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Comparative And Dynamic Analysis of Türkiye's Competitiveness in Unmanned Aerial Vehicles[1]

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İnsansız Hava Araçlarında Türkiye'nin Rekabet Gücünün Karşılaştırmalı ve Dinamik Analizi[2]

Abstract

The study aims to determine the competitiveness of Türkiye's UAV exports in a dynamic framework. The analysis used data from the first 20 countries with the largest share in the production and trade of products designated as UAVs by the Harmonic System six-digit and by the European Commission for 2012-2021. Within the scope of the study, it is determined that some countries have high competitiveness in 4 product groups examined with five different foreign trade indexes. It is concluded that Türkiye has strategic and dynamic superiority in two of the four product groups.

Keywords : UAV, International Trade, International Economics, Revealed Comparative Advantage Indices, NRCA.

JEL Classification Codes : F00, F01, F14.

Öz

Çalışmanın amacı; Türkiye'nin İHA ihracatının rekabet gücünü dinamik bir çerçevede belirlemektir. Analizde, 2012-2021 dönemi, Harmonik sistem altı hane ve Avrupa Komisyonu tarafından İHA olarak belirlenen ürünlerin üretimi ve ticaretinde en büyük paya sahip ilk 20 ülkenin verileri kullanılmıştır. Çalışma kapsamında 5 farklı dış ticaret endeksiyle incelenmiş olan 4 ürün grubunda bazı ülkelerin rekabet güçlerinin yüksek olduğu belirlenmiştir. Türkiye'nin ise dört ürün grubunun ikisinde stratejik ve dinamik üstünlüğe sahip olduğu sonucuna varılmıştır.

Anahtar Sözcükler : İHA, Uluslararası Ticaret, Uluslararası İktisat, Açıklanmış Karşılaştırmalı Üstünlük Endeksleri, NRCA.

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1. Introduction

Unmanned Aerial Vehicles (UAVs) are vehicles that do not have a pilot, can be controlled remotely, or can fly autonomously on a determined route (Kurt & Ün, 2015). They can also be aircraft that do not have a pilot, can carry different equipment depending on the purpose of use, are managed in a specific management centre, or can move spontaneously on a predetermined route (Akkamış & Çalışkan, 2020).

UAVs were initially designed to serve military purposes. However, especially in recent years, they have begun to be widely used for civilian purposes. For military purposes, UAVs are used for reconnaissance, surveillance, tracking, border and coastal security, and offensive purposes. For civil purposes; they are used for many purposes, such as; remote sensing applications in agriculture (Akkamış & Çalışkan, 2020; Türkseven et al., 2016; Del Cerro et al., 2021), detection of pests and diseases in plants and forests (Akgül et al. 2016), cargo transportation, visualising and making 3D models of historical buildings (Mırdan & Yakar, 2017), hobby photography, weather forecasting, prediction of natural disasters such as forest fires, earthquakes, landslides, etc. and carrying out work during the event, creating traffic simulations to prevent traffic jams and accidents (Wang et al., 2016), selecting the most suitable location for a project, carrying out city planning, etc.

Armed Unmanned Aerial Vehicles (UCAV) are UAVs that carry ammunition to attack specified targets. They are managed from a specific command centre or can autonomously destroy predetermined targets. The number of countries using UCAV worldwide for military and civilian purposes is rapidly increasing. While the number of countries owning UAVs was 60 in 2010, this number has reached 102 in 2020 (Gettinger, 2020). Some of the reasons for this increase include UAVs' particular features, such as being able to be produced at low cost, having low costs of maintenance-repair and fuel, being able to perform tasks that humans cannot do or tasks that would be dangerous for humans to do, being able to produce sensitive and high-quality data, and having low emissions (Yılmaz et al., 2018). The advantages of UAVs used in the military field are that there is no risk of pilot loss, there are no human-related restrictions (e.g., working hours, sleep requirements, etc.), low cost, fuel and maintenance-repair costs compared to warplanes and enemy radars due to their small size. They can be considered difficult to detect by researchers (Nişancı et al., 2018).

While using UAVs has many advantages, it also has some disadvantages. The first of these is that UAVs have limited airtime. This situation sometimes creates a disadvantage, especially in activities carried out in large areas. Furthermore, UAVs are negatively affected by wind and rain, affecting the mission's quality. Third, electronic communication and data flow must be ensured for UAVs to be used effectively. Interruption of this flow due to environmental or defence measures may cause negative consequences (Dikmen, 2015). Fourth, UAVs can be used for services such as espionage and attacks in the hands of terrorist organisations or malicious individuals. Fifth, trained users are needed to use UAVs effectively. For this purpose, lengthy and costly training must be provided. Finally,

according to some experts, UAVs have software and hardware vulnerabilities and are vulnerable to cyber attacks, so the reliability of UAVs is questioned.

Business Insider Intelligence says worldwide UAV sales exceeded 12 billion dollars in 2020. In addition, UAV sales have increased by an average of 7.6 per cent annually since 2016 (Business Insider Intelligence, 2020). As can be seen from these data, the UAV market is proliferating. Türkiye also wants to get a high share of this market.

Türkiye is a country that has been the target of terrorism for many years. For this reason, the development of UAV technology in Türkiye has been carried out mainly for military purposes. The first UAV used in the Turkish Armed Forces was the Banshee system, produced by Meggitt company, which started to be used in 1989. The İHA-X1-Şahit project, the first project Türkiye developed to produce domestic UAVs, was launched in March 1990 (Aksan, 2020). Although two X1-Şahit UAVs were made and flown successfully, mass production was not started due to budget problems. In 1993, 5 CL-89 UAVs were donated to Türkiye by Germany. However, these UAVs were removed from the inventory due to logistical difficulties and accidents. Türkiye imported GNAT-750 UAVs from the USA in 1994, used on active duty between 1994 and 1998. Türkiye purchased ten Herons from Israel in 2008 (Yanarocak, 2020). Türkiye could not get the desired efficiency from imported UAVs for various reasons.

For this reason, Türkiye has taken steps to produce domestic UAVs in parallel with importing the UAVs it needs. As a result of this, Turkish Aerospace Industries (TUSAŞ) made the following uncrewed aerial vehicles respectively Turna-Keklik (1996), Pelikan-Martı (2003), Öncü (2008), Şimşek (2012) and ANKA (2010). Bayraktar Mini UAV, produced by Baykar in 2007, entered the Turkish Armed Forces inventory. This UAV was exported to Qatar in 2012, becoming the first domestic UAV. Later, Baykar produced Malazgirt (2009) and Bayraktar TB2 (2014). In addition, the production of Bayraktar AKINCI TİHA (Assault Unmanned Aerial Vehicle) and Bayraktar DİHA was carried out. In particular, Bayraktar TB2s were equipped with weapon systems in 2015 and were used effectively in Türkiye's Euphrates Shield (2016), Olive Branch (2018), Peace Spring (2019) and Spring Shield (2020) operations (Urcosta, 2020). In addition, Bayraktar TB2s were used by the Ukrainian army in the 2nd Karabakh War, in which Azerbaijan won a victory, and in the war that started with Russia's military intervention in Ukraine on February 24, 2022. Apart from these, many UAVs/SIHAs are produced by domestic companies in Türkiye. While TAI is developing the ANKA series, Baykar company continues to develop MIUS (Combat Unmanned Aircraft System), officially known as Kızılelma. Türkiye has become a UAV exporter considering the extent that it has reached regarding UAV production. According to the 2022 data of the Turkish Exporters Assembly (TİM), the number of countries Türkiye exports UAVs has exceeded 30. Türkiye's involvement in UAV production and exports will help both fight against terrorism and reduce the current account deficit by increasing its exports. It also contributes significantly to Türkiye's increase in economic growth. For this reason, Türkiye is trying to gain a competitive advantage in UAV production and exports. In this context, the study aims to measure the international

competitiveness of Türkiye's UAV exports. For this purpose, the study used Revealed Comparative Advantage (RCA3), Normalized Revealed Comparative Advantage (NRCA), Dynamic Revealed Comparative Advantage (DRCA), Revealed Symmetric Comparative Advantage Index (RSCA) and Trade Balance Index (TBI), all of which are widely used in the literature in competitiveness analyses. In the study, in addition to these indices, the Product Mapping application was carried out by using RSCA and TBI indices.

A literature review on the subject is included in the first part of the study. In the second part, the conceptual information about UAVs is given under Unmanned Aerial Vehicle. In the third part, information is given about the UAVs and UCAVs produced by Türkiye under the title of UAVs Produced by Türkiye. The methods and indices used in the study are explained in the fourth section. The fifth chapter explains the findings obtained from the analysis. Finally, the findings are aggregated, and policy recommendations are made in the conclusion.

2. Literature Review

This part of the study includes a literature review of academic studies on UAVs. It has been observed that the number of scholarly studies on UAVs has increased rapidly, especially in recent years. The literature review included the studies conducted with UAVs in Türkiye and the studies investigating the place of UAVs in international trade. Kahvecioğlu and Oktal (2014) have analysed the UAVs that Türkiye is developing and the future of UAV production in Türkiye. As a result, it is predicted that Türkiye's development of independent UAV systems will reduce production costs. Thus, Türkiye will be able to act more freely when using UAVs. Kahveci and Can (2017) have inquired about the situation regarding civilian usage areas, the purposes of UAVs, and the legislation in Türkiye and the world. They concluded that measures should be taken to prevent using UAVs for malicious purposes in Türkiye and the world. However, it was emphasised that using UAVs should not be restricted while taking these measures. In Bakır's (2019) study, the Turkish UAV sector, which has shown significant development, especially in recent years and has become an export item, was analysed. He concluded that the UAV sector is crucial in reducing foreign dependency on the defence industry and becoming a technology-producing country. Yeşilay and Macit (2019) attempted to analyse the place of UAVs in the economy, which has shown significant development recently. They stated that the developments in the UAV sector will positively impact the country's economies today and in the future. Düz (2020) has evaluated the past, present, and future of Türkiye's UAV sector from military, industrial, and geopolitical perspectives. This study found that Türkiye has increased its military capacity with UAVs and is competitive in the world's UAV sector. Türk (2020) has evaluated Türkiye's UAV industry and presented the problems seen in Türkiye's UAV industry and suggested solution suggestions, among which especially the importance of developing artificial intelligence is emphasised. The attack potential of UAVs and the measures that can be taken against UAVs have been analysed by Şen and Akarslan (2020). Giving examples from Türkiye, they emphasised that UAVs have a high attack potential and that taking defensive measures against UAVs is extremely important, especially within the

scope of the fight against terrorism. Ateş (2021) has analysed the competitiveness of Türkiye's UAV exports. The study calculated Revealed Comparative Advantage and Revealed Competitive Advantage Indices and Export Specialization Index (ES). According to the calculation results, Türkiye's export concentration in the UAV field has increased.

3. Theoretical Background

The concept of competitiveness is a complex notion. There is no consensus about the meaning of the notion of competitiveness in international trade (Siudek & Zawojska, 2014: 91). According to Barker and Köhler (1998), under free and fair conditions, the degree of a country's competitiveness belongs to producing goods and services which are approved in international markets while simultaneously maintaining and expanding the real incomes. Krugman (1990; 1994) said that competitiveness in international economics is strongly related to production productivity. According to the European Commission (2001) and World Economic Forum (1996), the competitiveness of a country creates its nation's rise in life standards and economic growth.

A highly competitive country is thought to get a higher share of international markets. With the increase in globalisation, countries need to determine their competitiveness in products subject to foreign trade, and it has become essential for them to take positions accordingly. A country's competitiveness can be defined as its position in international markets for a particular good or service. The position of countries in global markets in specific products belongs to their production productivity (Lee & Karpova, 2018: 193).

Theoretically, the concept of competitiveness is associated with three leading theories in international economics. The first is Adam Smith's concept of "absolute advantage", which states that every country should produce and export products at the most minor cost and import at a high price. The second one is David Ricardo's concept of "comparative advantage", which states that there is only a need for comparative differences in production costs in international trade. The last one is Heckscher-Ohlin's theory, which explains that a country should specialise in producing and exporting those commodities that require relatively intensive use of locally abundant factors of production. Consequently, we can say that the concept of competitiveness relates to production costs and productivity.

4. Empirical Application

4.1. Data Set

There are different opinions about the classification of UAVs (Mohsan et al., 2022: 7). In the literature, it has been observed that two views predominate regarding the classification of UAVs. The first is a regular performance-based classification which evaluates weight, distance, speed, number of wings, etc. The second is the classification based on Arjomandi's study (2007), which evaluates their intended use, such as military, civilian, observation, etc. In this study, the UAV classification was made based on weight.

Since the UAV output was examined in the study, the Harmonized System (HS) from the systems of global products was used.

This study aims to determine which countries have competitive power in world trade in products defined as unmanned aerial vehicles (UAV) by the European Parliament. Various indices in the literature were used to measure trade competitiveness, balance of trade, and intra-industry trade to reach this aim. These indexes consist of comparative advantage (RCA3), Normalized Revealed Comparative Advantage (NRCA), Dynamic Revealed Comparative Advantage (DRCA), Revealed Symmetric Comparative Advantage Index (RSCA), and Trade Balance Index (TBI). The purpose of using the RCA3 index in this study is its general use in the literature and its traditional index for measuring comparative advantages. The NRCA index was used in this study because it provided a new perspective for measuring competitive advantages and answered the RCA3 index in the literature. This study used the DRCA index to compare and show the changes in comparative advantage over time. Lastly, the RSCA and the TBI indexes were used in this study to make a product mapping analysis.

According to the European Commission, the dataset used in this study consists of the products accepted as UAVS. According to the European Commission decision, six products were accepted as UAVs in the Harmonized System (HS) (Europe Commission, 2017). These products can be seen in Table 1;

Table: 1
Table of Product Groups Including UAVs According to HS Classification

Product Codes and Names	**Included in the Study or Not**
880211- "Helicopters with a curb weight not exceeding 2000 kg",	Included
880212- "Helicopters with curb weight between 2000 kg and 15000 kg",	Included
880220- "Airplanes and other aircraft with a curb weight not exceeding 2000 kg",	Included
880230- "Airplanes and other aircraft with a curb weight between 2000 kg and 15000 kg."	Included
852580- "Television cameras, digital cameras and video camera recorders",	Not Included
950330- "Tricycles, scooters, pedal cars and similar wheeled toys; baby carriages, dolls; other toys, small (scale) models and similar recreation models, working or not; puzzles of all kinds."	Not Included

Source: Own editing.

In this study, two product groups (852580 and 950330) included in the classification of the European Commission were excluded from the analysis. The reason for not including these two product groups mentioned in the analysis is that the share of UAVs within these groups is considered low. The data used in this study included the top 20 importer countries of 4 products in 2021 (880211, 880212, 880220, and 880230). The data was gathered from the UN COMTRADE database and the annual data term between 2012 and 2021. The reason for concentrating on this period in this study is that the UAV technologies have been highly advanced during this term.

4.2. Revealed Comparative Advantage Index (RCA3)

The Balassa Index specifies that one country has a comparative advantage for a related product or industry (Balassa, 1965: 105). This study has used one of the Balassa

Indexes, RCA3. The reason for using this index is that RCA3 uses export and import data. If the results of the RCA3 index are higher than 1, the country has a comparative advantage in this product or industry. The RCA3 index is formulated as in equation 1;

$$\text{RCA3}=\frac{X_{ij}/X_{it}}{M_{ij}/M_{it}}=\frac{X_{ij}/M_{ij}}{X_{it}/M_{it}} \tag{1}$$

In this formula, X_{ij} represents country i's exports of goods j; X_{it} expresses country i's exports of goods *t*; M_{ij} represents country *i*'s imports of goods *j*; Mit expresses country *i*'s imports of goods *t*.

4.3. Normalized Revealed Comparative Advantage (NRCA)

The Balassa index shows comparative advantages only at a particular moment. For this reason, the Balassa index has received criticism from the related literature (Hillman, 1980; Deardorff, 1994; Hoen & Oosterhaven, 2006). The Normalized Revealed Comparative Advantage (NRCA) index has been proposed to answer this criticism. The NRCA index is derived from a need to gain dynamism to the Balassa index. Yu et al.'s (2009) paper put forward the NRCA index. Yu et al. (2009) proposed three types of NRCA indexes. These are comprised of cross-commodity comparison, Cross-country comparison, and Temporal comparison. In this study, this type of NRCA index is used to demonstrate a change for that temporally in comparative advantages. The index is calculated as in equation 2;

$$\begin{aligned}\Delta\text{NRCA}^{i}_{j,t+1} &\equiv \text{NRCA}^{i}_{j,t+1}-\text{NRCA}^{i}_{j,t}\\ &=\left(\frac{E_{j,t+1}}{E_{t+1}}-\frac{E^{i}_{j,t}}{E_{t}}\right)-\left(\frac{E^{i}_{t}}{E_{t}}\frac{E_{j,t}}{E_{t}}-\frac{E^{i}_{t+1}}{E_{t+1}}\frac{E_{j,t+1}}{E_{t+1}}\right)\end{aligned} \tag{2}$$

Since the NRCA's total value, mean value, and distribution properties are time-invariant, it may be compared throughout time. The change of NRCA scores country i's j goods between time t+1 and t can be shown as $\left(\frac{E_{j,t+1}}{E_{t+1}}-\frac{E^{i}_{j,t}}{E_{t}}\right)$ shown as change. $\frac{E^{i}_{t}}{E_{t}}\frac{E_{j,t}}{E_{t}}$ and $\frac{E^{i}_{t+1}}{E_{t+1}}\frac{E_{j,t+1}}{E_{t+1}}$, represent the expected export level of product j of country i's under the comparative advantage-neutral situation at times t and t+1, respectively;$\left(\frac{E^{i}_{t}}{E_{t}}\frac{E_{j,t}}{E_{t}}-\frac{E^{i}_{t+1}}{E_{t+1}}\frac{E_{j,t+1}}{E_{t+1}}\right)$ represents the comparative advantage-neutral situation between time t and t+1. Therefore, the temporal comparison of comparative advantage compares a country's actual change in the level of exports of a particular good with the amount of exports of that good the country would be expected to have under a neutral state of comparative advantage (Demir, 2019: 323). While $\Delta\text{NRCA}^{i}_{j,t+1}>0$ (or $\Delta\text{NRCA}^{i}_{j,t+1}<0$) shows the growth in the actual export level of country i in commodity j; (measured by $\frac{E_{j,t+1}}{E_{t+1}}-\frac{E^{i}_{j,t}}{E_{t}}$) It is determined by the equation (measured by $\left(\frac{E^{i}_{t}}{E_{t}}\frac{E_{j,t}}{E_{t}}-\frac{E^{i}_{t+1}}{E_{t+1}}\frac{E_{j,t+1}}{E_{t+1}}\right)$ whether the expected growth required for country i to

maintain its comparative advantage-neutral level in this good is higher or lower than the expected growth rate (Demir, 2022: 911). Consequently, $\Delta \text{NRCA}_{j,t+1}^{i} > 0$ (or $\Delta \text{NRCA}_{j,t+1}^{i} < 0$) shows that country i's comparative advantage in good j increases (or decreases) between time t+1 and time t (Yu et al., 2009: 275).

4.4. Dynamic Revealed Comparative Advantage (DRCA)

The DRCA index originates from the RCA index. RCA index static form fails for the catch to changing comparative competitiveness during in time (Tunca & Güneş, 2021: 410). To solve this problem, Edward and Schoer (2002) offered the DRCA index. Dynamic Revealed Comparative Advantage index, which was constituted by Edward and Schoer (2002), is calculated as in equation 3;

$$\frac{\Delta RCA_{ij}}{RCA_{ij}} = \frac{\Delta(X_{ij}/X_i)}{X_{ij}/X_i} - \frac{\Delta(X_{wj}/X_w)}{X_{wj}/X_w} \tag{3}$$

In equation 3, the Δ symbol denotes the difference between two years. Therefore, the first term in this formula displays the change in product j's export from nation i over two years. As a result, the first term on the right-hand side of this equation represents growth in the RCA index of country i, whereas the second term on the left-hand side shows growth in world exports in the j^{th} product.

4.5. Revealed Symmetric Comparative Advantage Index (RSCA)

One of the biggest criticisms of the Balassa index is the difficulty in comparing the results. Since the results obtained with the Balassa index are between 0 and 1, some problems are encountered in its interpretation. To address this deficiency, Dalum et al. (1998) and Laursen (1998) put forward the Revealed Symmetric Comparative Advantage (RSCA) index in their studies (Widodo, 2009: 68). The index is calculated as equation 4.

$$RSCA_{ij} = \frac{RCA_{ij}-1}{RCA_{ij}+1} \tag{4}$$

In Equation 4, RCAij is the Balassa index score of country i goods j. RSCA index values range from -1 to +1. If the index value is positive, the country in question has a comparative advantage in that sector; If it is negative, it is interpreted as having no comparative advantage.

4.6. Trade Balance Index (TBI)

The Trade Balance Index (TBI) is used to determine whether a country specialises in exporting (as a net exporter) or importing (as a net importer) for a specific category of items. This index was proposed in Lafay's (1992) study. It is calculated using equation 5. The index has values between -1 and +1. If a country just imports, the TBI is extremely -1; yet, if a country only exports, the TBI is extremely +1.

$$TBI_{ij} = \frac{x_{ij} - m_{ij}}{x_{ij} + m_{ij}} \quad (5)$$

Equation 5, TBIij represents the TBI index score country i goods j. Xij symbolises the country i's export of product j, and mij represents the country i's import of product j. The index has values between -1 and +1. If a country just imports, the TBI is extremely -1; yet, if a country only exports, the TBI is extremely +1. When the value of TBI is negative for a specific group of products, a country is referred to as a "net-importer," when the value of TBI is positive, it is referred to as a "net-exporter."

In addition to the above indexes, the products mapping analytical tool was used in this study. This analytical tool was proposed in Widodo's study (2009). Widodo (2009) states that the tools used must be RSCA and TBI indexes. In this analytical tool, the RSCA index represents international competitiveness; the TBI index represents trade balance, shown in the Cartesian coordinate system (Widodo, 2009: 66).

Table 3 shows that Group A's products have comparative advantages and export specialisation. In contrast, the products in Group B have a comparative advantage but no export specialisation. The products in Group C have export specialisation but no comparative advantage, and the products in Group D have neither comparative advantage nor export specialisation (İzgü & Kavacık, 2023: 1113).

Table: 3
Product Mapping

RSCA > 0	**Group B:** Comparative Advantage Net-importer (RSCA > 0 and TBI <0)	**Group A:** Comparative Advantage Net-exporter (RSCA > 0 and TBI >0)
RSCA < 0	**Group D:** Comparative disadvantage Net-importer (RSCA < 0 and TBI <0)	**Group C:** Comparative disadvantage Net-exporter (RSCA < 0 and TBI >0)
	TBI < 0	TBI > 0

Source: Widodo T., Comparative Advantage: Theory, Empirical Measures and Case Studies. 2009: 67.

5. Empirical Results

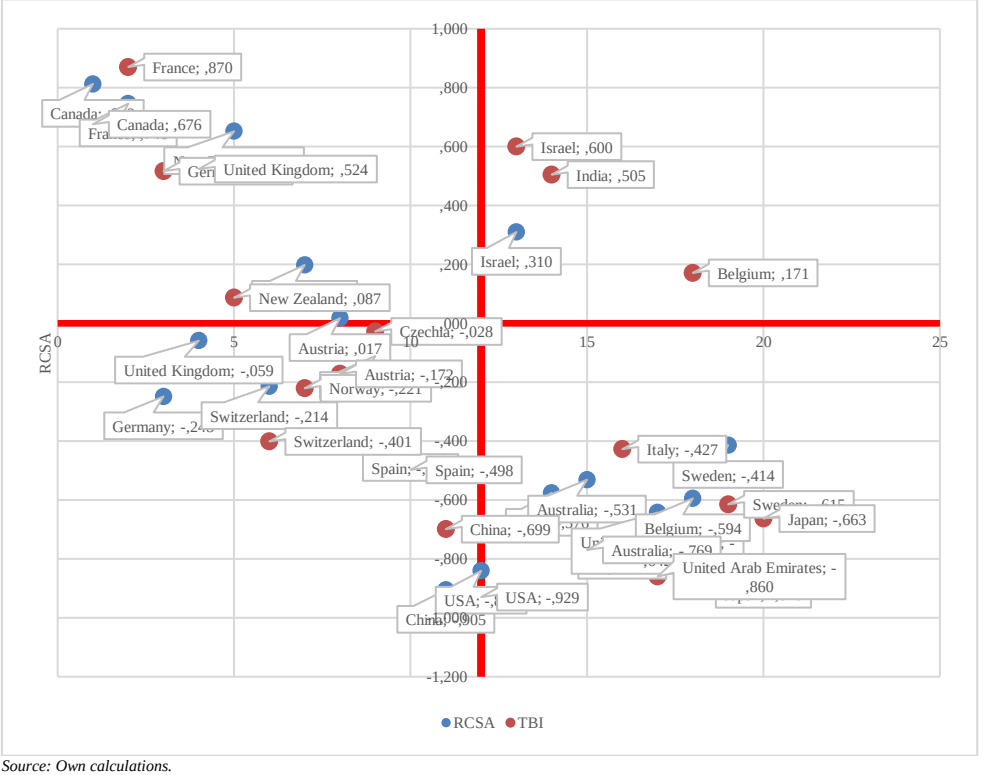
This research section summarises the results according to the four product groups included in the study. Analysis results are shown in two stages. Firstly, product mapping, which belongs to related products, appears in Figures 1-4**.** Secondly, RCA3, DRCA, and NRCA index results can be seen in Appendixes 1-4.

5.1. 880211- Helicopters with a curb weight not exceeding 2000 kg

The result of product mapping can be seen in Figure 1. Additionally, the results of the RCA3, DRCA, and NRCA indexes can be seen in Appendix 1. According to the results, Israel has a comparative advantage and is a net-exporter country. France and Canada have a comparative advantage, but they are net importers. These results show that France and Canada could become net exporters in the long run. Australia, Italy, Japan, Sweden, and the United Arab Emirates do not have a comparative advantage but are net exporters. These

results demonstrate that these countries could be transformed from net exporters to importers. Switzerland, Spain, and China are net importers with no comparative advantage on related products. These countries could be significant markets for exporter countries in this product.

Figure: 1
880211 Product Mapping



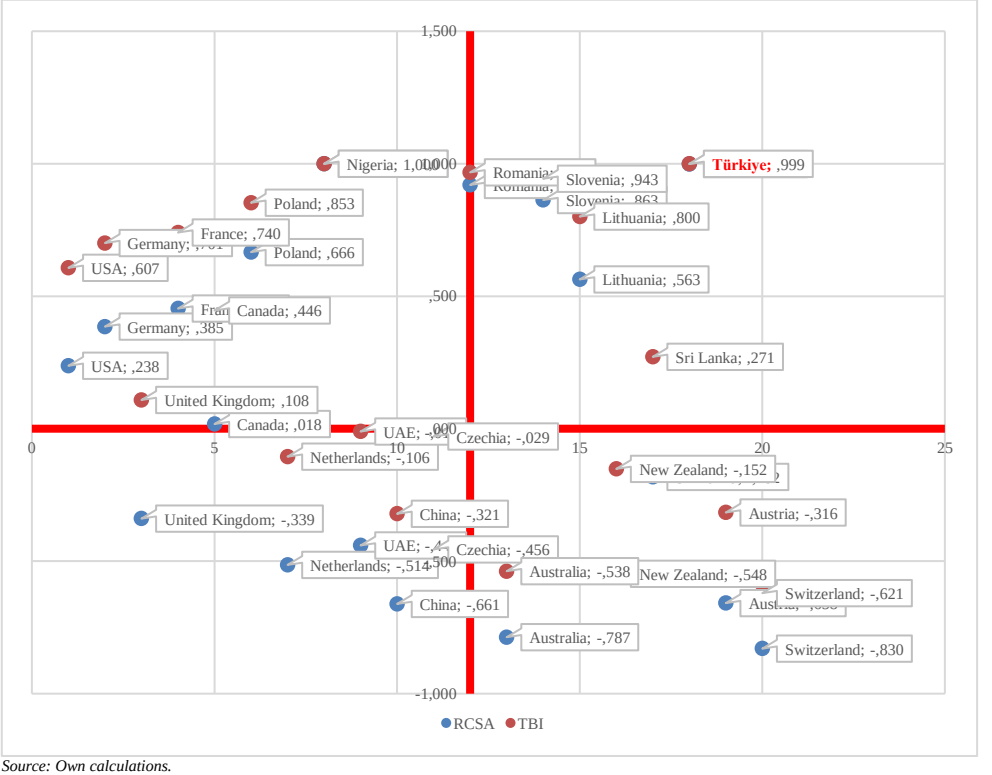
Source: Own calculations.

5.2. 880212- Helicopters with curb weight between 2000 kg and 15000 kg

The result of product mapping belongs to the product 880212, which can be seen in Figure 2. Additionally, the results of the RCA3, DRCA, and NRCA indexes can be seen in Appendix 2. According to the analyses, Türkiye, Slovenia, and Lithuania have a comparative advantage in this product and are net-exporter countries. Nigeria, Poland, Germany, the USA, and France also have a comparative advantage but are net importer countries. These results demonstrate that they could be transformed from net importers into net exporters in the long run. Australia, New Zealand, Austria, and Switzerland do not have a comparative advantage but are net exporters. These findings show that these nations might become net

importers instead of exporters. Lastly, The Netherlands and China have no comparative advantage on related products and are net importers. It might be argued that these nations represent sizable export markets for this commodity.

Figure: 2
880212 Product Mapping



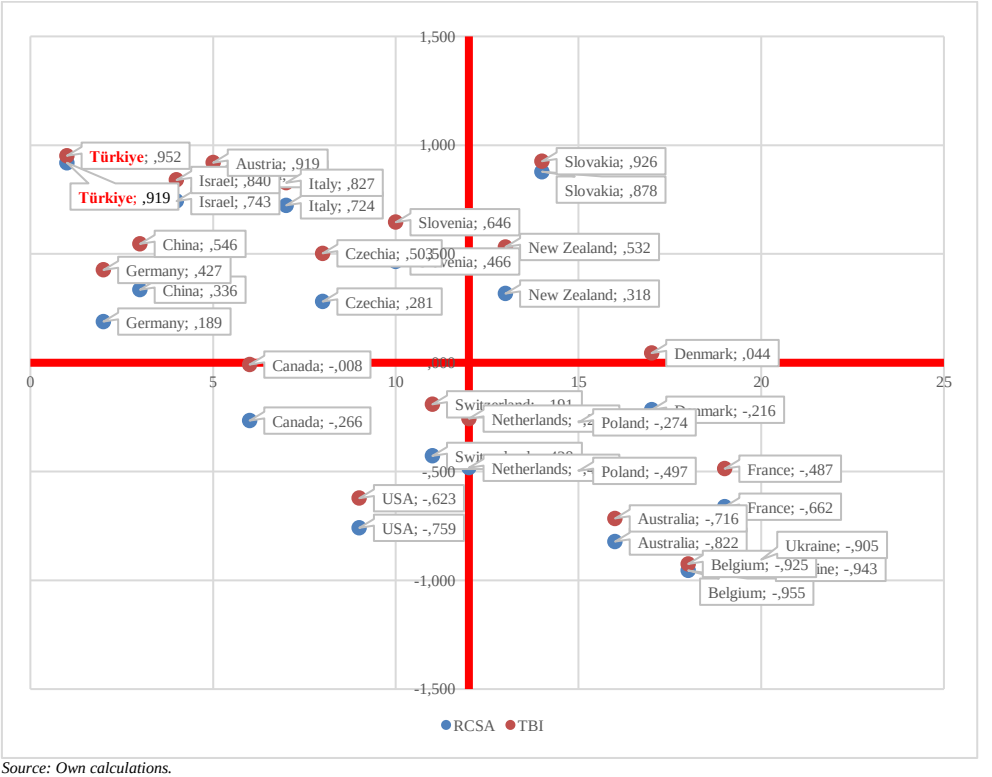
Source: Own calculations.

5.3. 880220- Airplanes and other aircraft with a curb weight not exceeding 2000 kg

The product 880212 is represented by the product mapping result in Figure 3. The results of the RCA3, DRCA, and NRCA indexes are additionally displayed in Appendix 3. According to the analyses, Slovakia and New Zealand have a comparative advantage and are net exporters of this product. Türkiye, Israel, Italy, Czechia, Germany, China, and Slovenia have a comparative advantage but are net importer countries of this product. These findings show that they could eventually turn from net importers into. The Netherlands, Poland, France, Australia, Belgium, and Ukraine do not have a comparative advantage but are net exporters. These findings show that these nations might lose their comparative

advantages on this product. Lastly, the USA and Switzerland have no comparative advantage on related products and are net importers. It might be argued that these nations could serve as significant export markets for this product.

Figure: 3
880220 Product Mapping



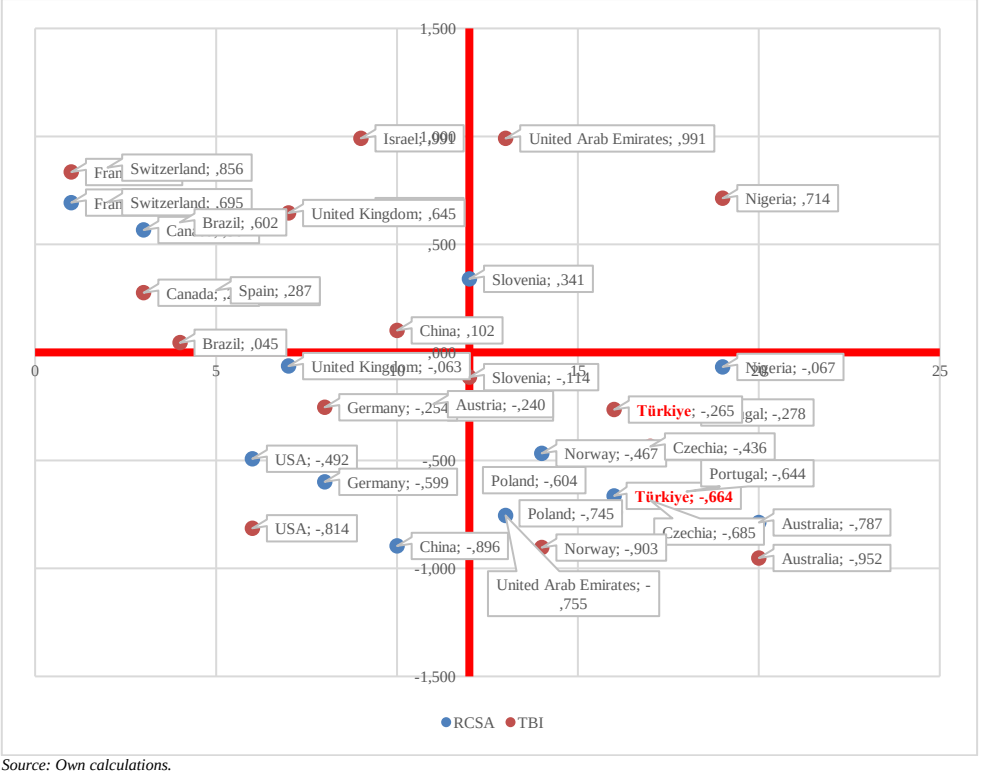
Source: Own calculations.

5.4. 880230- Airplanes and other aircraft with a curb weight between 2000 kg and 15000 kg

The product mapping result in Figure 4 represents the product 880230. Appendix 4 further displays the outcomes of the RCA3, DRCA, and NRCA indices. According to the analyses, no country has comparative advantages and is not a net product exporter. France, Switzerland, Canada, Brazil, and Israel have comparative advantages but are net importers. These results indicate that they may eventually become net exporters instead of net imports. Türkiye, Australia, Portugal, Norway, and Czechia have no comparative advantage but are net exporters. These results indicate that these countries may gain a comparative advantage in this commodity. Austria, Germany, and the USA are net importers with no comparative

advantage on related products. There is a chance that these countries will become important export destinations for this commodity.

Figure: 4
880230 Product Mapping



Source: Own calculations.

6. Discussion and Conclusion

This research aims to answer the question, "Which countries have comparative advantages in the rising UAV markets?". UAVs can be multi-tasking tools that aim to take photographs in historical places, predetermine forest fires, or follow migrating animals. However, UAVs are used predominantly for military purposes, like reconnaissance, hitting particular targets, or attacking enemy personnel or vehicles. Although previously used on a limited basis, this type of UAV has increased due to the success of the 2020 Second Nagorno-Karabakh War. Azerbaijani Armed Forces used UAVs very effectively against the Armenian Armed Forces, which has changed the way of thinking about using UAVs on the battlefields (Köker, 2020; Özgen, 2021). Afterwards, UAVs showed their ability for military purposes during the Ukrainian-Russian War in 2022 (TRTHaber, BBC News Türkçe). This

process has caused increasing interest in many countries in UAVs. Türkiye is one of the pioneer countries in developing UAVs. Türkiye's process of developing UAVs goes back to the beginning of the 1990s. As a result, Turkish UAVs have received attention in the UAV market.

The results of this research manifest that Türkiye has no place in the top 20 exporter countries for the product 880211. Türkiye has a comparative advantage and is also a net-exporter country for the product 880212. For the product 880220, Türkiye has a comparative advantage but is also a net-importer country. Lastly, for the product 880230, Türkiye has no comparative advantages but is a net-exporter country. As a result, it can be said that the Turkish drone industry is concentrated on drone scales below 2000 kg and 2000-15000 kg.

These results prove that Türkiye has followed a correct and effective policy in the 880212 product, in which Türkiye has a comparative advantage and is also a net exporter country. Improving and preserving Türkiye's gains and advantages in this product will further increase its competitiveness. Developing policies that will reduce Türkiye's import dependency for the 880220 product, which has a comparative advantage but is a net importer, will be beneficial in terms of reducing its foreign trade deficit and increasing its comparative advantage. For the 880230 product, where Türkiye does not have a comparative advantage but is a net exporter, and for the 880211 product, where Türkiye is not among the top 20 producer and exporter countries, Türkiye should follow the right policy and strategy for these products as it did for the 880212 product. These products should also turn to new markets where they can use their export potential more. In summary, Türkiye started developing UAV technology at an early period. In this way, Türkiye obtains benefits such as becoming a country that produces and develops technology, reducing foreign dependency in the defence industry, ensuring the advancement of technology in other sectors thanks to the technology created, and reducing foreign trade deficits through exports. Türkiye needs to continue developing UAVs and provide some incentives to facilitate development to maintain the comparative advantage achieved in UAVs.

On the other hand, in this study, foreign trade indices were used to determine the competitiveness of Türkiye's UAV exports in a dynamic framework. In future studies, econometric models can be designed to measure the impact of factors determining competitiveness or the projection of Türkiye's UAV trade, which can be estimated using an autoregressive moving average model.

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Appendix: 1
Product of 880211

8802211		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Canada	RCA3	2,95	2,80	4,06	9,54	6,49	4,28	3,55	5,91	3,77	4,91
	NRCA	-0,21	-0,20	-0,24	-0,35	-0,19	-0,20	-0,25	-0,37	-0,33	-0,34
	DRCA		-0,01	0,10	0,39	-0,36	0,03	0,24	0,37	-0,05	0,00
France	RCA3	15,37	20,89	26,46	11,96	10,41	13,42	24,38	12,96	12,27	13,68
	NRCA	-0,32	-0,29	-0,36	-0,28	-0,23	-0,20	-0,14	-0,22	-0,23	-0,27
	DRCA		-0,06	0,16	-0,15	-0,13	-0,12	-0,23	0,35	0,06	0,19
Germany	RCA3	12,71	16,50	5,91	6,66	10,91	16,80	3,74	4,13	1,03	2,98
	NRCA	-0,07	-0,04	0,01	0,07	0,01	-0,07	0,04	0,04	0,06	0,05
	DRCA		-0,15	-0,24	-0,38	0,70	0,70	-0,53	0,00	-0,17	0,05
UK	RCA3	0,00	0,00	0,35	0,84	0,71	0,18	0,51	0,83	0,96	3,04
	NRCA	0,05	0,05	0,04	0,02	0,02	0,02	0,02	0,02	0,02	0,00
	DRCA		0,00	0,00	1,09	0,23	-0,19	0,02	-0,21	-0,08	1,30
New Zealand	RCA3	0,54	0,52	0,40	0,40	0,58	0,26	0,15	0,36	0,27	1,13
	NRCA	-0,01	-0,01	-0,01	-0,01	-0,02	0,00	0,00	-0,01	0,00	-0,02
	DRCA		-0,22	0,11	0,12	0,60	-0,85	0,13	0,94	-0,56	1,36
Switzerland	RCA3	0,30	0,34	0,33	0,65	0,31	0,89	0,45	0,77	0,42	0,41
	NRCA	0,02	0,03	0,02	0,02	0,02	0,00	0,01	0,01	0,01	0,01
	DRCA		-0,32	0,42	0,27	-0,22	2,41	-0,32	0,11	-0,15	0,00
Norway	RCA3	0,94	0,47	0,11	0,78	0,66	0,57	1,09	0,47	0,69	0,61
	NRCA	0,00	0,01	0,01	0,00	-0,01	0,00	-0,04	-0,01	-0,02	-0,01
	DRCA		-0,41	-0,30	1,71	0,95	-0,56	4,50	-0,46	0,54	-0,58
Austria	RCA3	1,73	1,13	4,55	1,10	0,78	0,76	3,06	0,35	0,97	0,67
	NRCA	0,01	0,01	0,00	-0,01	0,01	0,00	0,00	0,00	-0,01	0,00
	DRCA		0,29	0,22	0,66	-0,50	0,67	0,13	-0,01	0,58	-0,44
Czechia	RCA3	7,46	13,41	7,33	4,05	2,66	3,69	0,63	0,40	1,26	0,90
	NRCA	-0,03	-0,05	-0,05	0,00	-0,02	-0,02	0,00	0,00	-0,02	0,00
	DRCA		0,53	-0,08	-0,63	0,80	0,10	-0,49	-0,21	1,09	-0,55
Spain	RCA3	0,00	5,42	0,44	0,50	0,26	0,47	0,03	0,25	1,35	0,32
	NRCA	0,01	0,01	0,02	0,02	0,02	0,02	0,03	0,03	0,00	0,02
	DRCA		-0,01	-0,39	-0,36	0,59	0,50	-0,97	7,73	4,51	-0,53
China	RCA3	0,00	0,00	0,04	0,25	0,00	0,00	0,02	0,04	0,06	0,17
	NRCA	0,20	0,21	0,21	0,20	0,22	0,22	0,22	0,22	0,24	0,25
	DRCA		0,00	17,61	3,95	-0,88	-0,53	7,10	0,24	0,43	0,54
USA	RCA3	0,00	0,01	0,00	0,00	0,16	0,44	0,65	0,00	0,00	0,03
	NRCA	0,15	0,14	0,15	0,15	0,10	0,05	-0,01	0,15	0,14	0,12
	DRCA		6,60	-0,82	0,00	0,00	1,26	0,55	-0,86	-0,95	0,00
Israel	RCA3	3,54	0,13	1,18	2,00	31,28	0,02	0,23	0,33	3,49	3,80
	NRCA	0,00	0,01	0,00	0,00	-0,06	0,01	0,00	0,00	0,00	0,00
	DRCA		-1,01	0,50	2,43	10,20	-1,15	1,13	0,34	7,09	0,22
India	RCA3	0,79	0,28	1,77	0,07	0,09	0,32	0,86	0,00	1,07	2,89
	NRCA	0,02	0,03	0,02	0,02	0,03	0,03	0,02	0,03	0,02	0,02
	DRCA		-0,53	0,32	-0,44	-0,23	0,09	1,18	-0,86	76,22	2,44
Australia	RCA3	0,00	0,00	0,00	0,07	0,16	0,21	0,12	0,40	0,27	0,12
	NRCA	0,02	0,02	0,01	0,01	0,01	0,01	0,01	0,00	0,01	0,02
	DRCA		0,19	1,12	0,00	0,33	-0,15	-0,18	1,10	-0,27	-0,47
Italy	RCA3	1,01	7,69	1,62	2,10	2,42	0,63	1,07	0,52	1,02	0,38
	NRCA	0,03	-0,04	0,04	0,02	0,03	0,04	0,03	0,03	0,01	0,04
	DRCA		4,35	-0,74	1,73	-0,33	-0,24	0,20	0,21	1,20	-0,79
UAE	RCA3	0,03	2,03	0,00	0,13	0,72	21,57	5,55	4,01	0,34	0,07
	NRCA	0,03	0,03	0,03	0,03	0,02	0,02	-0,03	0,00	0,02	0,03
	DRCA		6,38	-0,82	0,00	16,87	-0,23	4,17	-0,45	-0,52	-0,46
Belgium	RCA3	0,43	0,66	0,75	1,96	1,07	0,15	0,07	0,50	1,24	1,34
	NRCA	0,03	0,03	0,03	0,02	0,02	0,03	0,03	0,03	0,01	0,02
	DRCA		0,15	-0,35	2,98	-0,40	-0,91	0,28	0,61	5,49	-0,59
Sweden	RCA3	1,20	0,25	2,10	0,77	1,46	1,05	0,62	0,82	1,73	0,23
	NRCA	0,00	0,01	-0,01	0,00	-0,03	-0,01	0,00	0,00	0,00	0,01
	DRCA		-0,95	4,67	-0,26	2,09	-0,64	-0,33	0,12	-0,32	-0,41
Japan	RCA3	0,06	0,03	0,06	0,21	0,17	0,06	0,07	0,09	0,15	0,19
	NRCA	0,07	0,06	0,06	0,06	0,06	0,07	0,06	0,06	0,06	0,05
	DRCA		-0,32	0,70	0,43	-0,06	-0,74	0,74	-0,23	0,45	1,21

Appendix: 2
Product of 8802212

8802212		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
USA	**RCA3**	0,65	1,09	1,41	2,41	6,17	1,61	0,93	1,92	1,75	1,62
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		-0,18	-0,43	0,02	0,09	0,33	-0,07	-0,45	0,30	-0,18
Germany	**RCA3**	9,64	4,38	2,00	3,29	5,40	13,33	5,31	2,11	0,84	2,25
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		0,34	-0,04	0,24	0,27	-0,28	-0,27	1,56	-0,17	0,34
UK	**RCA3**	0,00	0,00	0,34	0,27	0,33	0,68	1,69	1,79	1,07	0,49
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		-0,16	-0,45	0,75	1,12	0,37	-0,08	-0,52	0,21	0,06
France	**RCA3**	0,00	36,12	74,49	3,37	3,98	7,84	4,14	1,33	2,94	2,66
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		0,00	0,00	-0,10	0,02	0,27	-0,09	-0,10	0,03	-0,27
Canada	**RCA3**	4,83	1,88	0,89	0,95	1,30	0,99	0,98	0,88	0,79	1,04
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		-0,23	0,28	-0,34	-0,45	-0,05	1,37	-0,66	0,09	-0,23
Poland	**RCA3**	53,94	6,31	2,25	0,11	0,08	1,17	1,28	0,64	1,28	4,99
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		-0,30	-0,34	-0,26	-0,43	0,47	-0,39	-0,15	0,10	-0,41
Netherlands	**RCA3**	0,01	0,23	0,10	0,00	0,00	0,00	0,84	0,00	10,92	0,32
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		-0,24	-0,48	-0,96	-0,09	6,20	1,88	-0,76	0,08	0,00
Nigeria	**RCA3**	0,00	16,43	0,52	0,00	0,00	0,00	0,27	25175,9	8,31	4310,2
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		17,93	-1,33	38,35	-0,94	0,00	0,00	-1,25	37,86	-0,10
UAE	**RCA3**	0,07	0,16	1,70	1,71	0,31	0,00	1,02	7364,4	0,22	0,39
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		3,73	0,37	5,29	-0,94	0,00	-0,89	9,60	3,06	-0,51
China	**RCA3**	0,39	0,29	0,20	0,10	0,00	0,06	0,01	0,06	0,14	0,20
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		-0,22	-0,49	0,40	-0,27	-0,61	0,00	-1,44	5,62	9,55
Czechia	**RCA3**	0,00	0,32	1,94	0,00	0,06	0,49	0,52	0,21	0,33	0,37
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		0,73	-1,06	0,07	-0,94	0,00	-0,86	6,10	1,55	0,10
Romania	**RCA3**	0,00	2,64	5,38	840,21	0,00	0,00	0,00	0,05	0,62	23,98
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		0,00	-0,19	-1,06	0,00	13,83	0,67	-0,88	0,02	0,53
Australia	**RCA3**	0,00	0,00	0,00	0,14	0,05	0,13	0,26	1,29	0,08	0,12
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		0,00	-0,63	-0,84	-0,03	0,03	-1,00	0,00	0,77	1,00
Slovenia	**RCA3**	0,00	0,00	0,00	0,00	0,00	0,30	0,53	0,10	0,42	13,60
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		0,77	-0,19	-0,71	4,15	0,07	0,26	1,42	-0,75	0,43
Lithuania	**RCA3**	3,37	0,85	41,84	0,00	3,28	5,35	1,02	0,58	0,69	3,58
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		0,00	0,00	0,00	0,00	0,00	0,92	-0,99	1,14	-0,15
New Zealand	**RCA3**	0,06	0,02	0,11	0,03	1,37	1,34	0,15	0,09	0,66	0,29
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		-0,99	0,95	-1,06	0,00	-0,02	-0,07	-0,28	-0,01	0,55
Sri Lanka	**RCA3**	0,00	0,00	0,00	8,39	0,00	0,00	0,00	0,00	0,00	0,69
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		-0,45	0,59	-0,72	1,38	0,55	-0,57	-0,43	1,05	0,32
Türkiye	**RCA3**	0,03	0,01	0,04	0,03	0,02	0,17	0,43	0,02	0,37	1550,95
	NRCA	-0,02	-0,02	-0,02	-0,01	-0,01	-0,02	-0,02	-0,02	-0,02	-0,01
	DRCA		-1,16	0,00	0,00	-0,84	-0,61	0,00	0,00	0,00	-0,71
Austria	**RCA3**	1,49	0,28	0,35	0,25	0,00	0,00	0,18	0,83	0,00	0,21
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		-0,81	2,27	-0,53	-0,68	7,54	1,95	-1,16	-0,23	0,71
Switzerland	**RCA3**	0,16	0,07	0,37	0,51	0,00	0,22	0,08	0,25	0,24	0,09
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		-0,38	1,52	-0,70	-0,94	0,00	0,00	-1,44	68,64	-0,65

Appendix: 3
Product of 880220

8802220		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Türkiye	RCA3	0,50	0,00	0,02	0,03	0,01	0,01	0,27	30,12	10,62	23,77
	NRCA	-0,01	-0,02	-0,02	-0,02	-0,02	-0,02	-0,02	0,20	0,23	0,42
	DRCA		-1,19	3,36	1,12	-0,74	-0,39	1,45	265,21	0,14	0,92
Germany	RCA3	1,84	1,94	1,37	6,12	1,33	1,01	2,47	1,09	1,05	1,47
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		0,27	-0,59	0,84	-0,77	0,12	0,49	-0,96	0,38	-0,10
China	RCA3	0,21	0,01	0,37	1,61	3,39	4,20	0,71	0,51	0,86	2,01
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		-1,17	107,68	6,86	0,85	0,12	-0,25	-0,52	0,41	-0,42
Israel	RCA3	16,38	24,05	25,05	6,37	4,21	3,25	12,66	22,02	3,47	6,78
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		-0,29	-0,23	-0,99	0,24	-0,59	1,04	1,58	-0,27	-0,34
Austria	RCA3	8,45	2,91	5,41	3,31	4,05	2,00	15,14	13,13	35,56	14,06
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		-0,48	0,44	-0,64	0,19	-0,25	0,77	-0,05	-0,23	-0,46
Canada	RCA3	0,40	0,30	0,16	0,57	0,39	0,10	0,52	0,82	0,80	0,58
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		-0,13	-0,81	1,68	-0,37	-0,57	1,27	-0,19	0,39	-0,61
Italy	RCA3	9,77	4,01	2,76	1,23	1,77	3,16	15,66	3,88	4,26	6,24
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		-0,61	-0,01	-0,37	-0,28	-0,08	0,72	-0,42	-0,12	-0,40
Czechia	RCA3	4,40	5,10	1,12	0,67	1,05	0,65	2,25	1,38	1,96	1,78
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		-0,34	-0,41	-0,27	-0,20	-0,13	0,55	-0,81	0,30	-0,32
USA	RCA3	0,54	0,27	0,02	0,07	0,02	0,13	0,19	0,15	0,05	0,14
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		-0,34	-1,44	3,67	-0,87	5,79	0,14	-0,30	-0,55	1,09
Slovenia	RCA3	2,14	5,20	3,49	2,72	6,31	7,50	3,49	1,54	2,84	2,74
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		0,25	-0,46	-0,36	-0,53	0,68	0,40	-0,88	0,35	-0,20
Switzerland	RCA3	1,35	5,01	11,85	2,26	0,86	0,21	0,61	0,87	0,49	0,40
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		2,34	0,90	-0,99	-0,97	-0,67	0,37	1,08	-0,58	-0,21
Netherlands	RCA3	0,45	0,64	0,56	0,48	0,39	0,32	1,06	0,65	0,79	0,35
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		-0,07	0,83	-0,45	-0,26	-0,42	0,52	-0,13	0,36	-0,94
New Zealand	RCA3	1,74	0,39	0,21	0,44	0,71	0,20	1,02	0,34	0,20	1,93
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		-0,69	-0,81	0,53	0,45	-0,59	0,90	-1,03	-0,52	0,69
Slovakia	RCA3	5,22	3,93	3,20	0,51	1,63	0,40	4,21	2,68	4,27	15,41
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		0,14	-0,85	-0,44	0,16	-0,35	1,01	-0,81	0,33	-0,07
Poland	RCA3	0,60	0,62	0,10	0,25	0,26	0,16	0,27	0,25	0,17	0,34
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		-0,47	-0,95	0,01	-0,43	0,04	0,29	0,11	-0,17	0,10
Australia	RCA3	0,15	0,18	0,17	0,10	0,07	0,05	0,20	0,22	0,18	0,10
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		-0,17	-0,38	-0,18	-0,25	-0,53	1,21	-0,40	-0,13	-1,00
Denmark	RCA3	1,51	0,07	0,24	0,05	0,10	0,02	1,47	0,22	0,47	0,64
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		-1,15	0,62	-0,55	1,51	-0,64	3,30	-1,09	0,39	5,01
Belgium	RCA3	0,51	0,06	0,61	0,14	0,21	0,15	0,20	1,81	0,26	0,02
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		-1,12	4,12	-0,72	0,55	0,11	0,00	1,86	-0,04	-0,09
France	RCA3	0,11	0,13	0,04	0,15	0,14	0,07	0,46	0,15	0,20	0,20
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		-0,39	-0,65	1,32	-0,49	-0,42	3,29	-1,25	1,16	-0,70
Ukraine	RCA3	0,39	1,30	0,51	0,40	0,06	0,17	0,94	0,05	1,60	0,03
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		-0,25	-0,58	0,70	-0,76	-0,45	2,58	-0,41	0,74	-0,69

Appendix: 4
Product of 880230

8802230		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
France	RCA3	5,10	4,33	4,81	6,43	3,42	4,99	5,10	10,28	6,86	12,97
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		0,07	0,13	-0,15	-0,01	-0,09	0,23	0,01	-0,06	0,07
Switzerland	RCA3	1,85	1,44	2,66	3,98	2,71	3,69	5,61	7,47	7,79	14,95
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		-0,66	0,99	0,43	-0,28	0,12	0,63	0,08	-0,13	0,51
Canada	RCA3	3,43	2,32	4,29	4,04	5,27	3,01	4,16	3,49	6,13	2,05
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		-0,32	-0,03	0,39	-0,07	-0,09	0,27	-0,30	0,18	-0,23
Brazil	RCA3	1,93	1,19	1,15	2,01	5,90	2,29	2,53	1,95	1,92	1,27
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		-0,38	-0,08	0,47	0,10	-0,31	0,15	0,20	0,15	-0,25
Spain	RCA3	17,12	8,79	56,40	10,79	4,86	1,60	1,94	3,52	3,29	2,10
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		1,53	-0,60	-0,37	-0,14	-0,51	-0,12	1,03	0,38	-0,04
USA	RCA3	0,05	0,02	0,04	0,04	0,06	0,20	0,09	0,18	0,18	0,12
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		-0,63	0,69	0,23	0,30	1,52	-0,34	0,78	-0,03	-0,23
UK	RCA3	0,00	0,00	1,58	2,07	2,39	10,57	3,14	2,85	1,50	5,40
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		0,00	0,00	0,04	0,36	0,40	-0,48	-0,28	-0,34	0,32
Germany	RCA3	0,55	0,51	0,54	0,56	0,24	0,27	0,43	0,40	0,74	0,69
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		-0,17	0,01	-0,09	-0,52	0,26	0,05	0,43	0,29	0,35
Israel	RCA3	1,91	2,66	13,06	5,56	8,18	27,12	0,55	203,92	54,22	266,58
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		-0,17	9,25	-0,21	-0,74	1,07	-0,63	-0,63	29,30	0,65
China	RCA3	0,17	0,20	0,18	0,51	0,90	1,30	0,70	0,31	1,20	1,43
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		-0,08	-0,03	-0,09	0,77	0,02	-0,13	-0,57	0,09	0,54
Austria	RCA3	0,24	0,55	0,33	0,72	0,41	0,25	0,26	0,16	0,14	0,71
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		-0,22	-0,04	0,51	-0,66	0,30	0,10	-0,55	0,62	1,25
Slovenia	RCA3	0,35	0,46	0,18	0,98	0,67	0,81	0,66	0,96	1,22	0,92
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		-0,17	-0,79	6,29	0,04	0,45	-0,18	2,70	-0,46	0,27
UAE	RCA3	0,02	0,00	0,20	0,00	0,26	0,00	0,00	0,02	1,75	248,21
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		-1,18	0,00	30,16	-0,99	0,69	-0,75	0,00	154,79	26,91
Norway	RCA3	0,00	0,00	0,00	0,01	0,01	0,00	0,02	0,01	0,05	0,06
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		0,00	0,00	0,00	0,49	-0,83	0,00	-0,63	3,70	-0,18
Poland	RCA3	0,35	5,87	0,98	1,39	0,07	0,11	0,25	1,10	0,34	0,29
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		-0,15	-0,39	-0,42	-0,90	6,35	-0,28	2,52	-0,48	0,57
Türkiye	RCA3	0,16	0,01	0,61	0,68	0,16	0,68	0,34	1,88	0,06	0,68
	NRCA	-0,02	-0,02	-0,02	-0,02	-0,01	-0,01	-0,01	0,00	-0,02	-0,01
	DRCA		-1,08	49,93	-0,76	-0,33	0,08	-0,59	0,96	-0,56	6,00
Czechia	RCA3	0,54	1,38	1,22	1,25	1,34	1,83	0,90	1,16	3,83	0,46
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		0,76	-0,18	-0,52	0,66	0,10	-0,10	0,14	0,27	-0,66
Portugal	RCA3	0,85	1,12	0,95	0,20	0,63	0,32	0,12	0,10	2,57	0,25
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		1,61	0,29	-0,72	4,40	-0,57	-0,53	-0,71	18,79	-0,72
Nigeria	RCA3	0,00	0,47	0,66	4,36	0,00	0,00	5,57	41,87	0,00	6,98
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		0,00	0,49	6,58	-0,99	0,00	0,00	-0,09	-0,72	0,00
Australia	RCA3	0,00	0,00	0,00	0,57	0,25	0,02	0,13	0,04	0,02	0,03
	NRCA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DRCA		-0,87	0,56	0,01	0,22	-0,34	2,05	-0,36	-0,09	-0,36