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Comparison of High-Tech Industries in Newly Industrialized Countries

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ABSTRACT

The aim of this study is to measure the competitiveness of Newly Industrialized Countries (NICs) in high-technology manufacturing industries. For this purpose, Ballassa's Revealed Comparative Advantage (BRCA) index, a static comparison, was first calculated. Subsequently, the dynamic comparison of the change in the Normalized Revealed Comparative Advantage (NRCA) index cross-country variation was calculated. The analysis revealed that India in "basic pharmaceutical products and pharmaceutical preparations"; the Philippines in "computer, electronics, and optical products"; and Brazil in " manufacturing of air and spacecraft and related machinery" had the highest competitiveness. It is concluded that Türkiye's overall competitive advantage is weak compared to other NICs. These conclusions are of significant importance for understanding the global competitiveness of high-technology industries in NICs and for guiding future policy decisions.

Keywords: Competition Power, High-Technology Industries, Ballassa's Revealed Comparative Advantage, Normalized Revealed Comparative Advantage, Cross-Country Variation

JEL Classification: F11, F14, F43

Yeni Sanayileşmiş Ülkelerdeki Yüksek Teknolojili Endüstrilerin Karşılaştırılması

ÖZ

Çalışmada Yeni Sanayileşmiş Ülkeler'in (NICs) yüksek teknolojili imalat endüstrilerindeki rekabet gücünün ölçülmesi amaçlanmıştır. Rekabet gücünü ölçmek için hem statik bir bakış açısıyla hesaplayan Balassa'nın açıklanmış mukayeseli üstünlük (BRCA) endeksi hem de dinamik bir bakış açısıyla hesaplayan normalleştirilmiş açıklanmış karşılaştırmalı üstünlük endeksinin (NRCA) çapraz ülke karşılaştırmasına sahip varyasyonu kullanılmıştır. Analiz sonuçlarına göre temel eczacılık ürünleri ve eczacılığa ilişkin malzemelerde Hindistan; bilgisayar imalatı, elektronik ve optik ürünlerinde Filipinler; hava ve uzay araçları ve ilgili makinelerin imalatında Brezilya'nın en yüksek rekabet gücüne sahip olduğu bulunmuştur. Türkiye'nin diğer NICs'nin karşısında genel olarak rekabet üstünlüğünün zayıf olduğu sonucuna ulaşılmıştır. Bu sonuçlar, NICs'lerde yüksek teknoloji endüstrilerin küresel rekabet gücünü anlamak ve gelecekteki politika kararlarına rehberlik etmek açısında bir öneme sahiptir.

Anahtar Kelimeler: Rekabet Gücü, Yüksek Teknolojili Endüstriler, Balassa'nın Açıklanmış Karşılaştırmalı Üstünlük İndeksi, Normalleştirilmiş Açıklanmış Karşılaştırmalı Üstünlük İndeksi, Çapraz Ülke Varyasyonu

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1. INTRODUCTION

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With globalization, technology, and international trade have become important strategic elements for countries in terms of growth and competition. With economic and technological developments, new goods and service opportunities have emerged, resulting in significant competition between nations. Technological developments and the removal of trade barriers, the flow of goods and services between all countries has accelerated, and the world has become a single market as if there were no geographical borders. Countries have experienced great competition to get a larger share of this market and have had the opportunity to reach the desired level of foreign trade by adapting to the changing conditions in an increasingly competitive environment. Technology and foreign trade have become strategic goals for competing with other countries and obtaining a share of the international market (Gültekin, 2011: 30).

Technology, seen as a factor that shapes the production process through its contribution to the efficiency of labor and capital, is also an important determinant of international competitiveness. Technology, defined in the economic literature as transforming inputs into outputs, is the transfer of scientific knowledge to the production process; it can be considered as the whole of knowledge, organization, and techniques (Jones, 2001: 73).

The entire set of techniques available to the firm refers to the firm's technology in a narrow sense. In contrast, technology broadly covers the different methods of combining inputs and organizational processes. Industry or country-level technology combines firm-specific technology sets (Gomulka, 1990: 6). Any firm's technology set expands through the inter-firm diffusion of technological knowledge. The same interpretation is valid for national and world economies (Bayraktutan and Bıdırdı, 2016: 4). R&D activities dissemination of technological advances through publications, technical partnerships, observation and learning processes, personnel flows, and technological abilities acquired through learning by doing and using; technological development occurs through the acquisition of innovation developed by other industries or countries and contained in capital or intermediate goods (Dosi, 1988: 1125). The acquisition and dissemination of knowledge or technology are essential for economic development. Adopting new techniques, machines, and production processes is the primary determinant of increased productivity and competitiveness. While high-income countries carry out most R&D and innovation, Newly Industrializing Countries (NICs) depend heavily on imported technologies. This does not mean no R&D or technological development in the NICs. By following and adapting innovations, technology acquisition has become essential in NICs.

The international spread of technology can occur through three channels (Hoekman and Javorcik, 2006: 1-7). The first channel is the form of global trade in goods and services. Trade as a whole carries the potential to transfer technological knowledge. Imported capital goods and technological inputs can be used to increase efficiency in the production process. In addition, actors who share product design and production techniques can also improve their technologies by exporting them to innovators. Trade can provide domestic producers access to new technologies in imported machinery and equipment or contribute to international technology diffusion by offering opportunities for reverse engineering products developed abroad. Trade can also create export opportunities and incentives for technology acquisition and development. The second channel is foreign direct investment (FDI) or joint ventures seeking project specificity. FDIs often transfer technological knowledge to subsidiaries, which directly affects their productivity. Investments by multinational or transnational corporations (MNCs) may allow NICs to access more efficient and effective technologies. Since the knowledge produced is not limited to partner firms or businesses, FDI can lead to technological spillovers that operate through various channels (Hoekman and Javorcik, 2006: 6). The third channel of technology diffusion is the direct exchange of knowledge through technology purchase or licensing. This exchange can occur within firms, joint ventures, or unrelated firms. Licensing and FDI are channels that can be used interchangeably but can also be complementary. Since technology level/capacity and development ability are not simultaneous and equivalent in every country or

sector, new products or production methods are subject to transfer between countries and sectors. In addition to patent/copyrights and license agreements, imitation acts as a channel for acquiring technology, and new technologies can lead to unpredictable spread and spillovers within or between sectors (Bayraktutan and Bıdırdı, 2016: 7).

Competitiveness reflects the capabilities needed for sustainable economic growth in an international competitive environment involving different countries/regions/companies (Cantwell, 2005: 544). National competitiveness concerns how international trade changes over time to reflect changing capabilities and competitive advantage. This can also be considered a transformation in countries' comparative advantage.

A distinction can also be made between price and technology-based competitiveness for international competitiveness (Aiginger, 1997: 575). While technology-based competitiveness is the ability to compete in high-technology fields, innovate, and exist in the most developed market segments, price-based competitiveness is the ability to produce at low costs, especially in mature and homogeneous markets/products. With non-price technological competitiveness, innovation, and new value-creation channels/methods, increased prosperity is achieved through higher average prices as an indicator of higher quality (Cantwell, 2005: 546).

It is possible to talk about a new high-technology neo-mercantilism in which science and technology have become essential tools in industrialized countries and many newly industrializing countries. In an economic environment where country resources and strategic mergers between companies are made and where R&D efforts, knowledge, and qualified human capital needs spread to more countries/companies over time, competition is now based on new, unorthodox tools (Yentürk, 1991: 249).

Competitiveness and R&D activities are interconnected elements. It is tough to increase competition without increasing investments. Many studies indicate that R&D activities are among the most important determinants of national, company, and industrial competitiveness.

The "Technological Divide Hypothesis" put forward by Posner (1961) attributed the reason for foreign trade between developed industrial countries to new products and production methods developed by innovative companies. According to this theory, because innovations are protected by laws such as patents and intellectual property rights, developed industrial countries that find new products or production methods become the first exporters of such goods. However, with the abolition of laws and the acquisition of goods through imitation or free trade, countries with relatively cheap labor or natural resources can produce the goods in question much more affordable. Thus, innovative and first-exporting countries gradually become importers. According to the "The Product Cycle Hypothesis" proposed by Vernon (1966), a developed version of the Technological Gap Hypothesis, some countries specialize in existing goods, and some specialize in new goods. In other words, it concerns the shift from an inventive country to an imitator country. This process, explained by the life cycles of the product, on the one hand, describes the uninterrupted emergence of innovations and, on the other hand, bases the reason for international trade on the technology developed by a qualified workforce and R&D expenditures. The quality of the workforce, through the production and use of technology, is essential for competitiveness. Keesing (1965) and Kenen (1965) attributed foreign trade to differences in workforce qualifications. According to this approach, countries rich in certain types of professional and skilled labor will have a competitive advantage and export ability in goods whose production depends mainly on these factors. According to these theories and explanations, countries and businesses that design future technologies, create technology strategies, carry out R&D, and attach importance to technology development will obtain a competitive advantage in international markets. The basis of this advantage is the link between technological innovation and international competitiveness. These connections can be explained in three ways: Process innovations increase competitiveness by reducing production and output

costs. Second, secondary product innovations improve the quality of goods, making them more attractive in domestic and international markets. Third, product innovations provide monopoly profits by creating a monopolistic situation that will help these products hold on to the market for a limited period (Archibugi and Michie, 1998: 10-11). Technological innovation positively affects the foreign trade balance by reducing the innovative country's import requirement and foreign exchange expenses in the short term. In contrast, in the long term, it provides an opportunity to improve foreign trade conditions and specialization in sectors that offer high returns. In other words, high-technology production gives countries high competitiveness in the international markets. Therefore, countries are racing to increase their market share and profitability by focusing on R&D expenditures and technological developments to gain a solid competitive advantage in international markets.

In this context, this study aims to produce policies by measuring the international competitiveness of NICs in their high-technology industries, which are trying to follow and adapt innovations and gain global competitiveness. This study aimed to determine the competitiveness levels in the New Industrialized Countries (NICs), including Türkiye, in high-technology industries for the period 1996-2020. When looking at the literature, it can be seen that there is no joint decision regarding newly industrialized countries because there are different perspectives. In this study, Brazil, China, Indonesia, Philippines, South Africa, India, Malaysia, Mexico, Thailand, and Türkiye were considered as the countries evaluated within the scope of NICs by "world data." In this context, static competitiveness was first measured with Ballassa's Revealed Comparative Advantage (BRCA), and then cross-country comparison, a variation of the Normalized Revealed Comparative Advantage (NRCA) index, was included. The first part of the study explains the importance of high technology. In the second part, a literature review of the subject is presented. In the third part, after explaining the method and data set, findings were obtained by measuring the competitiveness of NICs in high-technology industries, and the study was completed in the conclusion part.

2. LITERATURE REVIEW

Due to the importance of competitive advantage for countries, many studies have been conducted in the literature have been conducted to measure competitiveness. However, many sectors, different countries, and periods were considered in the studies. Additionally, the indices used were varied.

Amighini (2005) investigated the competitiveness of information and communication sectors in China from 1991-2001. The RCA index was calculated using the SITC 5-digit product classification. The results revealed a comparative advantage in labor-intensive sectors, a disadvantage in technology-intensive sectors, and increased competitiveness in some industries.

Kaya (2006) analyzed Türkiye's competitiveness among EU-15, EU-10, and candidate countries in manufacturing industry exports from 1991 to 2003 using the RCA index. As a result, it was determined that both EU markets specialize in similar manufacturing industry sub-product groups, especially in labor-intensive products that do not require much technology.

Vergil and Yıldırım (2006) examined Türkiye's competitive power in the EU. The RCA index was obtained from 1993 to 2002, and panel data analysis was performed. The results show that the Customs Union positively affected Türkiye's competitive power in high-technology and research-intensive goods that are difficult to imitate. In contrast, it negative affected its competitive power in capital-intensive and intermediate-technology goods. It has also been shown that the Customs Union relationship supports the catch-up paradigm with its competitive power in high-technology and research-intensive goods that are difficult to imitate. In contrast, it

supports the polarization theory with its competitive power in capital-intensive and intermediate technology goods.

Kösekahyaoğlu and Özdamar (2009) examined the competitiveness of the manufacturing industry in Türkiye and EU countries for the period 1991-2005. The Balassa and Donges methods were used and evaluated using a regression analysis. The results showed that while Türkiye had an advantage over EU countries in the SITC 6 and SITC 8 groups, it was a disadvantage in other products. It has also been concluded that wages and domestic market size are determinants of Türkiye's competitiveness in labor and technology-intensive sectors.

Şimşek and Sadat (2009) analyzed Türkiye's competitive power in the Economic Cooperation Organization market. The competitiveness in raw material and labor intensive sectors was analyzed between 1997 and 2005. Balassa and Vollrath indices were used in the study. The results show that Türkiye has an advantage in labor-intensive industries and a disadvantage in raw material-intensive sectors.

Şimşek et al. (2010) examined Türkiye's competitiveness against the EU regarding technology classification. Different trade measures were used in the study for 1993-2008. As a result, it was revealed that Türkiye had an advantage in raw material and labor-intensive goods. It was seen that Türkiye was at a disadvantage in R&D-intensive goods, while it had a relative advantage in capital-intensive goods.

Eşiyok (2014) analyzed the competitive power and intra-industry trade between Türkiye and the EU according to technology intensity. Balassa index was calculated for the period 2008-2013. The study revealed that Türkiye's competitive power in high-technology sectors is low, and intra-industry trade is based on low and medium-high technology. The study also showed that Türkiye maintains a competitive advantage in certain product groups, but this advantage is gradually decreasing.

Özdamar (2014) examined the structure and competitiveness of Türkiye's EU trade by separating the manufacturing industry according to its technology intensity. The analysis was carried out for the period 1996-2012 with the help of various indices. The results show that Türkiye's EU exports are at the medium-low technology level, and its imports are at the medium-high technology level. Also, it has a disadvantage in high-technology and medium-high-technology industries, high competitive power in low-technology industries, and borderline competitive power in medium-low-technology industries. It is found that intra-industry trade between Türkiye and the EU has increased, except in low-technology industries, and that sectors other than high-technology industries have returned to the intra-industry structure since 2002.

Ünlü (2018) analyzed the competitiveness of Türkiye and BRICS countries according to the technology intensity of the manufacturing industry. The RCA index was calculated for the period 1996-2017. The study concluded that Türkiye's competitive power is high in low and medium-technology goods and that China is the country with the highest competitive power in high-technology goods.

Çelik (2019) examined the competitiveness of export structures between Turkey and BRICS countries in terms of factor density for the period 1995-2017 using the RCA index. The study revealed that while India, China, and Türkiye have a competitive advantage in labor-intensive goods, the comparative advantage of labor-intensive goods has decreased over the years. It has been determined that Brazil, Russia, and Türkiye have a weak comparative advantage in the production and export of capital-intensive goods, Russia has a solid competitive advantage in raw material-intensive goods, and Brazil and South Africa have a moderate advantage. Finally, the competition between R&D-based goods, which are easy and difficult to imitate, is relatively low in the BRICS and Turkish economies.

Başkol and Bektas (2020) examined the competitiveness of the Turkish manufacturing industry according to its technological structure by calculating the RCA index for the period 2000-2018. The results show that 50 out of 112 sectors had a comparative advantage. It was determined that 32 industries were in the low-technology sectors, 17 in the medium-technology sectors, and 1 in the high-technology sectors.

Dumrul and Kılıçarslan (2022) examined the competitiveness of 12 service sub-sectors in BRICS countries by calculating the RCA index for the period 2016-2020. As a result of the study, it was determined that the competitiveness of BRICS countries was high in construction services, telecommunications, computer and information services, and other commercial services.

Demir and Önder (2023) examined the competitiveness of Albania, Serbia, Montenegro, North Macedonia, and Türkiye in the textile sector for the period 2010-2020 with the help of the RCA index. As a result of the study, it was determined that Albania had high competitiveness in 6, Serbia in 7, North Macedonia in 9, and Turkey in 18 product groups in 24 textile product groups.

Since the emergence of RCA and its derivative indices, which allow the measurement of competitiveness, a vast body of literature on competitiveness has emerged in Türkiye and other countries. In the studies conducted, the competitiveness of various countries or country groups in terms of sectors or product groups was measured using various index methods for multiple periods.

3. MEASURING NORMALIZED COMPETITIVENESS

The following section explains the method and dataset used to measure the competitiveness of Newly Industrialized Countries. The findings of the analysis are shared after the explanations.

3.1. Method and Dataset

There are many types of indexes in the literature in terms of measuring competitiveness. The most commonly used approach is the Revealed Index of Comparative Advantage (BRCA). The BRCA (Balassa's Revealed Comparative Advantage) approach was first put forward by Liesner but was developed and popularized by Balassa (1965). Balassa focused on exports rather than imports because it is challenging to determine countries' and products' price and non-price factors when measuring comparative advantages. This situation was explained by the fact that if the same tariff were applied to all exporters, relative export performance would not deteriorate (Balassa, 1965: 104). Most studies on the BRCA index are considered from a static perspective. The dynamic RCA index was developed by Edwards and Schoer (2002) to analyze changes in comparative advantage over time. This index, which the authors developed, analyzes the relative change of the BRCA index. Yu et al. (2009) developed the Normalized Revealed Comparative Advantage (NRCA) index, which allows BRCA to compare goods, countries, and time. NRCA ensures comparability across goods, countries, and time dimensions by normalizing the deviation of a country's real exports from its neutral level with a space-invariant scale variable, E (Yu et al., 2009: 274). Cross-commodity comparisons of NRCA values show the relative level of specialization a country has in two commodities. Temporal comparisons show the change in the actual export level of a country in a single commodity. Cross-country comparison compares the relative performance of two countries on a commodity. It can calculate which country among the two countries has a comparative advantage over the other country for a commodity or group of commodities.

The NRCA index is derived from the fundamental index, the BRCA index. Detailed information about the BRCA index is available in the study of Demir et al. (Demir et al., 2024: 252-253).

In neutral comparative advantage, the country's exports of good j are symbolized as $\hat{E}_j^i$ and equivalent to $E^i\mathrm{E_j} \;/\; E$. The country's main export of good j to the world is E_j^i, which is usually dissimilar from $\hat{E}_j^i$. It is possible to express this difference as follows (Demir, 2022: 910):

$$\Delta E_j^i \equiv E_j^i - \hat{E}_j^i = E_j^i - (E^i\mathrm{E_j}) \;/\; \mathrm{E} \quad (1)$$

It was normalized by dividing ΔE_j^i by E, and the NRCA index was obtained as follows:

$$NRCA_j^i \equiv \Delta E_j^i / \mathrm{E} \;= E_j^i / \mathrm{E} - \mathrm{E_j} E^i \;/\; \mathrm{EE} \quad (2)$$

Comparison of a single good between countries is formulated as follows;

$$\Delta NRCA_j^{1-2} \equiv NRCA_j^1 - NRCA_j^2 = \frac{E_j}{E}\left[\left(\frac{E_j^1}{E_j} - \frac{E_1}{E}\right) - \left(\frac{E_j^2}{E_j} - \frac{E_2}{E}\right)\right] \quad (3)$$

According to the score obtained from the formula, if $\Delta NRCA_j^{1-2} > 0$, taking into account the average export performance, the relative export performance of country 1 in good j is calculated as $\left(\frac{E_j^1}{E_j} - \frac{E_1}{E}\right)$ means that country 2's relative export performance in good j is more robust than. $In\ contrast$, $\Delta NRCA_j^{1-2} < 0$, taking into account the average export performance, means that the relative export performance of country 1 in good j is weaker than that of country 2 in good j. In the first case, country 1 has a more vital comparative advantage in good j than country 2, while in the second case, it has a weaker comparative advantage (Yu et al., 2009: 274-275).

This study includes the period 1996-2020. Owing to the lack of data after 2020, it could not be included in the analysis. For the BRCA index, the years 1996-2020 were taken into account, and for the NRCA index used for cross-country comparison, the last five years, 2015-2020, were taken into account instead of the entire analysis period because of the redundancy of calculations and the fact that there would be too many tables in the study. According to technology intensity, manufacturing industry products have complied with NACE Rev 2 3 prepared by Eurostat, considering the ISIC Rev 4 classification. Since it is evaluated in terms of high-technology industries, "Manufacture of basic pharmaceutical products and pharmaceutical preparations," "Manufacture of computers, electronic, and optical products," and "Manufacture of air and space and related machines" are discussed. Import and export data of high-technology industries were obtained from the OECD database. On the other hand, total export and import data were obtained from the World Bank database.

3.2. Empirical Results

In this section, firstly the BRCA index for NICs was calculated and then the cross-country NRCA index was calculated. Table 1 presents the BRCA indices of the competitiveness of NICs in the high-technology manufacturing industry as the average for the 1996-2020 period.

Table 1: Competitiveness of Newly Industrialized Countries BRCA (1996-2020 Average)

	Basic pharmaceutical products and pharmaceutical preparations		**Computer, electronic, and optical products**		**Air and spacecraft and related machinery**	
	Index Value	Ranking	Index Value	Ranking	Index Value	Ranking
Brazil	4,71	4	0,61	7	32,84	1
China	7,74	2	8,15	3	2,35	9
India	24,54	1	0,41	10	4,94	8
Indonesia	1,84	8	1,94	6	1,10	10
Malaysia	1,09	9	12,82	2	8,79	2
Mexico	5,70	3	6,23	5	5,41	6
Philippines	0,82	10	15,83	1	5,17	7
South Africa	2,93	6	0,44	9	6,65	5
Thailand	1,87	7	6,34	4	8,53	3
Türkiye	3,57	5	0,58	8	6,85	4

Source: Arranged and calculated by us using the OECD database.

The country with the highest advantage in the "manufacture of basic pharmaceutical products and pharmaceutical preparations" was India, whereas the country with the lowest advantage was the Philippines. While the country with the highest advantage in "manufacture of computer, electronic, and optical products" was the Philippines, the countries with the lowest were India, South Africa, Türkiye, and Brazil. The country with the highest advantage in "manufacture of air and space and related machinery" was Brazil, while the country with the lowest advantage was Indonesia.

Table 2 includes a cross-country comparison of basic pharmaceutical products and preparations, one of the high-technology industries, for 2015-2020. Although cross-country comparisons can be made for all countries included in the analysis, Türkiye was compared with other NICs according to the study's primary purpose.

Table 2: Cross-Country Comparison Results (Basic pharmaceutical products and pharmaceutical preparations)

$\Delta NRCA_j^{TÜRKİYE-COUNTRY2}$	2015	2016	2017	2018	2019	2020
$\Delta NRCA_j^{TÜRKİYE-BRAZIL}$	-8,586414	-9,153315	-8,097676	0,000008	0,000012	0,000036
$\Delta NRCA_j^{TÜRKİYE-CHINA}$	-0,000423	-0,000450	-0,000465	-0,000491	-0,000481	-0,000659
$\Delta NRCA_j^{TÜRKİYE-INDIA}$	-0,000587	-0,000624	-0,000560	-0,000557	-0,000646	-0,000785
$\Delta NRCA_j^{TÜRKİYE-INDONESIA}$	0,000020	0,000016	0,000016	0,000027	0,000031	0,000050
$\Delta NRCA_j^{TÜRKİYE-MALAYSIA}$	0,000036	0,000030	0,000027	0,000036	0,000038	0,000060
$\Delta NRCA_j^{TÜRKİYE-MEXICO}$	-0,000025	-0,000014	-1,001861	6,613501	0,000014	0,000039
$\Delta NRCA_j^{TÜRKİYE-PHILIPPINES}$	0,000040	0,000034	0,000033	0,000042	0,000046	0,000067
$\Delta NRCA_j^{TÜRKİYE-SOUTH AFRICA}$	0,000023	0,000017	0,000015	0,000026	0,000030	0,000051
$\Delta NRCA_j^{TÜRKİYE-THAILAND}$	0,000030	0,000025	0,000022	0,000030	0,000033	0,000056

Source: Arranged and calculated by us using the OECD database.

Both negative and positive results were obtained when cross-country results for basic pharmaceutical products and pharmaceutical preparations were examined. Although Türkiye did not have a competitive advantage over Brazil until 2017, it has become a competitive advantage, albeit weak, since 2018. It can be seen that the competitive advantage over China and India in all years was opposing, albeit very weak. There is a possibility that Türkiye can turn its negative outlook into a positive one if it adopts a favorable policy towards these countries in the relevant sector. It has achieved a positive, albeit weak, competitive advantage over Indonesia, Malaysia, the Philippines, South Africa, and Thailand. Türkiye must take more decisive steps to prevent it from losing its superiority to these countries. As this advantage is weak, it can be lost at any time. Although Türkiye's competitive advantage over Mexico was fragile during 2015-2016, its opposing competitive advantage (disadvantage) increased further in 2017. However, its competitive advantage became very high in 2018, and it maintained its competitive advantage, albeit weakly, in 2019-2020.

Table 3 includes a cross-country comparison between 2015 and 2020 for computer, electronic, and optical products among high-technology industries.

Table 3: Cross Country Comparison Results (Computer, electronic and optical products)

$\Delta NRCA_j^{TÜRKİYE-COUNTRY2}$	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
$\Delta NRCA_j^{TÜRKİYE-BRAZIL}$	0,000122	0,000105	0,000113	0,000104	0,000067	0,000122
$\Delta NRCA_j^{TÜRKİYE-CHINA}$	-0,027270	-0,025575	-0,025341	-0,025473	-0,025118	-0,028770
$\Delta NRCA_j^{TÜRKİYE-INDIA}$	0,000378	0,000385	0,000403	0,000347	0,000219	0,000359
$\Delta NRCA_j^{TÜRKİYE-INDONESIA}$	-0,000206	-0,000194	-0,000177	-0,000176	-0,000202	-0,000235
$\Delta NRCA_j^{TÜRKİYE-MALAYSIA}$	-0,002999	-0,002975	-0,003143	-0,003499	-0,003408	-0,003977
$\Delta NRCA_j^{TÜRKİYE-MEXICO}$	-0,002858	-0,002841	-0,002825	-0,002672	-0,002716	-0,002839
$\Delta NRCA_j^{TÜRKİYE-PHILIPPINES}$	-0,001398	-0,001418	-0,001281	-0,001230	-0,001611	-0,001733
$\Delta NRCA_j^{TÜRKİYE-SOUTH AFRICA}$	-0,000158	-0,000154	-0,000148	-0,000151	-0,000172	-0,000183
$\Delta NRCA_j^{TÜRKİYE-THAILAND}$	-0,001613	-0,001568	-0,001605	-0,001498	-0,001293	-0,001625

Source: We arranged and calculated it using the OECD database.

Negative and positive results were obtained when the cross-country results of computers, electronics, and optical products were examined. It has been observed that Türkiye has a positive, albeit weak, competitive advantage over India and Brazil. On the other hand, it has been concluded that Türkiye has a negative, albeit weak, competitive advantage over China, Indonesia, Malaysia, Mexico, the Philippines, South Africa, and Thailand.

Table 4 includes a cross-country comparison between 2015 and 2020 for air, space, and related machines, which are high-technology industries.

Table 4: Cross-Country Comparison Results (Air and spacecraft and related machinery)

$\Delta NRCA_j^{TÜRKİYE-COUNTRY2}$	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
$\Delta NRCA_j^{TÜRKİYE-BRAZIL}$	-0,000254	-0,000294	-0,000225	-0,000233	-0,000161	-0,000081
$\Delta NRCA_j^{TÜRKİYE-CHINA}$	-0,000140	-0,000152	-0,000109	-0,000130	-0,000111	-0,000046
$\Delta NRCA_j^{TÜRKİYE-INDIA}$	-0,000143	-0,000123	-0,000095	-0,000154	-0,000117	-0,000114

$\Delta NRCA_j^{TÜRKİYE-INDONESIA}$	0,000039	0,000043	0,000080	0,000050	0,000063	0,000053
$\Delta NRCA_j^{TÜRKİYE-MALAYSIA}$	-6,621891	-0,000016	8,588853	-0,000034	-0,000028	-0,000049
$\Delta NRCA_j^{TÜRKİYE-MEXICO}$	-0,000033	-0,000045	-0,000016	-0,000047	-0,000055	-0,000021
$\Delta NRCA_j^{TÜRKİYE-PHILIPPINES}$	0,000016	9,738462	0,000051	0,000013	0,000034	0,000031
$\Delta NRCA_j^{TÜRKİYE-SOUTH AFRICA}$	0,000010	0,000017	0,000061	0,000037	0,000047	0,000039
$\Delta NRCA_j^{TÜRKİYE-THAILAND}$	1,203502	-0,000020	-4,150482	-0,000037	0,000011	-0,000100

Source: We arranged and calculated it using the OECD database.

Negative and positive results were obtained when cross-country results for air, space, and related machines were examined. Türkiye's negative competitive power over Brazil, China, India, and Mexico is weak. It has a positive (albeit weak) competitive advantage over Indonesia and South Africa. It was concluded that the positive advantages over Thailand were very high in 2015. While Türkiye's opposing competitive advantage (disadvantage) over Malaysia was very high in 2015, this situation developed in Türkiye's favor in 2016. In 2017, Türkiye reached positive competitiveness with an index value that could be considered high. However, this situation was unsustainable, and Türkiye's competitive advantage weakened again from 2018-2020. Although the positive competitive advantage against the Philippines increased to a high level in 2016, it remained weak in other years.

Table 5 shows the cross-country comparison averages of the high-technology industries between 2015 and 2020. The calculation was performed by taking the average of "basic pharmaceutical products and pharmaceutical preparation," "computer, electronic, and optical products," and "air and space and related machinery."

Table 5: Cross-Country Comparison Results (High-Technology Average)

$\Delta NRCA_j^{TÜRKİYE-COUNTRY2}$	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
$\Delta NRCA_j^{TÜRKİYE-BREZİLYA}$	-2,862182	-3,051168	-2,699263	-0,000041	-0,000027	0,000026
$\Delta NRCA_j^{TÜRKİYE-ÇİN}$	-0,009278	-0,008726	-0,008638	-0,008698	-0,008570	-0,009825
$\Delta NRCA_j^{TÜRKİYE-HİNDİSTAN}$	-0,000117	-0,000121	-0,000084	-0,000121	-0,000182	-0,000180
$\Delta NRCA_j^{TÜRKİYE-ENDONEZYA}$	-0,000049	-0,000045	-0,000027	-0,000033	-0,000036	-0,000044

$\Delta NRCA_j^{TÜRKİYE-MALEZYA}$	-2,208285	-0,000987	2,861912	-0,001166	-0,001133	-0,001322
$\Delta NRCA_j^{TÜRKİYE-MEKSİKA}$	-0,000972	-0,000967	-0,334901	2,203594	-0,000919	-0,000940
$\Delta NRCA_j^{TÜRKİYE-FİLİPİNLER}$	-0,000447	3,245693	-0,000399	-0,000392	-0,000510	-0,000545
$\Delta NRCA_j^{TÜRKİYE-GÜNEYAFRİKA}$	-0,000042	-0,000040	-0,000024	-0,000029	-0,000032	-0,000031
$\Delta NRCA_j^{TÜRKİYE-TAYLAND}$	0,400640	-0,000521	-1,384022	-0,000502	-0,000416	-0,000556

Source: Arranged and calculated by us using the OECD database.

According to the results above, it has been seen that Türkiye has a positive, albeit weak, competitive advantage (advantageous) against other NICs in high-technology manufacturing, only against Thailand in 2015 and against Brazil in 2020. It was concluded that the positive advantages over the Philippines in 2016, Malaysia in 2017, and Mexico in 2018 were very high. In 2019, Türkiye had a weak, opposing competitive advantage in all the countries.

4. CONCLUSION

With globalization and liberalization of foreign trade, international trade has become an essential element for countries in terms of growth and competition. With economic and technological development, new goods and service opportunities have emerged, creating a competitive environment between countries. With the removal of trade barriers, the flow of goods and services between countries has accelerated, and the world has become a single market. Countries have entered great competition to get a larger market share, and the notion of competitiveness has come to the fore.

In this context, the study first calculated the competitiveness of Newly Industrialized Countries and the BRCA index of high-technology manufacturing industries. In the analysis for the period 1996-2020, it was seen that the high-technology sector in which Türkiye has the highest advantage is "air and space and related machines." In recent years, competition has increased in the "manufacturing of air and space and related machinery." The NICs with the highest advantage in relevant sector was Brazil, whereas Indonesia had the lowest advantage. It has been observed that the high-technology industry in which Türkiye has the lowest advantage is "computer, electronic, and optical products manufacturing." The NICs with the highest advantage in the relevant sector was the Philippines, whereas India had the lowest advantage.

After finding the BRCA index values, the NRCA index, used in cross-country comparisons for the three high-technology industries, was calculated by considering 2015-2020. According to cross-country results, Türkiye's "basic pharmaceutical products and pharmaceutical preparations" are ahead of Indonesia, Malaysia, Philippines, South Africa, and Thailand; it has been found that it has achieved a positive, albeit weak, competitive advantage over Brazil and India in "computer, electronics and optical products". It has been found that it has achieved a positive, albeit weak, competitive advantage over Indonesia and South Africa in the "manufacturing of air and space and related machinery." Looking at the high-technology average, we conclude that Türkiye's overall competitive advantage against other NICs is weak

with a negative outlook. The weak negative index value in question provides information that can be eliminated by the policies Türkiye will follow against other NICs in these sectors.

On the other hand, if policy generalization is made, it can be said that newly industrialized countries should be able to make a sustainable benefaction to economic growth in the long term. In particular, increasing competitiveness and gaining a significant market share will significantly contribute to economic growth. For this purpose, it is necessary to closely follow technological developments, prioritize R&D studies, and develop high-technology industries. In the manufacturing industry, instead of low-technology production, it is essential to use technology-based methods to increase quality and produce products with high added value. In addition, conducting infrastructure work for production processes and attracting foreign investors to the country will help improve the production of high-technology products. Türkiye should reduce its import dependency, especially by producing its products. The decrease in dependency on imports will have a positive impact on both competitiveness and foreign trade deficit.

Statement of Research and Publication Ethics

This study has been prepared in accordance with the rules of scientific research and publication ethics.

Contribution Rates of Authors to the Article

Gökçe Demir contributed 50% to the article and Üzeyir Aydın contributed 50% to the article.

Declaration of Interest

There is no conflict of interest for the authors or third parties arising from the study.

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