REPUBLIC OF TURKEY
YILDIZ TECHNICAL UNIVERSITY
GRADUATE SCHOOL OF SOCIAL SCIENCES
DEPARTMENT OF ECONOMICS
MASTER OF ARTS PROGRAMME IN ECONOMICS

MASTER'S THESIS

INTERNATIONAL COMPETITIVENESS OF HOME APPLIANCE SECTOR OF TURKEY

ZEKİ CAN SEMİZOĞLU
15729038

THESIS SUPERVISOR
Asst. Prof. Dr. HASAN AĞAN KARADUMAN

İSTANBUL
2019

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Date of Submission: 28.06.2019

Date of Defence: 27.06.2019

Thesis is approved by unanimity vote of the committee.

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ISTANBUL

JUNE 2019

ABSTRACT

INTERNATIONAL COMPETITIVENESS OF HOME APPLIANCE SECTOR OF TURKEY

Zeki Can Semizoğlu

JUNE, 2019

The main purpose of this study is to determine international competitiveness of Home Appliances Sector of Turkey. In the study, the main sub-products are analyzed, the concept of competition are defined and the main competition concepts in the literature are insetigated. After the countries with the hugest export value are listed and a comparative analysis is conducted in a descriptive manner.

In the study, Balassa's revealed comparative advantage index method is used to measure competitiveness. The data span used is from first quarter of 2006 to third quarter of 2018. So the revealed comparative index for Turkey is calculated by using this data. For the term studied, it is found that Turkey has revealed comparative advantage. Then, the revealed comparative advantage index is calculated for other countries that are in the scope of the study. As result, it is detected that Turkey has strong comparative advatage over other countries in home applaince sector.

At the end of the study, the link between real effective exchange rate and relevaled comparative advantage index is investigated by using the econometric tools like cointegration analysis and error correction model in this study. As a result, there exists a statistically moderate emprical link between two series of interest in the long-run.

Keywords: Revealed Comparative Advantage, Home Appliances Sector, International Trade

ÖZ

TÜRKİYE'NİN BEYAZ EŞYA SEKTÖRÜNÜN ULUSLARARASI REKABET GÜCÜ

Zeki Can Semizoğlu

HAZİRAN, 2019

Bu çalışmanın ana amacı Türkiye'nin beyaz eşya sektörünün uluslararası arenada rekabet gücünü belirlemektir. Çalışmada sektörü oluşturan ürün gruplarına yer verilmiş, rekabet kavramı tanımlanmış ve literatürde popüler rekabet ölçüm metotlarına yer verilmiştir. Ardından en yüksek beyaz eşya ihracat miktarına sahip ülkeler belirlenmiş ve alt ürünlere göre ihracat performansları kıyaslanmıştır.

Çalışmada rekabet ölçme metodu olarak Balassa tarafından geliştirilen açıklamalı karşılaştırmalı üstünlük endeksi kullanılmıştır. Çalışmadaki veriler 2016 yılının ilk çeyreğinden 2018 yılının üçüncü çeyreğine kadardır. Türkiye'nin açıklamalı karşılaştırmalı üstünlüğü hesaplanırken bahsedilen dönem kullanılmıştır. Dönem boyunca Türkiye'nin beyaz eşya sektöründe karşılaştırmalı üstünlüğü olduğu ortaya çıkmıştır. Daha sonra 2006 yılından 2017 yılına yıllık olarak açıklamalı karşılaştırmalı üstünlük endeksi çalışmaya konu olan tüm ülkeler için hesaplanmış ve Türkiye en yüksek rekabet gücüne sahip ülke çıkmıştır.

Ardından reel efektif döviz kuru ile rekabet gücü arasında bir bağlantı olup olmadığı araştırılmış ve bunun için ekonometrik bir analiz yapılmıştır. Sözkonusu çeyreklik iki zaman seri arasında uzun dönem denge ilişkisini bulmak için koentegrasyon analizi ve kısa dönemli ilişkileri de incelmek için hata düzeltme modeli kurulmuştur. Bahsi geçen iki serinin uzun dönem denge ilişkisi içerisinde olduğu da ortaya çıkmıştır.

Anahtar Kelimeler: Açıklamalı Karşılaştırmalı Üstünlük, Beyaz Eşya Sektörü, Uluslararası Ticaret

ACKNOWLEDGMENTS

Before all, I would like to thank my mother and my family for all the self-devotion throughout my life. I also would like to thank my thesis advisor Asst. Prof. Dr. Hasan Ağan Karaduman, who has always been supporting me during my thesis, for the insight and knowledge he gave me. He always makes us feel special with his helpfulness any time I needed. I would like to thank my dear friend İbrahim Engin Kılıç for his suggestions and help. My managers at Arçelik A.Ş. deserves a special thanks for their support and understanding throughout my study.

İstanbul, June 2019 Zeki Can Semizoğlu

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LIST OF ABBREVIATIONS

ADF	: Augmented Dickey-Fuller Test
ECT	: Error Correction Term
EOI	: Export Orientation Index
GDP	: Gross Domestic Product
RCA	: Revealed Comparative Advantage
UN	: United Nations
USA	: United States of America
US	: United States

1. INTRODUCTION

Turkey is an important production hub for the Turkish brands and the international brands. The country's manufacturing operates in various manufacturing sectors like textile, automotive and home appliance etc. global textile and automotive brands have production plant in Turkey. Home appliance sector is one of the most important sectors in Turkish manufacturing. Because the country is not just a production hub for foreign brands. In this sector, turkey has its own global, successful brands like Arçelik and Vestel. On the other hand, Turkey has the hugest production plant of BSH, which is one of the hugest home appliance producers.

The literature is not rich in terms of international competitiveness of home appliance sector of Turkey. Study of Akiş (2008: 222) is one of the most notable study to measure competitiveness of Turkey's home appliance sector. the study's result asserts that Turkey has strong competitive advantage in home appliance sector over other producers.

In the first half of the first section, mainly the concept of competition and importance of competition in economics will be emphasized. Types of competition are also briefly handled. In the second half of the first section, the main topic is the methods to measure competition. The main methods to measure international competitiveness are elaborated. In this section, Revealed Comparative Advantage, which is a popular tool to measure competitiveness and is the mail tool to measure international competitiveness of sector in this study.

In the second section, a general overview of sector is mentioned. The main purpose of the section is to define what home appliance products are and how big of the sector's share in the world economy. The section looks for relationship between the path sector and world economy.

In the third section, export performance of top nine countries are presented and the export performance of these nine countries are compared in home appliance sector. The section does not only contain a general comparison of countries. Along with

general comparison, comparisons of export performance in sub-products are also analysed.

The main purpose of the forth section is to measure competitiveness. The revealed comparative advantage is the main tool to measure competitiveness and the results from first quarter of 2006 to third quarter of 2018 are obtained and the sector is found strongly competitive. Along with that, the revealed comparative index is calculated for other competitors and it is found that Turkey has strong comparative advantage over other competitors.

Exchange rate has always been an important determinant in the export performance. To test if it fits in home appliance sector, a cointegration and error correction model built to test if there is a long-run relationship between real effective exchange rate and competitiveness of home appliance sector. Firstly, the theoretical background of cointegration and error correction model is briefly discussed. And then the estimation results are presented. The results assert that there is a moderate link between real effective exchange rate and international competitiveness of home appliance sector of Turkey in the long-run.

2. COMPETITION IN AN INTERNATIONAL SETTING

In this section, the main definitions of competition are given. Firstly, the hugest antitrust fines in the business history is listed to emphasize how the regulators and policy makers take the effectiveness of competition seriously. After defining the concept of competition from different sources, market types based on the degree of competition are briefly mentioned.

Competitiveness has always been an important factor in economics. It is always considered as one of the main driving forces of a capitalist system. In classical theory, it is believed that competition between firms and labour bring improved productivity. Hence some regulations are designed to sustain more competitive environment in global and international markets. Some of the hugest companies are fined for antitrust violations. The biggest antitrust fines are as follows (Berman, 2016):

- Microsoft MVP: Microsoft fines around 2.1 by European and US courts for violating antitrust law by block rivals to develop hardware compatible with Microsoft software, forcing PC users to use Internet Explorer and Windows Media Player.
- Google Android Case: It is a still on-going case and it is expected to reach 7.5 billion dollars fine for forcing cell phone producers to install eleven google applications.
- LG, Samsung, Panasonic and Others: These companies are fined total 1.6 billion dollars for not to compete for certain customers, fixing prices and sharing markets.
- AU Optronics faced 500 million dollars' worth fine for fixing price.
- Hoffmann-La Roche fined for 500 million dollars for fixing price in 1999.
- Yazaki Corp fined 548 million dollars for price-rigging and bid-fixing schemes in 2012.
- Bridgestone Corp faced 45 million dollars' worth fine for price fixing and big-rigging in 2014.
- LG Display America fined 400 million dollars for price fixing in 2009.

- Societe Air France fined 505 million dollars for 505 million dollars with other five companies for fixing international shipping rates in 2008.

It is hard to find one unique definition for competition. It can be defined as "the potential of a country or firm to obtain more share in global trade in a certain sector" by myself. Another one is "a country's ability for producing goods and services that have international competitive power, while that country's citizens are having rising and sustaining living standards" (Krugman, 2004, p. 31). Some argues that a country's competitiveness is related to its exchange rates, interest rates, situation of government budged but it is not easy to find one size for all situations. For example, countries like Japan, Italy and South Korea are having better life standards while those countries' suffering budget surplus at the same time or on the other hand, countries like Germany and Switzerland are having appreciating currencies. Some argues that competitiveness is driven by cheap labour but again countries like Germany, Switzerland and Sweden have relatively expensive labour while those countries having high competitiveness. In addition to that, it is not something unachievable. That is what makes it something that has always been desired by other countries. At first, Italy was the top country that leaded the home appliance industry with its scale economies, early movers' advantages, customer relationships and improved distribution channels. But Germany improved its competitiveness with strong brand franchises and differentiated products. Japanese automakers are good examples of showing how a competition can be sustainable. They have sustained their competitiveness by penetrating small markets with small and cheap cars with adequate quality. They have built large plants to reap benefits of economies of scale and invested in innovation to sustain their competition in the global markets (Porter, 1990, pp. 75-78). In a study of Bucky, Pass and Prescott (2010, p. 176) mentions both competitiveness at the level of firm and competitiveness at the national level. Here competitiveness at the firm level is defined as the ability of a firms to produce high quality of goods with lower cost than its national and international competitors. National level competitiveness defined as the ability to produce resource to meet its national needs. Hence, there are various definitions for competition and the most common features of these definitions are quality of goods produced and low production cost.

2.1 Market Types

There are four different market types in microeconomics. They can be listed as follows;

2.1.1 Perfectly Competitive Markets

Perfectly competitive markets can be defined as a fragmented market undifferentiated goods, perfect information about prices, equal access to reach resources (Besanko, Braeutigam, 2011:330).

It is fragmented because in a perfectly competitive market, there must be large number of buyers and seller. Undifferentiated goods are another perquisite for perfectly competitive market. Perfect information is another important perquisite for perfectly competitive market because in a market consist of undifferentiated products, price is the main determinant for a buyer. The last perquisite for perfectly competitive markets is that equal access to resources. In a perfectly competitive market, firms can reach sources like capital and labour.

2.1.2 Oligopoly

Oligopoly has two version. The first one is homogenous products oligopoly markets, which can be defined as a market with small number of companies sell the almost identical products with almost same price. The second one is differentiated products oligopoly markets, which can be as a market a small number of firms sells products that are substitute for each other and on the other hand that are different from each other in terms of performance and look (Besanko, Braeutigam, 2011:530).

2.1.3 Monopoly and Monopsony

Monopoly and monopsony define a market with only one buyer refers to monopsony. A market with only one seller, which is a price setter, refers to monopoly (Besanko, Braeutigam, 2011:530).

2.1.4 Imperfect Competition

A market with imperfect competition can be defined as a market that violated perfectly competitive market. The typical firms have some market power, but that market power is not as big as in the monopolies. So, some markets stay between perfect competition and monopolies. Those situations called imperfect competition (Mankiw, 2008:330).

2.2 How to Measure International Competitiveness

In this subsection, the issue of how competition can be measured and tools to measure competition is handled. The methods to measure international competitiveness is listed and explained thereafter.

Measuring competitiveness has always been an important issue for the international economists. In this subsection, the tools and methods to measure international competitiveness of countries' and sectors' are presented.

Before analysing these measurements, it is crucial to define some important concepts in international economics. They are namely **Absolute Advantage** and **Comparative Advantage**.

2.2.1 Absolute Advantage: According to Adam Smith, trade should be determined by efficiency of two countries in production of two different goods. If country 1 is more efficient in the production of good 1 than country 2 and if country 2 is more efficient in producing good 2 than country 1, then one can say that country 1 has absolute advantage in good 1 over country 2 and country 2 has absolute advantage in good 2 over country 1. According to absolute advantage theory both countries should specialize on the good they have more efficiency (Salvatore, 2013: 34).

In the Salvatore's textbook, there is a good illustration to understand how absolute advantage works. In the Table 2.1 below, one hour of labour time produces 6 piece of apple in United States but only one piece of apple in United Kingdom. On the other hand, one hour of labour produces 5 pieces of peach in United Kingdom and 4 piece of peach in United States. That means that Unites States has absolute advantage in production of apple over United Kingdom. On the other hand, United Kingdom has absolute advantage in production of peach over Unites States.

Table 2. 1 Production of Apple and Peach

	US	UK
Apple (piece / hours)	6	1
Peach (piece / hour)	4	5

Dominic Salvatore, **International Economics**, (Wiley: New Jersey, 2013:35)

2.2.2 Comparative Advantage: According to comparative advantage theory, if a country is less efficient (has absolute disadvantage) in producing both goods, trade between these countries can still be beneficiary. For that, country with absolute disadvantage in both goods should produce the goods on which, it has less disadvantage relative to other goods and import the goods with the greater disadvantage (Salvatore, 2013: 36).

Table 2. 2 Production of Apple and Peach

	US	UK
Apple (piece / hours)	6	1
Peach (piece / hour)	4	2

Dominic Salvatore, **International Economics**, (Wiley: New Jersey, 2013:37)

In the Table 2.2 above, which is taken from Salvatore's textbook, United States produces six pieces of apple in one hour of labour and United Kingdom produces one piece of apple in one hour of labour. On the other hand, United states produces four pieces of peach in one hour of labour and United Kingdom produces two pieces of peach in one hour of labour. United States is twice more productive than Unites Kingdom in producing peaches and six times more productive in production of apples.

Here United States has absolute advantage both in production of apple and peach. United Kingdom has comparative advantage in production of peach because its inefficiency in peaches is less than apple's. Therefore, one can say that United States has comparative advantage in clothes. Law of comparative advantage asserts that both countries can gain if Unites States specializes in apple and United Kingdom specializes in peach.

2.2.3 Porter's Diamond

In Porter's Diamond model, competitiveness has four determinants which can be listed as follows (Porter, 1990: 78).

2.2.3.1 The Factor Conditions

It is important to supply necessary factor conditions like skilled labour and infrastructure for an economy to sustain international competitiveness. Today the most important factors of production are factors like human resources and intellectual

properties. Even natural sources do not support related industry, this disadvantage can turn into an advantage with the help of skilled labour force and technological progress (Porter, 1990: 79-82).

2.2.3.2 The Demand Conditions

It is important for an industry to have high domestic demand to sustain international competitiveness. Rise of the globalization did not lessen the significance of domestic demand. The domestic market is especially more important for the sector if domestic demand is more sophisticated than foreign markets. Sometimes domestic market may give a clue about where the global trend in sector goes to (Porter, 1990:82).

2.2.3.3 The Related and Supporting Industries

The International competitiveness related to the industries in the supplier side is an important determinant to sustain competitiveness. Internationally competitive suppliers can deliver effective and cheap supplies with high quality and they are a supportive factor for competitiveness.

2.2.3.4 The Firms Strategy, Structure and Rivalry

Not only international rivalry, domestic rivalry is important for quality enhancement. Naturally firm's management is one of the keys to sustain international competitiveness. Every sector needs different perception in management and countries must give this perspective to become internationally competitive.

Porter emphasizes that succeeding in the above items alone is not enough for the international competitiveness. Those items must be succeeded together as a whole. In other words, the national environment should permit accumulation of assets and high skilled labour. After that it should let to companies to produce competitive products. In the end, all that forces companies to compete together to gain competitive advantage. According to Porter, the governments have an important role in creating competitive industries. Porter asserts that government cannot create industries that are internationally competitive but can support privately build industries to be more competitive internationally. Its role should not be creative and should be supportive.

2.2.4 Revealed Comparative Advantage

Revealed Comparative Advantage perspective is one of the most popular method in international economics to measure international competitiveness. The index designed by Bela Balassa in 1965. Factor prices has an important effect on competitiveness of countries, but it is hard to measure factor prices for multiple countries. Because unlike the models studied in classical economics, most of the manufactured goods have more than two factor prices and non-price factors. Revealed Comparative Advantage suggests that trade patterns for a commodity between countries reflects relative costs and as well as non-price factors. Export performances of individual countries can be evaluated using two measures. The first one is the comparing relative shares of a country in the world export of a commodity and the second one is to indicate changes in relative shares over time. For that, data should turn into a normal series by "dividing a country's share in the exports of a given good by its share in the joined exports of manufactured goods of the ten industrial countries under consideration and expressing the result in index format. Thus, for a given export good of a particular country, an index number, such as 110, will denote that the country's share in this commodity's exports is 10% higher than its share in the total exports of manufactured goods" (Balassa, 1965: 103-105).

The World Bank formulates what Balassa asserts in 1965 as follows;

$$RCA_{ij} = (\frac{x_{ij}}{x_{it}})/(\frac{x_{wj}}{x_{wt}})$$

In the formula, RCA_{ij} denotes the Revealed Comparative Advantage of country i in product j. x_{ij} denotes the export of country i in production j. x_{it} denotes total export of country i. x_{wj} denotes the export of world in product j. x_{wt} denotes the total export of world. If Revealed Comparative Advantage index is above 1, then it can be concluded that country j has comparative advantage in product I and country j should persist to produce product i. If Revealed Comparative Advantage index is less than 1, then it can be concluded that country j has comparative disadvantage in product i. In that case country j should not persist to produce product i and it should use its sources in producing another good with which, country j has comparative advantage.

2.2.5 Cost Competitiveness

The indicators containing cost measures are very popular to measure international competitiveness. Unit Labour Cost is the easiest measure in terms of data availability. Unit Labour cost can be described as the ratio of workers' earnings per employee to labour productivity. A rise in Unit Labour Cost implies an increase in ratio of labour cost of production to productivity which leads a loss in competitiveness. On the contrary, a decrease in Unit Labour Cost implies a decrease in ratio of labour cost of production to productivity, which leads a gain in competitiveness (Central Bank of Malta, 2016:56). But there exists some disadvantages of this method. Some measurements use the employment rate to measure aggregate output and it is possible to observe biased output in case of misestimation of employments. That may lead misestimation of productivity if cost defined in terms of output (Peterson, Barras, 1987: 132).

2.2.6 Weighted Exchange Rates

Another tool to measure international competitiveness is real exchange rates. Meher, Wong and Chee use this method in an article written in 1999. In this new method, all prices and exchange rates are weighed by a basket of currency rather than a single currency. After that they calculated real exchange rate based on purchasing power parity to compare the new measures performance with purchasing power parity. They used cointegration method for comparison. It is proven that this new measure was more correlated with export performance of countries.

2.2.7 Export Orientation Index

Export orientation index is a modified revealed comparative advantage index to measure sectors' or firms' competitiveness from a different perspective. Here firm base data is used, which can easily be obtained from firms' balance sheets.

$$EOI = \frac{\frac{\sum_{i=1}^{k}(R_{ia}/(R_{it}))}{k}}{\frac{\sum_{i=1}^{n}(R_{ia}/(R_{it}))}{n}}$$

Above stays the equation of Export Orientation Index. Index's purpose is basically to measure a share of abroad sales of group of firms in a specific sector. Here R_{ia} denotes

abroad sales of a company i and R_{it} denotes the total sales of company i. Upper side of the equation basically gives us average share of abroad sales in total sales. Here k denotes the number of firms in a specific sector in a selected country.

The denominator side of the equation basically gives us average share of abroad sales in total sales in a specific sector. Here "n" denotes the number of total firms in this specific sector.

The export orientation index is considered as an important measure because it allows us to compare share of abroad sales in total sales in country's selected sector with share of abroad sales in total sales of this sector globally. As in the Revealed Comparative Advantage Index, if the index number is higher than 1, then it is concluded that our country's selected sector's foreign share has more share in total sales than sector's global average. Then it can be concluded that this sector is more export oriented than its competitors in the sector of interest.

3. OVERVIEW OF HOME APPLIANCE SECTOR AND ITS SHARE IN THE WORLD ECONOMY

Home appliances sector is one of the biggest sectors in the World. Almost every household uses white goods and in the age of modern times it can be asserted that it is not an option. Sector's market size is 505 billion dollars in 2017 and it is expected market size to grow 703 billion dollars by 2022 (MarketWatch, 2018).

3.1 Overview of Home Appliance Sector

Products in this study are the core home appliances products and Table 3.1 contains those products' custom tariff numbers, definition and category that they belong. All data about home appliances products in this study consist of sum of sub-product below. To determine which sub-products will be used, the article published by European Commission is the main source benefited from (Özden, 2009). The goods for household use are especially studied. Because goods like refrigerators, washing machines and dishwashers can be differentiated as industrial use and household use. It is important to emphasize this difference between goods. In this study, goods produced for household use will be analysed. Appliances produced for industrial purposes or other purposes are not the subject of this study. It is also important to note that televisions are not included in this study because some companies in this sector do not produce televisions and that may cause measurement problems.

Table 3. 1 Product and Sub-Product Definitions by Custom Codes

Custom Tariff Number	Definition	Product Category
8418.10	Combined refrigerator-freezer with external doors	Refrigerator-Deep Freezer

Table 3.1 Continuation

8418.21	Household use refrigerator, compression type	Refrigerator-Deep Freezer
8418.29	Household use refrigerator, absorption type	
8418.30	Chest type freezer smaller than 800 l.	
8418.40	Upright type freezer smaller than 900 l.	
8422.11	Household use dishwashing machine	Dishwasher
8450.12	Household use or laundry-use washing machines with built in centrifugal drier.	Washing Machine
8450.19	Household use or laundry-use washing machines with capacity lower than 6 kg without fully automation.	
8516.50	Microwave Ovens	Oven

Table 3.1 Continuation

7321.11	Goods for baking, frying, grilling and cooking and plate warmers, for domestic use, of iron or steel, for gas fuel or for both gas and other fuels (excluding large cooking products)	Oven
7321.12	Goods for baking, frying, grilling and cooking and plate warmers, for domestic use, of iron or steel, for liquid fuel	
7321.19	Goods for baking, frying, grilling and cooking and plate warmers, for domestic use, of iron or steel, for solid fuel or other non-electric source of energy.	
8516.40	Electric smoothing irons	Electric Iron
8508.11	Vacuum cleaners, incl. dry cleaners and wet vacuum cleaners, with self-contained electric motor, power less than 1500 W and having a dust bag or other receptacle capacity less than 20 l.	Hoover

Table 3.1 Continuation

8509.40	Domestic food grinders and mixers and fruit or vegetable juice extractors, with self-contained electric motor	Electrical Kitchen Appliances
8516.60	Electric ovens, cookers, cooking plates and boiling rings, electric grillers and roasters, for domestic use (excluding space-heating stoves and microwave ovens)	
8516.71	Electro-thermic coffee or tea makers, for domestic use	
8516.72	Electric toasters, for domestic use	
8516.79	Electro-thermic appliances, for domestic use	
8451.21	Drying machines, of a dry linen capacity lower than 10 kg.	Dryer

Retrieved from Damla Özden. **Home Appliances Sector Report**. (Blacksea,2009)

Home appliances concept covers lots of products. They are known by everyone and have place every house. A house without those products is not a usual one. Home appliances goods can be divided into two categories. First if "the large home appliances" and the second one is "the small appliances". Fridges, freezers, ovens, dishwashers, washing machines and dryers are in large home appliances group. On the

other hand, vacuum cleaners, kettles, coffee and tea makers, irons, grinders, juicers, food processors, toasters and slicers are in small home appliances group.

The sector of interest is very competitive in terms of market participants. There are a lot of players and production hubs in Asia, South America, North America and Europe. Arçelik and Vestel in Turkey, Bosch-Siemens Hausgeræte in Germany, Electrolux in Sweden, Haier and Midea in China, Whirlpool in United States, Samsung and LG in South Korea are important brands in the market. There are more players in market but in this study, only major players are included.

3.2 Sector's Share in World Economy

In this section, at first the general global macroeconomic outlook is handled. Total Export of Goods and Services, Total World Output and World GDP per capita between 2006-2017 period will be depicted in a graph and explained trends and relationship between them (Figure 3.1) Then the hugest exporters and importers of home appliance products are listed with respect to their import and export value and share of world market. At the end total export and import of home appliances products are graphed year by year from 2006 to 2016 with their share in total world trade. Home appliance sector is one of the biggest sectors in the world economy. The sector's importance does not stem from the sector itself. It supports several subsidiary industries like steel industry, logistics sector. That makes home appliances sector's demand very strong.

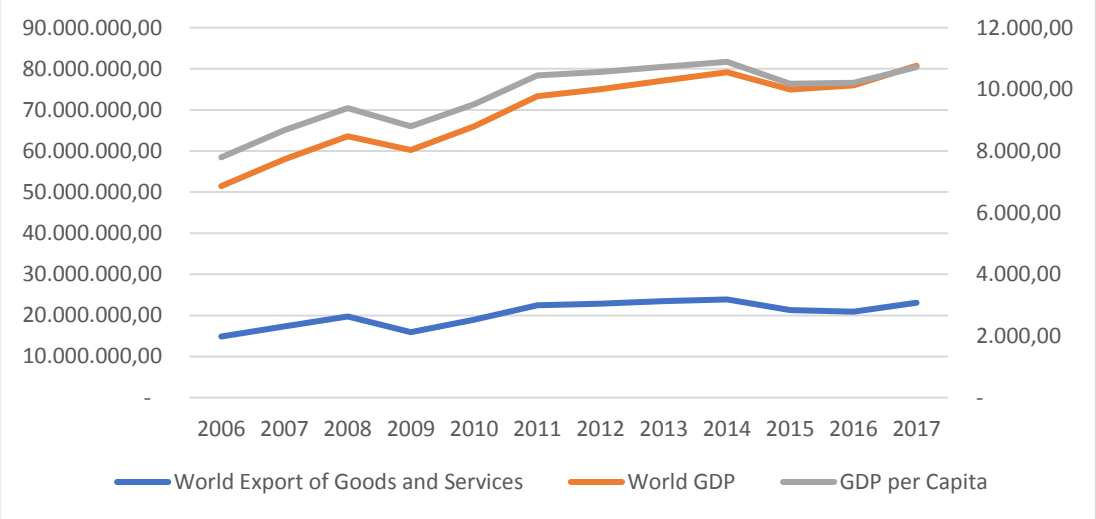


Figure 3. 1: World Export of Goods and Services vs. Total World GDP (Million US$)

Retrieved from World Bank open data, (https://data.worldbank.org, 23.02.2019)

In Figure 3.1 above, there are Total World Export of Goods and Services, Total World GDP and GDP per Capita in form of US dollars. The blue line represents the World Export of Goods and Services, the orange line represents world GDP and grey line represents GDP per capita. GDP data is taken from World Bank database and calculated with total income approach. From 2006 to 2017 it is can observable that the total export of goods and services, the total World GDP and GDP per Capita generally rises except 2009 and 2015. The decline in 2009 is natural and expected due to the 2008 crash in global economy. The rise in the total world economy is stronger than rise of the export of goods and services. It means that the development of domestic sectors is stronger than the development of global trade. The path GDP per Capita and Total World GDP follow is almost same as expected. But after 2014, the recovery of GDP per capita is not as strong as world total output.

At Table 3.1**,** there is the Top 10 Home Appliance Exporter Countries and Top 10 Importer Countries in 2016. Top 10 exporter countries are shared at Table 3.1 because our research interest is international competitiveness of sector and export power is the most important side of our studies. The list allows us to determine on which countries focused in our study. The top 10 importers list is important for our study because with that list can be determined which market is important for foreign home appliance trade.

Table 3.2: Top 10 Home Appliance Exporter Countries and Top 10 Importer Countries

Top Exporter Countries in 2016			**Top Importer Countries in 2016**		
Country	**Value (million$)**	**World Share %**	**Country**	**Value (million$)**	**World Share %**
World	100.623,1	100	World	102.466,8	100
China	36.228,4	36	USA	19.462,6	19
Germany	9.191,6	9.1	Germany	8.618,3	8.4
Mexico	5.120,4	5.1	UK	5.800,8	5.7
Poland	4.871,9	4.8	France	5.585,7	5.5
Italy	4.423,2	4.4	Japan	5.566,9	5.4
Turkey	3.755,6	3.7	Italy	3.441,1	3.4
Thailand	3.285,3	3.3	Netherlands	3.258,4	3.2
USA	3.190,8	3.2	Canada	2.853,2	2.8
S. Korea	3.078,1	3.1	Spain	2.415,5	2.4
Netherlands	2.539,7	2.5	Australia	2.402	2.3

Retrieved from United Nations, **International Trade Statistics Yearbook** (New York, 2016),376

In the Table 3.2, it is observable that the total worth of export of home appliance products in 2016 is more than 100 billion dollars and total worth of import of home appliance products in 2016 is more 102 billion dollars. On the left half of the table there are the top exporters. By far the hugest exporter country is China with 36,2 billion dollars export value, %36 world share. The second hugest exporter is Germany with 9.1 billion dollars export value and 9.1 world share. The third exporter is Mexico with 5.1 billion dollars export value and 5.1 world share. Poland is the fourth biggest exporter country with 4.8 billion and %4.8 world shares. Italy is the fifth hugest exporter country with 4.4 billion dollars export value and %4.4 world share. Turkey is the sixth hugest exporter country with 3.7 billion dollar and %3.7 world share. Thailand is the seventh hugest exporter country with %3.2 world share. United States of America is the eighth hugest exporter country with 3.1 billion dollars export value and %3.2 world share. South Korea is the ninth hugest exporter with 3 billion dollars export value and %3.1 world share. Netherlands is the tenth hugest exporter country with 2.5 billion dollars export value and %2.5 world share.

On the right half of the Table 3.2, the top importers of home appliances products are shown. The table show us the biggest international markets apart from domestic market. United States of America is by far the hugest importer with 102 billion value and %20 world share. Germany is the second hugest importer country with 8.6 billion import value and %8.4 world share. United Kingdom is the third hugest importer country with 5.8 billion dollars import value and %5.7 world share. France is the fourth hugest importer country with 5.5 billion dollars import value and %5.5 world share. Japan is the fifth hugest importer with 5.5 billion import value and %5.4 world share. Italy is the sixth hugest importer country with 3.4 billion dollars import value and %3.4 world share. Netherlands is the seventh hugest importer country with 3.2 billion dollars import value and %3.2 world share. Canada is the eighth hugest importer country with 2.8 billion dollars import value and %2.8 world share. Spain is the ninth hugest importer with 2.4 billion dollars import value and %2.4 world share. Australia is the tenth hugest importer country with 2.4 billion import value and %2.3 world share.

Some common features can be observed in importer countries. All ten countries with hugest import values are in high income group. According to World Bank, a country with more than 12.055 dollars GNI per capita is considered as high-income country (World Bank, 2019). Based on this classification all the top ten countries can be

considered as high-income countries. 6 of the top ten importer countries are the countries with the highest population in high-income group. If all countries with more than 12.055 dollars GDP per capita with the order of high population to low population and high income to low income listed respectively, then it is realized that first six of them are 6 of the top importers and order is almost identical. They are Unites States of America, Japan, Germany, France, United Kingdom and Italy. Spain is the ninth, Canada is eleventh, Australia is thirteenth and Netherlands is fifteenth country with highest population in high-income group. Then it can be concluded that high population with high income specification makes a country a good market for home appliance producers. There are plenty of developing countries with high population like Bangladesh, Brazil and India. It can be concluded that the countries have the hugest market potential for sector in the future. Why those countries are not in the list is possibly huge poverty rate in those countries. This makes home appliance products unaffordable for families that live in those countries.

Value of total export and total import between 2006-2016 is depicted in Figure 3.2**.** left axis denotes the total world import value and total worlds export value in billion dollars form. The right axis denotes total export share and import share in world trade.



Figure 3. 2: Total World Import and Total World Export of Home Appliances vs. Total Share of Import and Export in World Trade

Retrieved from United Nations. **2016 International Trade Statistics Yearbook**. (New York, 2016),376

The blue line denotes the total world import value of home appliance products and orange line denotes the total world export of home appliance products. The grey line denotes share of home appliance import in world trade and the yellow line denotes the share of export in world trade. In the figure, the grey line cannot be seen because share of export of home appliance products in world trade and share of import of home appliance products in world trade is identical during to period of 2006-2016. During the period export value and import value of home appliance products extremely correlated as expected. It is observed that both series declined after 2008 crisis as a result of contraction of global economy and after 2009 recovers until the 2015, which is another contraction date for global economy.

The share of export and import of home appliances products in the world trade fluctuates between the ratio of 0,5 and 0,6 and it can be concluded that the share of home appliance trade in world trade consistent. It can be observable that the share of export and import of home appliance products pioneer for contraction of trade of these products. The share of home appliance products' share declined just before the contraction of trade of these products.

4. EXPORT PERFORMANCE COMPARISON OF COUNTRIES IN HOME APPLIANCES

In this section, the different types of home appliance are investigated. The subject countries are top nine home appliance exporters. These countries are Turkey, China, South Korea, Germany, Unites States of America, Italy, Poland, Thailand and Mexico. Every sub-section belongs to a sub-product and in these sub-section, export performances of countries will be compared. At the end of the section total export performance of sector is also mentioned. The products of interest are dishwashers, refrigerator, washing machines, electrical kitchen appliances, hoovers, ovens, dryer machines and irons.

4.1 Dishwasher

In this sub-section, the top nine home appliance countries' performances are reported and compared for the export of dishwashers between 2006-2017. In the Figure 4.1, Turkey is denoted with the blue line, China is denoted with the orange line, the grey line denotes Germany, the yellow line denotes Poland, the green line denotes Thailand, USA is denoted with the dark blue line, the brown line denotes Korea and the black line denotes Italy. In addition, it should be noted that Thailand's dishwasher export data was not available at the time. Hence it was not included in the figure.

During the period export values of countries is examined, Germany is the by-far leader country. After Germany in export of dishwasher, second country is Poland. Third country is China, but their production is almost half of the Germany's. The fourth country is Turkey. Germany has relatively stable export performance, but it shows declining trend over the years. Poland's performance during era is notable. It did not showed decline even in the global crisis and Poland doubled its export value from 2006 to 2017. China too showed important improvement during the period and it almost tripled its export value.

Turkey's performance is another exceptional performance in export of dishwashers. They increased their export value more than doubled and the increasing trend even in the global crash is observed.

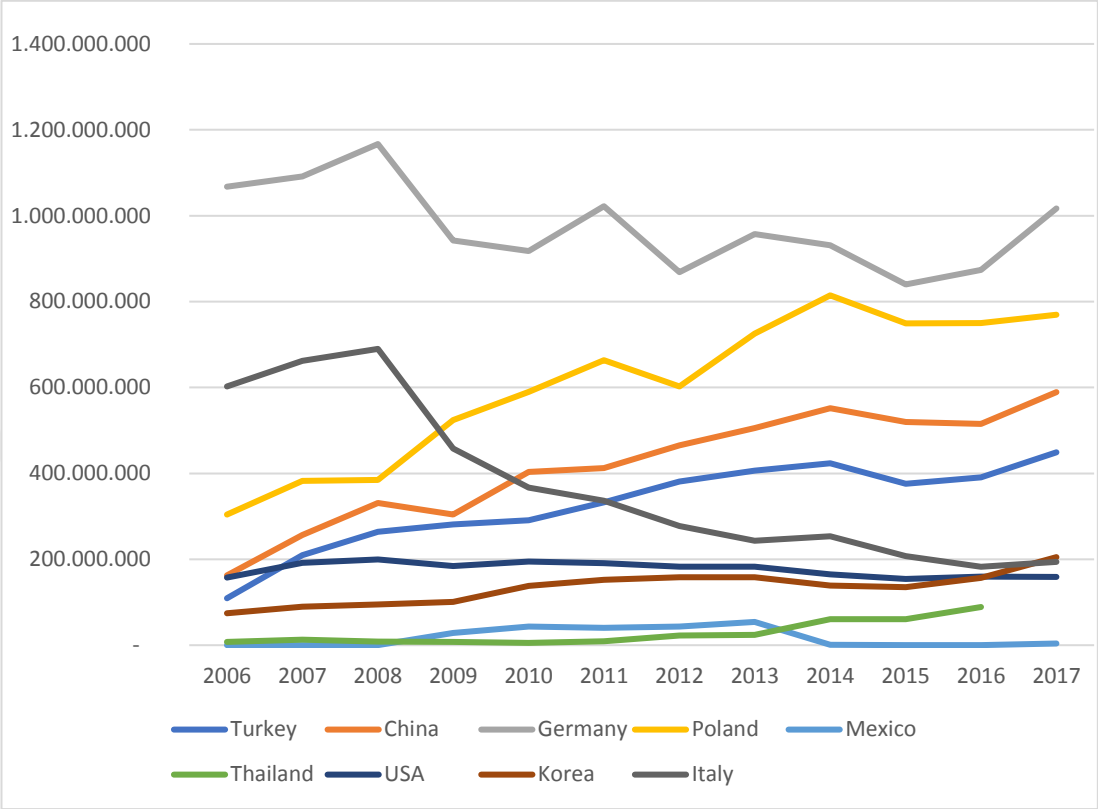


Figure 4. 1: Export of Dishwasher by Country Between 2006-2017 (US$)

Retrieved from Trademap, Trade Statistics (New York, 01.09.2019)

Other countries like USA, Korea, Italy, Thailand and Mexico has relatively lower export values in dishwashers. Other countries' performance is close to each other, but especially Mexico's performance is extremely bad. It should be noted that Thailand's dishwasher export data was not available at the time. Hence it was not showed in the figure.

4.2 Refrigerator

In this sub-section, the top nine home appliance countries' performance will be mentioned and compared for the export of refrigerator between 2006-2017. In Figure 4.2, it can be seen the top nine refrigerator exporter. Turkey, China, Germany and Poland are symbolized with the blue line, the orange line and the yellow line respectively. The green line denotes Thailand, USA is denoted with the dark blue line, the brown line denotes Korea and the black line denotes Italy. In addition, it should be

noted that Thailand's refrigerator export data was not available at the time. Hence it was not showed in the figure.

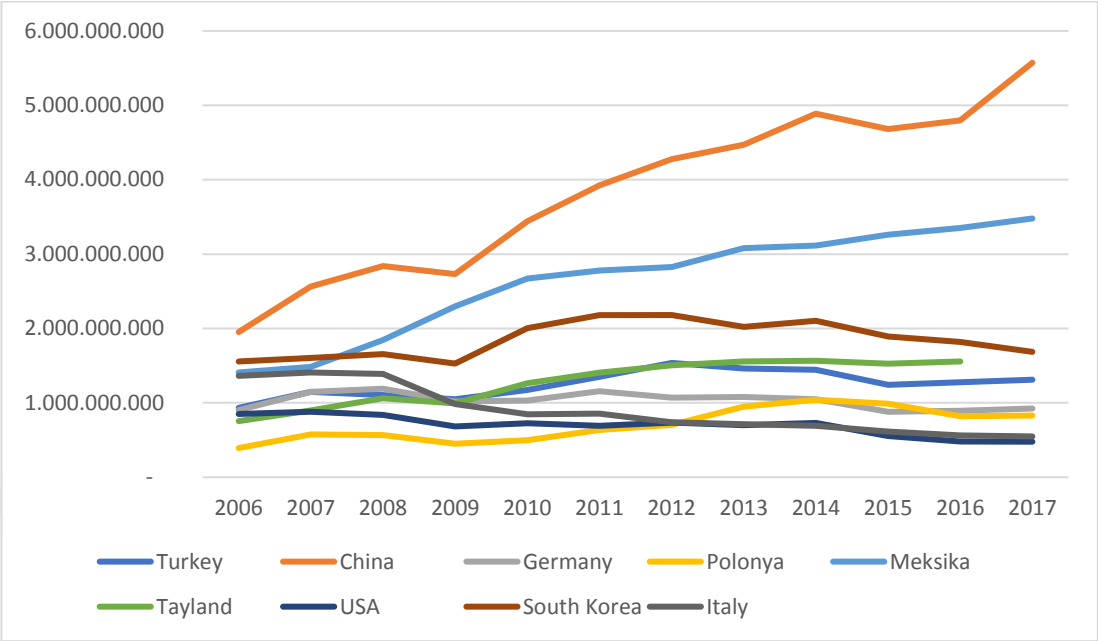


Figure 4. 2: Export of Refrigerator by Country Between 2006-2017 (US$)

Retrieved from Trademap, Trade Statistics (New York, 01.09.2019)

It is easily observable in the Figure 4.2 that China has by the hugest export among other top countries. Another important fact is China's rapid increasing performance after 2006 and it reaches up to five billion dollars a year. In 2016, all countries' export value in refrigerator is very close but after 2006 China showed extreme improvement. After China, Mexico come but almost half value as China's and it reaches up to three billion dollars. Mexico is the second country that shows strong improvement during the term. Other countries' export values are at important level but Mexico and China have the most remarkable export performance during the term. Other countries have relatively stable and stationary export performance between 2006 and 2017. Their yearly export value fluctuates between one billion dollars and two billion dollars.

Turkey is the best fifth country in the exporting refrigerator in international trade. It demonstrates relatively consistent performance during the term and its export value is very close to Thailand's and South Korea's as of 2017.

4.3 Washing Machine

In this sub-section, the top nine home appliance countries' performance will be mentioned and compared for the export of washing machines between 2006-2017. In the Figure 4.3**,** Turkey is denoted with the blue line, China is denoted with the orange line, the grey line denotes Germany, the yellow line denotes Poland, the green line denotes Thailand, USA is denoted with the dark blue line, the brown line denotes Korea and the black line denotes Italy. In addition, it should be noted that Thailand's washing machine export data was not available at the time. Hence it was not showed in the figure.

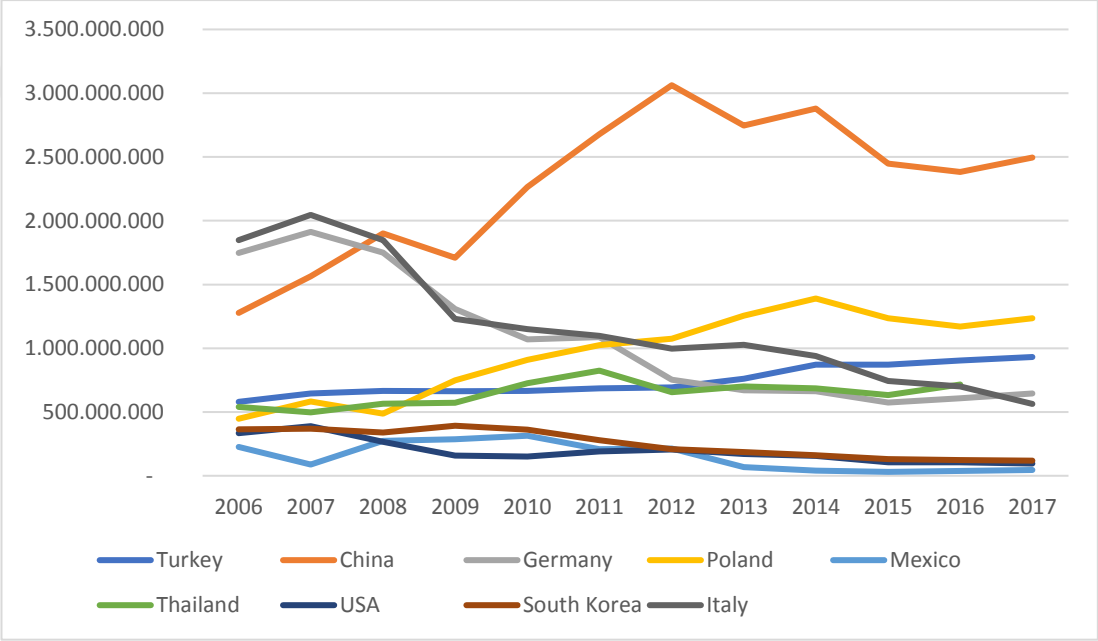


Figure 4. 3: Export of Washing Machine by Country Between 2006-2017 (US$)

Retrieved from Trademap, Trade Statistics (New York, 01.09.2019)

Like in the other sub-products, China is the leader country in exporting washing machine. But until 2008, export of Germany and Italy was higher than China. After 2008, both countries showed strong decline and on the contrary China demonstrated strong improvement. Poland is another important country in exporting washing machine and it is the second country with highest export value as of 2017. Poland's performance during the term is impressive and it almost tripled its performance in 2006.

Turkey is the best third country with the highest export in international trade. As of 2017, it doubled its performance in 2006. In the long run, it is observable that it has

potential to catch Poland. When some countries increase their export value during that period some's export performance weakened. Italy and Germany demonstrated strong decline in export value. Other countries' performances are relatively weaker, and they demonstrated stable export performance during the term.

4.4 Electrical Kitchen Appliances

In this sub-section, the top nine home appliance countries' performance will be mentioned and compared for the export of electrical kitchen appliances between 2006-2017. In the Figure 4.4, Turkey is denoted with the blue line, China is denoted with the orange line, the grey line denotes Germany, the yellow line denotes Poland, the green line denotes Thailand, USA is denoted with the dark blue line, the brown line denotes Korea and the black line denotes Italy. In addition, it should be noted that Thailand's electrical kitchen appliances export data was not available at the time. Hence it was not showed in the figure.

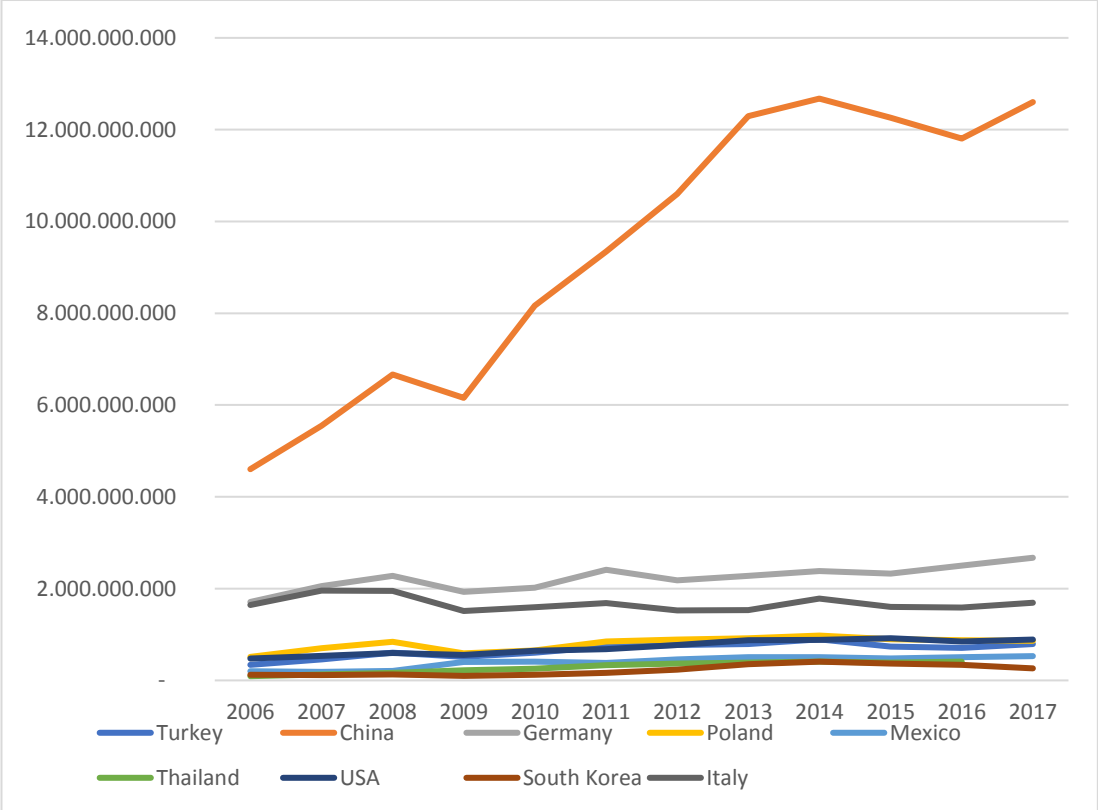


Figure 4. 4: Export of Electrical Kitchen Appliances by Country Between 2006-2017 (US$)

Retrieved from Trademap, Trade Statistics (New York, 01.09.2019)

China is the leader country in exporting of electrical kitchen appliances. China demonstrated an impressive development during these twelve years even it was the leader country in 2006 in exporting of this sub-product group and now it sustains its leader position by far the best. Germany is the second country with the best export performance, but its performance depicts a scheme that is far away from china's. On the other hand, Germany demonstrates relatively stable performance in exporting of kitchen appliances. Along with Germany, other countries demonstrate stable performance between 2006-2017 in comparison with China.

Turkey is the sixth country with highest export value in international trade. It has 790 million dollars export value as of 2017 and its value is very close to its closest competitors which are United States of America, which has 886 million dollars export value and Poland, which has 864 million dollars export value.

4.5 Hoover

In this sub-section, top nine home appliance countries' performance will be mentioned and compared for the export of hoovers between 2007-2017. In Figure 4.5, Turkey, China, Germany, Poland, Thailand and USA are denoted by the blue line, the orange line, the grey line and the yellow line, the green line and the dark blue line respectively. The brown line denotes Korea and the black line denotes Italy. In addition, it should be noted that Thailand's hoover export data for 2017 and Mexico's export data for 2007 were not available at the time. Hence, they were not showed in the figure.

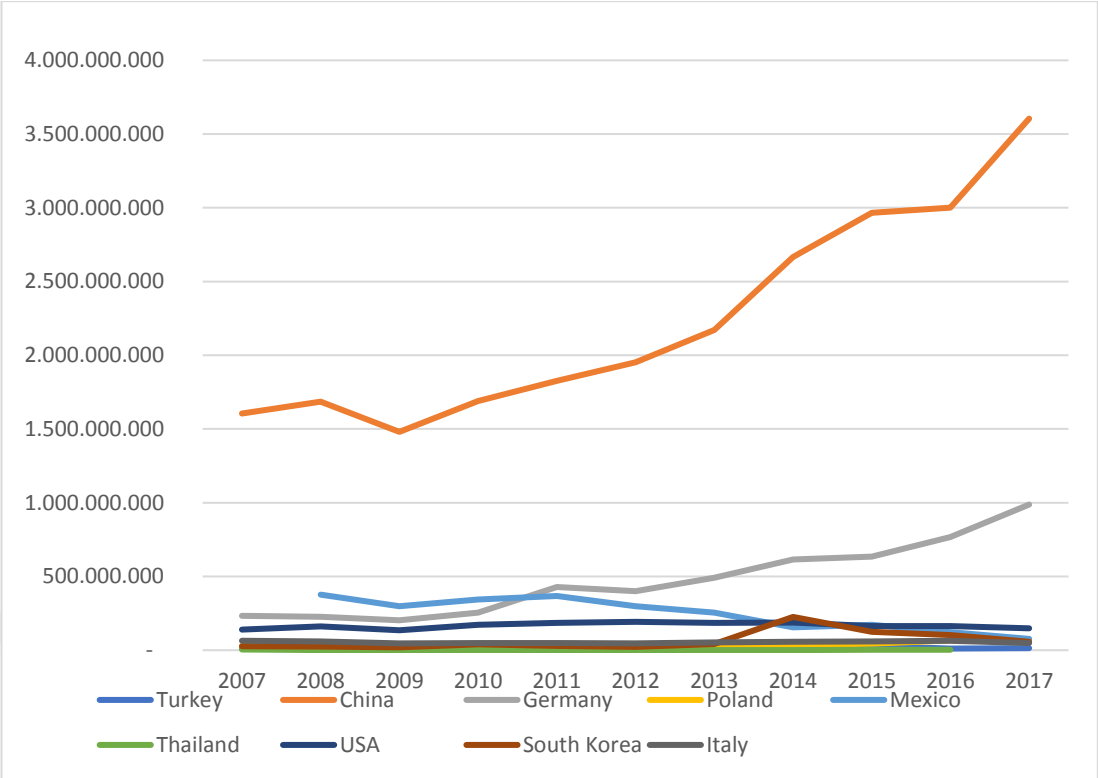


Figure 4. 5: Export of Hoover by Country Between 2007-2017 (US$)

Retrieved from Trademap, Trade Statistics (New York, 01.09.2019)

China is the leader country in the export of hoover. In 2006, china's export value is 1.5 billion. Mexico's hoover export value is not available for 2006 but Mexico is probably the second country with the highest export for hoover in 2006. China's export value rose to more than 3.5 billion as of 2017. As of 2017, second country with hugest export value is Germany. Germany's export value was around 250 million in 2006 and the number rose to 1 million in 2017, which is an important improvement. But Germany's export value is still one third of China's as of 2017 in the export of hoover. Turkey is the eighth country in exporting hoover and it is one of the worst positions between those nine countries. Its export value is very far away from its competitors.

4.6 Oven

In this sub-section, top nine home appliance countries' performance will be mentioned and compared for the export of ovens between 2006-2017. In the Figure 4.6, Turkey is denoted with the blue line, China is denoted with the orange line, the grey line denotes Germany, the yellow line denotes Poland, the green line denotes Thailand, USA is denoted with the dark blue line, the brown line denotes Korea and the black

line denotes Italy. In addition, it should be noted that Thailand's oven export data was not available at the time. Hence it was not showed in the figure.

Like in the other products, China is the leader country for oven. They export 2.5 billion dollars' worth oven in 2006 and that number rose to 5.5 billion in 2017, which is and impressive improvement during the term. Second country in exporting oven is but it demonstrates a declining performance and it is far away from China's number. Other countries' performance in this product pales beside China's performance between 2006 and 2017. They cannot increase performance over the years and some cannot even sustain its performance during the term.

Turkey is the fifth best country in exporting oven in international trade. Turkey's export value is 294 million dollars as of 2017. Turkey's performance is relatively stationary during the term and its closest competitor is united states of America with 350-million-dollar export value.

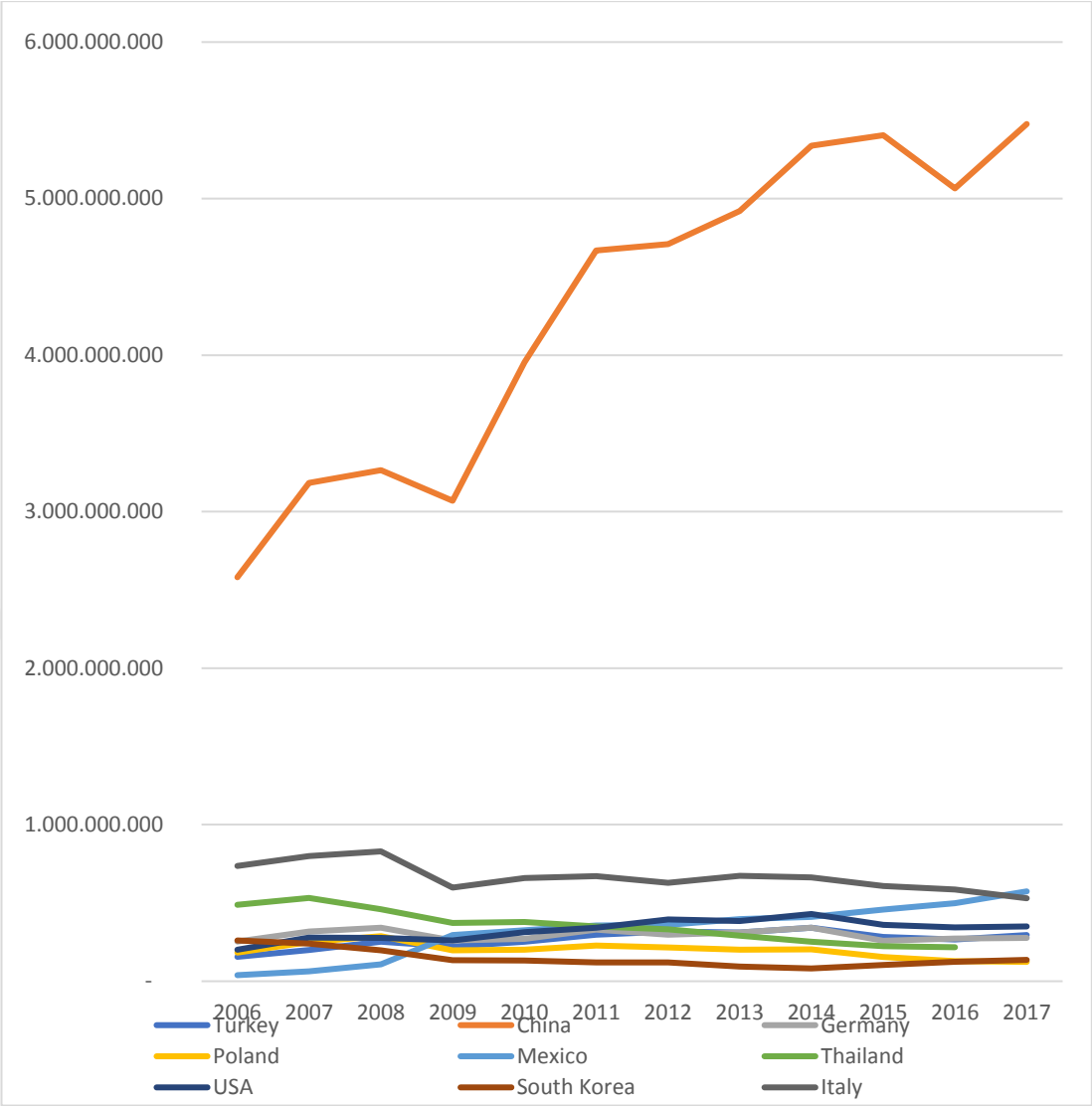


Figure 4. 6: Export of Oven by Country Between 2006-2017 (US$)

Retrieved from Trademap, Trade Statistics (New York, 01.09.2019)

4.7 Drying Machines

In this sub-section, top nine home appliance countries' performance will be mentioned and compared for the export of drying machines between 2006-2017. In the Figure 4.7, Turkey is denoted with the blue line, China is denoted with the orange line, the grey line denotes Germany, the yellow line denotes Poland, the green line denotes Thailand, USA is denoted with the dark blue line, brown line denotes Korea and the black line denotes Italy. In addition, it should be noted that Thailand's and Turkey's drying machine export data was not available at the time. Hence Turkey's and Thailand's data were not showed in the figure.

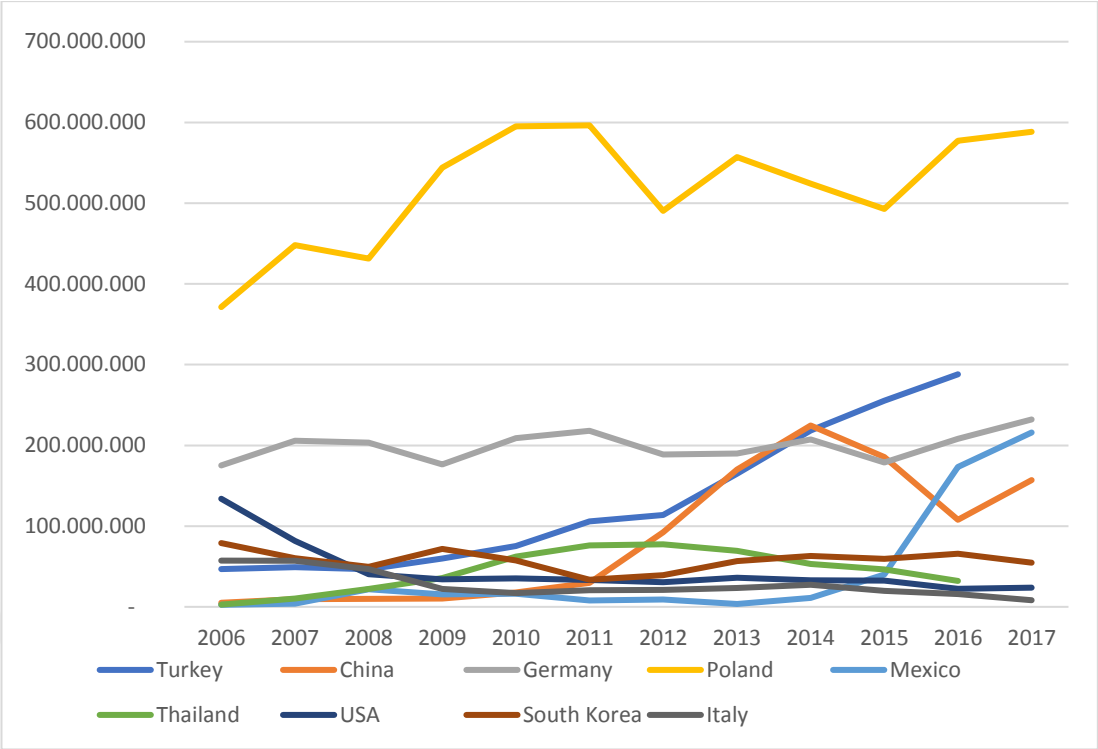


Figure 4. 7: Export of Drying Machine by Country Between 2006-2017 (US$)

Retrieved from Trademap, Trade Statistics (New York, 01.09.2019)

In contrast to other sub-products mentioned in this study before, leader exporter in drying machines is Poland throughout the term. For 12 years, there is %50 increase in export of drying machine of Poland, which means from 400 million to 600 million. An important nuance in Poland is that it still suffers 2009 crash and still cannot reach the level of export they have in 2009.

The second country in the export of drying machine is Turkey. Turkey's performance throughout the term is remarkable and Turkey's export value is almost tripled between 2006-2016, which means a movement from 100 million to 300 million. At the beginning of the graph, Germany was the second hugest exporter in drying machine, but it was exceeded by Turkey after 2014. There is some improvement in Germany throughout the term, but its improvement is less than Poland and Turkey. Mexico is the forth hugest exporter of drying machine. Their progress is impressive, and their export value today almost comes from nothing previous years. Until 2014, Mexico's drying machine export was around 11 million and now it reaches to more than 200 million. Fifth country with the highest export was china. Unlike other products, china does not have the absolute leadership. They demonstrate strong improvement until 2014 but after that year their export value started to decline. Other countries has much

lower export value in comparison with countries mentioned above and their performance relatively stationary throughout the term.

4.8 Irons

In this sub-section, top nine home appliance countries' performance will be mentioned and compared for the export of irons between 2006-2017. In the Figure 4.8, Turkey is represented by the blue line, China is represented by the orange line, the grey line represented Germany, the yellow line represents Poland, the green line represents Thailand, USA is represented by the dark blue line, the brown line represents Korea and the black line represents Italy. In addition, it should be noted that Thailand's iron export data was not available at the time. Hence it was not showed in the figure.

China is the leader country in the export of iron. They export 600-million-dollar iron in international markets in 2006 and that amount rose to almost 900 million dollars as of 2017 despite some fluctuations during term. Second country with the highest export rate is Germany, whose declining trend during the term and Germany's export value is one of seven of China's export value. That means that china is the absolute leader in the export of iron in international trade.

Turkey demonstrates an unstable performance for export of irons between 2006 and 2017. At the beginning Turkey's export value is 32 million dollars but as of 2017, it is declines to 8,7 million dollars, which is a devastating decline. From 2006 to 2009, export value declines but after 2009 until 2014, it had a momentum to rise. After 2014, export value of iron started to decline again. Export value of Turkey in this sub-product is at a competitive level in international level.

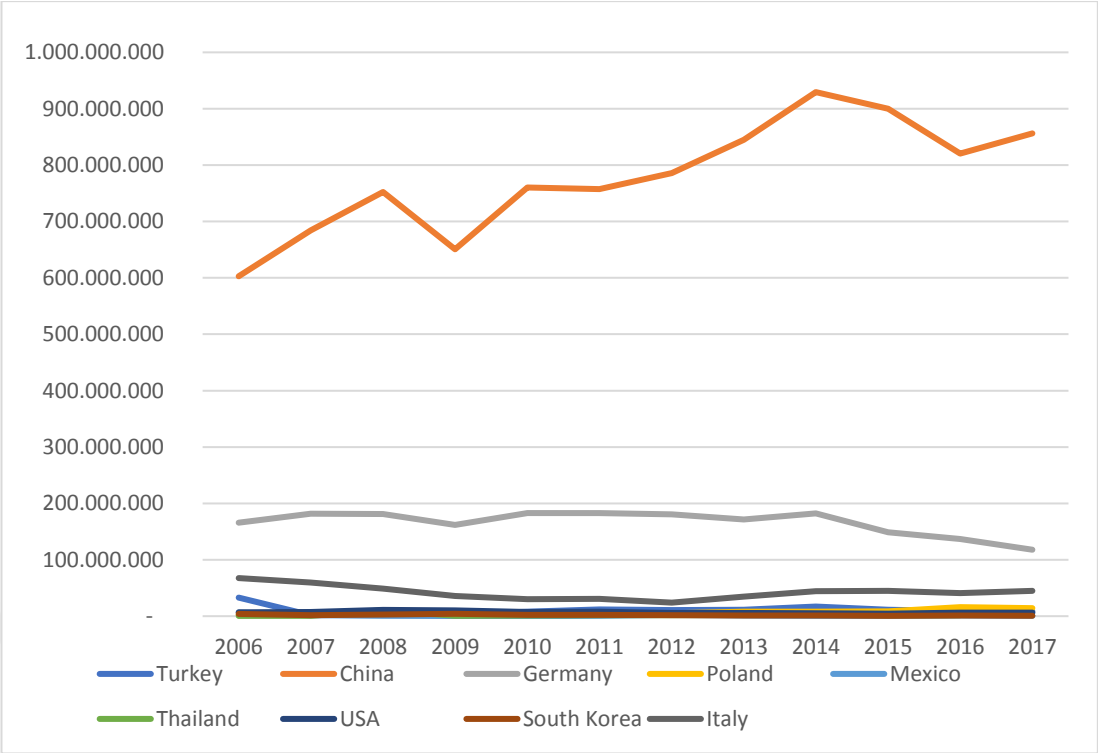


Figure 4. 8: Export of Iron by Country Between 2006-2017 (US$)

Retrieved from Trademap, Trade Statistics (New York, 01.09.2019)

4.9 Total Export Value of Home Appliance Goods

In the prior sub-sections, a comparative analysis of export value of home appliances sub-products was discussed. Each country's export value for each sub-product was presented year by year from 2006 to 2017. After that, these values compared and interpreted. The trends from 2006 to 2017 are analysed and it was seen that almost all exporters affected from 2009 crash and 2014 contraction. In this sub-section, the same way will be followed to analyse export performance of countries. The only difference from the prior analysis is that main source of data is total home appliance export data of countries.

The main plan of this subsection is that every country will be handled in a different sub-section. In these sub-sections, countries' export performances from 2006 to 2018 will be interpreted. Role of home appliance producers in these countries is another subject that will be mentioned in this sub-section. Globalization allow companies to invest in different countries regardless of distance and logistics. Low cost, know-how and human capital advantages are the main factors that pull foreign investment. In these sub-sections, these subjects are mentioned briefly.

In the Figure 4.9, total home appliance products by country from 2006 to until 2017 represent. All countries' data is represented in the same figure; thus, it is easier to compare countries' performances together. Data used in this figure is combination of data used in the prior sub-section and figures in this section.

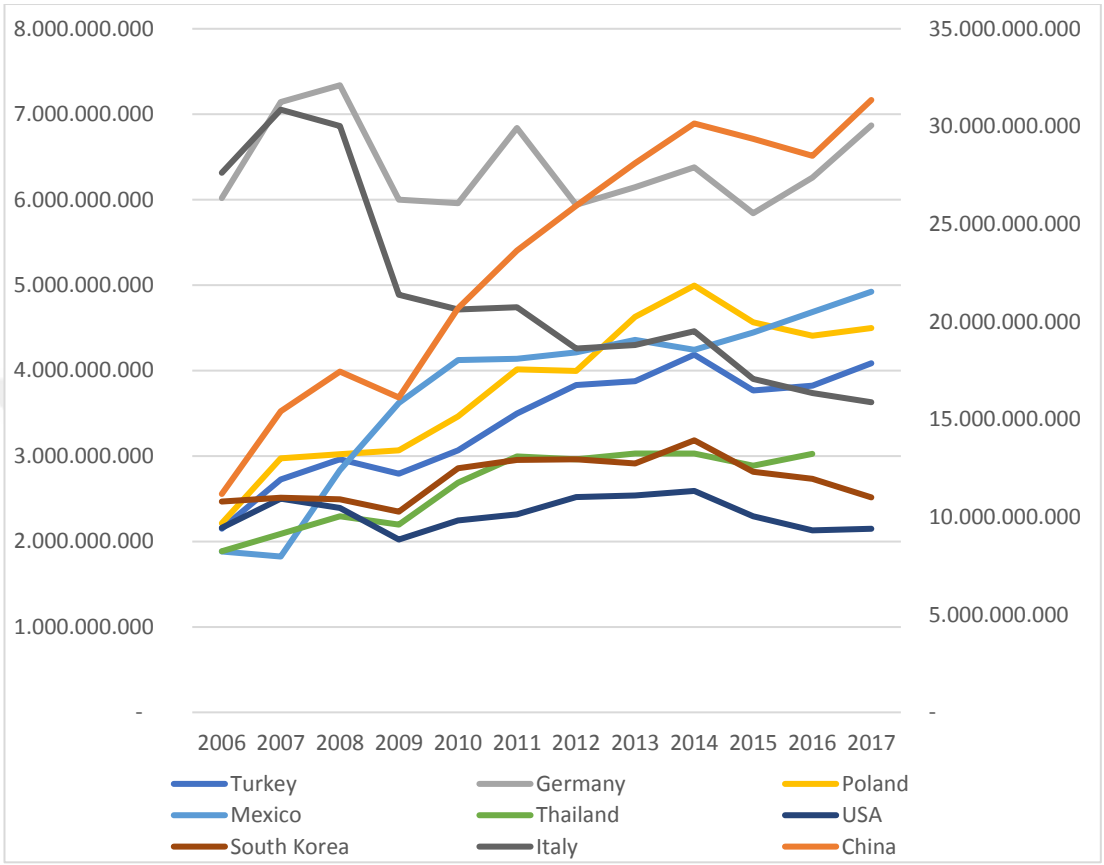


Figure 4. 9: Export of Home Appliance Goods by Country Between 2006-2017 (US$)

Retrieved from Trademap, Trade Statistics (New York, 01.09.2019)

The leader exporter of home appliance goods is China, which is denoted with orange line and on the right axis. Other than China, all countries export value placed on the left axis. After China, Germany follows it as the second hugest exporter, which is denoted with the grey line. Mexico is the third hugest exporter of home appliance goods and denoted with the light blue line. Poland is the fourth hugest exporter in home appliance goods and denoted with the yellow line. After Poland, comes Turkey as the fifth hugest exporter in international trade and Turkey is denoted with the blue line. After Turkey, the sixth hugest home appliance exporter is Italy with the black line. Thailand is the seventh hugest home appliance exporter and it is denoted with the green line. After Thailand, South Korea is the eighth hugest home appliance exporter, which

is denoted with the brown line. As the ninth hugest home appliance exporter, come United States of America with the dark blue line.

If a brief interpretation of figure made, it can be seen that all exporter countries have increased their export value for the term has been studying, except for Germany, South Korea and United States of America. Almost all countries suffered from 2009 crash and 2014 global contraction. According to World Bank data, in 2015, all countries' economies have been studied in this study except United States of America and China, contracted, even the world GDP contracted too for the same year. This naturally affected export rate of our countries in home appliance products segment.

In the other figures, only one axis used to represent countries export values in related goods but in this figure, two axes used to represent countries' export value in whole home appliance goods because there is huge difference between china and other countries. With only one axis, it is hard follow trend of other countries other than China.

4.9.1 China

The first thing to notice at the Figure 4.9 is the absolute hegemony of China. China is absolute leader in international markets from 2006 to 2017 with an increasing difference from other competitors. China differentiates from all countries even from its closest competitor, Germany. There is a decline in 2009, when global crash happened, and in 2015, when the global economic contraction happed, but except 2009 and 2015, there is continuous improvement in export value of home appliance products (except Mexico, all countries suffered from global crash in 2009 but Mexico continued to rise its export value). In 2006, china's export value is around 11 billion dollars and as of 2017, its export value in global home appliance market is around 31 billion dollars. For the 12 years studied in this study, China is the leader of global home appliance market by far the best.

According to a report of Battaglia Advisory Services, China accounts of total production of world-wide home appliance products. The first and the second home appliance producers in the world, which are Haier and Midea, are from China. Galanz is another important Chinese producer in the sector.

China’s internal market is growing every day and furthermore depreciating remindbi helps Chinese companies to expand their export (Ching, Shi, 2016).

4.9.2 Germany

The second country with the highest export value is Germany. During the 12 years, they demonstrate relatively stable performance with some fluctuations, but they succeeded to sustain its position in the second hugest exporter. Its export value in 2006 was around 6 billion dollars and its export value as of 2017 is 6,8 billion dollars. It improved its export value to 7,3 billion dollars until 2008 but after 2009 global crash, its export value declined by 0,8 billion dollars and ended increasing export trend.

All these data asserts that Germany is the one of the biggest players in the world. According to an info on homeappliance.com, German home appliance market is the third biggest market in the world after China and Unites States.

Germany has two important brands in the sector. they are BSH and Miele. BSH owns important home appliance producers like Bosch, Siemens, Gaggenau and Profilo.

4.9.3 Mexico

The third country with the highest export value in international trade is Mexico. Over the years, Mexico’s increase in export value of home appliance goods is impressive. In 2006, the country’s export value is around 2 billion dollars. As of 2017, it becomes around 5 billion dollars, which is an impressive development. Like most of the its competitors, Mexico faced contraction in international markets in 2009 due to the global crisis and in 2015 due to the global contraction.

Mexico is an important participant of bilateral trade agreements. North American Free Trade Agreement, Asia-Pacific Economic Cooperation, Pacific Alliance are important trade agreements Mexico has participated. Furthermore, Mexico has free trade agreements with japan, Israel and European Free Trade Area countries (International Trade Administration, 2019). Another advantage of Mexico is geographical position of country. The country positions centre of the America and it help producers to ensure that goods can be transport markets easily. All these factors are an incentive for foreign home appliance brands to invest in Mexico like Daewoo, Electrolux, Whirlpool, Samsung (ProMexico, 2014).

4.9.4 Poland

Poland is the fourth country with the highest export value. It has around 2 billion dollars export value in 2006 and as of 2017, it reached 4,5 billion dollars export value. One of the biggest rises in the figure belongs to Poland. It looks like that it did not much affected from 2009 crisis but like other countries, after 2014, it faced a contraction like other competitors in export market due to global economic contraction. After 2015, country's export value started to recover but still reach the level, at which it was standing in 2014.

Poland is an important production hub in Europe for leading home appliance manufacturers. Country's geographical position in Europe, low labour cost in comparison with other competitors in Europe like Germany, Italy and Turkey, no barriers to entry markets with the help of European Union's bilateral trade agreements are main advantages of Poland.

Poland has one brand, Amica, in the sector and share an important share in export share. Worldwide brands like Samsung, Whirlpool, LG, B/S/H, Indesit, Electrolux have production facilities in Poland. As of 2014, almost %85 of local production in Poland exported and main market to polish produced products are Germany, Great Britain France and Italy (Polish Information and Foreign Investment Agency, 2015).

4.9.5 Turkey

Turkey is one of the main exporters in home appliance sector. the fifth hugest exporter in the world is Turkey. Like other countries, Turkey face a contraction in export value in 2009 and 2015. Other years, it demonstrates an impressive development but after 2015 contraction, recovery was not as fast as it did in after 2009. This situation holds for other countries except Germany and China. Then, it can be concluded that recovery after 2015 contraction was slow maybe due to global macroeconomic contraction. In 2006, Turkey had 2-billion-dollar export value and as of 2017, it exceeded 4 billion dollar, which it the fourth best development performance among other competitors. Poland and Mexico have more export value than Turkey but in the home appliance market, their effectiveness is not as much as Turkey's because turkey has two important worldwide brands, Arçelik and Vestel. Both companies have important market share in global area despite of extreme competitiveness in the home appliance

market. According to company's institutional website, Arçelik has 30.000 employee and eighteen production facilities in seven countries. Its products are sold in 130 countries. The company is the leader in Poland and United Kingdom market and second in the European market.

Vestel is another important Turkish brand in the sector. It has the hugest production facility in a single place. on the other hand, it is one of the hugest producers in Europe.

BSH is another company with important production facilities in Turkey. BSH group has 42 plants in worldwide and the company operates in 48 companies. The hugest plant among all 42 plants of BHS group is in Turkey and the plant has 6.2 million production capacity (BSH Turkey, 2019).

4.9.6 Italy

Italy is not just one of the biggest producers in the Europe, it is also one of the biggest producers in the world. According to a report of Europe Economics published in 2015, Italy has the second highest turnover in Europe after Germany. But on the other hand, Italy has the steepest decline trend in our nine countries. When it has 6 billion-dollar export value in 2006, that number declined to almost by half to around 3,5 billion dollars. Italy is the most affected country by 2009 crisis, which causes 33 per cent decline in export value. In 2006, Italy was the hugest home appliance exporter but in 2017, their place declined to 6^{th} place drastically.

4.9.7 Thailand

Thailand is the one of the most important production hubs in the world. Now it is in the seventh place in terms of export value as of 2016. It is important to emphasize again that trade data of 2017 for Thailand was not available at the time. It can be observed that in the Figure 4.9**,** Thailand got over 2009 crisis relatively better than other countries. After 2013, its export performance gets more stable and its growth in export value did not persist. According to a presentation of Electrical and Electronics Institute of Thailand, production amount by units of washing machine and refrigerator looks stable for 2014, 2015 and first half of 2016. When it is considered this two information together, both seems reasonable.

3.9.8 South Korea

South Korea is a prominent producer of consumer electronics goods. As a result of this, the country has huge producers like LG and Samsung in home appliance sector. Government subsidies were highly effective in development era of consumer electronics sector in the country and now South Korea is leader technology developer in the sector.

Export performance of South Korea in exporting home appliance products during the term is relatively stable. Now country is the eighth hugest exporter in international markets. In 2006, export value of the country was just under a little bit 2.5 billion dollars and this number only rises 2 billion and 215 million dollars as of 2017.

Like other countries, South Korea suffered global economics contraction in 2009 and 2014. After 2009, the country showed some recovery signs and their export value exceeded its prior 2009 value. Unlike after 2009 term, after 2014, the country showed a downfall trend until 2017.

4.9.9 United States of America

United States of America is the ninth hugest exporter in global markets. Country has one of the hugest producers in the sector, Whirlpool. Export performance of the country between 2006 and 2017 is very similar to South Korea's. In 2006, export value of United States of America was 2 billion and 215 million dollars. That number slightly decreased to 2 billion and 147 million dollars as of 2017. Like South Korea, United States of America severely affected in 2009 and 2015. The country showed some recovery after 2009 but after 2014, downfall trend did not end still.

5. MEASURING COMPETITIVENESS IN HOME APPLIANCES FOR TURKEY

Prior section mentioned some tools to measure competitiveness. In this study revealed comparative advantage will be used to measure competitiveness in international trade. In this section, at first, it will be shortly defined what revelated comparative advantage is and how it is measured theoretically. After defining it, competitiveness of countries in terms of revealed comparative advantage perspective in home appliance sector will be mentioned. Then, same method will be applied for sub-products and competitiveness of countries in different sub-products will be mentioned. At the end, a general conclusion is given how the countries' and especially Turkey's competitiveness is in international trade.

5.1 Revealed Comparative Advantage

In this section, it is shortly described revealed comparative advantage and Balassa index will be formulated. Then variables in the formula will be explained and interpreted.

Well-recognized economist Bela Balassa creates an index called Balassa index in 1965. Main purpose of the index was to measure a country's "Revealed Comparative Advantage". It is possible to measure index in different level, like global level, regional level or between countries (Utkulu, Seymen, 2004).

Interpretation of index is relatively easier than other tools in economics and it is one of the easiest tools to apply in economics. If the index is less than one, that indicates that competitiveness of related country's in related sector is low. If the index is higher than one, then it indicates that country's competitiveness is high. This index can be calculated as follows;

$$RCA_{ij} = \frac{\frac{x_{ij}}{x_{it}}}{\frac{x_{wj}}{x_{wt}}}.$$

In the numerator of the equation above; x_{ij} denotes value of country i's export of good j, x_{it} denotes total value of country i's export. In the denominator of the equation x_{wj} denotes value of world's total value export of good j and x_{wt} denotes total value of world export. It is in fact a proportion of share of export of good j in country x in country x's total export to share of total export value of good x in total world export.

5.1.1 International Competitiveness of Turkey in Home Appliance Sector

In this subsection, international competitiveness of Turkey will be measured, and findings will be interpreted. Analysis covers from 2006Q1 to 2018Q3 time span and frequency of data used in this study is quarterly. To analyse international competitiveness of Turkey in global markets, total export value of home appliance products, total export value of Turkey, total export value of home appliance products of World and total value of World export are needed. Data used in this study obtained from TradeMap. It is a reliable and trustworthy data source, which is in collaboration with European Union and World Trade Organisation, to obtain international trade data even at the sub-product level with detailed custom codes.

Home appliance concept is a little bit opaque. It is important to determine which product is in this concept. In this study our home appliance sector consists of dishwashers, deep freezers and refrigerators, washing machines, vacuum cleaners, electrical kitchen appliance, stoves, drying machines and irons. Some analyses do not include the small electrical appliances like stoves or ovens and on the other hand some analyses include televisions. In this study, it is included the small electrical appliances and stoves but exclude televisions.

Before starting to analyse competitiveness of Turkey, it is beneficiary to give some space to Turkey's foreign trade data. In the Figure 5.1, a comparison of Turkey's total export versus Turkey's total home appliance sector can be seen. In the Figure 5.2, a comparison of total world export versus total world home appliance sector is handled. In the Figure 5.3, revealed comparative advantage index for Turkey for the period 2006Q1 to 2018Q3 handled.

Below total export values and total home appliance export values of Turkey can be found in the Figure 5.1. Turkey's total export is represented by the orange line and Turkey's home appliance export value is represented by the blue line. The series cover

2006Q1-2008Q3 period. The left axis denotes the home appliance export values and the right axis denotes the total export value of Turkey in regarded period.

As Turkey's gross domestic product rises over time, country's export value and export in home appliances keep up with rise in gross domestic product rise. In the first quarter of 2006, the country's export value was 20 billion dollar and export value of the home appliance goods was 600 million dollars. In the third quarter of 2018, country's export value is around 40 billion dollar and the country's export value of home appliance sector is 1,2 billion dollars. Total export value of Turkey and export value of Turkey in home appliance goods indicators doubled their value during as of third quarter of 2018.

When take a look at the both series it can be easily observed that there is strong co-movement between two series except some points. One of them is after 2009Q1, which is right after 2008 crisis erupted. The series showed that after 2009Q1, there is much strong recovery for home appliance export series than total export series. Here home appliance sector has strong supportive role in Turkey's economic recovery. Another distinctive point is right after 2008Q1, when Turkish Lira has depreciated strongly.

Here home appliance sector again increases its export value, which has again a supportive role in the overall economy. There is a third distinction in the period of 2017Q1, when the private consumption tax subsidy by government started. It is possible that companies inclined to sell domestic market instead of foreign markets.

In the Figure 5.2, below there are two series. One of them is World's total home appliance export, which is the blue series and the other is World's total export value,

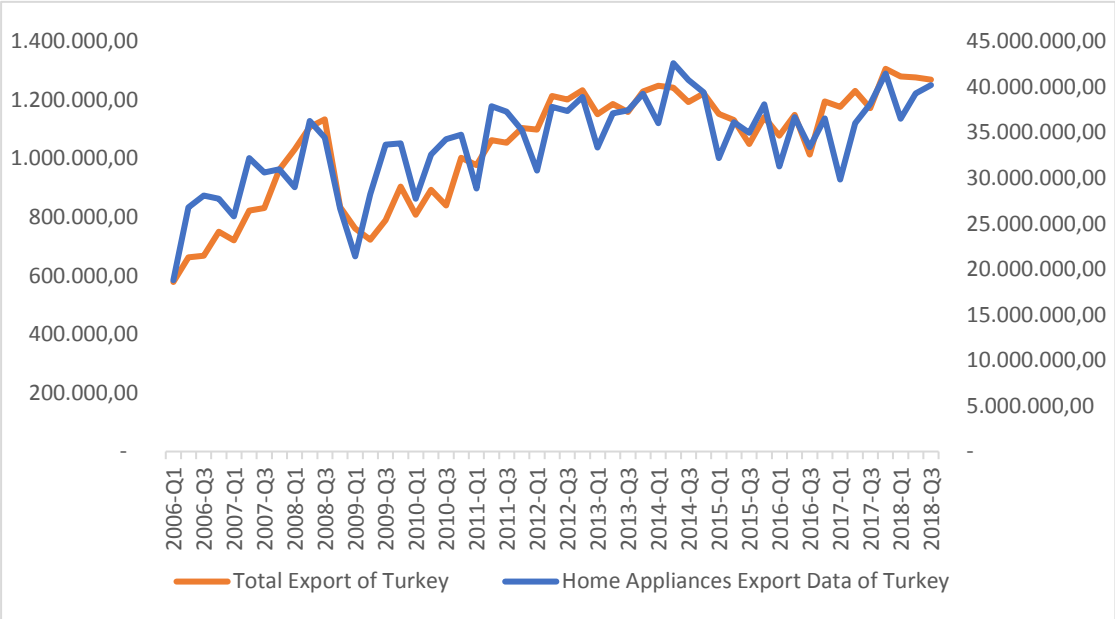


Figure 5. 1: Turkey's Total Export vs. Home App. Export 2006Q1-2018Q3

Retrieved from Trademap, Trade Statistics (New York, 01.09.2019)

which is the orange series. This series covers the same period as above, which is 2006Q1-2008Q3 period. Main difference between Figure 5.1 and Figure 5.2 is that series in the Figure 5.2 has more strong co-movement than in the Figure 5.1. As asserted above, distinctions between two series mostly due to positive disintegration of home appliance export value in Figure 5.1. there are some common sides between two series two. Series in the both figures show strong contraction in the 2008 crisis term as expected.

In first quarter of 2006, total world export was 2 trillion dollar and total world export in home appliance goods was around 15 billion dollars. In the last quarter of 2018, total world export was 3 trillion dollars and total world export in home appliance goods was around 21 billion dollars. During the term there sure is an increase but not as much as the increase in Turkey.

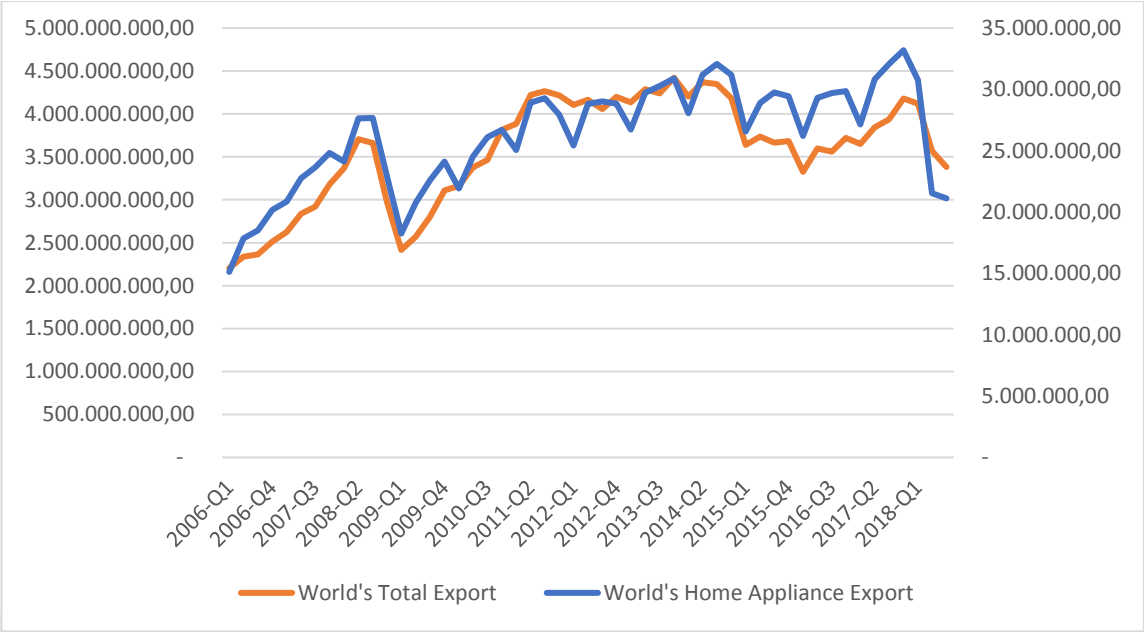


Figure 5. 2: Total World Export vs. Total Home Appliance Export

Retrieved from Trademap, Trade Statistics (New York, 01.09.2019)

After a brief macroeconomic analysis, general sector's competitiveness will be presented in the Figure 5.3. The calculation was made based on the equation mentioned at Section 5.1. As seen, the index from 2006Q1 to 2018Q3 is above the benchmark number "one", which indicates that the related sector has competitive power. But in our figure, the, index coefficient is much higher than coefficient 1. The average of number throughout the term is 4,33; which is extremely above the baseline coefficient 1.

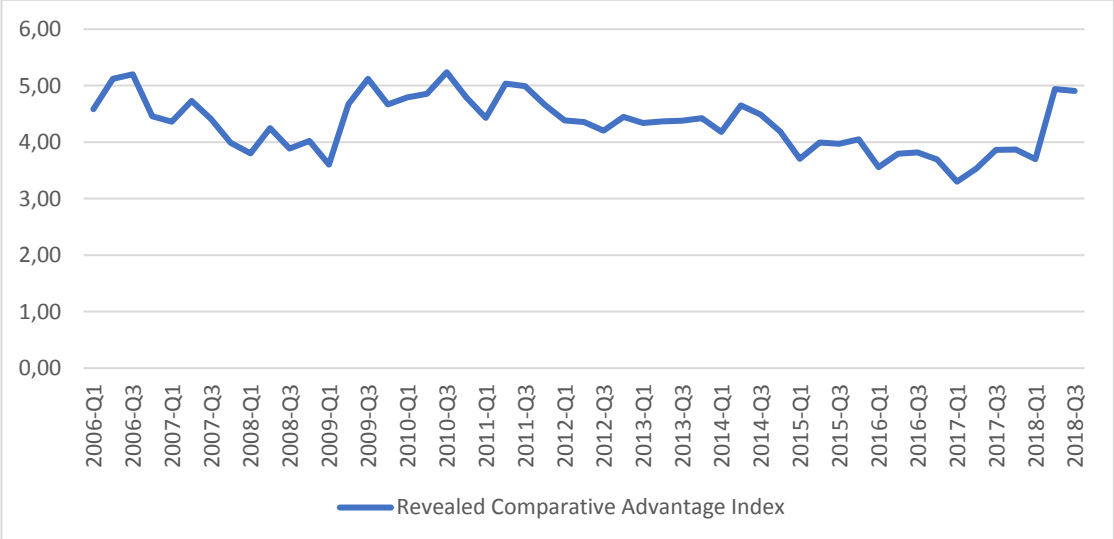


Figure 5. 3: Revealed Comparative Advantage Index

Retrieved from Trademap, Trade Statistics, calculation made by author (New York, 01.09.2019)

The higher point of the coefficient is 5,24 at the third quarter of 2010 and the series is looks stationary over time. It can be observed that there is not much improvement, but the index is conspicuously high, and it is hard to improve competitiveness to a higher level. Especially for such a competitive sector, in which lots of successful and well-known brand active are.

After the 2008 crisis, the competitive power started to decline until first quarter of 2009. After that time, competitiveness power showed a strong recovery, which supports the findings above. After that time, a gradual decrease in the index until first quarter of 2018 can be observed. After the first quarter 2018, a rapid increase in the competitive power can be observed. This increase most likely due to strong depreciation in Turkish lira. Because our domestic home appliance sector is highly export oriented. 75 per cent of domestic production is marketed in international market (Avcıoğlu, et al., 2018:8). The strong depreciation of Turkish Lira support export potential and competitive power of the sector.

5.1.2 Comparison of Competitiveness of Countries

Main purpose of this sub-section is to calculate countries' international competitiveness in home appliance sector. After calculation is completed, all countries' results will be represented in the same figure. Research method for this study is Revealed Comparative Advantage method. To conducts this method, Balassa index for every country need be calculated. Interested countries are the same countries examined prior sections. Time span for the study is from 2006 to 2017 and frequency of data is yearly.

Data source for the calculation is UN Comtrade and World Trade Organization's database. Calculations are made by authors and results are presented in the Figure 5.4**.** In the figure, the black line denotes Turkey and the green line denotes Poland. China and Thailand represented by the blue line and the dark blue line respectively. The light blue line denotes the Mexico. Grey line denotes Italy and orange line denotes Germany. South Korea and United States of America are represented by the yellow line and the brown lines respectively. If the index coefficient less than "1", it implies that the related country's international competitiveness in the related sector is not high. If the index coefficient is higher than "1", then it implies that the related country's international competitiveness in the related sector is high.

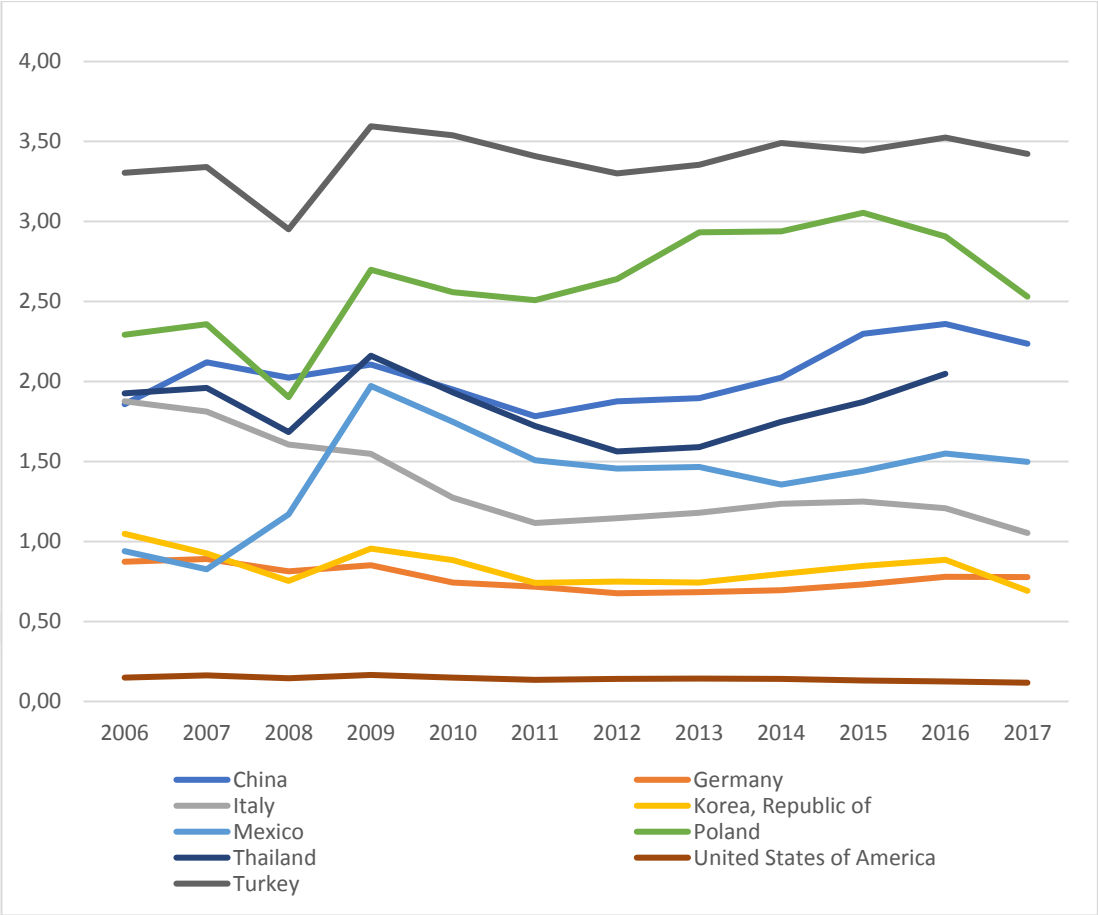


Figure 5. 4: International Competitiveness by Country 2006-2017

In the prior sections it is emphasized that Turkey is one of the most important exporter of home appliance sector and as of 2017, it is the seventh country with the highest export value. But when it comes to measuring competitiveness, Turkey is the leader country from 2006 to 2017 and the index coefficient is notably higher than our benchmark level "1". In 2006, Turkey's Balassa index was 3,3 and that number rises to 3,42 as of 2017. The country's international competitiveness shows a stationary path during the term except 2008, in which international competitiveness decrease to 2,95, which is still a high level from benchmark.

Poland is the second most competitive country in production of home appliance goods. Unlike the leader country Turkey, Poland demonstrates a good improvement during the term but after 2015, there is a rapid decrease in its competitiveness. Global contraction in 2015 affected Poland's competitiveness power. Other sharp decline in Poland's competitiveness is in 2009 as expected. But degree of decline in Poland is sharper than Turkey both in 2009 and in 2015. Then it can be concluded that competitiveness of home appliance sector in Poland is more fragile than Turkey.

If export value in home appliance goods was considered as the main metric for competitiveness, China would be the most competitive country in the world. But when it comes to revealed comparative advantage analysis, it is not. China is the third most competitive country among nine countries have been studied. The most spectacular thing in China's competitiveness is that the fall during the 2009 is not as much as others do. But there is not much improvement until 2011. After 2011, China started to improve its competitiveness to the 2,24 point from starting point 1,9. China maybe is not the most competitive country but its competitiveness still high.

Thailand is the fourth most competitive country in home appliance goods trade. In 2006, Thailand's competitiveness is almost the same with China and Italy. After 2006, China and Thailand started to improve their competitiveness. Thailand's competitiveness looks severely damaged after 2008 due to global crash, but the recovery is as fast as the fall. 2009 is the peak point of Thailand's competitiveness and after that year, it started to decline steady until 2012. After 2012, it started to recover again. It should be noted that competitiveness path of China and Thailand looks similar and Thailand is catching up with China. Another important point is that most country damaged from 2015 global contraction, but Thailand got over this term without harm in terms of competitiveness. Another important note is that 2017 trade data was not available for Thailand. Therefore, we were not be able to calculate Thailand's international competitiveness in home appliance market.

Mexico is the fifth most competitive country in international home appliance market trade and it demonstrates the best improvement in term of international competitiveness. In 2006, its index coefficient was less than one, which means Mexico is not competitive in international market. In 2007, its competitiveness decreased to a lower level but after that year Mexico shows extremely strong performance and it raises its competitiveness to 1,97 as of 2009. After 2009, there is some decrease in competitiveness but as of 2017, Mexico's competitiveness coefficient is 1,5, which is an important improvement since 2006.

Italy is one of the most important industry in Europe and the sixth most competitive country in home appliance market as of 2017. But the most notable fact in Italy's competitiveness is that Italy's competitiveness has been decreasing continuously since 2006. This decline is especially sharp between 2006-2012 and after 2012 it settled

down. As of 2017 Italy's competitiveness coefficient is 1,05 and it is just above competitiveness benchmark.

The most interesting country in the figure is Germany. Germany is the seventh most competitive country in terms of competitiveness index and its coefficient is less than 1, which considered as uncompetitive in international markets. Germany's competitiveness index relatively stable during the term but it can be observable that there is slightly decrease over time. As of 2007, country's competitiveness index is less than 1, which is 0,78.

South Korea is the eighth most competitive county in home appliance market. In 2006, its competitiveness index was 1,05, which considered as competitive, but its competitiveness decreases over time and as of 2017, it is 0,67, which is less than our competitiveness benchmark "1".

United States of America is the hugest economy and one of the hugest industries in the world, but when it comes to international competitiveness of home appliance sector, they are the leader and they are not even competitive. Their competitiveness coefficient is strongly stationary and far less than 1. From 2006 to 2017, there is not much improvement in country's competitiveness and it sustains same level over time.

Some results in the study interesting like positions of China and Germany. It can be asserted that revealed comparative advantage is also a measurement of importance of a related sector in a related country's foreign trade. Countries like Germany and China have huge export value and they have several strong sectors in their economic activity. Hence, home appliance sector does not relatively huge share in their export value even if they have important brands and huge production and research and development plants. But other countries do not have as much strong sector as China and Germany. Therefor an effective sector may have huge share in this country's export. That makes this sector relatively more important for this country.

6. EMPRICAL LINK BETWEEN REAL EXCHANGE RATE AND COMPETITIVENESS IN HOME APPLIANCE SECTOR OF TURKEY

The main purpose of this section is to inspect relationship between real change rate and international competitiveness of Turkey in home appliance sector. For this, two econometric tools are used. The first one is cointegration, an important econometric tool to detect long-term relationship between two variables and the second one is Error Correction Model, which allows us to estimate short-run dynamics along with the long-term equilibrium between the time series.

In the first sub-section, cointegration will be briefly defined on a conceptual basis. In the second sub-section, error correction model will be briefly explained. After that theoretical introduction, our model and data will be discussed. After estimating the error correction model, the diagnostic tests will be run to justify the assumptional validity. For this, several tests will be conducted. At the end, the findings will be presented and interpreted.

6.1 Concept of Cointegration and Unit Root

In this sub-section, the concept of unit root and cointegration are briefly discussed. Then the tests like Augmented Dickey Fuller unit root test and Engle-Granger cointegration test are explained to detect unit root and existence of cointegration. Before mentioning co-integration, it is important to explain the concept of unit root.

A non-stationary series can be identified as I(1), integrated in the order of one, if the first difference of the series is I(0). Generally, a time series can be identified as I(d), if a series is I(d), then it is concluded that this series has d number of unit roots. The most widely used test to detect a unit root is the Augmented Dickey-Fuller Test, which the null hypothesis is that a time series has a unit root and the alternative is that time series does not have unit root. To avoid the autocorrelation in the unit root test regression, he optimal number of lags of dependent variable should added to test regression. This test is called as Augmented Dickey Fuller Test (Davidson, Mackinnon, 2003).

Most of the series, especially the ones in macroeconomics involve nonstationary variables like income, consumption, money demand price level, etc. If we have two series that have stochastic trend, then it is easily concluded that both series are I(1). If there is no relationship between them, then it is concluded that difference between those series growing or shrinking. On the other hand, if two series that are I(1) process, has relationship between them in the long run, then it is expected that gap between those series are not widening or shrinking (Greene, 2008:756).

In econometrics, non-stationary series are useful under one special condition. In many cases of non-stationarity, the non-stationary series can be transformed into a stationary ones by differencing.

If $\{y_t: t = 0,1, \dots\}$ and $\{x_t: t = 0,1, \dots\}$ are both I(1) process. Let $y_t = \alpha + \beta x_t + u_t$ be our static model. It is reasonable to assert that y_t-βx_t is a I(1) process for any β. Sometimes y_t-βx_t can be an I(0) process, that means it has constant variance, constant mean and autocorrelation only depends on time difference between time variable. So, difference between two series are not widening. It can be concluded that x and y are cointegrated. This cointegration test is called Engle-Granger cointegration test (Wooldridge, 2016:646-650).

Testing the existence of cointegration is not a big issue. It is defined the variable s_t, which equals to y_t-βx_t. Then apply Augmented Dickey-Fuller test to s_t is applied. If unit root is rejected in favour of I(0), then it can be concluded that these series are cointegrated.

6.2 Error Correction Model

In this sub-section, theoretical background of error correction model will be explained. Error correction models allow us to analyse short-term dynamics between two series. Let's assume that the variables such as x and y are cointegrated with parameter β, then it can be asserted that there is an additional I(0) variable and that variable is mentioned in previous sub-section, which is $s_t = y_t - \beta x_t$. So that s_t is an I(0) process and has zero mean. To make it easier to understand, a dynamic model in first difference should be built as follows;

$$\Delta y_t = \alpha_0 + \alpha_1 \Delta y_{t-1} + \gamma_0 \Delta x_{t-1} + \delta s_{t-1} + u_t,$$

Where $E(u_t \mid I_{t-1}) = 0$ and I_{t-1} has the information on Δx_t and all past values of Δx and Δy. The term s_{t-1},which is also $(y_t - \beta x_{t-1})$, is named as error correction term and the model itself is called as error correction model. δ is the speed of adjustment which measures the degree of how fast the adjustment happens.

Error correction model are mostly used to determine short-run dynamics in the relationship between two variables, in this case x and y. Suppose that a simple model are built as follows:

$$\Delta y_t = \alpha_0 + \gamma_0 \Delta x_t + \delta(y_{t-1} - \beta x_{t-1}) + u_t,$$

where $\delta < 0$. If $y_{t-1} > \beta x_{t-1}$, then y in the previous period has overshoot the equilibrium because $\delta < 0$, the error correction term pushes y back to the equilibrium. In another case, if $y_{t-1} < \beta x_{t-1}$, the error term creates a positive change in y to the equilibrium. In case of knowing β, it is so easy to estimate error correction term, which can be found by regressing Δy_t on Δx_t and s_{t-1} (Wooldridge, 2016, pp. 651-652).

6.3 Real Effective Exchange Rate and International Competitiveness of Home Appliance Sector in Turkey

The main purpose of this subsection is to determine a long-term relationship between real effective exchange rate and revealed comparative advantage index of home appliance sector of Turkey. To conduct the analysis, at first one of our basic terms, real effective exchange rate will be defined. The concept of revealed comparative advantage will not be defined because it is widely defined in the previous sections. After basic definitions, a basic cointegration model will be built and detect if there is a long-term equilibrium between two series. After the detection of the existence of the cointegration between the variables of interest, an error correction model will be estimated and short run dynamics will be revealed.

The real effective exchange rate is an important determinant of international trade. There are lot of theory that tries to explain relationship between exchange rate movements and trade flows. In this sub-section, main purpose is to detect, if there is a long-term relationship between real effective exchange rate and international competitiveness of Turkey's home appliance sector. It is proofed that home appliance sector of Turkey is strongly competitive and export oriented. It is time to look for dynamics between real effective exchange rate and sector's competitiveness.

6.3.1. Data

For this analysis, there are a pair of time series. The first one is Balassa Index, which is used to determine Revealed Comparative Advantage. This index is calculated by the author in prior sections on a quarterly base and indicates that Turkey's home appliance sector is strongly competitive in international markets.

The second one is the real effective exchange rate. The real effective exchange rate is calculated by purifying the price effects in nominal effective exchange rate. Nominal exchange rate is weighted average of Turkish lira relative to basket of countries' currencies with significant effect on foreign trade of Turkey (Central Bank of Turkey, 2019). Real effective exchange rate is obtained from Central Bank of Turkey's database.

To question the existence of the long-term link between two series, the Engle-Granger cointegration test is a one of the most widely used tools. To conduct the test, both two time series need to be I(1).

6.3.2 Determining the order of integration: The results of Augmented Dickey Fuller Test

In the Table 6.1, the unit root tests of our variables real effective exchange rate and revealed comparative advantage index are reported. After Augmented Dickey-Fuller Test is applied, the below results obtained in Table 6.1. p-values obtained indicate that both series have unit root at %5 significance level. The upper table presents the unit root test for Revealed Comparative Advantage index, which denoted as RCA and the lower table presents the ADF unit root test for Real Exchange Rate, which denoted as REALEXCHANGERATE in the table. Both series are not stationary at %5 level.

Table 6. 1 Unit Root Test for Variables

Null Hypothesis:LRCA has a unit root			
		t-Statistic	Prob
Augmented Dickey-Fuller test statistic	Significance Level	-2.891359	0.0536
Test critical values:	1% level	-3.568308	
	5% level	-2.921175	
	10% level	-2.598551	
Null Hypothesis: LREALEXHANGERATE has a unit root			
		t-Statistic	Prob
Augmented Dickey-Fuller test statistic	Significance Level	0.801625	0.9931
Test critical values:	1% level	-3.568308	
	5% level	-2.921175	
	10% level	-2.598551	

The log of revealed comparative advantage index and log of real exchange rate can be seen in Figure 6.1.

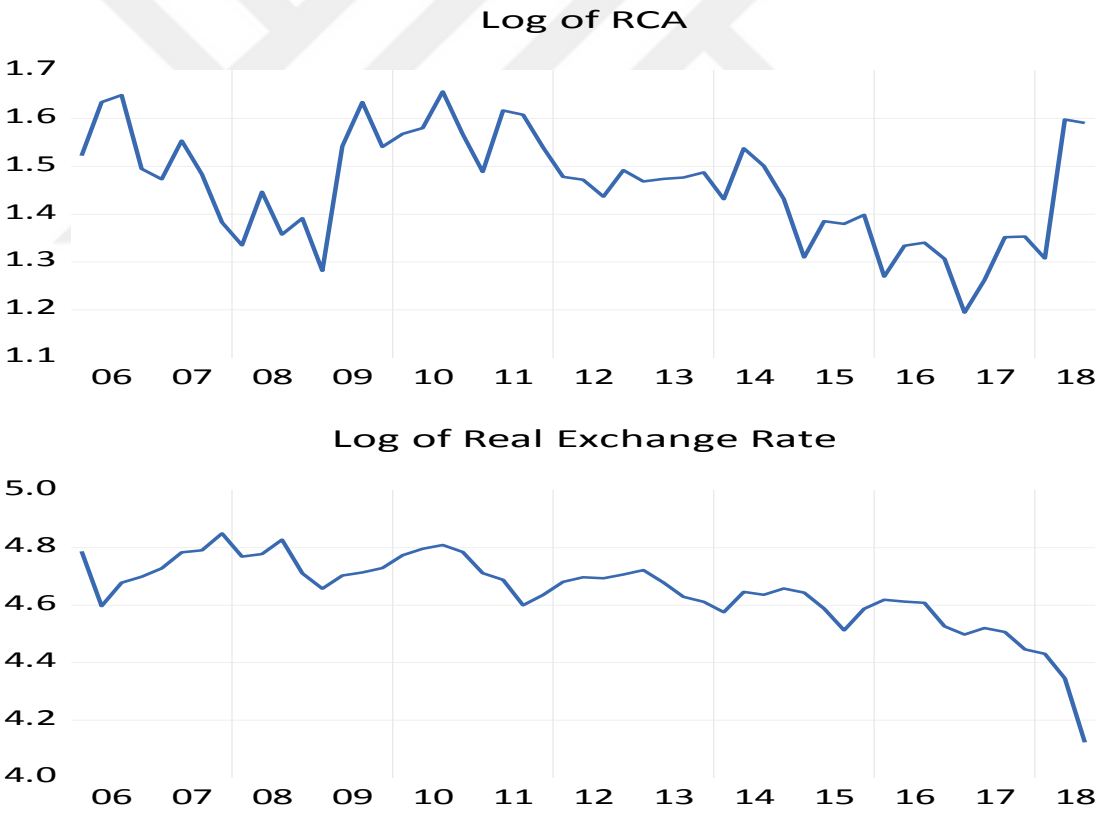


Figure 6.1: Log (Real Exchange Rate) and Log (RCA)

Table 6.2 shows the unit root test of first difference of revealed comparative advantage and first difference of real exchange rate variables. The main method to test unit root is Augmented Dickey-Fuller Test in this study and it is easily observed that both variables do not contain unit root, which means they are stationary in the first

difference. So both series are I(1). This is the main perquisite of Engle-Granger cointegration test. When first difference method is applied series, both series are stationary and so have stochastic trend. But after differencing, they become stationary. Hence, it is better to apply DLRCA and DLREALEXCHANGERATE variables in the error correction model.

Table 6.2: ADF Unit Root Test of DLRCA and DLREALEXCHANGERATE

Null Hypothesis: DLRCA has a unit root				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-8.311.631	0.0000
Test critical values:	1% level		-3.571.310	
	5% level		-2.922.449	
	10% level		-2.599.224	
Null Hypothesis: DLREALEXCHANGERATE has a unit root				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-6.144.923	0.0000
Test critical values:	1% level		-3.571.310	
	5% level		-2.922.449	
	10% level		-2.599.224	
*MacKinnon (1996) one-sided p-values.				

The graphs of first difference of log (revealed comparative advantage index) and first difference of log (Real Exchange Rate) are in the Figure 6.2. In the figure, it is clear that the mean reversion in the series exist. By first differencing, strong swings from the mean are removed and both series become stationary and the unit root hypothesis is strongly rejected. Then, according to tests applied, it is concluded that both series are nonstationary at the same level, which is in the order of one.

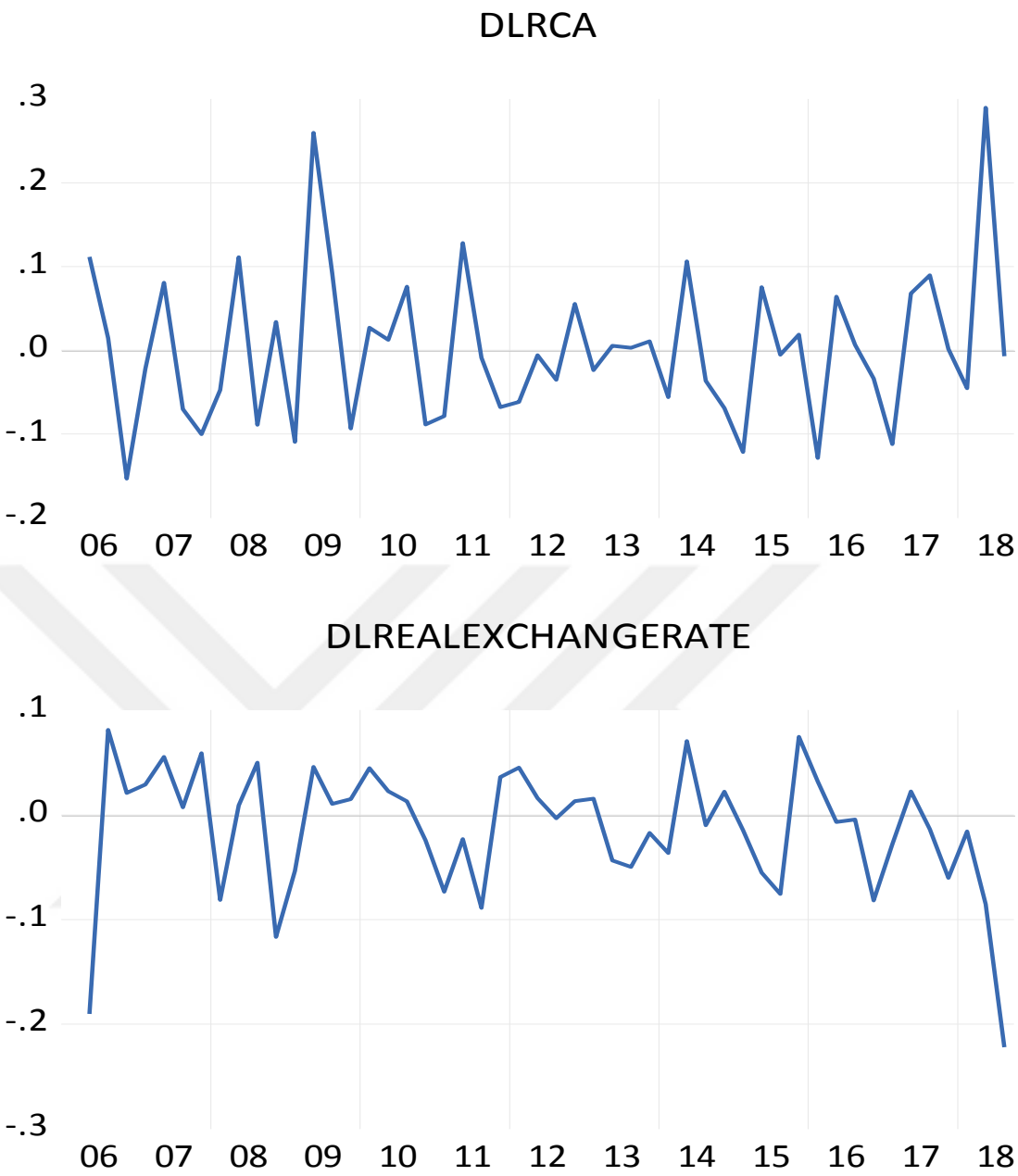


Figure 6.2: First Difference of Log (REAREXCHANGERATE) and Log (RCA)

6.3.3. The Results of the Static Model: Engle-Granger Cointegration with two variables

$$LRCA_t = a + \beta LREALEXCHANGERATE_t + \gamma Timetrend + u_t$$

Above equation is our static model that contains the long-run link between two series. After testing variables for unit root, then a basic model built and it's the residuals obtained. The first lag of the residuals are the error correction term, which is denoted as ECT in the Table 6.5. When Augmented Dickey Fuller Test applied to ECT variable and get below results in Table 6.3, which indicate that ECT does not have unit root at

%5 level. Then it can be concluded that real effective exchange rate and revealed comparative advantage index are in the state of equilibrium in the long-run. It can be said that both series have long-term relationship. Then the conclusion is that a real depreciation of Turkish lira increases competitiveness of home appliance sector.

Table 6.3: The Estimated Static Model

Dependent Variable: LRCA
Method: Least Squares
Date: 06/11/19 Time: 11:46
Sample: 2006Q1 2018Q3
Included observations: 51

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.022676	0.822682	3.674174	0.0006
LREALEXCHANGERATE	-0.306766	0.170605	-1.798104	0.0785
@TREND	-0.005504	0.001510	-3.644241	0.0007

R-squared	0.247302	Mean dependent var	1.458929
Adjusted R-squared	0.215940	Log likelihood	45.93555
S.E. of regression	0.101335	F-statistic	7.885314
Sum squared resid	0.492902	Prob(F-statistic)	0.001094

Table 6.3 contains the result of the static model. The model's dependent variable is the log of revealed comparative advantage index, the explanatory variable is log of real exchange rate and the model contains a trend variable. The coefficient (-0.306), which is log of real exchange rate, is the long run elasticity of revealed comparative advantage index with respect to real exchange rate.

Table 6. 4: The results of Engle-Granger Cointegration Test

Test	Significance Level	EG Test Statistics
Engle-Granger test statistic		-3.52
Asymptotic critical values (Wooldridge 2016):	1% level	-4.38
	5% level	-3.78
	10% level	-3.50

In the Table 6.4, Augmented Dickey-Fuller test statistics presented. According to test statistics, unit root hypothesis can be rejected in favour of stationarity in the residuals. Residuals obtained from static model do not contain a unit root at %10 level because

the test statistic is smaller than the critical value at %10 level. Then, it is concluded that there is a long-term link between Real Effective Exchange Rate and international competitiveness of home appliance sector of Turkey even it is not extremely strong.

6.3.4. The results of Error Correction Model and the Diagnostics

After the cointegration analysis, the error correction model will be used to estimate short run swings from equilibrium. An error correction model can be used to detect short-term deviations from long-term equilibrium. The error correction term is δECT_{t-1}, which is equals to $LRCA_{t-1}$-$LREALEXCHANGERATE_{t-1}$. As mentioned above, a dynamic model for error correction analysis was built and the model is structured as follows;

$$DLRCA_t = \beta_0 + \sum_{i=1}^{p} \emptyset_i DLRCA_{t-i} + \sum_{i=0}^{q} \theta_i DLREALEXCRATE_{t-i} + \delta ECT_{t-1} + u_t.$$

In the model, ECT_{t-1} is our error correction term. If δ is smaller than zero, then it is concluded that DLRCA overshoot the equilibrium, which means that error correction term push back DLRCA to the equilibrium. On the other hand, if δ is higher than zero, then it is concluded that positive change in DLRCA occurs, which is a movement back towards to the equilibrium (Wooldridge, 2016).

The results of the estimated error correction model based on the variables are presented in Table 6.5. The estimated signs of the variables are in line with prior theoretical expectation and highly significant. The insignificant lags of DLRCA DLREALEXCAHNGERATE are not included in the final error correction model.

As seen in the Table 6.5, the error correction term is negative, which validates the theoretical expectation, and statistically significant even at %1 level because its p-value is less than 0.01. The error correction term indicates that 36% of the temporary deviation from the long run equilibrium are corrected within a quarter.

Table 6. 5: The Estimation Results of the Error Correction Model

Dependent Variable: DLRCA				
Sample (adjusted): 2007Q2 2018Q3				
Included observations: 46 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.001306	0.010343	0.126316	0.9001
DLRCA(-4)	0.518005	0.124132	4.173.016	0.0001
DLREALEXCHANGERATE(-2)	-0.442663	0.228362	-1.938.425	0.0593
ERRCORRECTION_TERM(-1)	-0.346923	0.102411	-3.387.546	0.0015

R-squared	0.446291	Mean dependent var	0.002556
Adjusted R-squared	0.406741	p-value of Q stat lag =1	0.154000
S.E. of regression	0.069619	p-value of Q stat lag =2	0.344000
Sum squared resid	0.203566	p-value of Q stat lag =4	11.28405
F-statistic	11.28405	Prob(F-statistic)	0.000015

6.3.4.1 Diagnostic Checks for The Estimated Error Correction Model

In any time series regression, the most important diagnostic check is that the residuals should not be autocorrelated/serially correlated. In Table 6.5, the p-values of Q statistics, which imply the null hypothesis of no autocorrelation, show that there is no violation of the assumption of the absence of autocorrelation. So, the OLS estimators are efficient and the model is dynamically complete.

Homoscedasticity is one of the five assumptions for a proper Ordinary Least Squares estimation. If the error term has the same variance for any given value of the explanatory variables, then this situation called homoscedasticity. The contrary situation of homoskedasticity is heteroscedasticity. Testing for heteroskedasticity is important because in the state of heteroscedasticity, the estimators are not efficient and the standard errors are not reliable.

In the Table 5.6, the Breusch-Pagan test statistics are reported. The null hypothesis is that model has homoscedasticity and the s p-value s 0.2414, which is enough to fail to reject null hypothesis. Then, it is concluded that the estimated error correction model is homoscedastic.

Table 6.6: Breush-Pagan Heteroscedasticity Test

Heteroskedasticity Test: Breusch-Pagan-Godfrey Null hypothesis: Homoskedasticity			
F-statistic	1.451975	Prob. F(3,42)	0.2414
Obs*R-squared	4.322479	Prob. Chi-Square(3)	0.2287
Scaled explained SS	3.990612	Prob. Chi-Square(3)	0.2625

The normality assumption is especially crucial for inference in small sample regression analysis. In Figure 6.3, the normality test for residuals is reported. To test the normality of data, Jarque-Bera normality test is used. The null hypothesis proposes that the data has normal distribution. The Jarque-Bera test statistics is 2,648589. Then, the null hypothesis of normal distribution is not rejected.

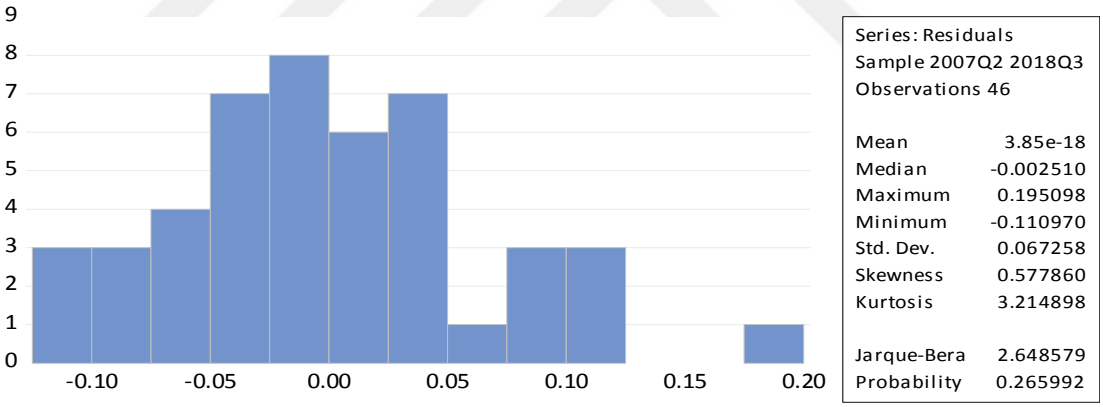


Figure 6.3 Jarque-Bera Normality Test

The most popular test to detect general functional misspecification is Ramsey's RESET test. The model has been tested for general functional misspecification and results are reported in Table 6.7. In this test, null hypothesis states that there is not general functional misspecification. As seen in the Table 6.7, the calculated p-value is 0.4859, so it means a failure to reject null hypothesis. The model does not have general functional misspecification.

Table 6.7 Ramsey Reset Test

Ramsey RESET Test
Equation: ERROR_CORRECTION_MODEL
Specification: DLRCA C DLRCA(-4) DLREALEXCHANGERATE(-2) ERRCORRECTION_TERM(-1)
Omitted Variables: Powers of fitted values from 2 to 3

	Value	df	Probability
F-statistic	0.734871	(2, 40)	0.4859
Likelihood ratio	1.659891	2	0.4361

7. CONCLUDING REMARKS

Competitiveness is one of the most important driving forces of economic development and technological innovation. That is why competitiveness is one of the favorite study subjects in economics. Home appliance sector is one of the biggest and most innovative industries of Turkey. The country has two important brands in the sector and a big player has placed its hugest plant in the country. Therefore, it is naturally expected that Turkey has strong competitive advantage over other competitors and that is what argued in this study.

The research covers the nine hugest home appliance exporter countries and the period from 2006 to 2017. At first, export values of sub-products by countries is represented and it is observed that China is the absolute leader in terms of export value. Turkey is not the leader among top five countries and in terms total home appliance export value Turkey is the fifth biggest exporter in international market.

After comparing export value of countries by sub-products, the widely used revealed comparative advantage index is used to calculate and compare countries' competitiveness in home appliance sector. This method is based on dividing share of home appliance export in total export of country x, to share of total world export of home appliance goods in total world export. After this method applied, it is possible to conclude that Turkey has the biggest competitiveness power in home appliance sector. It is expected that Turkey may has strong international competitiveness, but this result can be considered as surprise. The reason of this result is that share of home appliance sector's export in total export in Turkey is relatively more important and has bigger share than other countries.

After the revealed comparative advantage analysis, the relationship between real effective exchange rate and competitiveness is also investigated. To conduct this analysis, the quarterly data is employed. The empirical link between exchange rate movements and export is always a popular phenomenon in international economics. As an export-oriented sector, home appliance sector in Turkey may have a relation

with exchange rate movements. In this study the link between real effective exchange rate and competitiveness of home appliance sector in Turkey is studied and to measure this link, cointegration analysis and error correction model is used. After econometric analysis, it is concluded that competitiveness of home appliance sector and real effective exchange rate are associated in the long run according to cointegration analysis and our error correction model indicates that short-run swings from the long run equilibrium between the variables of interest. The basic diagnostics for the error correction economic model are handled. The diagnostic checks showed that the model does not violate any of the assumptions of the ordinary least squares regression.

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