Comparative Analysis of the Competitiveness in the Export of Science-Based Goods Regarding Turkey and the EU+13 Countries

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Abstract

In this study, Turkey and EU+13 countries' export competitiveness in the science-based goods are intented to measure and compare. In this context, between the years 1993-2012, the several revealed comparative advantage (RCA) indices for each country concerned are calculated according to the SITC Technology Classification. The results show that the science-based goods have not a significant impact on the rise of Turkey and the EU+13 countries' exports share in the world trade in general. However, the EU+13 countries' export competitiveness has been increasing after accession to the EU and Turkey's competitiveness is weaker than the EU+13 countries.

Keywords: Export Competitiveness, RCA Indices, Science-Based Goods, Turkey, the EU+13

1. Introduction

Increase in the export of a country from year to year is important. However, the factor endowments of the export of goods increased emerge as a more important concept and development indicator. If the majority of goods are scientifically based in a country's total export, the country's export revenues increase more and external deficits are reduced. Furthermore, the country's competitiveness rises in global markets as well.

In the article which is aimed to be measured and compared the export competitiveness of Turkey and the EU+13 countries, international competitiveness comparative advantage are discussed from a conceptual and historical framework firstly. Then, the difference between the concepts of comparative advantage and competitiveness is referred. However, literature survey is performed in this section. In the second part, the methods of calculation of export competitiveness are mentioned. In this perspective, the several indices of revealed comparative advantage (RCA) are described. In the last chapter, the topic is discussed as methodological, and different indicators of the export competitiveness in the science-based goods (easy to imitate and hard to imitate) related to Turkey and the EU+13 countries are calculated. In this context, the index of trade openness, the export similarity index, the export index of revealed comparative advantage, revealed symmetric comparative advantage and the index of comparative export performance are analyzed.

2. Comparative Advantage

The concept of comparative advantage is widely used in economic literature to evaluate the patterns of trade and specialization of countries in commodities which they have a competitive edge (Prasad, 2004).

The concept of comparative advantage based on David Ricardo (1817) is one of the oldest international trade theory (Ricardo, 2007).

The historical development of economic though in comparative advantage is detailed in Table 1 with some of the key elements.

Table 1: Foundations of Comparative Advantage Analysis

Approaches	Key Concept(s)	Mechanism(s)
Classical Political Economy		
A. Smith	Market size/productivity	Specialization, competition
D. Ricardo	Comparative advantage	International trade
J.S. Mill	Infant industries	Learning-by-doing
J.S. Mill	Politics of protection	Income distribution
Neoclassical Models		
Ricardian	Technical efficiency	Use of a single key resource
Heckscher-Ohlin	Factor-intensity	Use of more than one resource
Ricardo-Viner	Specific factors	Use of industry-spesific inputs
H-O-Samuelson	Consumer demand	Product preferences
Salter-Swan	Exchange rates	Nontraded goods, inflation
Challenges to Comparative Advantage		
Prebisch/Singer	Import-substitution	External terms of trade
A.O. Hirschman	Development strategy	Inter-industry linkages
New trade theorists	Strategic policy	Rent-shifting, externalities
Michael Porter	Competitive advantage	Factor creation, demand signaling

Source: Masters, 1995

The concept of comparative advantage is largely derived from the propositions on opportunity cost and labor specialization (Leishman, Menkhaus and Whipple, 1999). The theory explains that the driving force behind international trade is not "absolute" but "comparative" advantage. That is, even if an autarky country has absolute advantage in all the goods (i.e., it can produce all the goods more efficiently than other countries), it can still benefit from international trade through increasing specialization in the goods where its comparative advantage lies (Leung and Cai, 2007).

The comparative advantage explains how trade could benefit nations through more efficient use of the world's resource base (land, labor, capital inputs) when that trade is totally unrestricted (Rooyen, Esterhuizen and Doyer, 1999). Every country should produce and export the products with obvious comparative advantage or weaker comparative disadvantage, and input the products with obvious comparative disadvantage. So-called comparative advantage meant that one country had less comparative cost for a certain quality of the same product than another country, and then we called the country had comparative advantage in the product (Li-ping, 2009).

3. *International Competitiveness and Comparative Advantage*

The concept of international competitiveness, although controversial and elusive, has gained acceptance and continues to attract the attention of both academics and policymakers worldwide. International competitiveness, within the context of trade in goods and services, refers to a nation securing and maintaining a trade advantage vis-a-vis the rest of the world (Bobirca and Miclaus, 2011).

A large number of concepts of competitiveness has been proposed in the economic and business literature. This owes to the fact that competitiveness, unlike comparative advantage, has not been defined rigorously in the early economic literature. Thus, over time and after many attempts of definition, it has become a somewhat ambiguous concept. Some authors use the term synonymously or in a similar way as comparative advantage, others view it as an economy-wide characteristic (Siggel, 2007).

Comparative advantage is an ex-ante theoretical concept involving comparisons between countries and products. Measurement of comparative advantage would ideally enable us to predict trade flows and to evaluate the extent to which the resource allocation between industries is optimum or not.

Competitiveness, on the other hand, is an ex-post concept and should ideally involve comparisons between countries in regard to the efficiency of production (Thornhill, 1988) (or some would argue delivery to the market of the same product or related products). However, comparative advantage is a microeconomic concept, focusing on industry-spesific trade, explaining why one country might export labor-intensive products while another country might specialize in capital-intensive ones. By definition each country has a comparative advantage in the production of some products-those for which it has a lower relative (opportunity) cost than its competitors. Therefore, comparative advantage has little significance from a macroeconomic perspective. In addition, comparative advantage is an equilibrium concept, predicting a pattern of trade when prices, trade flows and exchange rates are in equilibrium. Business decisions, in contrast, often must explicitly consider short-term developments as well as long term equilibrium outcomes. These will include current economic conditions, exchange rate fluctuations, and other factors that represent deviations from long-run equilibrium conditions.
In contrast to comparative advantage, it is appropriate to talk meaningfully about international competitiveness both on the macro and micro level. International competitiveness is a matter largely of costs: which country is able to deliver the product to the market most cheaply. Contributing to costs are factors that directly affect input prices, such as exchange rates, domestic wages and material costs, and productivity, but also capabilities to produce goods of appropriate quality and meeting market specifications. Transportation and communication cost, and trade barriers and trade strategy may all play a role.

A dynamic improvement in competitiveness may mean that the competitiveness of currently exporting industries improves or that new products, perhaps technologically more advanced ones, become competitive (Adams, Gangnes and Shachmurove, 2004).

4. Literature Survey

In a literature review conducted on revealed comparative advantage, using of Balassa Index is outstanding. However, in some studies, other indices of revealed comparative advantage are used. Some examples related to literature is given in Table 2.

Table 2: Samples of Studies Conducted

Author	Methodolgy	Country	Result
B. Balassa and M. Noland (1989)	RCA index	Japan and United States	Indices show increased specialization in Japan in human-capital intensive product, at the expense of unskilled-labor intensive and natural resource products between 1967-1985. In turn, the US became increasingly specialized in natural-resource intensive products. Both countries have comparative advantages in high-tech products (Balassa and Noland, 1989).
B. Yılmaz and S.J. Ergun (2003)	Entropy Index, Balassa Index, Lafay Index, Trade Overlap, Export Similarities	Turkey, Bulgaria, Hungary, Romania, Poland, Czech Republic	Except for Hungary, all countries have comparative disadvantages in research-oriented goods (Yılmaz and Ergun, 2003).
H. Karpavicius (2007)	Index of Revealed Comparative Advantage (RCA) and Revealed Trade Balance (RTB)	Lithuania and EU	Lithuania's comparative advantage is concentrated in low to medium value-add goods (Karpavicius, 2007).
W. Abdmoulah and B. Laabas (2010)	RCA, Export Diversification Index, Trade Complementarily Index, Export Similarities	16 Arab countries	Arab countries are heterogeneous group in terms of resource endowment and export competitiveness. An important part of export competitiveness is composed of low-tech products in these countries (Abdmoulah and Laabas, 2010).

W. James and O. Movshuk (2000)	RCA index	Japan, Korea and Taiwan	Starting from early 1990s the comparative advantages of both Korea and Taiwan were no longer concentrated in labor-intensive product, but were increasingly clustered in products with high technological intensity (James and Movshuk, 2000).
W.H. Loke (2008)	RCA index	Malaysia and China	Malaysia's comparative advantages in high-tech goods have been eroding over the years since 1990s. China has begun to acquire comparative advantages in skill intensive goods (Loke, 2008).
M. Sevela (2003)	RCA index	Czech economy and other selected transition economies	After the political changes in 1989, radical changes have been about export competitiveness in high-technology products and efficiently of export has increased (Sevela, 2003).
S. Kubielas (1998)	RCA index	Central and Eastern Europe Countries (CEEs)	CEE economies appear to be uniformly and strongly disadvantaged in high-tech industries (Kubielas, 1998).
M. Widgren (2005)	RCA index	Asian, American and European Countries	American comparative advantage is based on intensive use of highly skilled labour and not on physical capital. Asian countries and the new member states have considerable overlap in their comparative advantage. EU15 has shifted in a skill-intensive direction interms of intensive of human capital (Widgren, 2005).

Literature review shows that there is not any study on the competitiveness in the science-based-goods for Turkey and the EU+13 countries in a comparative manner. Therefore, this study is expected to be a crucial contributor to the literature.

5. *Measurement of International Competitiveness: Indices of Revealed Comparative Advantage*

In empirical work, the concept of comparative advantage has been used extensively. In fact, the commodity pattern of comparative advantage is a central concept in international trade theory. This is despite the fact that the notion of comparative advantage faces a measurement problem because it is defined in terms of relative autarkic price relationship that are not observable in post-trade equilibria. This is because trade statistics reflect post-trade positions (Sharma and Dietrich, 2004). The linkage between comparative advantage and competitiveness (RCA) as follows (Ballance, Forstner and Murray, 1987):

$EC \rightarrow CA \rightarrow TPC \rightarrow RCA$

Economic condition (EC) in the various trading countries ultimately determine the international pattern of comparative advantage (CA). This pattern, in turn, governs the pattern of international trade, production and consumption (TPC) among countries. Indices constructed from TPC and, perhaps, other post-trade variables are normally used to indicate comparative advantage anda re referred to as indices of "revealed comparative advantage (RCA)".

The index of revealed comparative advantage was first introduced by *Liesner* (1958) and operationalized by Balassa (1965) in order to measure comparative advantages (Balassa, 1965).

The export index of revealed comparative advantage (RCA) has been defined as the ratio of a country's exports in a particular commodity category to its share in total merchandise exports (Balassa and Noland, 1989):

$RCA = (X_{ij}/X_j)/(X_{iw}/X_w)$

Where X stands for exports, i, j and w refer to industry (product category), country and world respectively.

The index neutralizes the effect of the size of a country's economy or industry, thereby making it possible to make meaningful comparisons between countries and the international performance of different industries.

The value of index varies between zero, indicating that a country has no exports in the industry being considered, and infinity, meaning that the industry is a major exporter relative to other industries of the economy. A branch with an RCA index of over one has a share in the world market share which exceeds the average share of the country in world exports. This means that it is relatively competitive, compared to the rest of its home economy. Such a branch has therefore a comparative advantage, or in Balassa's terminology, a revealed comparative advantage (Rivlin, 2000).

A more detailed analysis, in order to demonstrate the power of comparative advantage, Balassa's RCA index can be classified into four stages (Hinloopen, 2001):

Classification 1 → 0 < RCA ≤ 1; There is no comparative advantage.
Classification 2→ 1 < RCA ≤ 2; There is a week comparative advantage.
Classification 3→ 2 < RCA ≤ 4; There is moderate comparative advantage.
Classification 4→ 4 <RCA ; There is a strong comparative advantage.

When we apply logarithms to the index and we have lnRCA > 0 then there is comparative advantage; by contrast, when lnRCA < 0 there is comparative disadvantage (Faustino, 2008).

Balassa also employed one index about revealed comparative advantage, the net export index (NEI). The index has been defined as net exports divided by the sum of exports and imports for a particular industry (Balassa and Noland, 1989).

$NEI = (X_{ij}-M_{ij})/(X_{ij}+M_{ij})$

where M refers to imports.

The net export index (NEI) of revealed comparative advantage is, however, affected by the country's overall trade balance. The value of NEI ranges between -1 and 1. When NEI equals 1 indicates that the qualitative structure of exports above structure of imports or a country as net exporter. Converse, NEI equals -1 implies that a country as net importer. If the value of NEI with to zero, represents that the value of exports same as the value of imports in the country j. For simplify interpretation of the NEI, if NEI positive the mean as a net exporter and as e net importer when the index is negative (Ma, 2013).Its absolute value $\left[NEI\right]$ represents the portion of inter-industry trade relative to the total trade of any commodity group, and (1-$\left[NEI\right]$) consequently corresponds to the portion of intra-industry trade (Vixathep, 2011).

The use of the net export index is superior to the export index of revealed comparative advantage on trade-theoretical grounds. This is because, the former indicates the effects of comparative advantage on the relationship between exports and imports rather than on exports alone (Balassa and Noland, 1989).

To suppress the skewness problem, revealed symmetric comparative advantage (RSCA) index employed. The index is shown below (Dalum, Laursen and Villumsen, 1996):

$RSCA = (RCA - 1)/(RCA + 1)$

The RSCAs fall between +1.0 and -1.0 and avoid the problem with zero values which occur in the logarithmic transformation (when an arbitrary constant is not added to the RCA). The method has got the economic advantage of attributing changes below unity (zero in this case) the same weight as changes above unity. Further, the measure is the best of the alternatives discussed with respect to normality. Together with RSCA, ln version of RCA (lnRCA) can be calculated to suppress the skewness problem.

With export index of revealed comparative advantage (RCA), at the same time, we can use import index of revealed comparative advantage (RMA) and can measure revealed trade advantage (RTA) (Fertö and Hubbard, 2002).

$RMA = (M_{ij}/M_j)/(M_{iw}/M_w)$
$RTA = RCA – RMA = [(X_{ij}/X_j)/(X_{iw}/X_w)] - [(M_{ij}/M_j)/(M_{iw}/M_w)]$

If we want to compare the two countries directly, we can use the index of comparative export performance (CEP). It is based on export shares and therefore allows for a comparison of findings between two indices. The formula we use to measure the CEP index is given by (Bobirca and Miclaus, 2011):

$CEP = (X_{ia}/X_a)/(X_{ib}/X_b)$

where CEP represents the comparative export advantage of country a against country b. If index value is greater than 1, country a has a competitive advantage against country b.

However, we can measure comparative advantage by using the index of technological comparative advantage (TCA) (Uchida and Cook, 2004).

$TCA = (P_{ij}/P_j)/(P_{iw}/P_w)$

where P is the number of patents of country j in sector i. The range of index value is also between 0 and positive infinity. If the index value is greater than unity, it indicates a relative technological specialization of the country j in sector i.

RCA is based on observed trade patterns. An increasing in the value of RCA means an increasing in a country's competitiveness in a commodity (sector, industry). This kind of measurement is so easy that it is widely adopted. But in reality, observed trade patterns can be distorted by policies and interventions and therefore may misrepresent underlying comparative advantage. This is especially true of the agricultural sector. The extent to which import restriction, export subsidies and other protection policies might distort index of revealed comparative advantage is becoming a concern (Jing, 2004).

In addition to the indices of revealed comparative advantage, the index of trade openness (ITO) is an important indicator in terms of the competitiveness of countries as well. The index can be represented as follows(Department for Business Innovation&Skills, 2013):

$ITO = (X + M / GDP) \times 100$

The trade-to-GDP-ratio is the sum of exports and imports divided by GDP. This indicator measures a country's openness or integration in the world economy. It represents the combined weight of total trade in its economy, a measure of the degree of dependence of domestic producers on foreign markets and their trade orientation (for exports) and the degree of reliance of domestic demand on foreign supply of goods and services (for imports).
One of the indices related to the competitiveness is also the export similarity index (ESI). Thanks to the export similarity index, it can be measured the similarity between exports of countries to a third market. The more similar the export profiles are, the more likely that economies are competitors in global markets (Fundira, 2013). The index is defined as (Finger and Kreinin, 1979):

$$ESI = \sum \min \left[X_k (jw), X_k (mw) \right] \times 100$$

where $X_k(jw)$ is the share of exports of good k in total exports of country j and, $X_k(mw)$ is the share of exports of good k in total exports of country m.

The coefficient varies between 100, if the composition of exports in both countries is absolutely similar, and 0 when there is no similarity at all (Peters, 2008).

6. Methodology

In the study, it is aimed to compare Turkey and the EU+13 countries on the basis of international competitiveness. So, between1993-2012, by evaluating of export similarities of Turkey and the EU +13countries, level of export specialization and competition on the basis of factor intensity (science-based goods) were calculated. The revealed comparative advantage (RCA) indices of Turkey and the EU +13 countries are calculated on SITC technology classification. According to SITC technology classification, goods are classified into the following five groups (Hufbauer and Chilas, 1974):

- Raw material-intensive goods → SITC: 0, 21, 22, 23, 24, 25, 27, 28, 29, 32, 33, 34, 4, 56
- Labour-intensive goods → SITC: 26, 61, 63, 64, 65, 66, 69, 81, 82, 83, 84, 85, 89
- Capital-intensive goods → SITC: 1, 35, 53, 55, 62, 67, 68, 78
- Easy to imitate science-based goods → SITC: 51, 52, 54, 58, 59, 75, 76
- Hard to imitate science-based goods → SITC: 57, 71, 72, 73, 74, 77, 79, 87

The data used for making analysis are drawn from the United Nations Commodity Trade Statistics (UN COMTRADE Database) (http://comtrade.un.org).In the article, the following indicators are calculated:

- The index of trade openness index (ITO)
- The export similarity index (ESI)
- The export index of revealed comparative advantage (Balassa's RCA)
- ln version of the export index of revealed comparative advantage (lnRCA)
- The export index of revealed symmetric comparative advantage (RSCA)
- The index of comparative export performance (CEP)

7. Empirical Analysis

7.1. The Index of Trade Openness (ITO)

The indices of trade openness state that the EU+13 countries' openness and integration in the world economy at a significant level except for Cyprus, Crotia, Romania and Poland. However, the index of trade openness of the countries' have been increasing after accession to the EU. In particular, it is seen that Czech Republic, Hungary, Lithuania and Slovakia have opened to foreign dramatically. Compared with the EU+13 countries, it is observed that Turkey's indices of trade openness are less by years. It is great likely that this situation has been negative impact on the international competitiveness of Turkey against the rivals.

Table 3: The Index of Trade Openness

	1993	**1996**	**1999**	**2002**	**2005**	**2008**	**2012**
Bulgaria		112	71	86	103	115	117
Cyprus	52	57	47	47	47	50	40
Croatia	79	53	52	59	61	64	56
Czech Rep.	65	76	90	118	119	128	151
Romania	43	55	53	69	69	65	76
Hungary	50	62	110	108	116	141	158
Estonia		112	125	139	139	131	169
Latvia		67	64	68	88	74	101
Lithuania		94	71	93	107	117	146
Malta	130	124	123	116	105	95	155
Poland	35	39	44	48	63	72	76
Slovakia		62	71	90	108	146	172
Slovenia	99	84	83	92	105	116	122
Turkey	25	36	27	37	39	46	49

Source: It is prepared by us by using COMTRADE data.

7.2. The Export Similarity Index (ESI)

Export similarities of Turkey with the EU+13 countries' on the basis of science-based goods have changed from 1996 by 2012 considerably. Likewise, similarities in exports of the product group in question were more with Hungary, Slovenia and Lithuania in 1996. However, in 2012, the similarities were more Bulgaria, Romania and Poland. While Bulgaria was the last row in 1996, it is surprising that the first row in 2012.Accordingly, Turkey's main competitors in the export of science-based goods in the global markets are Bulgaria, Romania and Poland.

Table 4: The Export Similarity Index of Turkey

1996		2012	
Countries	**ESI**	**Countries**	**ESI**
Hungary	84,97	Bulgaria	79,59
Slovenia	78,66	Romania	79,08
Lithuania	77,29	Poland	77,65
Poland	74,11	Czech Rep.	73,82
Czech Rep.	71,69	Slovenia	73,33
Latvia	69,47	Croatia	69,25
Slovakia	69,39	Estonia	67,41
Cyprus	62,99	Lithuania	67,28
Estonia	62,26	Latvia	62,17
Romania	60,52	Hungary	61,94
Croatia	54,25	Slovakia	61,21
Malta	50,76	Malta	49,35
Bulgaria	38,53	Cyprus	38,82

Source: It is prepared by us by using COMTRADE data.

7.3. The Export Index of Revealed Comparative Advantage (RCA, LNRCA) and Revealed Symmetric Comparative Advantage (RSCA)

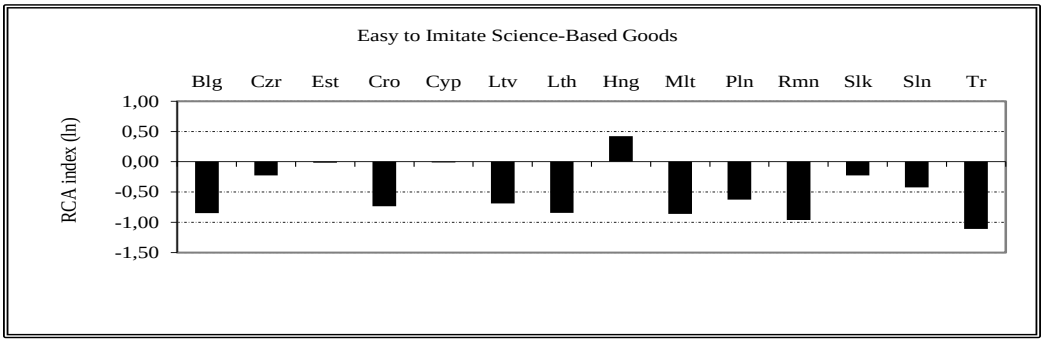
In Turkey and the EU+13 countries, the export index of revealed comparative advantage (Balassa's RCA), ln version of the export index of revealed comparative advantage (lnRCA) and the export index of revealed symmetric comparative advantage (RSCA) are calculated for two science-based product groups according to SITC Technology Classification. The results are displayed in Table 5, RCA, lnRCA and RSCA scores of 1993, 1998, 2003, 2008, 2012 are shown. Furthermore, the average of the scores of all years is shown as "mean". However, in order to reveal the deviation from the mean and analyze in more detail to the international competitiveness, the coefficients of variation* (CV) of Balassa's RCA are calculated.

The empirical results obtained for Turkey and the EU+13 with reference to the easy to imitate science-based goods are as follows (Figure 1):

- Except for Hungary, Turkey and all of the other twelve countries are not competitive in the easy to imitate science-based goods according to the average value. However, Czech Republic, Cyprus and Slovakia have been competitive in recent years. Estonia which had the competitiveness at first, on the other hand, has been losing the competitiveness recently. The average value and the course of indices of RCA, lnRCA and RSCA express that Turkey's international competitiveness in the easy to imitate science-based goods is relatively weak and not promising.
- Hungary has a weak competitiveness in the export of easy to imitate science-based goods. Referring to the CV, it is said that Hungary's competitiveness in the export of aforementioned goods is stable.
- When the coefficients of variation (CV) related to the easy to imitate science-based goods is analyzed, it is observed that the volatilities of RCA indices of Cyprus, Slovakia and Malta are quite high.

* In the modeling setting, the CV is calculated as the ratio of the root mean squared error (RMSE) to the mean of the dependent variable. In both settings, the CV is often presented as the given ratio multiplied by 100. The CV for a single variable aims to describe the dispersion of the variable in a way that does not depend on the variable's measurement unit. The higher the CV, the greater the dispersion in the variable. The CV for a model aims to describe the model fit in terms of the relative sizes of the squared residuals and outcome values. The lower the CV, the smaller the residuals relative to the predicted value. This is suggestive of a good model fit.
http://www.ats.ucla.edu/stat/mult_pkg/faq/general/coefficient_of_variation.htm

Figure 1: RCA Indices of Turkey and the EU+13 in Easy to Imitate Science-Based Goods (Average Value)



Source: It is prepared by us by using COMTRADE data.

Table 5: Various Revealed Comparative Advantage Indicators Related toTurkey and the EU+13

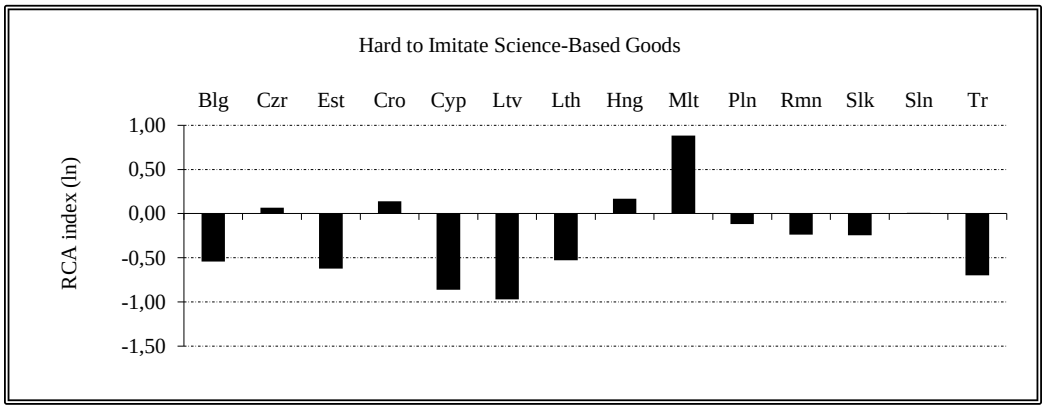
		Bulgaria			Czech Republic			Estonia			Croatia			Cyprus		
		RCA	RSCA	lnRCA	RCA	RSCA	lnRCA	RCA	RSCA	lnRCA	RCA	RSCA	lnRCA	RCA	RSCA	lnRCA
easy to imitate science-based	1993				0,50	-0,33	-0,69				0,69	-0,19	-0,38	0,75	-0,14	-0,29
	1998	0,51	-0,32	-0,67	0,45	-0,38	-0,79	1,13	0,06	0,12	0,49	-0,34	-0,72	0,42	-0,41	-0,86
	2003	0,32	-0,52	-1,15	0,81	-0,11	-0,21	1,03	0,01	0,03	0,45	-0,38	-0,79	0,68	-0,19	-0,39
	2008	0,47	-0,36	-0,76	1,17	0,08	0,16	0,58	-0,27	-0,55	0,39	-0,44	-0,95	1,19	0,09	0,17
	2012	0,47	-0,36	-0,76	1,16	0,07	0,15	0,90	-0,05	-0,10	0,49	-0,34	-0,72	1,77	0,28	0,57
	mean	**0,43**	**-0,40**	**-0,85**	**0,80**	**-0,11**	**-0,22**	**0,98**	**-0,01**	**-0,02**	**0,48**	**-0,35**	**-0,74**	**0,99**	**-0,01**	**-0,01**
	CV	**29,18**			**36,39**			**32,19**			**17,54**			**52,10**		
hard to imitate science-based	1993				0,79	-0,12	-0,24				0,68	-0,19	-0,39	0,36	-0,47	-1,02
	1998	0,52	-0,31	-0,65	1,13	0,06	0,12	0,37	-0,47	-1,01	1,22	0,10	0,20	0,28	-0,56	-1,27
	2003	0,56	-0,28	-0,57	1,16	0,07	0,15	0,49	-0,34	-0,71	1,20	0,09	0,19	0,25	-0,60	-1,37
	2008	0,69	-0,18	-0,37	1,20	0,09	0,18	0,79	-0,12	-0,24	1,51	0,20	0,41	0,64	-0,22	-0,45
	2012	0,64	-0,22	-0,44	1,11	0,05	0,10	0,77	-0,13	-0,26	1,06	0,03	0,06	0,50	-0,33	-0,69
	mean	**0,58**	**-0,26**	**-0,54**	**1,07**	**0,03**	**0,07**	**0,54**	**-0,30**	**-0,62**	**1,15**	**0,07**	**0,14**	**0,42**	**-0,41**	**-0,86**
	CV	**14,66**			**11,58**			**33,43**			**19,28**			**45,95**		
		Latvia			**Lithuania**			**Hungary**			**Malta**			**Poland**		
		RCA	RSCA	lnRCA	RCA	RSCA	lnRCA	RCA	RSCA	lnRCA	RCA	RSCA	lnRCA	RCA	RSCA	lnRCA
easy to imitate science-based	1993							0,80	-0,11	-0,22	0,48	-0,35	-0,73	0,39	-0,44	-0,94
	1998	0,35	-0,48	-1,05	0,36	-0,47	-1,03	1,46	0,19	0,38	0,23	-0,62	-1,47	0,45	-0,38	-0,80
	2003	0,37	-0,47	-1,01	0,27	-0,57	-1,30	1,77	0,28	0,57	0,28	-0,56	-1,26	0,42	-0,41	-0,87
	2008	0,79	-0,11	-0,23	0,46	-0,37	-0,79	1,86	0,30	0,62	0,85	-0,08	-0,16	0,74	-0,15	-0,30
	2012	0,74	-0,15	-0,30	0,46	-0,37	-0,77	1,55	0,21	0,44	0,49	-0,34	-0,71	0,78	-0,13	-0,25
	mean	**0,50**	**-0,33**	**-0,69**	**0,43**	**-0,40**	**-0,85**	**1,52**	**0,21**	**0,42**	**0,42**	**-0,41**	**-0,86**	**0,53**	**-0,30**	**-0,63**
	CV	**37,01**			**28,89**			**28,02**			**47,54**			**32,48**		
hard to imitate science-based	1993							0,81	-0,11	-0,21	2,38	0,41	0,87	0,69	-0,19	-0,38
	1998	0,30	-0,54	-1,21	0,47	-0,36	-0,75	1,18	0,08	0,16	2,59	0,44	0,95	0,75	-0,14	-0,29
	2003	0,32	-0,51	-1,14	0,79	-0,11	-0,23	1,33	0,14	0,28	2,50	0,43	0,92	1,09	0,04	0,08
	2008	0,44	-0,39	-0,82	0,64	-0,22	-0,44	1,30	0,13	0,26	2,54	0,43	0,93	0,99	0,00	-0,01
	2012	0,38	-0,45	-0,96	0,59	-0,26	-0,53	1,32	0,14	0,28	1,30	0,13	0,26	0,93	-0,04	-0,08
	mean	**0,38**	**-0,45**	**-0,97**	**0,59**	**-0,26**	**-0,53**	**1,18**	**0,08**	**0,17**	**2,42**	**0,41**	**0,88**	**0,89**	**-0,06**	**-0,12**
	CV	**20,79**			**13,96**			**15,64**			**16,92**			**17,73**		
		Romania			**Slovakia**			**Slovenia**			**Turkey**					
		RCA	RSCA	lnRCA	RCA	RSCA	lnRCA	RCA	RSCA	lnRCA	RCA	RSCA	lnRCA			
easy to imitate science-based	1993	0,28	-0,56	-1,26				0,56	-0,28	-0,57	0,27	-0,58	-1,32			
	1998	0,24	-0,62	-1,45	0,54	-0,30	-0,62	0,56	-0,28	-0,59	0,36	-0,47	-1,02			
	2003	0,31	-0,52	-1,16	0,39	-0,44	-0,95	0,69	-0,18	-0,37	0,38	-0,45	-0,96			
	2008	0,42	-0,40	-0,86	1,32	0,14	0,28	0,84	-0,09	-0,18	0,30	-0,54	-1,21			
	2012	0,53	-0,31	-0,64	1,24	0,11	0,21	0,94	-0,03	-0,06	0,32	-0,52	-1,15			
	mean	**0,38**	**-0,45**	**-0,96**	**0,80**	**-0,11**	**-0,23**	**0,65**	**-0,21**	**-0,42**	**0,33**	**-0,50**	**-1,11**			
	CV	**37,99**			**45,57**			**30,60**			**15,99**					
hard to imitate science-based	1993	0,58	-0,27	-0,55				0,85	-0,08	-0,16	0,27	-0,58	-1,32			
	1998	0,56	-0,29	-0,59	0,74	-0,15	-0,30	0,93	-0,03	-0,07	0,36	-0,47	-1,02			
	2003	0,72	-0,17	-0,33	0,78	-0,12	-0,25	1,12	0,06	0,11	0,51	-0,33	-0,68			
	2008	1,16	0,08	0,15	0,80	-0,11	-0,23	1,21	0,09	0,19	0,68	-0,19	-0,39			
	2012	1,04	0,02	0,04	0,72	-0,16	-0,33	1,12	0,06	0,12	0,60	-0,25	-0,51			
	mean	**0,79**	**-0,12**	**-0,24**	**0,78**	**-0,12**	**-0,25**	**1,01**	**0,00**	**0,01**	**0,50**	**-0,34**	**-0,70**			
	CV	**30,97**			**4,70**			**25,75**			**28,97**					

Source: It is prepared by us by using COMTRADE data.

The results of the hard to imitate science-based goods are as follows (Figure 2):

- Unlike the easy to imitate science-based goods, the EU+13 countries are more competitive in the hard to imitate science-based goods. Czech Republic, Crotia, Hungary, Malta and Slovenia have the international competitiveness.
- In general, the volatilities of RCA indices of the countries which are competitive is stable.
- Except for Malta, the other four countries are poor level of advantage. However, Malta, on the other hand, has a moderate advantage. Concerning the hard to imitate science-based goods, Malta has surprisingly the largest RCA indicators. The reason for this, Malta's export of electrical machinery, apparatus and appliances quite high.
- As in the export of the easy to imitate science-based goods, Hungary is competitive in the hard to imitate science-based goods as well. So, from the analyzed countries, only Hungary is superior in the export of either goods.
- Considering both products, together with Bulgaria, Latvia and Lithuania, Turkey has the lowest coefficients of RCA.
- Turkey has also competitive disadvantage in the export of hard to imitate science-based goods despite improvements in recent years.

Figure 2: RCA Indices of Turkey and the EU+13 in Hard to Imitate Science-Based Goods (Average Value)



Source: It is prepared by us by using COMTRADE data.

7.4. The Index of Comparative Export Performance (CEP)

In the previous section, Turkey and EU+13 countries' export competitiveness in global markets are examined. In this section, on the other hand, Turkey's competitive positionagainstEU+13 countries is examined by calculating the index of comparative export performance (CEP).

Table 6: The Index of Comparative Export Performance (Turkey against the EU+13)

		TR-BLG		TR-CZR		TR-EST		TR-CRO		TR-CYP	
		RCA	lnRCA	RCA	lnRCA	RCA	lnRCA	RCA	lnRCA	RCA	lnRCA
easy to imitate science-based	1993			0,53	-0,63			0,39	-0,94	0,36	-1,03
	1998	0,70	-0,35	0,80	-0,22	0,32	-1,14	0,74	-0,30	0,86	-0,15
	2003	1,21	0,19	0,47	-0,75	0,37	-0,99	0,84	-0,17	0,56	-0,58
	2008	0,64	-0,44	0,26	-1,36	0,52	-0,65	0,78	-0,25	0,25	-1,38
	2012	0,68	-0,38	0,28	-1,29	0,35	-1,04	0,65	-0,43	0,18	-1,71
	mean	**0,88**	**-0,12**	**0,46**	**-0,77**	**0,37**	**-0,99**	**0,71**	**-0,34**	**0,42**	**-0,86**
hard to imitate science-based	1993			0,34	-1,08			0,39	-0,93	0,74	-0,31
	1998	0,69	-0,37	0,32	-1,14	0,99	-0,01	0,30	-1,22	1,29	0,25
	2003	0,90	-0,11	0,44	-0,83	1,03	0,03	0,42	-0,87	2,00	0,69
	2008	0,98	-0,02	0,57	-0,57	0,86	-0,15	0,45	-0,80	1,07	0,06
	2012	0,94	-0,06	0,54	-0,61	0,78	-0,25	0,57	-0,57	1,20	0,18
	mean	**0,92**	**-0,09**	**0,46**	**-0,78**	**1,01**	**0,01**	**0,43**	**-0,84**	**1,32**	**0,27**
		TR-LTV		**TR-LTH**		**TR-HNG**		**TR-MLT**		**TR-PLN**	
		RCA	**lnRCA**	**RCA**	**lnRCA**	**RCA**	**lnRCA**	**RCA**	**lnRCA**	**RCA**	**lnRCA**
easy to imitate science-based	1993					0,33	-1,10	0,55	-0,59	0,68	-0,38
	1998	1,03	0,03	1,02	0,02	0,25	-1,39	1,57	0,45	0,81	-0,21
	2003	1,04	0,04	1,40	0,34	0,22	-1,53	1,35	0,30	0,91	-0,10
	2008	0,38	-0,98	0,66	-0,42	0,16	-1,83	0,35	-1,05	0,40	-0,91
	2012	0,43	-0,85	0,69	-0,38	0,21	-1,58	0,65	-0,44	0,41	-0,89
	mean	**0,76**	**-0,27**	**0,86**	**-0,15**	**0,23**	**-1,46**	**0,96**	**-0,05**	**0,67**	**-0,40**
hard to imitate science-based	1993					0,33	-1,11	0,11	-2,19	0,39	-0,94
	1998	1,22	0,20	0,77	-0,27	0,31	-1,18	0,14	-1,97	0,48	-0,73
	2003	1,58	0,45	0,64	-0,45	0,38	-0,96	0,20	-1,60	0,47	-0,76
	2008	1,54	0,43	1,06	0,05	0,52	-0,65	0,27	-1,32	0,68	-0,38
	2012	1,57	0,45	1,02	0,02	0,46	-0,78	0,46	-0,77	0,65	-0,43
	mean	**1,40**	**0,33**	**0,87**	**-0,14**	**0,41**	**-0,88**	**0,22**	**-1,51**	**0,56**	**-0,59**
		TR-RMN		**TR-SLK**		**TR-SLN**					
		RCA	**lnRCA**	**RCA**	**lnRCA**	**RCA**	**lnRCA**				
easy to imitate science-based	1993	0,94	-0,06			0,47	-0,74				
	1998	1,54	0,43	0,67	-0,40	0,65	-0,43				
	2003	1,22	0,20	0,99	-0,01	0,55	-0,60				
	2008	0,71	-0,35	0,23	-1,48	0,36	-1,03				
	2012	0,61	-0,50	0,26	-1,36	0,34	-1,08				
	mean	**0,97**	**-0,03**	**0,51**	**-0,67**	**0,48**	**-0,74**				
hard to imitate science-based	1993	0,46	-0,77			0,31	-1,16				
	1998	0,65	-0,43	0,49	-0,71	0,39	-0,95				
	2003	0,71	-0,35	0,65	-0,43	0,45	-0,79				
	2008	0,58	-0,54	0,85	-0,16	0,56	-0,58				
	2012	0,58	-0,55	0,83	-0,18	0,54	-0,62				
	mean	**0,64**	**-0,45**	**0,65**	**-0,43**	**0,45**	**-0,80**				

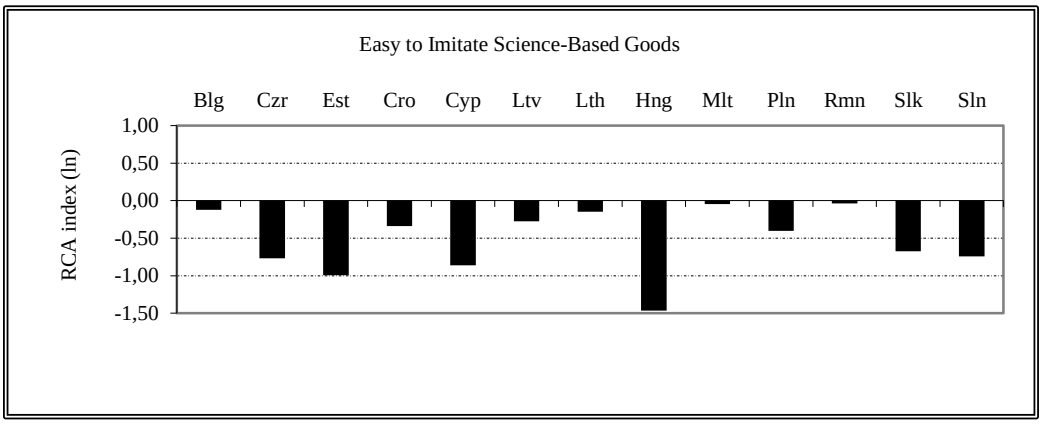
Source: It is prepared by us by using COMTRADE data.

The results for easy to imitate science-based goods can be expressed as follows:

- The index of comparative export performance (CEP) refers that Turkey has a comparative disadvantage against all of the EU+13 countries in the export of easy to imitate science-based goods.
- Turkey's disadvantage against Hungary, Estonia, Cyprus, Czech Republic and Slovenia is less compared to the others.
- Turkey's disadvantage against Bulgaria, Malta, Lithuania and Romania is more compared to the others.

- The results related to the easy to imitate science-based indicate that Turkey can not compete against its rivals.

Figure 3: The Index of Comparative Export Performance (Turkey against the EU+13) in Easy to Imitate Science-Based Goods (Average Value)

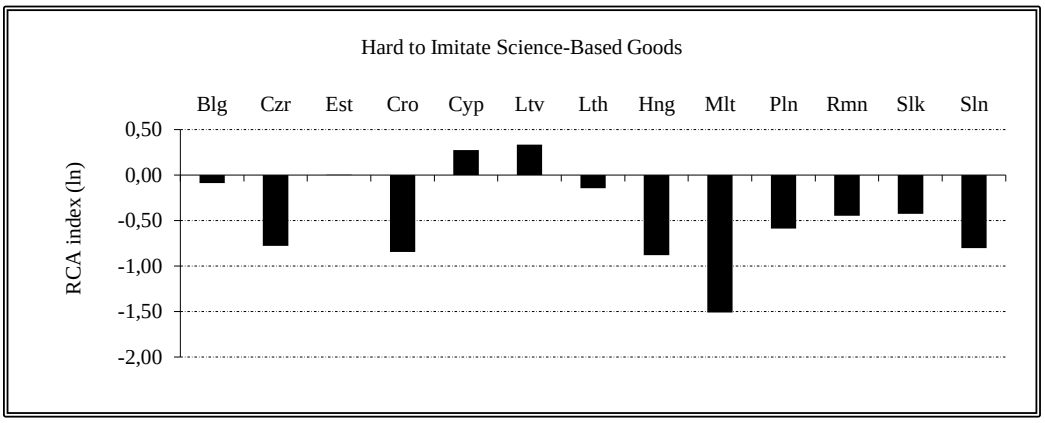


Source: It is prepared by us by using COMTRADE data.

The results for hard to imitate science-based goods can be expressed as follows:

- The index of comparative export performance (CEP) refers that Turkey has competitive disadvantage against most of the EU+13 countries in the export of hard to imitate science-based goods. It is clear that the CEP index as to these commodity groups are more encouraging.
- Turkey has competitive advantage against Estonia, Cyprus and Latvia.

Figure 4: The Index of Comparative Export Performance (Turkey against the EU+13) in Hard to Imitate Science-Based Goods (Average Value)



Source: It is prepared by us by using COMTRADE data.

When the overall evaluation, in conclusion, compared with the EU+13 countries, Turkey has essential disadvantage in the export of science-based goods. However, the CEP indices show that disadvantage condition has been decreasing year by year.

Conclusion

In the article, it is aimed to assess Turkey's competitive position against the EU+13 countries as well as in the global markets on the basis of the export of scientific goods with high value-added. The study as a whole indicates that the structure of competitiveness in the export of science-based (easy to imitate science-based and hard to imitate science-based) goods in Turkey and EU+13 countries is generally similar. Because, the countries concerned has not competitive advantage in the export of science-based goods in general. However, Turkey's competitiveness is weaker than the EU+13 countries. A number of EU+13 countries have managed to change the factor intensity in their exports. Now, the countries in question has become superior in the export of these goods. Turkey has still competitive disadvantage and Turkey's export competitiveness in the science-based goods is quite weak in international markets.

Turkey's export structure is dominated by low value-add products, as opposed to research-oriented products. Therewith, the terms of trade deteriorates and the foreign trade and current account deficit problem arises and in Turkey. This is also emerging as an unfavorable condition for Turkey in the EU accession process.

The indices of ITO, RCA, RSCA, lnRCA state that the trade openness and export competitiveness of the EU+13 countries have been increasing after accession to the EU. This result makes it inevitable for Turkey to the EU. When joins the EU, it is likely that Turkey's export competitiveness will increase.

In Turkey, small percentage of the manufacturing industrial products exported based on high technology. The most important reason for this is the export of the products in the raw form without processing in general. As a result, Turkey's export competitiveness is low. To overcome this problem, Turkey need to increase the value-added in production and exports. For this, first of all, Turkey must improve the quality of human capital and upgrade the level of education.

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