resources are used effectively. In the study, it is seen that economic and financial rantability ratios are far from 100%. In other words, ratios in question are not as high as desired. This shows that the sector has failed to use resources. When the productivity changes caused by the changes in technical efficiency in the period of 2007-2017 are analysed, it is seen that the productivity decreases in the automotive sector (TFP=0.972). The highest scores of the TFP are in 2016, 2013 and 2008, respectively, and the lowest scores of TFP are in 2017, 2015 and 2010, respectively.

When Turkey's competitiveness associated with revealed comparative advantage indices (BI, VI, NT, EIRI, LI) scores in the period of 2000-2016 are examined, it is seen that it has a low level of global competitiveness (comparative advantage). Besides, it is observed that the competitiveness has decreased in generally after 2009 (due to the global crisis). Also, the indices show that Turkey is unable to provide a specialization in automotive exports, but there is also weak level of global competitiveness.

When economic and financial rantability ratio analysis are evaluated with the results of financial efficiency (DEA, TFP) analysis and export competitiveness analysis, it is seen that there is a relationship between the variables. Accordingly, it is observed that the scores related to export competitiveness increased in 2007, 2008, 2013 and 2016 in which the TFP increased. Conversely, export competitiveness decreased in 2009, 2012, 2014 and 2015 when the TFP decreased. On the other hand, it is seen that this relationship could not be achieved only in 2009 and 2012. It is noteworthy that the years in which this relationship could not be achieved corresponded to the aftermath of the 2008 and 2011 crisis.

With based on the results obtained, a number of recommendations can be developed to increase both efficiency and rantability level of the automotive sector and export competitiveness. Young and growing population in Turkey is one of the strengths of Turkey in the automotive interior market, and it should be benefited from this dynamism. It is considered that withdrawal of old vehicles from traffic in renewal of the scrap incentive program will help both reducing the environmental pollution, and increasing the safety of vehicles or pedestrians. Moreover, this practice includes an important opportunity to revive the market and to reduce scrap imports. The tax burden which comes from the ratios of special consumption tax and value-added tax negatively affects the growth of home market. For this reason, the lower tax rates applied to commercial vehicles compared to their car segments will ensure the more powerful demand for the sector in Turkey. In addition, fluctuations in the exchange rate significantly affect the size of the market. Therefore, exchange rate stability should be given importance. A similar situation is valid on oil prices. Factors such as accelerating urbanization and facilitating access to credit are also expected to strengthen vehicle demand.

The foreign partnerships and the advanced supply industry of the strong groups in automotive production and the advanced supply industry keep the industry alive, consistently. Therefore, opportunities for cooperation with international companies should be strengthened. Compared to the EU countries, the low labor cost provides a competitive advantage in terms of production costs in the sector. Geopolitical position contributes to easily access to many

markets for the development of the sector, positively. There are a number of shortcomings in this sector despite of these advantages. The sector displays a weak view for industrial design, patent and international standards compared to other countries. The lack of trained labor force has appeared as an important obstacle in the transition of the sector to apply Industry 4.0 structures. The departments' related to automotive at the undergraduate and graduate level in universities cannot see sufficient demand. Despite of the development of logistics sector, there are still significant deficiencies in the infrastructure. Regional problems stemming from foreign policy also directly affect the sector. In order to solve such problems, sector representatives and decision-makers should improve their cooperation and develop long-term policy strategies.

Factors such as rapid economic growth, young and dynamic demographic structure, improvement in financial conditions, and the low level of car ownership rate in Turkey are (signals) indicators of which high growth in the automotive market will continue in the forthcoming days. In addition, the domestic automobile production and branding project as soon as possible to make a national issue of branding and creating a social synergy and domestic car consumption should be encouraged. In this context, the increase of direct foreign investments, further expansion of its product range with automotive manufacturers, the reduction of import intensity in the market in Turkey will be provided in case the market growth of automotive sector gets back on the rails. In this situation, the rising of efficiency, profitability and export competitiveness in the sector will be ensured.

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