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Araştırma Makalesi
Research Article

Identifying Sophisticated Product Groups to Focus on at the Regional Level in Türkiye: A Perspective for Sustainable Current Account Balance and Economic Growth[1]

Türkiye'de Bölgesel Düzeyde Odaklanılabilecek Sofistike Ürün Gruplarının Belirlenmesi: Sürdürülebilir Cari Açık ve Ekonomik Büyüme İçin Bir Perspektif

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ABSTRACT

This study aims to address Türkiye's persistent current account deficit and regional imbalances by considering the competitiveness dynamics of the economy. The study seeks to identify sophisticated product groups that Türkiye's 26 economic regions could focus on to achieve sustainable economic growth without generating high current account deficits. For this purpose, the sophistication of regional exports was comparatively analyzed using the EXPY method. Subsequently, the PRODY index was used to identify sophisticated product groups, and the Revealed Symmetric Comparative Advantage (RSCA) index was used to identify product groups in which regions have an export advantage. The analyses revealed that the level of sophistication of regional exports is heterogeneous. For example, it was found that regions such as TR41, TR42, TR51, TR52, and TR83 stand out positively in terms of export sophistication, while regions such as TR32, TR90, TRB1, TRB2, and TRC3 lag behind. Furthermore, the study identified many sophisticated product groups in which each region has a production and export advantage. This finding indicates that Türkiye has significant potential to achieve a more sophisticated production and export structure. In this context, the implementation of regional policies aimed at increasing the export of these sophisticated products for each region would contribute to increasing the sophistication of Türkiye's overall exports.

Keywords:

Current account deficit**,** export sophistication, EXPY, PRODY, region.

Jel Codes:

D24, H62, H68, L15, R58

ÖZET

Bu araştırma, ekonominin rekabet edebilirlik dinamiklerini dikkate alarak Türkiye'nin süregelen cari açığını ve bölgesel dengesizliklerini ele almayı amaçlamaktadır. Çalışmada yüksek cari açık vermeden sürdürülebilir bir ekonomik büyüme performansı için Türkiye'nin 26 ekonomik bölgesinin odaklanabileceği sofistike ürün grupları belirlenmeye çalışılmıştır. Bu amaçla ilk olarak bölgelerin ihracatlarının sofistike durumları EXPY yöntemi ile karşılaştırmalı bir şekilde analiz edilmiştir. Akabinde PRODY endeksi ile sofistike olan ürün grupları belirlenmeye çalışılmış ve bölgelerin ihracatında avantajlı oldukları ürün grupları Simetrik Karşılaştırmalı Üstünlük (RSCA) endeksi yardımı ile tespit edilmiştir. Yapılan analizler sonucunda bölgelerin ihracatlarının sofistike değeri bakımından heterojen oldukları tespit edilmiştir. Örneğin TR41, TR42, TR51, TR52 ve TR83 bölgelerinin ihracatın sofistike değeri bakımından diğer bölgelerden pozitif ayrıştığı; TR32, TR90, TRB1, TRB2 ve TRC3 bölgelerinin negatif ayrıştıkları tespit edilmiştir. Diğer taraftan her bölgenin üretim ve ihracat avantajına sahip olduğu birçok sofistike ürün grubunun olduğu belirlenmiştir. Bu durum Türkiye'nin daha sofistike bir üretim ve ihracat yapısı için önemli bir potansiyele sahip olduğunu işaret etmektedir. Bu bağlamda her bölgenin odaklanabileceği bu sofistike ürünlerin ihracatını arttıracak bölgesel politikaların uygulanması, Türkiye'nin toplam ihracatının daha sofistike olmasına katkı sunacaktır.

Anahtar Kelimeler:

Cari açık, sofistike ihracat, EXPY, PRODY, bölge.

Jel Kodları:

D24, H62, H68, L15, R58

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Introduction

It is argued that developing countries (EMs) should increase their fixed capital investments in order to converge to developed countries (Kormendi and Meguire, 1985; Barro, 1991; De Long and Summers 1991, 1992; Levine and Renelt 1992). These investments even more increase balance of payments deficits observed almost every developing countries (Thirlwall, 1979; Bajo-Rubio, 2014). Countries trying to cope with the emerging deficits primarily try to implement policies aimed at attracting foreign direct investments[8] (FDI) (Al Shubiri, 2016; Aurangzeb and Stengbos, 2014; Brewer, 1993), which are more stable than other types of financing (Lipsey et al., 1999; Goyal and Sharma, 2019). Countries that are unable to generate sufficient current account surpluses finance their needed foreign currencies through portfolio investments. However, portfolio investments, due to their ability to experience sudden inflows and outflows, can make national economies vulnerable, leading to crises (Yayla, 2020; Goyal and Sharma, 2019; Kazgan, 2016; Bhagwati, 1998; Durham, 2004). In this context, it can be stated that balance of payments deficits is one of the biggest obstacles to the sustainable economic growth of Developing Countries.

The Turkish economy, as a developing country, faces challenges related to its inability to foster industrialization and achieve sustainable development. These challenges stem partly from the historical legacy inherited from the Ottoman Empire, including anti-mercantile policies that prioritize satisfying the domestic market (Genç, 2000). Over the past 70-80 years, temporary measures have been taken to address balance of payments crises resulting from the lack of industrialization. However, these measures have been palliative in nature, providing short-term relief without offering long-term and comprehensive solutions. Consequently, the recurrence of such crises every decade has prompted discussions about the middle-income trap[9] in the latter half of the 2010s and the current risk of transitioning into the lower-middle income category (Emsen, 2022).

For Türkiye not to fall into the middle-income trap or to get out of this trap, it is important that it exhibits a sustainable economic growth performance without a balance of payments deficit with properly planned industrial policies. In order to demonstrate such a growth performance, it is obvious that policies aimed at improving the quality of production rather than a quantitative increase in industrial production are required. Otherwise, focusing on the production and trade of low-quality goods will inevitably lead to the terms-of-trade problem in foreign trade literature and thus to the phenomenon of "immiserizing growth", making it inevitable that less developed countries will fall into the "poverty trap" and developing countries into the "middle-income trap". In this context, a rapidly developing literature of economics also highlights the view that the development of the quality (sophisticated value) of production and exports rather than the quantitative increase is more effective on economic growth (Hausmann et al., 2007; Jarreau and Poncet, 2012; Lin et al., 2017; Minondo, 2010; Cristelli et al., 2013; Felipe et al., 2012; Jouini et al., 2016; Nguyen, 2016; Hartmann, 2017; Koch, 2021; Sciarra et al., 2020; Zheng and Wang, 2019; Coşkun et al., 2018; Nepelski and De Prato, 2020; Luu Hai, 2021; Sanguinet et al., 2022; Gerni vd., 2022; Nişancı vd., 2015).

It can be said that Türkiye, which has faced balance of payments deficits in the historical process, should focus on increasing the sophisticated value of its production and exports in order to enter a balanced growth path. In particular, for the Turkish economy and many emerging economies whose growth performance is not based on total factor productivity, it is evident that the capacity to produce high technology goods has been gradually declining, leading to persistent external deficits and the failure to achieve the desired leap in income (Buzdağlı vd., 2019; Aksu vd., 2018). However, in Türkiye, where there is a great heterogeneity among its regions, it would be more realistic to implement policies that will increase the sophisticated value of production and exports on a regional basis[10], considering the potential of each region as well as national policies. Thus, as reflections of efforts to produce qualified goods, it is highly likely to overcome not only the national problems of stable income growth and the persistent foreign trade deficit but also regional issues such as economic imbalances and migration, which accumulate along the East-West divide. In this study, the exports of Türkiye's 26 economic regions were examined, and the sophistication levels of these regions' exports were analyzed comparatively. Subsequently, the product groups in which the regions have advantages in production and exports were identified, and the

[8] Examples of such policies can include trade liberalization, reducing tariffs, reducing government interventions in the private sector, promoting investments, implementing appropriate environmental policies, and reducing the costs of doing business (see Alfaro et al., 2004; Owusu-nantwi and Erickson, 2019).

[9] According to the Middle-Income Trap theory, countries with low-income levels can transition from low-income to middle-income levels by incorporating the underutilized labor factor in agriculture into production during the initial stage of development. However, it is not as easy for countries that have reached the middle-income level to move beyond this stage. In order for a country to achieve a high-income level, it needs to produce more technologically intensive products that involve research and development (R&D) and innovative processes. Countries that fail to do so continue producing standardized products. These countries, which continue to produce products with standard technology, face competition from countries that follow them and have lower incomes and wages. Middle-income countries are unable to compete with these following countries in terms of price. As a result, middle-income countries not only lose their existing markets but also face deteriorating conditions (Felipe, Abdon and Kumar, 2012).

[10] According to 2022 data, it has been determined that there is a positive relationship (+0.546) between the per capita GDP of a region and the proportion of total exports contributed by the products belonging to the region's first and second PRODY groups.

sophisticated product groups on which each region can focus for more sophisticated production and exports were determined. This study aims to contribute to the literature by focusing comprehensively on the sophisticated value of Türkiye's exports on a regional basis.

1. Methodology and Data

In this study, first, the product groups in which regions have a comparative advantage will be calculated with the help of the RSCA index developed by Laursen (2015). Then, the PRODY values, which represent the sophisticated value of the product groups that the regions have a comparative advantage, will be calculated and with the help of these values the EXPY values, which represent the sophisticated value of the total exports of the regions will be revealed. In this part of the study, firstly, the data to be used in the study will be introduced and the sources from which these data have been obtained will be specified. Afterwards, the RSCA method and then the calculation of PRODY and EXPY values will be explained.

1.1. Data

The regional foreign trade data needed to determine the product groups in which Türkiye's regions have a comparative advantage were obtained from TUIK (Turkish Statistical Institute). Since foreign trade data on a regional basis have been available since 2002 as a result of the negotiations with TUIK, the study covered the period of 2002 and beyond. In the study, the foreign trade data of the countries needed to calculate the sophisticated value of the product groups were obtained from the United Nations' Un-Comtrade database. Again, GDP per capita at fixed prices (2017) used in calculating the sophisticated value of product groups according to purchasing power parity was compiled from the World Development Indicator (WDI) database of the World Bank.

1.2. RSCA

The RCA index created by Balassa (1965) gives information about whether a country has a comparative advantage in the product group examined.

$$RCA_k^i = \frac{X_k^i}{X^i} \Big/ \frac{X_k}{X^w} \quad (1)$$

RCA_k^i given in Equation 1 represents the comparative advantage value of country i in k product groups. X_k^i represents the exports of country i in k product groups, X^i represents the total exports of country i, X_k represents the world's total exports of k product groups, and X^w represents the world's total exports. A value between 0 and 1 for RCA indicates not having a comparative advantage, while a value between 1 and ∞ indicates having a comparative advantage. Vollrath (1991) states that this situation causes an asymmetry and proposes to take the logarithm of the RCA value to eliminate this asymmetry.

$$Adj(RCA_k^i) = \text{Ln}(RCA_k^i) \quad (2)$$

In Equation 2, $Adj(RCA_k^i)$ represents Vollrath's suggested asymmetrically corrected RCA value and Ln represents the natural logarithm. Laursen (2015) stated that Vollrath's method cannot be used because if the export value of a country is zero in a sector, since the logarithm of zero cannot be taken, he suggested to recover the RCA values from asymmetry with the help of Equation 3 to correct the asymmetry problem;

$$RSCA_k^i = (RCA_k^i - 1)/(RCA_k^i + 1) \quad (3)$$

The RSCA value in Equation 3 proposed by Laursen takes values between -1 and +1. If the RSCA value is greater than zero, it indicates that the country has a comparative advantage in the product group examined, and if it is less than zero, it does not have a comparative advantage. In this study, the product groups in which 26 economic regions in Türkiye have a comparative advantage will be determined by the RSCA method proposed by Laursen.

1.3. Export Sophistication

After the 2000s, the Balassa method began to be used in a very different way. While the traditional Balassa method analyzes the comparative advantage of a country in any product group, the sophisticated values of product groups and exports of countries have been tried to be calculated by using the Balassa method in studies conducted after the 2000s. Lall et al. (2006) is one of the pioneering studies focusing on the value of sophistication. Hausmann et al. (2007) developed the Lall et al. (2006) study -which dividing countries into 10 according to their income- by using per capita incomes of all countries.

$$PRODY_k = \sum_i \frac{X_k^i / X^i}{\sum_i X_k^i / X^i} * Y^i \quad (4)$$

In Equation 4, the expression $PRODY_k$ represents the sophisticated value of k product groups and Y^i represents GDP per capita at constant prices (2017) according to the purchasing power parity of country i. A high PRODY value indicates a product group with high technology intensity and value added, while a low PRODY value indicates a product group with low technology intensity and value added. In their study, the researchers determined that product groups with high R&D (Research and Development) intensity produced by early industrialized countries such as computers, automobiles and imaging technology have high PRODY values. On the contrary, they found that product groups whose technology has become ordinary, such as grain, agro-food industry and textiles, have low PRODY value. This result supports that PRODY value is successful in classification of product groups. The PRODY values enabled the researchers to use these values to create the EXPY index, which will help calculate the sophisticated values of the countries.

$$EXPY^{it} = \sum_i \frac{X_k^{it}}{X^{it}} * PRODY_k \quad (5)$$

In Equation 5, $EXPY^{it}$ represents the sophisticated value of country's exports each year. As a result of the study, researchers determined that countries such as the USA, England, Germany, Japan and France have high EXPY values, while countries such as Guinea, Niger and Bangladesh have low EXPY values. This situation can be interpreted as the indices calculated by the researchers are successful in classifying countries according to technology intensity.

Both studies conducted by Lall et al. (2006) and Hausmann et al. (2007) have been criticized for using countries' incomes to obtain the sophisticated value of products. Using income to calculate the PRODY value of product groups leads to an undesirable situation such as "rich countries exporting rich country products" (Hidalgo, 2009). Hidalgo and Hausmann (2009) developed indexes called the Product Complexity Index (PCI), representing the export sophistication of product groups using the reflection method by benefiting from physical and computer disciplines, and the Economic Complexity Index (ECI), representing the export sophistication of countries' total exports (Yıldırım, 2018). In this method, the Diversity and Ubiquity criteria were used instead of countries' incomes for the reflection method[11].

In Hausmann et al.'s (2007) study, first, the PRODY values of product groups are calculated, and then the EXPY values of countries are calculated using this value. In Hidalgo and Hausmann's (2009) study, however, the PCI values of product groups and the ECI values of countries are calculated iteratively at the same time. Therefore, the sample used to calculate PCI is also used to calculate ECI.

If the Hausmann et al. (2007) method is preferred, the PRODY value can be calculated using the data of all countries first and then the EXPY values of the regions can be obtained with the help of these values. The Hausmann et al. (2007) method was preferred in this study, since it is thought that it would be more consistent to use the data of all countries instead of only Türkiye's data when calculating the sophisticated values of the products[12]. In short, it is more appropriate to use Hausmann et al. (2007) study as it allows calculating the sophisticated value both based on country and region.

In this study, the PRODY values of product groups that Türkiye's 26 economic regions have a comparative advantage in were calculated, and it was attempted to determine which of the product groups that these regions have a comparative advantage in are more technology intensive. Then, the sophisticated value (EXPY) of exports of these regions was calculated for each year using the data from 2004 and onwards.

1.4. Functioning of the Method

In this study, three filters were used to identify the product groups that regions should focus on:

1. The product group should be within the region's top 100 most-exported products.
2. The RSCA value of region for the product group must be greater than zero.
3. The product group must be highly sophisticated, classified within PRODY groups 1 or 2.

The first filter ensures that the region does not focus on product groups with a minimal share in its exports, aiming to identify more relevant sectors. This approach refines the selection of product groups for the region and helps prevent the scattering of focus. The second filter aims to identify product groups where the region has specialized production, indicated by a symmetric comparative advantage. Finally, the third filter allows the recommendation of sophisticated product groups for the region. For this filter, the methodology from Felipe et al. (2012) was employed, classifying product groups into five separate categories based on their sophistication values. The first group includes the top 204 product groups with the highest PRODY values, representing the most sophisticated products, while the fifth group includes the 204 product groups with

[11] For the detailed calculation of the reflection method (See Hidalgo and Hausmann, 2009; Bayar, 2022).

[12] While the ECI method is acknowledged for its higher reliability compared to the EXPY method, it can be argued that the EXPY method is more convenient for conducting regional studies.

the lowest PRODY values. The second, third, and fourth groups were formed using the same taxonomy. Among these, the third group was determined as the base group. Products in the first and second PRODY groups, which are above the base group, were identified as sophisticated products that regions should focus on.

2. Results

In this study, the changes in the sophistication of regional exports were analyzed. For this purpose, the number of product groups in which the regions have comparative advantage between 2002 and 2022, for which regional data is available, was calculated. EXPY values representing the sophistication of total exports for the regions are also calculated for the period examined. Table 1 shows the changes in the export amounts, EXPY and RSCA values of Türkiye's 26 economic regions from 2002 to 2022.

Table 1. Total export, EXPY, number of RSCA of regions and their changes over the years (2002-2022)

Region	Provinces of Region	Export			RSCA			EXPY		
		2002	2022	Chg.	2002	2022	Chg.	2002	2022	Chg.
TR10	İstanbul	20.970	124.662	494%	486	490	1%	22.817	27.501	21%
TR42	Kocaeli, Sakarya, Düzce, Bolu, Yalova	1.804	20.849	1055%	147	175	19%	28.444	29.965	5%
TR31	İzmir	2.778	16.909	509%	275	325	18%	20.740	25.868	25%
TR41	Bursa, Eskişehir, Bilecik	3.621	14.229	293%	106	219	107%	27.686	28.752	4%
TR51	Ankara	1.515	11.778	677%	288	287	0%	26.226	30.018	14%
TRC1	Gaziantep, Adıyaman, Kilis	630	11.406	1710%	145	138	-5%	22.290	23.049	3%
TR62	Adana, Mersin	781	9.279	1088%	195	234	20%	20.733	22.440	8%
TR32	Aydın, Denizli, Muğla	877	6.665	660%	74	142	92%	15.985	21.615	35%
TR63	Hatay, Kahramanmaraş, Osmaniye	461	5.852	1171%	115	141	23%	18.460	22.152	20%
TR33	Manisa, Afyon, Kütahya, Uşak	457	4.325	846%	99	141	42%	24.772	26.741	8%
TR72	Kayseri, Sivas, Yozgat	366	4.074	1013%	81	112	38%	20.099	24.791	23%
TR52	Konya, Karaman	166	3.610	2074%	171	205	20%	27.556	30.155	9%
TR21	Tekirdağ, Edirne, Kırklareli	347	3.487	906%	90	186	107%	20.561	26.522	29%
TR83	Samsun, Tokat, Çorum, Amasya	71	3.386	4664%	131	99	-24%	23.259	34.255	47%
TR61	Antalya, Isparta, Burdur	239	3.302	1281%	93	175	88%	16.524	23.753	44%
TRC3	Mardin, Batman, Şırnak, Siirt	46	2.275	4897%	120	115	-4%	23.553	19.971	-15%
TR90	Trabzon, Ordu, Giresun, Rize, Artvin, Gümüşhane	507	2.092	313%	76	77	1%	14.362	16.786	17%
TR22	Balıkesir, Çanakkale	143	1.127	689%	90	129	43%	18.983	25.581	35%
TR81	Zonguldak, Karabük, Bartın	42	959	2163%	65	64	-2%	25.675	27.606	8%
TRB1	Malatya, Elâzığ, Bingöl, Tunceli	96	836	771%	27	70	159%	16.073	17.972	12%
TR71	Kırıkkale, Aksaray, Niğde, Nevşehir, Kırşehir	53	783	1366%	102	88	-14%	20.934	27.725	32%
TRC2	Şanlıurfa, Diyarbakır	14	728	5186%	70	126	80%	16.444	23.227	41%
TR82	Kastamonu, Çankırı, Sinop	25	670	2567%	33	58	76%	16.138	24.944	55%
TRB2	Van, Muş, Bitlis, Hakkâri	7	339	5049%	109	69	-37%	28.366	13.029	-54%
TRA2	Ağrı, Kars, Iğdır, Ardahan	26	159	519%	101	249	147%	23.084	25.227	9%
TRA1	Erzurum, Erzincan, Bayburt	8	54	612%	97	67	-31%	23.263	22.774	-2%

Source: Calculated by the authors using data from UN Comtrade, the World Bank, and TUIK.

Examining Table 1, it is observed that the TR10 region is the largest exporter in Türkiye in both 2002 and 2022. It is observed that TR83, TRB2, TRC2, and TRC3 are the regions that have seen the highest relative increase in exports over the examined years. It can be stated that the TR10, TR41, TR42, TR31, TR51, and TRC1 regions contributed significantly to Türkiye's exports by exporting more than 10 billion dollars. On the other hand, it has been determined that the export figures of the TR81, TRB1, TR71, TRC2, TR82, TRB2, TRA2, and TRA1 regions are very low, with these regions exporting less than 1 billion dollars as of 2022.

The RSCA index measures whether a region has a comparative advantage in each product group. A region that has a comparative advantage in a large number of product groups can be interpreted as a region that is diversifying its production and exports. The table shows that TR10, TR31, TR51 and TRA2 have a comparative advantage in a large number of product groups. TRB1, TRA2, TR41 and TR21 are identified as the regions with the highest relative increase in the number of product groups in which they have a comparative advantage during the period analyzed. TRB2, TRA1, and TR83 are the regions with the largest relative decrease in the number of product groups in which they have a comparative advantage from 2002 to 2022.

Examining the EXPY values of the regions, it was found that the EXPY values of 23 regions increased from 2002 to 2022. The TR82, TR83, and TR61 regions are identified as the regions where the EXPY value increased the most. The regions TRB2, TRC3 and TRA1 were found to have a decrease in their EXPY values. When the EXPY value of the regions is evaluated as a whole, it is found that the economic regions located in Eastern Anatolia, Southeastern Anatolia and Eastern Black Sea regions have low EXPY values. On the other hand, it was found that the economic regions located in Central Anatolia, Aegean, Central Black Sea and Marmara regions, where production is concentrated in Türkiye, have high EXPY values. This situation can be interpreted as the calculated EXPY values successfully represent the sophistication of the production of the regions.

After presenting the exports, the number of product groups in which the regions have a comparative advantage, and the EXPY values, Table 2 shows the distribution of the regions' exports by PRODY groups.

Table 2. Product complexity level (1 – highest; 5 – lowest)

Region	PRODY Group-1	PRODY Group-2	PRODY Group-3	PRODY Group-4	PRODY Group-5	PRODY Group 1+2	PRODY Group 4+5
TR42	7%	53%	24%	14%	2%	60%	16%
TR83	46%	12%	10%	14%	18%	58%	32%
TR52	15%	40%	28%	13%	4%	55%	17%
TR51	22%	27%	29%	13%	9%	49%	22%
TR41	13%	32%	29%	18%	8%	45%	27%
TR10	14%	27%	22%	20%	18%	40%	38%
TR33	3%	36%	22%	25%	14%	39%	39%
TR31	11%	26%	20%	19%	23%	37%	42%
TRC2	5%	30%	22%	20%	24%	35%	44%
TR21	13%	18%	33%	14%	21%	32%	35%
TR61	12%	16%	17%	22%	34%	28%	55%
TRA2	6%	19%	37%	20%	18%	26%	38%
TR22	12%	14%	31%	33%	10%	26%	44%
TR81	13%	13%	50%	23%	2%	25%	25%
TR71	13%	12%	42%	27%	6%	25%	33%
TR62	4%	17%	23%	24%	32%	21%	56%
TR32	2%	14%	23%	30%	31%	16%	61%
TR82	12%	4%	37%	18%	29%	15%	48%
TRC3	10%	4%	14%	18%	54%	15%	71%
TRC1	3%	10%	23%	42%	21%	14%	63%
TR63	2%	10%	22%	44%	22%	13%	65%
TRA1	2%	8%	20%	64%	5%	11%	69%
TR72	4%	7%	42%	39%	8%	11%	47%
TR90	2%	7%	7%	32%	53%	9%	85%
TRB1	3%	3%	14%	12%	68%	7%	79%
TRB2	2%	5%	8%	10%	76%	6%	86%
Türkiye	**12%**	**26%**	**23%**	**21%**	**18%**	**38%**	**39%**

Note: The ranking of the regions is made by considering Groups (1+2).
Source: Calculated by the authors using data from UN Comtrade, the World Bank, and TUIK.

Table 2 shows the export shares of the regions according to their PRODY groups. PRODY Group 1 and PRODY Group 2 are classified as sophisticated products. It has been observed that the share of sophisticated products in the total exports of TR42, TR83, TR52, TR51, TR41 and TR10 regions is high. On the other hand, it was found that the majority of exports from TRB2, TRB1, TR90, TR72 and TRA1 regions consist of non-sophisticated products. Analyzing the distribution of the regions' exports based on their PRODY values, it can be observed that regions with relatively technology-intensive production and export centers, such as İstanbul, Ankara, Kocaeli, Izmir, Bursa, Konya, and Eskişehir, are leading in sophisticated production. Conversely, regions in East Anatolia, Southeast Anatolia, and the Eastern Black Sea region, which rely mainly on low-technology products such as agriculture and agricultural-based industrial products, are predominantly engaged in exporting non-sophisticated PRODY groups.

After a comparative analysis of the level of sophistication of regional exports, Table 3 identifies the product groups on which each region could focus in order to achieve more sophisticated exports and economic development. In identifying these product groups, three criteria outlined in the methodology section were applied. First, for a product group to be

recommended to a region, it must be among the top 100 product groups exported by that region. Second, the region must have a Symmetric Comparative Advantage (SCA) in that product group. Finally, the product group must be sophisticated. Table 3 lists three product groups that meet these conditions for each region, while additional recommended products for the regions are listed in the Appendix.

Table 3. Descriptive statistics on product groups that regions should focus on (Million USD)

Region	Product Code	Product name	Region's Export	Türkiye's Exports	World Import
TR83 (Samsun, Tokat, Çorum, Amasya) EXPY:34.255	8973	Jewellery of gold, silver or platinum group metals (except watches and watch-cases) and	1.484	8.206	105.210
	7843	Other parts and accessories of the motor vehicles of groups 722, 781, 782 and 783	166	6.542	419.073
	7271	Machinery used in the milling industry or for the working of cereals or dried leguminous vegetables (other than farm-type machinery)	61	258	1.363
TR52 (Konya, Karaman) EXPY: 30.154	7843	Other parts and accessories of the motor vehicles of groups 722, 781, 782 and 783	437	6.542	419.073
	8913	Non-military arms	123	335	2.830
	7211	Agricultural, horticultural or forestry machinery for soil preparation or cultivation; lawn or	81	252	11.227
TR51 (Ankara) EXPY: 30.018	9310	Special transactions & commodities not classified according to kind	1.354	4.731	704.383
	7224	Wheeled tractors (other than those of headings 744.14 and 744.15)	432	587	27.287
	7929	Parts, n.e.s. (not including tyres, engines and electrical parts), of the goods of group 792	399	613	69.167
TR42 (Kocaeli, Sakarya, Düzce, Bolu, Yalova) EXPY: 29.964	3346	Petroleum oils & oils obtained from bituminous minerals (other than crude) & preparations	3.722	13.092	990.451
	7812	Motor vehicles for the transport of persons, n.e.s.	3.383	9.345	751.544
	7843	Other parts and accessories of the motor vehicles of groups 722, 781, 782 and 783	1.022	6.542	419.073
TR41 (Bursa, Eskişehir, Bilecik) EXPY: 28.751	7843	Other parts and accessories of the motor vehicles of groups 722, 781, 782 and 783	1.209	6.542	419.073
	7139	Parts, n.e.s, for the internal combustion piston engines of subgroups 713.2, 713.3 and 713.8	779	1.759	65.617
	7812	Motor vehicles for the transport of persons, n.e.s.	540	9.345	751.544
TR71 (Kırıkkale, Aksaray, Niğde, Nevşehir, Kırşehir) EXPY: 27.725	7284	Machinery and mechanical appliances specialized for particular industries, n.e.s.	54	803	84.594
	7271	Machinery used in the milling industry or for the working of cereals or dried leguminous	44	258	1.363
	566	Vegetables prepared or preserved otherwise than by vinegar or acetic acid, n.e.s., frozen	24	133	11.291
TR81 (Zonguldak, Karabük, Bartın) EXPY: 27.605	6751	Flat-rolled products of silicon-electrical steel	82	170	5.054
	7372	Metal-rolling mills and rolls and other parts therefor	26	109	4.006
	6756	Flat-rolled products of other alloy steel, not further worked than cold-rolled (cold-reduced)	20	41	2.874
TR10 (İstanbul) EXPY: 27.501	3346	Petroleum oils & oils obtained from bituminous minerals (other than crude) & preparations	7.697	13.092	990.451
	8973	Jewellery of gold, silver or platinum group metals (except watches and watch-cases) and	6.378	8.206	105.210
	7812	Motor vehicles for the transport of persons, n.e.s.	5.386	9.345	751.544
TR33 (Manisa, Afyon, Kütahya, Uşak) EXPY:26.741	7843	Other parts and accessories of the motor vehicles of groups 722, 781, 782 and 783	482	6.542	419.073
	8121	Boilers (other than those of group 711) and radiators, for central heating, not electrically	433	1.116	12.564
	7781	Batteries and electric accumulators and parts thereof	114	599	144.475
TR21 (Tekirdağ, Edirne, Kırklareli) EXPY: 26.521	7843	Other parts and accessories of the motor vehicles of groups 722, 781, 782 and 783	98	6.542	419.073
	7456	Mechanical appliances (whether or not hand-operated) for projecting, dispersing or spraying	82	337	23.877
	6755	Flat-rolled products of stainless steel, not further worked than cold-rolled (cold-reduced)	62	542	28.412
TR31 (İzmir) EXPY:24.849	7843	Other parts and accessories of the motor vehicles of groups 722, 781, 782 and 783	1.008	6.542	419.073
	9310	Special transactions & commodities not classified according to kind	478	4.731	704.383
	7169	Parts, n.e.s., suitable for use with the machines of group 716	387	618	22.460
TR22 (Balıkesir, Çanakkale) EXPY: 25.580	7842	Bodies (including cabs), for the motor vehicles of groups 722, 781, 782 and 783	48	102	7.644
	7169	Parts, n.e.s., suitable for use with the machines of group 716	46	618	22.460
	7219	Agricultural, horticultural, forestry, poultry-keeping or bee-keeping machinery, n.e.s. and	19	124	8.778
TRA2 (Ağrı, Kars, Iğdır, Ardahan) EXPY:25.226	5249	Inorganic and organic chemical products, n.e.s.	3,6	45	4.843
	7832	Road tractors for semi-trailers	1,6	1.294	15.111
	5533	Preparations for use on the hair	1,6	301	16.674
TR82 (Kastamonu, Çankırı, Sinop) EXPY: 24.944	9310	Special transactions & commodities not classified according to kind	72	4.731	704.383
	6991	Locksmiths' wares, safes, strongboxes, etc., and hardware, n.e.s., of base metal	8,9	882	57.183
	2815	Iron ores & concentrates, not agglomerated	6,5	262	134.898
TR72 (Kayseri, Sivas, Yozgat) EXPY: 24.791	8724	Medical, dental, surgical/veterinary furniture (e.g., operating tables, examination tables,	40	116	5.324
	7331	Machine tools (including presses) for working metal by forging, hammering or die-	28	409	8.717
	6782	Wire of stainless steel or other alloy steel	26	306	6.264
TR61 (Antalya, Isparta, Burdur) EXPY:23.753	7144	Reaction engines	168	213	51.967
	8722	Instruments and appliances used in medical, surgical or veterinary sciences (including sight-	153	490	118.423
	7931	Yachts and other vessels for pleasure or sports; rowing-boats and canoes	56	429	10.623
TRC2 (Şanlıurfa, Diyarbakır) EXPY:23.226	2815	Iron ores & concentrates, not agglomerated	111	262	134.898
	7456	Mechanical appliances (whether or not hand-operated) for projecting, dispersing or spraying	12	337	23.877
	7519	Other office machines (e.g., hectograph or stencil-duplicating machines, addressing	11	81	80.173
TRC1 (Gaziantep, Adıyaman, Kilis)	6572	Non-wovens, whether/not impregnated, coated, covered/laminated, n.e.s.	450	767	17.490
	6594	Carpets and other textile floor coverings, tufted, whether or not made up.	186	442	6.848

EXPY:23.049	989	Food preparations, n.e.s.	124	638	85.396
TRA1 (Erzurum, Erzincan, Bayburt) EXPY:22.774	5721	Polystyrene	0,6	356	9.065
	2321	Synthetic rubber and factice derived from oils, in primary forms or in plates, sheets or strip;	0,5	160	29.914
	5429	Medicaments, n.e.s.	0,4	1.057	398.052
TR62 (Adana, Mersin) EXPY: 22.440	3346	Petroleum oils & oils obtained from bituminous minerals (other than crude) & preparations	913	13.092	990.451
	7239	Parts, n.e.s., of the machinery of group 723 (excluding heading 723.48) and of subgroup	64	476	44.358
	6942	Screws, bolts, nuts, coach screws, screw hooks, rivets, cotters, cotter pins, washers	35	804	52.833
TR63 (Hatay, K.Maraş, Osmaniye) EXPY: 22.151	6415	Paper and paperboard, uncoated, in rolls or sheets, n.e.s.	84	251	25.251
	6793	Other tubes and pipes (e.g., welded, riveted or similarly closed), having internal and external	76	433	2.803
	3352	Mineral tars and products of their distillation	51	1.281	16.255
TR32 (Aydin, Denizli, Muğla) EXPY: 21.615	341	Fish, fresh (live or dead) or chilled (excluding fillets and minced fish)	335	649	21.704
	7414	Refrigerators, freezers and other refrigerating or freezing equipment (electric or other), other	114	917	32.633
	5755	Cellulose and its chemical derivatives, n.e.s.	50	134	6.782
TRC3 (Mardin, Batman, Şırnak, Siirt) EXPY:19.971	8973	Jewellery of gold, silver or platinum group metals (except watches and watch-cases) and	181	8.206	105.210
	7641	Telephone sets, including telephones for cellular networks or for other wireless networks;	18	306	640.169
	7725	Electrical apparatus for switching or protecting electrical circuits, or for making connections to or in electrical circuits (e.g., switches, relays, fuses, surge suppressors, plugs, sockets, lamp-holders, junction boxes), for a voltage not exceeding 1,00	10	786	125.591
TRB1 (Malatya, Elazığ, Bingöl, Tunceli) EXPY: 17.971	7448	Lifting, handling, loading or unloading machinery, n.e.s.	8,4	279	23.169
	7272	Other food-processing machinery and parts thereof, n.e.s.	7,4	279	14.398
	7413	Industrial or laboratory furnaces and ovens, etc. and parts thereof	6,4	155	10.593
TR90 (Trabzon, Ordu, Giresun, Rize, Artvin, Gümüşhane) EXPY: 16.785	341	Fish, fresh (live or dead) or chilled (excluding fillets and minced fish)	34	649	21.704
	5986	Organic chemical products, n.e.s.	14	236	71.009
	8919	Parts and accessories of articles of headings 891.12, 891.14 and subgroup 891.3	8,7	53	3.002
TRB2 (Van, Muş, Bitlis, Hakkari) EXPY: 13.029	8919	Parts and accessories of articles of headings 891.12, 891.14 and subgroup 891.3	6,2	53	3.002
	6991	Locksmiths' wares, safes, strongboxes, etc., and hardware, n.e.s., of base metal	2,1	882	57.183
	7165	Generating sets	0,9	687	20.177

Source: Calculated by the authors using data from UN Comtrade, the World Bank, and TUIK.

Considering the sophisticated product groups identified for all regions, it can be stated that if the regions focus on these products and increase their exports, they could achieve a more sophisticated production and export structure. Since the regions have comparative advantages in these identified product groups, they are well-positioned to produce and export these products. The number of product groups identified for each region varies. For example, 20 product groups have been identified for TR10, 33 for TR21, 23 for TR22, 28 for TR31, and 15 for TR32. However, Table 3 reports only the top three exported products for each region. Other product groups identified for each region are provided in the appendix.

In Table 3, the sophisticated products recommended for the regions, along with the exports of these products by both the region and Türkiye, as well as the total global import figures for the examined product groups, are also reported. Upon reviewing the table, it is evident that for many sophisticated products with a significant share in global trade, Türkiye's share is relatively low. For instance, in the product group "Motor vehicles for the transport of persons, n.e.s," which has a global import value of approximately 750 billion USD, Türkiye's total exports amount to only 9 billion USD, a very low figure. According to the analyses, it can be argued that Türkiye needs to increase its exports in this sophisticated product group, which contributes to the sustainable economic growth of countries. The regions identified as having high export potential and the ability to focus on this product group are TR41, TR42, and TR10. Similarly, in the product group "Other parts and accessories of the motor vehicles of groups 722, 781, 782, and 783," which has a global import value of 419 billion USD, Türkiye's exports amount to only 6.5 billion USD. In this sophisticated product group, it has been determined that many regions, such as TR21, TR31, TR33, TR41, TR42, TR52, and TR83, could focus on this product group.

3. Conclusion

One of the key challenges faced by developing countries in their development processes is the current account deficit problem. To prevent or minimize the impact of exchange rate shocks and economic crises, these countries need to maintain a sustainable level of current account deficit. This entails shifting from labor-intensive sectors with low value-added and high competition to sophisticated sectors with high value-added in terms of production and exports. Successful countries that have converged the level of developed countries in recent decades have undergone this transformation in their production and exports. Rather than implementing national-level policies, regional policies should be employed, taking into account the unique potential of each region. Identifying and focusing on the appropriate products based on regional potential is crucial in this regard.

All the economic crises that Türkiye, as a developing country, has experienced, without exception, have originated from the current account deficit problem. In order to prevent Türkiye from being exposed to these crises more frequently in the future, it is necessary to address the current account deficit problem by ensuring the structural transformation of its production and exports rather than relying on recurring palliative measures. To this end, this study aims to determine the general state and sophistication of exports in Türkiye's 26 economic regions and to identify the sophisticated product groups that each region could focus on.

The analysis of the regional data shows that the TR10 region contributes to approximately 50% of the country's total exports, followed closely by the TR41 and TR42 regions. Conversely, the regions with the lowest export figures are identified as TRA1 and TRB2. The analysis revealed that the exports of most regions in Türkiye are not very sophisticated. However, it was found that the economic regions located in parts of the Marmara, Aegean and Central Anatolia regions stand out positively geographically compared to others. For example, the exports of TR41, TR42, TR51, TR52 and TR83 regions were found to be more sophisticated compared to other regions. On the other hand, TR32, TR90, TRB1, TRB2 and TRC3 regions were found to have a relatively ordinary export structure.

As a result of the analyses conducted to identify sophisticated product groups that regions could focus on, it was found that there are many sophisticated product groups in which each region has a production and export advantage. This finding highlights the significant potential for Türkiye to achieve a more sophisticated production and export structure. For example, 37 sophisticated product groups were identified for TR41, 35 for TR42, 40 for TR51, 49 for TR52, and 20 for TR10. On the other hand, for regions with less sophisticated production and export, such as TR32, 15 groups were identified, for TR90, 11 groups, for TRB1, 14 groups, and for TRC3, 8 groups.

In addition, the analysis showed that Türkiye's share in global exports of sophisticated product groups with a significant presence in world trade, such as "motor vehicles for passenger transport", "other parts and accessories of motor vehicles of groups 722, 781, 782 and 783" and "medical, surgical and veterinary instruments and appliances (including instruments for sight testing but excluding electrodiagnostic and radiological instruments and appliances)", is very low. The fact that many regions have a production advantage in these product groups indicates Türkiye's potential to increase its exports in the production and export of these sophisticated products.

Evaluating the results of the study as a whole, it can be said that Türkiye's production and exports are not highly developed. In order to avoid recurring balance of payments deficits, Türkiye must not only increase the quantity of its production and exports, but also improve their quality. Regional level analysis, which identifies many sophisticated product groups in which each region has a production advantage, suggests that Türkiye has significant potential for structural transformation.

Data and material (Veri ve Materyal)

Available upon request from the corresponding author.

Available upon request from the corresponding author.

Etik Beyan ve Açıklamalar (Ethical Declarations and Disclosures)

1. Çıkar Çatışması Beyanı (Conflict of Interest Declaration)

Bu çalışmada yazarlar arasında çıkar çatışması yoktur

There is no conflict of interest between the authors in this study

2. Yazar Katkı Oranı Beyanı (Author Contribution Rate Declaration)

Yazarların çalışmaya katkıları eşit orandadır.

Authors contributed equally to the study.

3. Etik Kurul Bilgileri Beyanı (Ethical Committee Information Declaration)

Tarafımızca yapılan bu bilimsel araştırmada etik kurul kararı gerektirecek herhangi bir faaliyet/çalışma bulunmamaktadır.

In this scientific research conducted by us, there is no activity/study that would require an ethical committee decision.

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Appendix.

Appendix 1. Sophisticated product groups in which regions have competitive power.

Region	Number of products	Product Codes
TR10	17	9310-7832-3352-7753-5429-7165-6991-7725-5416-5335-7726-5922-5752-8939-989-7478-6997
TR21	30	989-6299-7163-6647-7414-5752-5753-7284-7249-6649-6997-7429-5532-5535-7211-7485-6572-6417-5817-5533-7418-7755-8742-5813-7452-6795-6415-7757-6573-5531
TR22	20	249-6956-6994-224-6992-7418-5249-7212-7456-8724-230-8913 -7712-7351-7331-7339-7728-7271-7211-8319
TR31	25	6942-7189-7139-7783-6417-341-5829-7485-7422-8722-7932-7929-7414-7452-7284-6997-8939-5711-7239-8996-5335-7478-7163-5111-7429
TR32	12	353-6782-6647-7372-7211-7272-7435-7244-7418-7484-7245-8946
TR33	23	7414-7726-5829-7211-6632-7417-6994-7724-7929-7728-7491-6415-5332-6795-7219-6763-6631-7853-7418-5419-8996-566-7441
TR41	34	7149-6299-7331-7783-6991-7424-7414-8121-7311-7239-7485-6956-5753-7189-7422-7284-6539-7931-5829-566-6942-7929-7448-7281-7429-6647-7472-7499-7478-8939-7447-6751-7449-6649
TR42	32	7932-6755-5721-7931-7725-7284-7712-5429-5829-6299-6647-7937-5535-6997-5754-5138-2822-7491-7239-2321-5752-6993-6211-5532-6649-7434-6763-5817-6757-7438-6795-7479
TR51	37	7781-5429-6891-7139-7726-7239-7641-2815-8722-7461-7165-6942-6793-8719-7418-8741-7916-7712-7724-5986-7449-6637-6956-8996-7448-7189-7478-7923-6997-6647-7456-7339-8131-5817-7482-8724-6795
TR52	46	7271-7272-7139-7449-6942-733-7331-7189-7448-7431-7456-7212-7438-7485-7414-7219-2815-7239-7484-7788-7452-6299-7429-7284-7163-8939-7418-7481-7425-6994-7443-7919-7726-7479-7426-7478-7413-224-5817-7351-7419-7339-230-7421-8919-7422
TR61	24	7932-8746-7599-8913-8741-8121-5137-7456-6594-6991-7414-7284-7781-7763-7929-7212-6649-8131-7522-7528-8946-249-7448-7426
TR62	9	5138-5721-6793-7212-5335-5752-5754-2772-7189
TR63	6	6417-6751-6782-7246-2815-6754
TR71	14	7212-7163-7219-7447-7272-7418-7425-7482-7211-7481-224-7268-7427-7928
TR72	15	7414-5829-7481-6635-7434-6994-6991-6571-7284-6637-5533-7285-7919-6639-6539
TR81	19	6299-7449-3352-6414-6763-8121-6754-7919-7371-7443-2881-7331-7931-7317-6770-129-7413-7373-7359
TR82	11	7213-2321-6770-7417-6795-7788-7219-7471-6542-8743-8749
TR83	15	341-7413-6415-6299-5817-7434-6795-7728-7418-8919-7212-7499-7482-249-7755
TR90	8	7932-7931-7272-7447-8913-6649-5419-6412
TRA1	18	6793-5829-2815-7478-6782-8722-7212-7725-5986-7211-8939-6635-5817-8744-6795-7373-7425-7162
TRA2	26	7725-5335-7448-733-5721-6991-8121-7726-6649-7755-5922-7414-7212-6594-7311-5535-7211-7426-6415-8939-7478-7484-7451-7481-5752-7456
TRB1	11	7281-989-5829-6635-5711-5813-5751-5755-8312-485-7412
TRB2	10	6649-5533-5817-7212-7427-7472-7162-7441-712-8745
TRC1	7	733-5829-5533-4217-7245-6519-5751
TRC2	19	5533-6793-7163-5817-7426-7523-249-7712-7522-7614-7211-7212-5416-7244-7853-733-7219-8746-7449
TRC3	5	989-7757-5335-7272-249

Appendix 2. EXPY values of the regions by the years

Region	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
TR10	22.817	23.244	23.774	24.208	24.401	24.861	24.523	23.972	23.952	24.580	22.837	25.751	26.050	25.243	25.117	25.870	26.531	26.812	26.574	26.998	27.501
TR21	20.561	20.646	21.041	22.057	22.401	22.646	22.197	22.373	23.269	22.772	22.813	23.077	22.553	22.240	24.513	25.045	25.312	25.380	25.233	26.810	26.522
TR22	18.983	19.534	19.847	21.760	20.649	22.231	23.602	23.989	23.354	23.344	24.831	25.569	25.476	25.363	25.699	25.164	25.163	25.667	25.389	25.651	25.581
TR31	20.740	20.979	21.632	21.829	22.438	22.779	23.388	22.793	23.700	24.352	24.667	23.581	23.429	24.135	23.958	24.769	24.658	24.849	24.243	25.602	25.868
TR32	15.985	16.274	16.956	17.447	18.344	18.976	19.734	19.591	19.874	20.539	20.798	20.608	20.807	20.960	20.812	21.042	21.436	21.467	21.328	21.228	21.615
TR33	24.772	24.205	24.206	24.736	24.472	24.891	25.232	24.307	27.163	27.017	26.719	25.832	26.289	26.430	26.040	26.517	26.740	26.677	26.615	26.810	26.741
TR41	27.686	27.717	28.331	28.468	29.125	29.468	29.742	30.060	29.939	29.652	29.638	28.497	28.618	28.971	29.442	29.476	29.485	29.450	28.974	28.717	28.752
TR42	28.444	30.139	31.101	31.304	31.403	31.473	31.208	30.915	29.963	30.027	30.244	30.374	30.521	30.288	30.498	31.160	31.010	30.675	30.225	29.900	29.965
TR51	26.226	26.216	26.336	26.940	26.834	27.061	26.848	26.570	26.873	26.450	26.882	30.087	30.876	30.987	30.783	30.701	30.966	31.527	30.234	30.126	30.018
TR52	27.556	27.945	27.685	26.916	26.941	27.018	27.164	27.870	26.910	26.747	27.721	28.752	28.955	28.869	28.930	29.031	29.011	29.280	29.942	29.784	30.155
TR61	16.524	21.847	23.210	18.124	18.430	19.785	18.327	18.131	18.146	19.136	18.833	19.470	19.992	20.307	20.633	21.005	21.924	22.539	22.490	22.658	23.753
TR62	20.733	19.797	22.086	22.273	21.952	22.539	22.029	21.435	21.656	21.855	22.164	22.461	21.938	21.999	22.000	22.380	22.289	22.636	22.315	21.797	22.440
TR63	18.460	18.412	19.345	19.764	19.985	19.889	20.084	19.902	20.315	20.843	21.040	20.963	20.955	21.062	20.954	21.381	21.896	22.041	21.535	22.164	22.152
TR71	20.934	20.418	22.565	22.609	23.340	23.600	23.689	23.713	23.723	22.919	23.705	24.212	24.374	25.046	25.043	25.540	25.838	26.339	26.653	26.800	27.725
TR72	20.099	21.727	21.348	21.483	21.552	21.150	22.324	23.321	22.703	22.961	23.555	24.074	24.244	24.435	24.083	23.715	23.828	24.439	24.784	24.670	24.791
TR81	25.675	26.919	27.156	24.935	22.842	24.826	25.477	25.536	26.079	26.251	26.012	26.090	25.759	25.707	26.292	26.904	26.527	26.397	25.980	26.533	27.606
TR82	16.138	15.472	14.812	12.566	12.450	16.205	10.999	15.442	19.383	19.781	21.674	17.070	19.529	20.413	21.577	22.469	22.067	24.501	20.895	20.313	24.944
TR83	23.259	23.742	23.388	23.056	24.122	24.803	22.968	22.904	23.095	23.006	23.838	24.833	24.560	22.680	24.160	24.956	31.960	36.912	28.786	25.140	34.255
TR90	14.362	14.381	13.689	13.373	14.052	14.877	15.687	15.666	15.568	15.375	15.376	15.778	15.786	15.063	14.718	15.033	15.537	14.640	15.507	15.506	16.786
TRA1	23.263	23.633	23.805	23.793	25.371	25.248	14.499	18.897	25.168	26.839	24.348	27.388	24.785	25.543	24.981	23.692	23.834	24.159	20.876	22.581	22.774
TRA2	23.084	22.637	21.658	22.987	22.798	20.023	23.716	24.629	24.090	24.695	25.368	26.234	24.225	23.541	24.333	24.819	24.982	25.378	25.026	24.921	25.227
TRB1	16.073	16.246	16.286	16.505	15.376	16.406	17.146	17.765	18.233	18.288	19.068	16.881	17.788	17.255	16.311	15.943	16.787	17.804	18.989	17.512	17.972
TRB2	28.366	27.690	24.895	24.143	24.071	20.497	21.519	22.712	23.490	25.394	26.847	28.400	28.111	29.549	24.395	18.787	19.176	20.352	15.572	14.055	13.029
TRC1	22.290	23.276	23.376	23.436	24.083	24.595	22.123	22.581	23.094	22.447	22.499	22.893	22.748	21.636	22.137	22.639	23.164	23.345	23.377	23.061	23.049
TRC2	16.444	20.547	20.723	21.812	21.530	19.331	20.042	17.978	18.489	18.187	20.153	23.749	23.747	21.345	21.883	22.069	22.728	23.618	24.594	24.579	23.227
TRC3	23.553	18.330	18.246	18.851	18.816	20.066	19.219	18.731	19.359	19.749	20.564	20.105	19.929	19.153	19.430	18.580	18.829	19.735	20.669	19.570	19.971