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A Products Mapping-Based Analysis of Türkiye's Agricultural Trade Performance: A Longitudinal Perspective with Categorical Transitions

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Abstract This study examines agricultural trade performance of Türkiye from 2002 to 2023 using the products mapping approach developed by Widodo (2008), which combines the Revealed Comparative Advantage (RCA) Index and Trade Balance Index (TBI) to classify products into four categories. This taxonomy provides insight into export specialization and trade dynamics across three major agricultural product groups: animal products, plant products, and processed food products. Using trade data at the 6-digit HS level, the study tracks product transitions between categories over time through bivariate categorical analysis, supported by contingency tables and scatter diagrams. The findings show that processed food products exhibit the strongest performance, characterized by rising net exports and a notable transition from the least competitive category D to more competitive categories A and B, indicating an increasing comparative advantage. In contrast, plant products display more complex dynamics. Although category A products positively contribute to the trade balance, these gains are largely offset by increasing deficits in categories B and D. This outcome is closely linked to a production structure which has increasingly centered on the processing of imported agricultural inputs. This structure has generated sustained trade surpluses in processed food products since the 2000s, alongside a weakening performance in raw and unprocessed agricultural goods. For animal products, the strong performance in fish and poultry exports is the main driver of net export growth. These products moved from category C in 2002 to category A by 2023, thereby partially offsetting rising imports of live animals and meat.

Keywords Products mapping approach · Revealed comparative advantage · Agricultural trade performance

Jel Codes F16, O53, Q17

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A Products Mapping-Based Analysis of Türkiye's Agricultural Trade Performance: A Longitudinal Perspective with Categorical Transitions

Assessment of a country's economic specialization and competitiveness is essential for understanding its role and position within the evolving dynamics of international trade. Various indices have been developed to measure trade performance in terms of specialization, quality, and diversification, offering insights into how economies adjust to global market trends. Among these, the concept of revealed comparative advantage (RCA), initially introduced by Balassa (1965), remains a widely used measure to evaluate a country's export specialization relative to global trade patterns. However, traditional RCA indices focus solely on export flows and often fail to capture the broader complexities of trade performance, particularly in sectors characterized by high import dependency or participation in global value chains.

To address these limitations, Widodo (2008) introduced the products mapping approach, integrating the RCA index with the Trade Balance Index (TBI) to classify products into four distinct categories based on their trade competitiveness. This method allows for a more nuanced analysis by distinguishing between net exporters and importers while also accounting for comparative advantage. By incorporating both exports and imports, the products mapping approach provides a more comprehensive framework for evaluating trade performance, particularly in agricultural trade, where global supply chains, processing industries, and domestic market conditions play a significant role.

This study applies Widodo's products mapping approach to analyze Türkiye's agricultural trade patterns from 2002 to 2023. By examining trade flows at the 6-digit product details in Harmonized System (HS) classification of 2002, the research aims to categorize agricultural products into different groups based on their trade performance and specialization. It also examines how these products move between categories over time, providing insights into structural changes, policy effects, and shifts in comparative advantage. The findings contribute to a deeper understanding of Türkiye's position in global agricultural trade and highlight key trends shaping its specialization in plant, animal, and processed food products.

In the remainder of the study, the next section provides an overview of key trade performance indices such as the RCA index and its extensions, exploring their properties, limitations, and relevance to international trade analysis. With a specific focus on agricultural markets, Section 3 reviews previous empirical studies on agricultural trade performance, focusing on international and Turkish case studies that have applied different trade indices, including products mapping, to assess competitiveness and specialization. Section 4 examines Türkiye's agricultural trade trends between 2002 and 2023. By analyzing export and import flows, net trade balance changes, and shifts in key product groups, it provides context for understanding how trade patterns have evolved over time. Section 5 describes the dataset and methodological approach, developed by Widodo (2008), which combines RCA with the trade balance index to categorize products based on their trade. Besides, it discusses the significance of category shifts derived by the products mapping approach. Section 6 presents the core findings of the study. It first analyzes the distribution of the number of

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agricultural products across the four products mapping categories, identifying their comparative advantage status and net trade balance for the 2002-2023 period. In doing so, it tracks the changes in export and import volume within each category for two decades. Then, a bivariate categorical transition analysis is conducted, tracking how individual products have shifted between categories over time. Contingency tables and scatter diagrams are used to visualize these transitions, highlighting major trends in Türkiye's agricultural trade performance. The study concludes with final remarks.

Empirical Insights into the Theoretical Framework

A series of indices have been developed in order to empirically measure countries' international trade performances in terms of specialization, quality, and diversification. As the number of these indices has grown, their statistical properties have been widely analyzed and compared in numerous studies (Sanidas and Shin, 2010; Liu and Gao, 2019; Stellian and Danna-Buitrago, 2022). In this section, we aim to provide a concise overview of the main indices in terms of their insights over international trade patterns of countries without delving into a detailed statistical comparison. The earliest of these indices, the index of revealed comparative advantage (Liesner, 1958; Balassa, 1965), was introduced to determine the composition of a country's export basket and the significance of its relative specialization in specific products compared to the other countries all over world. This index has been generally accepted and used in many studies due to its simplicity and clarity. It can be expressed as follows:

$$RCA = \frac{X_{ij}/X_i}{X_{jw}/X_w}$$

In the formula, X_{ij} denotes country *i*'s exports of good *j*, and X_i is for country *i*'s total exports. X_{jw} and X_w refer to the total exports of product *j* in the world and total world exports, respectively. Accordingly, the index compares the export share of product *j* in total exports of country i (X_i) with the share of product *j* in total world exports (X_w). If country *i*'s export share of product *j* is higher than the global export share of this product (*RCA > 1*), country *i* has a comparative advantage in product *j*[1].

This index, initially termed "revealed comparative advantage" by Balassa (1965) building on Liesner's (1958) methodology, is regarded as an ex-post indicator of the specialization and division of labor that arise from the comparative advantages highlighted by traditional trade theories. The rationale is that if country *i* produces product *j* more efficiently both within its own product range and in comparison to other countries, it will specialize in producing product *j* at given world prices and export it. This approach seeks to infer the underlying reason (comparative advantage) from the result (exports). For that reason, the calculated value is the 'revealed' comparative advantage. It reflects how a country's division of labor and specialization are manifested in its exports. Unlike absolute advantage, comparative advantage does not indicate a country's market share; instead, it highlights the country's relative specialization in a particular product.

In evaluating countries' international specialization, the export-based RCA index has been widely accepted, frequently revised, and statistically tested. This index is sometimes employed to identify the sectors where a country is strong or weak in exports. However, a country's relative specialization in a product (resulting in higher exports) does not necessarily indicate strength in that sector. Especially, for small countries, the ($\frac{X_{ij}}{X_i}$) share in the RCA calculation will be higher compared to a relatively large country exporting good *j*. This is either because their total exports X_i might be relatively small or because their exports of

[1] Alternatively, when the formula is written as $RCA = \frac{X_{ij}/X_{jw}}{X_i/X_w}$, comparative advantage compares country *i*'s export share of good *j* in World exports of good j to the share of country *i* in total world exports.

that particular good X_{ij} might be relatively large due to a concentration on a limited number of traditional products (Greenaway & Milner, 1993: 186). However, when both countries' exports of product *j* to the world (*Xij*) are compared in absolute terms, the larger country may be exporting a greater amount of product j. For instance, when countries are ranked by their agricultural export performance, the USA holds the top position with $144 billion in 2020. However, agricultural exports constitute only about 12 percent of the USA's total exports of $1.2 trillion (World Integrated Trade Solutions [WITS], 2024). Therefore, while comparative advantage indicates a country's international specialization in export products, it is not sufficient by itself to evaluate export performance (Laursen, 2015: 101). In addition, it is important to include absolute advantages (market share) in the analysis. Another reason for the inadequacy of the RCA index in assessing a country's export performance in a particular product is that while the world market share of the relevant product ($\frac{X_{jw}}{X_w}$) increases relatively, the value of the index decreases (Edwards & Schoer, 2002: 1025). However, an increasing market share of a product globally signifies that it is a relatively "growing" product. However, the RCA index does not address the position of a specific country within a product category with a growing market share. Yet what matters for trade gains is not just a country's increased specialization in a particular product, but also whether that product represents a growing sector worldwide. In a study addressing this issue, researchers evaluated both the change in a country's share of the global market for a specific product and the change in worldwide exports of that product (International Trade Center, n.d.: 15-24; ITC-Trade Map, n.d.). Accordingly, the compound growth rate of country i's world market share of product j (CGR_{ij}) and the compound growth rate of world exports of product j (CGR_j) can be formulated as follows:

$$CGR_{ij} = \left(\left(\frac{X_{ij}^{t}}{X_{jw}^{t_0}}\right)^{\frac{1}{t-t_0}} - 1\right) \text{ x } 100$$

$$CGR_{j} = \left(\left(\frac{X_{jw}^{t}}{X_{jw}^{t_0}}\right)^{\frac{1}{t-t_0}} - 1\right) \text{ x } 100$$

The first indicator refers to the average annual percentage growth of the selected country's share in world exports of *j* over the most recent 5-year period. The latter shows the average annual percentage growth of world exports (in value) of the industry under review over the most recent 5-year period. A positive growth rate suggests that the industry under review is expanding and holds specific potential for future exports. When (CGR_{ij}) is *positive/negative*, country *i* is a *winner/loser* in industry *j*. Besides, product indicates a *growing/declining* market if (CGR_j) *exceeds/falls short* of the growth in global trade (CGR_w). When these two conditions are considered together, the following four scenarios regarding the country's export performance emerge:

$(CGR_{ij}) > 0$ and $CGR_j > CGR_w$ → winners in growing sectors

$(CGR_{ij}) < 0$ and $CGR_j > CGR_w$ → losers in growing sectors

$(CGR_{ij}) > 0$ and $CGR_j < CGR_w$ → winners in declining sectors

$(CGR_{ij}) < 0$ and $CGR_j > CGR_w$ → losers in declining sectors

Thereby, this method enables the examination of how a country's export performance changes over time by comparing the growth of its world market share in a particular product to the overall global market growth of that product.

In a similar vein, Edwards and Schoer (2002) argued that focusing solely on the RCA value and its change would overlook the underlying reasons for the shifts in the components comprising the RCA index. Conversely, using the dynamic RCA indicator they developed, they separately calculated the growth of the numerator (the share of product *j* in the export basket of country i and the denominator (the global export

share of product *j*) of the RCA index between two years. This dynamic framework provides a more nuanced view than static RCA, as it captures trends and shifts in comparative advantage rather than just a snapshot at a single point in time. By analyzing relative trends of the share of product *j* in the export basket of country *i* and world, they evaluated country *i*'s dynamic export performance in six different scenarios shown in Table 1[2].

Table 1

Analysis of Dynamic Export Performance

The share of product j in the export basket of country i: $\frac{\Delta\left(\frac{x_{ij}}{\sum_j x_{ij}}\right)}{\frac{x_{ij}}{\sum_j x_{ij}}}$		The world export share of product j: $\frac{\Delta\left(\frac{x_{wj}}{\sum_j x_{wj}}\right)}{\frac{x_{wj}}{\sum_j x_{wj}}}$	Market position of export products
↑	>	↑	Rising Stars
↑		↓	Falling Stars
↓	>	↓	Lagging retreat
↓	<	↓	Leading retreat
↑	<	↑	Lagging opportunity
↓		↑	Lost opportunity

Source: Edwards & Schoer, 2002: 1026.

Hence, it is crucial not only to boost exports of products with rising market share but also to cut back on exports of products with falling market share. The larger the proportion of products in a country's export basket that are losing market share globally more than locally, the greater the country's ability to withdraw from these exports and shift its focus to other products compared to its counterparts.

On the other hand, Balassa's (1965) traditional RCA index has faced criticism for focusing solely on export flows. If export growth is fuelled by the intensive use of imported inputs, the comparative advantage of the product may be called into question. The Ricardian theory of comparative advantage is based on the trade relationship between two countries within a simplified, two-country framework. Thus, comparative advantage reflects not only which country exports relatively more goods to a specific market. It also implies that in a bilateral trade relationship, one country exports to the other the product in which it has a comparative advantage and in return, imports from the other country the product in which it has a comparative disadvantage. For this reason, it is essential to consider both import and export flows in theoretical analysis. Lafay (1992: 210) states that specialisation is reflected in the trade surplus or deficit of countries in certain products. Moreover, self-sufficiency in agricultural production is crucial in terms of food security, especially for developing countries with relatively high population growth rates. With the shift from production specialization to production sharing within global food chains, agricultural imports by developing countries have risen recently. Consequently, indices that incorporate net trade have gained importance in assessing trade performance.

An earlier version of these indices was developed by Balassa (1966: 470-471) to measure intra-industry specialisation rather than trade performance[3]. This intra-industry specialization for a country in industry *i*

[2] Edwards & Schoer (2002) define a "Leading Retreat" as a situation where a country's export share of product *j* falls more slowly than the global average. However, this interpretation appears conceptually unclear. One could argue that if a country reduces its export share less rapidly than the world, it may actually be adjusting more slowly to declining demand, which could be interpreted as a lagging behavior rather than leading. On the other hand, a country whose export share declines more quickly than the global average might be viewed as making an earlier or more proactive adjustment, which might be considered as an example of leading behavior.

[3] In fact, Balassa (1965: 107) also proposed an alternative index based on the export-to-import ratio alongside the revealed comparative advantage index, which assesses relative export performance. However, he downplayed this index in later studies, arguing that imports

is calculated by the ratio of the absolute difference between the industry's exports and imports to the sum of these exports and imports. Lafay (1992: 212-213) was the first to adapt this intra-industry trade index in calculating comparative advantage, arguing that net trade balance serves as a more accurate indicator of comparative advantage.

Another method for analysing the trade performance of a country is developed by Widodo (2008). Building on Lafay's (1992) concept, Widodo (2008: 148) employed a trade balance index (TBI) to show whether countries are net exporters or net importers of a specific product group i[4].

$$TBI = \frac{X_i - M_i}{X_i + M_i}$$

The use of this index is based on the assumption that once a country's domestic production of a product reaches a sufficient scale, it will develop a comparative advantage and begin exporting it; at the same time, imports of that product are expected to decline as exports increase (Widodo, 2008: 158). Ultimately, he developed a products mapping method by using the TBI index together with the symmetric RCA index developed by Laursen (1998) based on Balassa (1965). The symmetric RCA index can be formulated as follows[5]:

$$\left[RSCA_{ij} = \frac{RCA_{ij} - 1}{RCA_{ij} + 1} \right]$$

Using this approach, products are classified into four distinct categories based on the values of the RSCA and TBI indices.

- Group A: RSCA > 0 and TBI > 0 Comparative Advantage and Net Exporter
- Group B: RSCA > 0 and TBI < 0 Comparative Advantage and are Net Importer
- Group C: RSCA < 0 and TBI > 0 No Comparative Advantage and Net Exporter
- Group D: RSCA < 0 and TBI < 0 No Comparative Advantage and Net Importer

By integrating the TBI index with the RSCA, products mapping approach mitigates the lower RSCA values typically observed in developed countries, which tend to have more diversified product structures and higher overall export volumes.

In a different study that incorporates both imports and exports in the analysis, Vollrath (1991: 276) introduced a revealed competitiveness index (*RC*) designed to cover not only the relative demand side of trade but also the relative supply side. This index, calculated using the logarithmic difference between the relative export advantage RXA_a^i and relative import advantage RMA_a^i indices, can be represented as follows:

$$RC = \ln RXA_a^i - \ln RMA_a^i$$

are significantly influenced by tariffs and other protectionist policies (Balassa, 1977). Yet, trade interventions impact not just imports; measures like export incentives and voluntary export quotas can lead actual export values to diverge from a country's production and specialization patterns (Lafay, 1992: 212).

[4]Since the trade balance index relies on the real value of the net trade balance rather than its absolute value, it clearly reveals whether a country is a net exporter or net importer of a particular product, in contrast to the intra-industry trade indices developed by Balassa (1966) and Grubel and Lloyd (1975).

[5]The RCA index in its classical form is an asymmetric index, which takes values between 0 and +∞ (indicating a comparative advantage for the interval (1, +∞) and comparative disadvantage for the interval [0, 1). The two intervals differ in length; one is finite, whereas the other is bounded on the left. Hence Laursen (1998) overcomes this problem of asymmetry by developing the RSCA index.

$$RXA_a^i = \frac{\frac{X_a^i}{X_n^i}}{\frac{X_a^r}{X_n^r}} \quad ; \quad RMA_a^i = \frac{\frac{M_a^i}{M_n^i}}{\frac{M_a^r}{M_n^r}}$$

In the equations RXA_a^i and RMA_a^i, *r* stands for countries other than country *i*, whereas *n* denotes all other traded products, except product a. In this way, RXA_a^i is formulated as a simple modification of Balassa RCA to prevent double counting of the countries and industries under analysis. Accordingly, a comparative advantage is indicated when RC and RXA_a^i takes positive and RMA_a^i negative values.

On the other hand, Lafay (1992: 212) argued that some cyclical deviations can arise in the foreign trade structure of a country, which in turn might affect the measurement of a country's structurally determined comparative advantage. Therefore, these deviations should be eliminated to accurately analyse foreign trade performance. Based on these considerations, the index he developed can be expressed as follows:

$$LI_{ij} = \left(1000\frac{X_{ij} - M_{ij}}{Y_i}\right) - \left(\frac{X_{ij} + M_{ij}}{\sum_j (X_{ij} + M_{ij})} . \frac{1000\sum_j (X_{ij} - M_{ij})}{Y_i}\right)$$

Lafay (1992) aimed to reduce deviations due to macroeconomic factors by incorporating a country's national income (Y_i) into the analysis. According to the formula above, for country *i* to have a comparative advantage in foreign trade of product *j*, the ratio of the trade balance for this product to national income should be higher than the expected ratio. The expected ratio (the second component in the calculation) is obtained by multiplying the ratio of the sum of the trade balances of all products to national income by the share of product *j* in total trade. Thus, an estimated trade balance ratio for product *j* is obtained. Comparative advantage is valid when the realised balance exceeds the expected balance.

The methodology of Lafay (1992) represents one of the earliest examples of indices which try to analyse trade performance by measuring contributions to trade. This group of indices uses the normalized difference between the actual trade balance and its expected level, where a positive difference indicates comparative advantages and, a negative difference indicates comparative disadvantages. Typically, total trade or the GDP of the country being analyzed is used as the normalization variable (Stellian and Danna-Buitrago, 2022: 130).

Finally, another theoretical approach focuses on the shifts in the international specialization patterns of countries by analysing the relationship between RCA index values and their lagged values through a simple OLS regression. In these studies, the regression equation is expressed as follows:

$$RCA_{i,t_1} = \alpha + \beta\left(RCA_{i,t_0}\right) + \varepsilon_i$$

In this formula, the RCA index at t_1 is regressed on the RCA index at t_0 for each industry *i*. Hence the specialization pattern within an industry is classified into three categories based on the values of the β parameter. For those industries where $\beta \geq 1$, initial specialization pattern is estimated to strengthen over time. If $0 < \beta < 1$, it indicates that the initial specialization pattern stagnated and for $\beta < 0$, it even turned around (Spatz & Nunnenkamp, 2004: 124). While the regression coefficient is useful for understanding average trends, it provides no insight into the changes in the distribution's dispersion (Zaghini, 2003: 17). Assessing changes in the dispersion of the comparative advantage distribution requires a second step, during which the following equation is utilized:

$$\frac{\sigma_{t_1}^2}{\sigma_{t_0}^2} = \frac{\beta^2}{R^2}$$

The left-hand side of this equation shows the ratio of variances of the initial and final values of RCA. Hence, the relation between these variances is related with the square of the correlation coefficient (R^2) and the square of the slope parameter (β^2). Accordingly, the degree of specialization increases from t_0 to t_1, if $\beta>R$, and decreases if $\beta<R$. If $\beta=R$, then the distribution dispersion remains unchanged. Here, the correlation coefficient R is assumed to be a measure of the mobility of sectors along the distribution, and a low level indicates a higher mobility within the distribution (Zaghini, 2003: 22).

As can be seen, each index and comparison method discussed in this section has its advantages and certain limitations. Consequently, there has been a growing trend of studies using multiple indices together to conduct a more comprehensive evaluation of countries' foreign trade structures, aiming to offset the limitations of individual indices by combining them. In doing so, they try to compensate the shortcomings of a single index with another one. The following section reviews pioneering empirical studies arising from these indices, with a particular focus on analysing agricultural foreign trade.

Literature Review

Research on agricultural trade performance varies significantly based on the time frame, products or product groups studied, and countries or country groups analysed. Some studies focus on comparing the effects of changing trade policies on a country's agricultural trade performance across different periods. Others investigate the comparative advantage of multiple countries competing within a specific product market during a particular period. Additionally, when a single country is the subject of the analysis, the literature includes studies that provide a detailed evaluation of agricultural trade performance with a comparison of sub-product groups. In this section, given the subject's scope, the methods and indices specifically applied to analysing agricultural trade performance are comparatively evaluated, drawing on both key studies in the international literature and examples from Türkiye.

Bojnec (2001), known for his research on agricultural trade competitiveness, conducted an early study analysing comparative advantages in Central and Eastern European countries. Following the methodology of Vollrath (1991), he calculated the relative revealed comparative export advantage index (RXA), the relative revealed import penetration index (RMA), and the relative revealed trade advantage index (RC), which represents the difference between RXA and RMA. The results for the 1992–1997 period showed that RXA values exceeded 1 for Estonia, Lithuania, Hungary, Bulgaria, and Poland, indicating an export advantage. In contrast, RXA values were below 1 for Czechia, Latvia, Romania, Slovakia, and Slovenia. On the other hand, the RMA values for all these countries were greater than 1, indicating a comparative disadvantage in import penetration. This lack of advantage was also evident in the RC index, with all countries except Bulgaria and Hungary showing negative or near-zero values. Based on these findings, Bojnec (2001) concluded that these countries did not achieve a relative comparative trade advantage in global agricultural trade following economic liberalization.

Málaga and Williams (2006) analysed the export performance of Mexico's agricultural and food product exports from 1989 to 2004 using the RCA index and export market share. Their findings revealed that Mexico's RCA for agricultural products dropped sharply from approximately 2.5 in 1989 to 0.7 in 1992, attributed to Mexico's unilateral market liberalization during the pre-NAFTA period. While this sharp fall can be observed in all four main subgroups, the RCA values for vegetables and fruit consistently remained above 4 and 1, respectively, indicating a strong revealed comparative advantage pattern. Furthermore, although the RCA analysis indicates that Mexico lacks a comparative advantage in both animal and processed food products,

the processed food category demonstrates dynamic growth in competitiveness, gradually approaching the neutral threshold for comparative advantage. The authors suggest that the future competitiveness of Mexican agricultural and food exports hinges on leveraging products with high export potential. This includes adopting new technologies for crops like tomatoes and peppers, overcoming sanitary and phytosanitary barriers for products like avocados and poultry, and aligning marketing strategies with global consumer trends.

Bojnec and Fertö (2008, 2015, 2016, 2017) conducted a series of studies examining the competitiveness of agricultural trade across various countries, product groups, and time periods. They analyzed the stability of the RCA index distribution and stability of index values for specific product groups, introducing a dynamic perspective on comparative advantage. In their 2015 study, they compared the export competitiveness of agri-food products between new and established EU member states. Using RCA values for 789 product groups at the HS 6-digit level across EU-27 countries from 2000 to 2011, they found a median RCA value below 0.5, revealing the heterogeneous nature of sectoral export competitiveness for most of the countries. While new EU member states had higher RCA values than EU-15 countries, dynamic improvements were observed only in the latter, whereas stagnation or decline characterized the EU-12 countries. Additionally, some of the EU-15 countries (for example, the Netherlands, France and Spain) had a greater number of products maintaining long-term export competitiveness. According to authors, this highlights the importance of the agri-food sector internationalisation and competitive agri-food export integration into global markets to ensure improved market efficiency and stronger linkages between national and global agri-food markets.

Smutka et al. (2012) examined Czech agrarian trade as a whole, with a particular focus on trade with six major partners (Austria, Germany, Italy, the Netherlands, Poland and Slovakia), and tried to identify the impact of world economic crisis in its structure and competitiveness for the period between 2008-2011. While the RCA index is employed to figure out the comparative advantages based on the total volume of transactions in the global agricultural market, the LFI index is preferred to evaluate the comparative advantages specific to the Czech Republic in bilateral trade exchanges. When evaluating the overall competitiveness of Czech agricultural foreign trade for two-digit agricultural product groups under the HS01-24 classification, they found that agriculture as a whole lacks a comparative advantage both in the global market and within the EU market. Nevetheless, certain individual components (commodity groups) do achieve a comparative advantage, not only in the EU market but also on a global scale. They also identified that the years 2008–2011 did not result in a significant deterioration of the comparative advantages of Czech exports, either with respect to the analysed countries, the broader EU27 market, or third countries.

Ishchukova and Smutka (2013) analyzed Russian agricultural trade using Widodo's (2008) products mapping approach. To effectively assess changes in the structure of Russian exports within this RSCA-TBI grouping, they preferred to examine not only the number of products in each category but also their values and their proportion of the total agricultural foreign trade value from 1998 to 2010. Although the majority of products were categorized in Group D, indicating no revealed comparative advantage and a negative trade balance, an analysis based on the export value rather than the number of products revealed that a significant portion of the export value was concentrated in Group A. In addition, the share of Group A in the total value of agricultural exports increased from 43.8% in 1998 to 50.6% in 2010.

Platania et al. (2015) analyzed the agri-food trade specialization patterns across Italian regions using the Lafay index. They identified diverse regional patterns. While 9 regions had comparative advantage in primary agricultural products in the first period, this number decreased to 5 in the second period, attributed to

industrial structures reliant on importing and re-exporting raw materials. Changes in specialization patterns were observed in regions that restructured the distribution of trade flows within the agri-food sector. While specialisation in primary agricultural products declined continuously between 1992 and 2012, in the food and beverage industry, on the contrary, the Lafay index value tends to increase continuously. They also evaluated whether international specialization had intensified or declined over time by conducting an ordinary least squares regression. In this analysis, the Lafay index value from the 1991–1992 period served as the independent variable to predict the 2011–2012 index value for 20 Italian regions. A coefficient (β) greater than 1 indicated an intensification of specialization. Their findings revealed that four regions enhanced their levels of specialization without altering their comparative advantage models.

Fojtíková (2018) examined the changes in China's trade competitiveness in agricultural products after the implementation of World Trade Organisation commitments. Accordingly, it is argued that the trade liberalization on agricultural products was a necessity for fulfilling the imbalance between the domestic supply and demand for agricultural products on the Chinese market. By calculating the contribution to trade balance index and RCA index for 6-digit products from HS01-24 and for the years 2001 to 2015, it was found that China maintained its contribution to the trade balance in some prepared foodstuffs (HS16, HS20) and some vegetable products (HS07) in both 2001 and 2015, but the index values declined in 2015. This can be explained by the increase in China's agricultural imports in the relevant period. On the other hand, oilseeds and fruits (HS12) stand out among product groups with a negative contribution to the trade balance in both periods. According to the RCA index, China has comparative advantage in HS05, HS07, HS13 and HS16 product groups in 2015. However, the trade in some of these products was subject to higher state control and regulation, which implies a biased impact on the competitiveness of these products.

Verter et al. (2020) conducted a study using the Lafay index to examine the dynamics of comparative advantage in the agri-food products trade between Nigeria and the EU 28 countries from 1995 to 2017. While they applied the products mapping method, they differed from Widodo (2008) by combining the trade balance index with the Lafay index instead of the RSCA index. Analyzing 46 products at the three-digit level of detail in SITC Revision 3, they observed a decline in Nigeria's comparative advantage in these product categories over the related period.

Saeyang and Nissapa (2021) investigated the trade competitiveness of four palm oil products (crude palm oil, refined palm oil, crude palm kernel oil, and refined palm kernel oil) from Indonesia, Malaysia, and Thailand in the global market between 2001 and 2017 in HS 6-digit categorization. By employing the products mapping approach of Widodo (2008), they illustrated the RSCA-TBI mapping of three countries for each product group. Accordingly, Indonesia consistently demonstrated the highest comparative advantage and was a net-exporter for all four palm oil products throughout the study period. It is argued that policy reforms encouraging higher-value refined product exports strengthened its competitiveness in refined palm oil and refined palm kernel oil. Malaysia initially outperformed Indonesia in refined palm oil and kernel oil until 2011, but its competitiveness declined thereafter, due to intensified competition from Indonesia. Lastly, Thailand showed varying levels of competitiveness, with its strongest trade performance observed in crude palm kernel oil, where it held a net-exporter status and a position of comparative advantage.

Rumankova et al. (2022) evaluated trade competitiveness in agricultural products for Czechia and eight other European countries within the same climate zone in a comparative fashion. Focusing on agricultural products significant to Czechia's production and trade structure, they analyzed data for 2005, 2010, 2015, and 2019. Using the Lafay and RCA indices, they categorized the results for each product group and country into

four groups based on the indices' values. They then assessed the development of these countries within the groups over the study period. Their findings revealed that Austria improved its comparative advantage, whereas the other countries either maintained their positions or experienced a decline.

Jarosz-Angowska et al. (2022) evaluated the effect of European integration on the competitiveness of the agricultural sector in countries that joined the EU in or after 2004. The study assessed the changes in the competitive positions of EU-13 countries between 2004 and 2022, categorizing them into four groups based on Vollrath's (1991) revealed comparative export advantage index and trade balance, following a methodology similar to that of Widodo (2008). The findings indicated that the overall competitiveness of all EU-13 countries in agricultural trade within the EU market improved, though significant disparities were observed among individual member states. In 2020, Hungary, Bulgaria, Lithuania, and Croatia were identified as net exporters with a comparative advantage, whereas Poland, Czechia, Slovakia, Estonia, and Malta were net importers with a comparative disadvantage. Latvia and Romania showed improvements in their agricultural trade competitiveness.

When examining the relevant literature on Türkiye, Akgüngör et al. (2002) stand out as one of the earliest contributions to the literature focusing on Türkiye in this field. They analyzed competitiveness of Türkiye in the EU market for tomatoes, grapes, and citrus fruits, which are key products in the fruit and vegetable processing industry. Using the export similarity index, they assessed the similarity between the agricultural export basket of Türkiye in this category and that of EU countries. Their findings indicated that the export composition of the country closely resembled those of Greece, Spain, and Portugal during 1994-1997. To evaluate competitive position, they applied the revealed comparative advantage index and the comparative export performance index. The results showed that Türkiye lacked a comparative advantage in processed tomato exports compared to its competitors but held an advantage in processed grape product exports over Portugal and Spain and in processed citrus exports over Portugal and Greece.

Fidan (2009) examines the citrus products trade of Türkiye with EU-15 member states, analyzing key differences in trade performance (for grapefruits, lemons and limes, oranges, mandarins, and other citrus) using RCA values for exports and imports, as well as Vollrath's (1991) RC index. On average, Türkiye demonstrates comparative trade advantage, as indicated by the RC index, in two product groups: lemons and lime and, grapefruits. According to the mean RCA for exports calculated from the period 1990 to 2003, Denmark, Finland, Greece, Portugal, Spain, and Sweden have comparative advantages in oranges and mandarins relative to other countries. For this product group, the index value of Türkiye exhibits greater variability as measured by the coefficient of variation. It is asserted that the introduction of the Entry Price System in the EU-15 market has adversely affected Turkish orange and mandarin exports.

Şahinli (2013) conducted a comparative analysis of trade performance of Türkiye vis a vis the EU in the agricultural sector using the revealed comparative advantage index. He found that Türkiye held a comparative advantage in 95 out of 420 agricultural products, whereas the EU had an advantage in 186 of these products in 2008.

Erol (2014) examined agricultural trade competitiveness for Türkiye from 1990 to 2013 using Vollrath's comparative advantage index. The analysis revealed that among the 124 sectors prominent in foreign trade volume, 55 exhibited high competitiveness, 10 were at the borderline, and 59 showed low competitiveness. Further evaluation based on RCA trends indicated that, over the 24-year period, competitiveness improved in 18 of the 55 highly competitive sub-sectors, remained unchanged in 3, and declined in 34 sectors. Further-

more, an analysis of the sectoral categories revealed that agri-food products exhibit greater competitiveness than agricultural raw materials.

Erkan et al. (2015) examined the comparative advantage of Türkiye in vegetable exports using the revealed comparative advantage index. Based on the comparison of annual average values for two periods (1993–2002 and 2002–2012), their findings showed that, among 11 sub-products, only the export competitiveness of tomatoes improved, while the competitiveness of other products declined significantly. The study further evaluated the stability of comparative advantage using the coefficient of variation. Accordingly, the comparative advantage in frozen and dried vegetables remained stable, whereas the competitive advantage in potato exports showed considerable instability.

Ceylan et al. (2018) analyzed comparative advantage of Türkiye in the export markets for grapes and cherries using revealed comparative advantages as well as revealed and comparative export performance indices. They found that while Türkiye maintains a comparative advantage in these product categories, its advantage has diminished over time, particularly in comparison to relatively weaker competitors such as France, Spain, and China. Additionally, based on the revealed competitiveness index, which considers both export performance and import capacity, Türkiye outperformed all competitors except Greece and Egypt. However, the study emphasized the need for Türkiye to enhance its comparative export performance in the grape market by focusing on improvements in production, quality, and marketing.

Kesgingöz (2018) assessed the agricultural foreign trade performance of Türkiye from 2001 to 2017, focusing on two-digit agricultural product groups under the HS01-24 classification using the products mapping method. The analysis found that Türkiye had a comparative advantage and was a net exporter in chapters 07, 08, 11, 14, 17, 19, 20, 21, and 24 for nearly all years. Conversely, in chapters 01, 10, 13, and 23, Türkiye exhibits a comparative disadvantage and was also a net importer.

In another study which employs the products mapping approach, Bashimov (2018) analysed Türkiye's structure of foreign trade in live animals and livestock products for the period of 2001-2015. Accordingly, Türkiye has a comparative disadvantage as a net importer in the HS 01 (Live Animals) product group. In the HS 02 (Meats and Edible Offal), HS 03 (Aquaculture Products), and HS 04 (Dairy Products, Eggs, and Honey) product groups, Türkiye holds a net exporter with a comparative disadvantage. Meanwhile, in the HS 05 (Other Products of Animal Origin) category, the comparative advantage-net exporter status has shifted to a comparative disadvantage-net exporter position. The study argues that the comparative disadvantage of Türkiye in all product categories might be a result of the small-scale production structure which drives up production costs and, in turn, raises product prices. This also poses challenges for marketing efforts.

An Overview of the Agricultural Trade of Türkiye

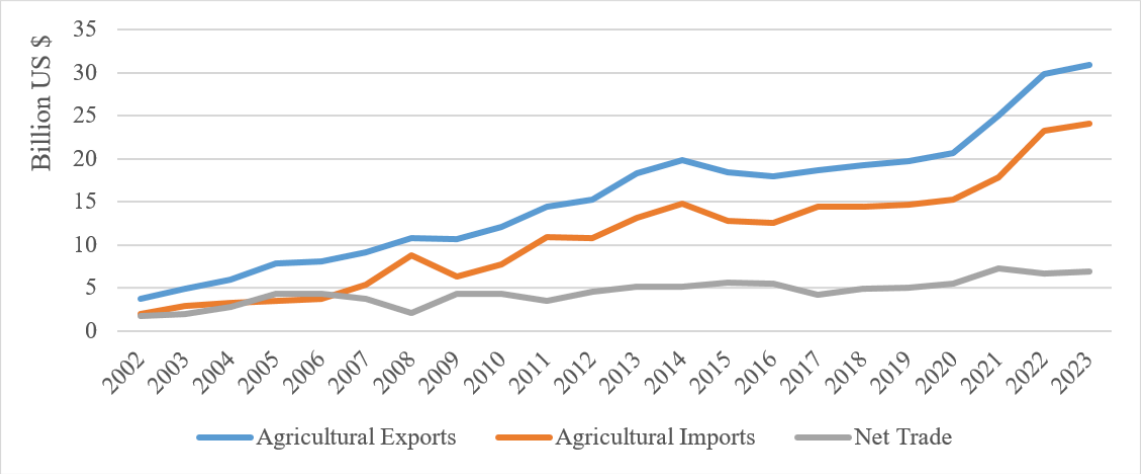
Türkiye plays a significant role in global agricultural production, contributing notably to the world food supply. In 2021, it ranked eighth globally in terms of agricultural value-added, accounting for 1.74% of the global share—equivalent to $65.58 billion (WDI, 2022). Based on FAO data, Türkiye also ranked seventh in 2023 in terms of gross agricultural production value[6] (FAOSTAT, 2025). However, despite this strong production capacity, the country's agricultural exports were valued at nearly $31 billion, placing it only 19th among the world's top agricultural exporters (WITS, 2024). This discrepancy between production and export performance may be attributed to several factors, including high domestic consumption driven by a large

[6]Gross production consists of the intermediate inputs within the agricultural sector (seed and feed). FAO (2025) https://www.fao.org/statistics/methods-and-standards/agriculture/en#navbarNavWebsite.

population, an export composition dominated by lower-value plant-based goods, and limited access to high-demand export markets due to tariffs and non-tariff barriers—particularly sanitary and phytosanitary measures. Nevertheless, the share of agricultural exports to GDP gradually increased from 1.52% in 2010 to 2.67% in 2023, indicating an increase in the international openness of the agricultural sector (FAOSTAT, 2025).

Figure 1

Agricultural Trade Flows in Türkiye



Source: WITS, 2024.

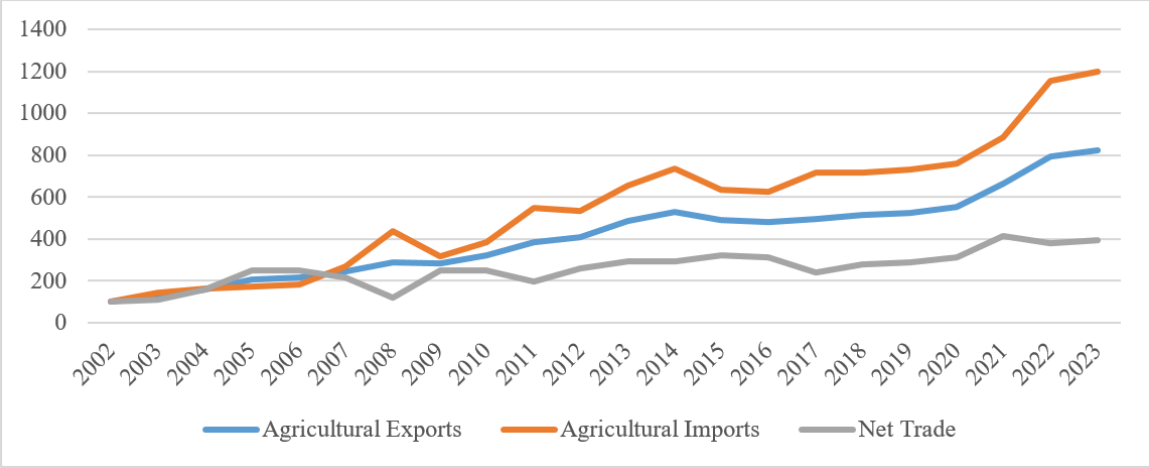
The trajectory of Türkiye's agricultural foreign trade[7] between 2002 and 2023 reveals that total exports consistently exceeded total imports each year, resulting in a sustained surplus in the agricultural trade balance. In 2023, agricultural export and import volumes reached nearly $31 billion and $24 billion, respectively. Figure 1 illustrates that although a foreign trade surplus in agricultural products has been sustained, the net trade balance has remained stagnant over the past decade, a phenomenon that calls for further investigation.

Figure 2 shows agricultural exports and imports indexed to their 2002 levels. When focusing on the trend of agricultural imports, it becomes clear that the increase in imports has outpaced that of exports. Between 2002 and 2023, agricultural exports grew by a factor of 7.25, whereas agricultural imports rose by a factor of 10.99. Consequently, the trade balance experienced only a relatively modest growth of 2.96 times during this period.

[7]The study identifies agricultural food products as those classified under codes 01-24 in the Harmonized System 2002 classification of agricultural trade data.

Figure 2

Trends in Agricultural Trade in Türkiye (2002 = 100)

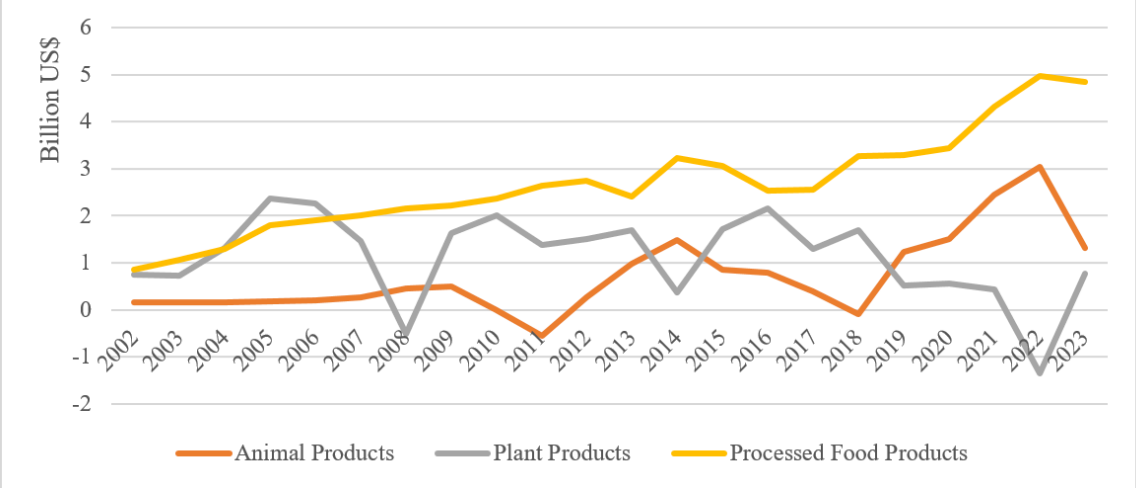


Source: WITS, 2024.

Analysing the stagnation in net trade by key product categories in Figure 3 reveals a declining trend in net trade flows for plant products, which comprised 50% of the total agricultural export basket in 2023. On the other hand, net trade of processed food products exhibits a stable upward trend during the same period.

Figure 3

Turkish Agricultural Trade Balance by Main Product Categories



Source: WITS, 2024.

One of the key factors behind this trend is the neoliberal transformation of Türkiye's agricultural production, specialization, and foreign trade structure over the past 25 years. Due to production activities focused on processing imported agricultural raw materials, both within and outside the scope of the inward processing regime, Türkiye's agricultural trade balance since the 2000s has been marked by a surplus in processed food products and a declining trend in agricultural raw materials and unprocessed goods (Aydın & Aydın, 2018: 127; Karagöz Özenç, 2023: 59). It is also worth noting that the processed food exports include the re-export of certain imported agricultural inputs, which may lead to an overestimation of their actual value. Therefore, a more accurate assessment can be achieved by examining export and import flows at a detailed product level.

In the animal products category, net exports have shown an upward trend. This positive trade balance is primarily driven by exports of fresh chilled fish, poultry, and fish fillets, which have offset the increased imports of live bovine animals and their meat since 2010. This outcome is further analysed in Section 6.

Data and Methodology

In the context of the indices summarised so far, Widodo's (2008) products mapping method is chosen to examine the performance of Türkiye in the agri-food trade. The study employs an exploratory data analysis approach to graphically interpret the data and identify general trends, differences, and changes.

In his study, Widodo (2008: 160) examines SITC Rev. 2 trade data at the 3-digit aggregation level. He justifies this level of aggregation by arguing that the Heckscher-Ohlin trade model relies on the assumption of perfectly homogeneous commodities, which cannot be accurately identified using more disaggregated data. In contrast, this study prioritizes utilizing the most detailed data available in the agri-food industry, covering both homogeneous and differentiated products. It considers that specialization and trade patterns may arise from factors such as economies of scale, vertical disintegration of production, love of variety, income inequality, rather than solely by differences in technology or factor endowments, as proposed by classical trade theories. Taking these factors into consideration allows us to shift from the assumption of comparative advantage in distinct goods, based on the premise of homogeneous products, toward explaining comparative advantages in differentiated versions of similar goods.

For this reason, this study employs agricultural product trade data from 2002 to 2023 for products categorized under HS01-24 codes in the Harmonized System 2002 classification at the 6-digit aggregation level. Notably, this is the first study to assess the agricultural trade of Türkiye at this level of product detail using the products mapping method. There are a total of 729 products under HS01-24, of which Türkiye traded (exported and/or imported) 720 at least once during the 2002-2023 period. As part of the analysis, the net trade values for these 720 6-digit products were calculated based on export and import data retrieved from the WITS database. Additionally, RCA indices were also obtained from the WITS database.

Table 2

The number of traded products in each product category

	Harmonized System 01-24 products	Agricultural products, RCA is valid for Türkiye	Agricultural products, TBI is computed for Türkiye
HS01-05 Animal Products	220	188	212
HS06-15 Plant Products	315	301	314
HS16-24 Processed Food products	194	189	194
Total	**729**	**678**	**720**

Source: Author's own computation.

Accordingly, at least one RCA value was obtained for 678 products in the same period. As shown in Table 2, RCA values could not be determined for all 720 products included in the trade balance index. This limitation arises because RCA values are calculated solely based on export data. Consequently, only 678 of 720 products were subject to exporting, whereas the rest were only imported[8]. Products mapping was

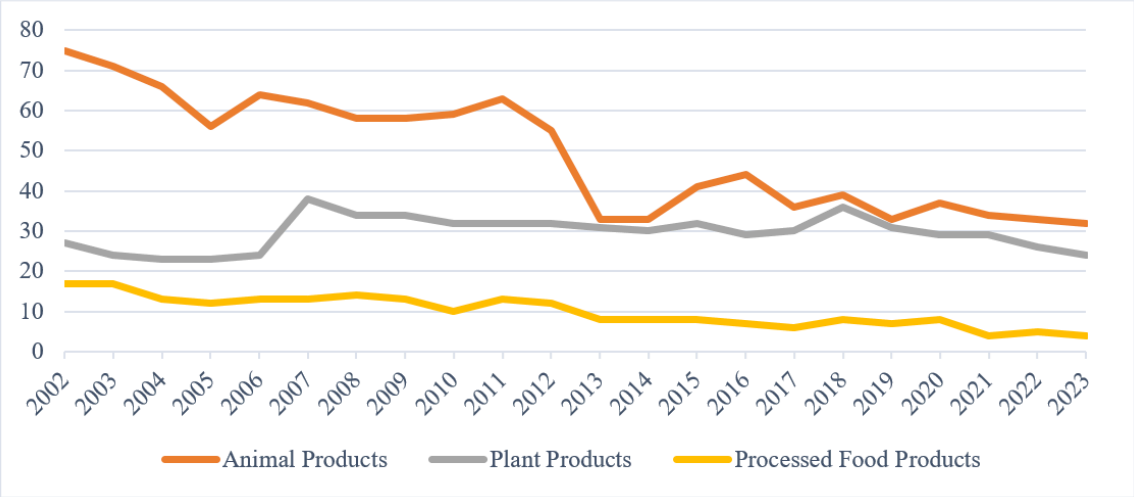
[8]Among the 42 products that Türkiye exclusively imported without exporting during the entire period, 24 fall under the Livestock category, 13 under Crop Products, and 5 under Processed Food Products.

conducted for these 678 products, comprising 188 animal products, 301 plant (vegetable) products, and 189 processed food products, combining the RCA values with TBI values.

On the other hand, a comparison of the 720 products that were traded at least once with the number of traded products each year reveals that over the past twenty years, the number of non-traded products in the animal and processed food categories has consistently declined annually (see Figure 4). It is a notable observation that provides insight into Türkiye's growing integration with global food markets in recent years especially in the animal products category.

Figure 4

Trends in the Number of Non-Traded Products for Türkiye



Source: Author's own computation.

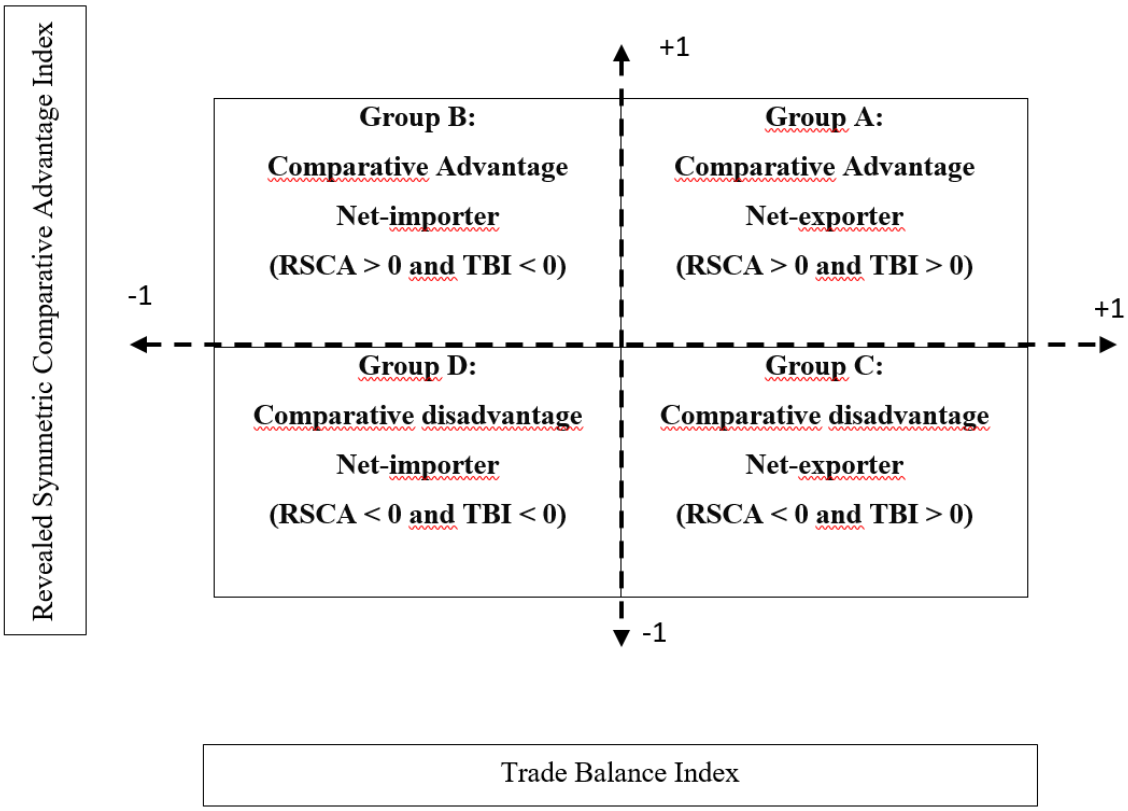
As mentioned earlier, the products mapping approach is based on the categorization of a country's trade flows into four groups based on the values of two indices, as shown below. While the vertical axis distinguishes products in terms of a country's comparative advantage, the horizontal axis classifies them based on its trade balance. Including trade balance in the analysis is particularly important, when considering the country's size. For instance, a small country may have a RSCA value greater than 1 for a specific product but still experience a trade deficit. Conversely, the larger countries might exhibit low RSCA values, even if their trade balance in that product is positive.

In addition, analysing the annual trends for each product offers a chance to monitor the evolution of a country's trade performance. For instance, if a product experiences a shift from category C to category A, it implies an attainment of comparative advantage through a consistent trade surplus.

In a similar vein, a transition from category B to category A indicates a stable comparative advantage, promoting exports and facilitating a shift from a net importer position to a net exporter position.

Figure 5

The Products Mapping Approach



Source: Widodo, 2008: 160.

The shift from category C to category B might suggest that the country has increased specialization in products with a worsening trade balance. This may indicate a rise in the export share of these products within the country's export basket (numerator in RSCA), which leads to a positive RSCA. Nevertheless, transition to a negative trade balance might be an indicator of an increased domestic demand for the concerned product, which might not be satisfied with domestic supply.

For a product in group D, where the country is a net importer and lacks a comparative advantage, a progression to group A over time will only be feasible if the country consistently prioritizes these products in its production and specialization strategies. In this scenario, production is likely to first target the domestic market before focusing on exports. Therefore, the transition to group A is expected to occur via group C rather than group B. In other words, the trade balance is anticipated to improve (through increased domestic consumption and reduced imports) before achieving a comparative advantage. Otherwise, this could indicate an export processing regime where products bypass the local market and/or are directed exclusively toward exports.

Considering these potential shifts, the next section adopts a longitudinal approach to observe how products have transitioned between categories over time. Since each product's category is defined by the values of two indices, the analysis involves examining how changes in these two variables influence the transition of products from one category to another.

Analysis of Agricultural Trade Patterns of Türkiye: A Products Mapping Approach for HS 6 digit products

Utilizing the products mapping approach, this section aims to analyze Türkiye's agricultural trade patterns in two stages. First, it examines the yearly distribution of agricultural products across categories based on the products mapping results. Subsequently, it performs a bivariate categorical transition analysis, tracking how individual products shift between categories from 2002 to 2023, to gain insights into the development trajectory and trade performance of agricultural production.

Assessment of the Products Mapping Results

Table 3 presents the numerical distribution of agri-food products, categorized into four primary groups (A, B, C, and D) within the products mapping framework. Since the analysis uses 6-digit detailed product data, some products had neither exports nor imports in certain years. As a result, net trade balance indices could not be calculated for these products during the specified period, and they are classified as "No Trade" in Table 3.

Table 3

The number of products in each category

Animal Products	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
A	17	15	16	18	17	16	17	16	17	17	18	17	20	19	18	17	17	23	21	25	26	21
B	1	1																				
C	66	72	69	73	65	74	68	60	60	56	65	77	66	65	62	68	75	69	90	87	86	83
D	47	48	52	55	57	55	61	65	66	70	63	74	83	79	82	82	73	81	60	61	60	68
No Trade	57	52	51	42	49	43	42	47	45	45	42	20	19	25	26	21	23	15	17	15	16	16
Plant Products	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
A	81	82	70	68	70	67	68	72	76	72	64	63	61	68	66	64	75	73	70	79	78	72
B	6	3	4	8	6	3	7	4	3	4	4	6	10	5	7	7	11	12	14	14	12	21
C	74	79	82	79	73	69	65	65	65	69	73	74	69	68	70	70	66	71	76	73	84	85
D	122	122	130	132	137	136	138	138	135	136	139	139	142	141	141	141	126	127	123	118	110	107
No Trade	18	15	15	14	15	26	23	22	22	20	21	19	19	19	17	19	23	18	18	17	17	16
Processed Food	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
A	45	42	37	39	42	39	42	44	45	48	46	47	47	45	44	44	49	45	49	53	54	48
B	2	4	3	4	3	3	2	3	1	2	1	3	3	2	2	3	3	3	2	3	6	4
C	59	56	59	62	55	63	53	49	55	60	65	58	55	54	58	60	59	62	60	62	62	63
D	70	74	78	73	77	76	81	83	82	70	68	77	80	83	81	79	74	76	73	69	65	72
No Trade	13	13	12	11	12	8	11	10	6	9	9	4	4	5	4	3	4	3	5	2	2	2

Source: Author's own computation based on WITS data.

In the case of animal products, while the number of non-tradable items has decreased significantly from 57 to 16 over time (Table 3), a cross-reference with Table 6 reveals that many of the newly introduced products —especially those appearing after 2012—have been classified under categories C and D. This suggests that

these products are largely those where Türkiye lacks a comparative advantage, but exhibits variations in net trade. Moreover, the average annual number of animal products in category A is approximately 19, which is significantly lower than those in categories C and D in all years.

Furthermore, while the number of plant products classified under categories A and D declined over time, the number of plant products in categories B and C grew. Conversely, the distribution of products across each category in the processed food product group has remained relatively stable over the years.

Meanwhile, Table 4 presents the distribution of export values across these categories. Comparing this table with Table 3 reveals that, despite the limited number of products in category A, the export value of animal products reaches at 85% of the export basket in animal products in this category, and this figure amounts for $2,8 billion in 2023 (Annex Table 1). Furthermore, Table 5 and Annex Table 2 illustrates the distribution of import shares and values across these categories, respectively. As compatible with the construction of products mapping method, import values are naturally concentrated mostly in category D for all product groups. In 2023, animal product imports in category D totaled $1.7 billion.

Table 4

Export Value Shares in Each Category

Animal Products	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
A	76	71	75	71	69	65	67	70	72	81	75	81	82	79	80	77	77	82	84	90	88	85
B	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C	19	21	20	24	26	31	30	24	26	18	24	18	16	18	17	21	21	15	14	8	9	12
D	5	4	4	5	6	4	3	7	1	1	1	2	2	2	2	2	2	3	2	2	2	3
Plant Products	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
A	96	96	94	95	94	95	92	93	92	91	92	86	81	83	82	76	83	83	80	81	78	77
B	1	1	1	1	1	1	3	2	1	4	2	2	7	3	3	8	7	7	10	9	10	12
C	2	3	5	3	4	3	4	3	3	4	4	3	3	3	4	4	4	2	2	3	3	7
D	1	1	1	1	1	1	1	3	4	2	2	9	9	11	12	12	6	7	7	7	9	4
Processed Food	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
A	92	87	88	88	85	84	91	90	91	90	90	85	84	84	82	81	82	80	81	83	80	83
B	1	1	1	1	5	7	0	1	1	1	1	6	6	5	6	6	6	1	1	4	6	5
C	4	9	8	8	9	8	6	6	6	6	8	6	6	5	6	8	6	9	8	6	11	8
D	2	3	3	4	1	1	3	3	2	2	1	3	4	6	6	5	6	11	10	7	3	4

Source: Author's own computation based on WITS data.

On the other hand, the plant products group holds the largest share in the Turkish agricultural trade. In 2023, exports and imports of plant products reached $15.6 billion and $14.8 billion, respectively. These figures account for 50% of agricultural exports and 62% of agricultural imports. However, the plant products group has experienced a notable decline in trade performance, both in terms of net export values and the products mapping results. As shown in Figure 3 (Section 3), net trade flows for plant products have been on a downward trend. When analyzed alongside the products mapping results in Tables 4 and 5, this reveals a significant pattern in trade performance. The export value share of products classified under category A has steadily declined from 96% in 2002 to 77% in 2023. Meanwhile, the export value share of category B

has notably increased from 1% to 12% over the same period. On the import side, the import value share of category D gradually declined from 88% to 53% over the same period, while category B saw an increase from 5% to 32% for plant products. The increased significance of category B on both export and import value shares is driven by the transition mainly from category D and partly from category A to category B, a development that will be explored further in the next section.

Table 5

Import Value Shares in Each Category

Animal Products	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
A	26	24	26	20	14	11	11	6	4	3	4	26	33	10	10	7	4	16	17	18	26	9
B	5	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C	3	4	3	5	2	8	12	7	7	4	5	9	12	11	8	6	5	5	6	11	11	7
D	66	64	70	75	84	81	78	87	88	93	91	64	55	79	82	87	91	80	77	71	62	84
Plant Products	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
A	6	5	4	6	6	5	3	8	9	4	6	8	3	10	13	7	11	9	7	7	10	10
B	5	11	13	14	10	11	11	10	8	13	8	9	12	6	10	14	18	18	27	26	25	32
C	0	1	1	1	3	1	0	0	0	1	1	1	2	1	1	1	1	1	1	1	1	4
D	88	84	82	79	81	84	85	82	82	83	85	82	83	83	75	78	71	73	66	66	65	53
Processed Food	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
A	7	4	5	6	7	6	18	19	20	21	18	21	19	14	11	11	13	13	11	16	17	24
B	4	7	2	6	18	16	1	4	2	6	2	10	10	11	11	17	17	2	2	17	23	14
C	1	1	2	4	6	6	4	3	3	3	6	3	4	3	3	5	4	5	5	3	11	4
D	88	88	91	84	69	72	77	74	75	69	75	66	67	72	74	67	66	80	83	64	49	58

Source: Author's own computation based on WITS data.

Evaluating the foreign trade performance of the processed food product group using the products mapping method, Table 3 indicates that in 2023, the majority of the 189 products in this group fell under categories C and D, while only 48 products were classified in category A. Regarding export value shares in Table 4, although the number of category A products is relatively modest, their total export value reached nearly $10 billion in 2023, accounting for 83% of total processed food product exports. While this share remains significant, it has declined from 92% in 2002. Over the same period, the export value shares of all other categories have increased, with category C emerging as the most prominent among them, holding an 8% share in 2023.

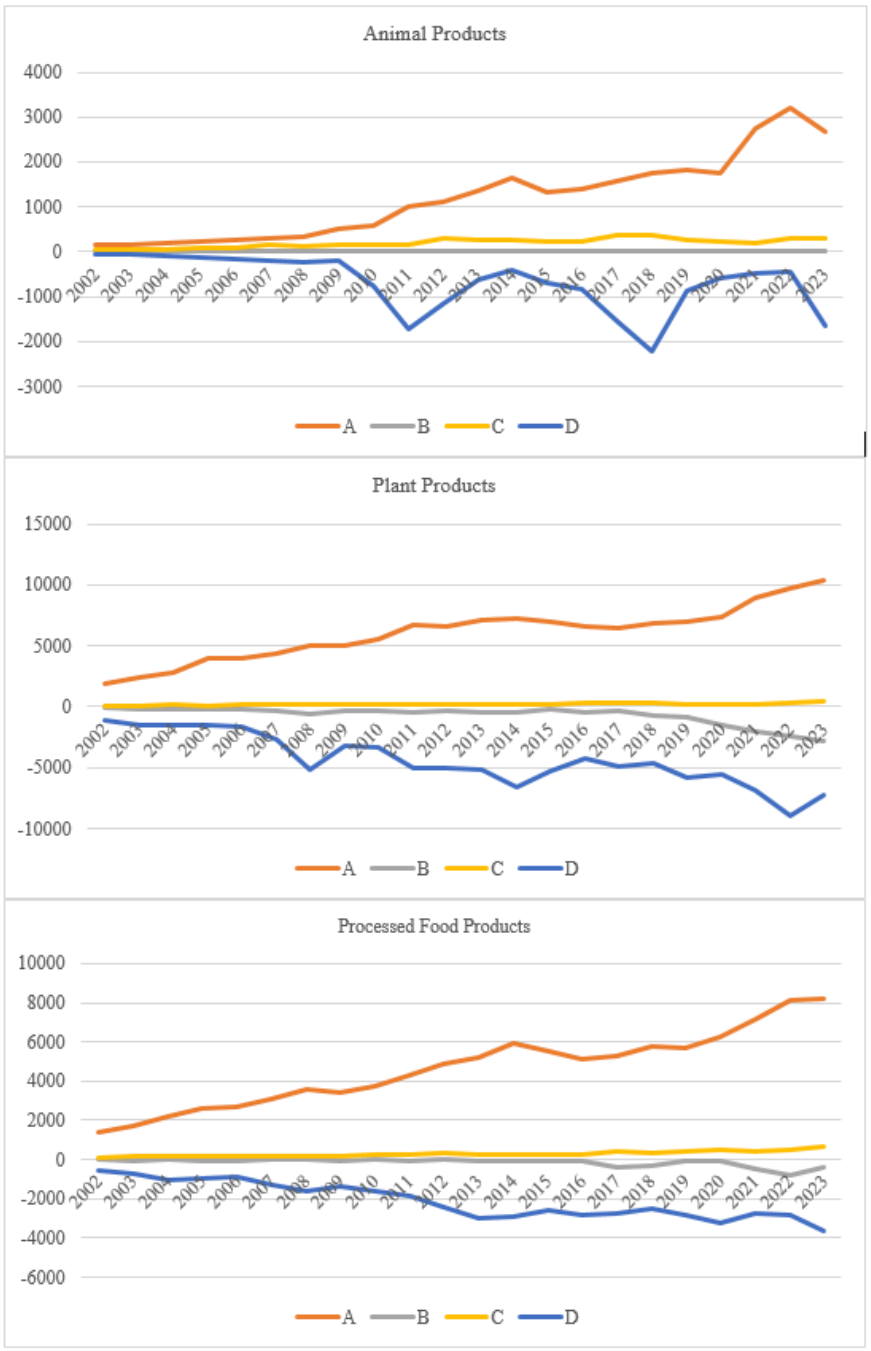
Meanwhile, for the processed food product group, Table 5 shows that the import value share of category D steadily decreased from 88% to 58% over the same period, mirroring the trend observed in plant products. In contrast, category A increased from 7% to 24%, whereas category B rose from 4% to 14% for this group. Similar to the pattern observed in plant products, this shift is likewise driven by the movement from category D to categories A and B, a development that will be examined in more detail in the following section.

Lastly, Figure 6 depicts the net trade flows for each products mapping category across the three main product groups. As discussed earlier in the theoretical background, comparative advantage not only determines which country exports more goods to a specific market, but also implies that, in a bilateral trade

relationship, each country imports products in which it has a comparative disadvantage. Moreover, in today's globalized multilateral economy, where a country can both export and import the same product, net trade flows play a key role in comparing countries' comparative advantages.

Figure 6

Net Trade Flows in Each Category



Source: Author's own computation based on WITS data.

Hence, considering this fact, Figure 6 shows that the net trade balance of products in category A has increased in animal and processed food products, while in plant products, it began to rise recently after

a stagnation between 2011 and 2020. Nevertheless, for plant products, the positive impact of the growing trade surplus in category A was mostly offset by the rising trade deficit in categories B and D during the same timeframe. In animal products, the improvement in the foreign trade balance for category A appears to have partially offset the deficit in group D. Compared to other main product groups, processed food products show relatively strong performance. While the foreign trade balance of the most disadvantaged category, group D, has recently begun to gradually worsen after a prolonged period of stagnation, the foreign trade balance of products in the best-performing group A appears to be on an upward trend.

Thus far, the overarching trends in the products mapping categories were examined. However, these findings do not offer a detailed discussion on whether any change in one category is driven by the change in the existing products in that category or by the result of products transferred from/to other categories. The following section seeks to provide further clarification on this issue.

Products Mapping and Category Transitions: A Longitudinal Analysis

In the previous section of the products mapping analysis, an overall evaluation of the distribution of the main product groups into four categories was conducted, with an attempt to highlight general trends. While these assessments help us understand the overall concentration of products over time, they do not offer specific insights into the trajectories of individual products over the years. Hence, this section is devoted to tracking the changes in each product by comparing 2002 and 2023, using contingency tables and scatter diagrams to illustrate the shifts between categories. Thereby it is aimed to analyse the development trajectory and trade performance of agricultural production on a product basis.

Table 6 distributes the number of products of each category in 2002 (the rows) to 2023 categories in the columns. In doing so, it displays the overall shifts across the four products mapping categories in three main product groups in a matrix format. A quick glance at Table 6 provides us with initial, broad insights into the changes in the distribution of the number of products, enabling a clear comparison of trade performance between 2002 and 2023.

Beginning with animal products in category A, the highest-performing category, it is evident that it included 17 products in 2002. By 2023, the number of products remaining in category A increased to 21, driven by the transition of 9 products from category C, 2 from category D, and 1 from the non-traded category. However, some products moved out of category A, including 2 shifting to category C, 2 to category D, and 4 to the non-traded category. The non-traded products in 2023 are outside the scope of our analysis, as they primarily reflect the removed product codes. Meanwhile, category C experienced the most significant growth, rising from 66 to 83 products, primarily driven by the transition of 20 products from category D and 29 from the non-traded category. By 2023, the majority of non-traded products from 2002 had moved into categories C and D, following a logical pattern that indicates Türkiye started trading products in which it lacks a comparative advantage. Among them, Türkiye emerged as a net exporter of 29 products and a net importer of 23.

However, focusing solely on the number of product movements can be misleading without considering the magnitude of export and import values associated with each product. The scale of trade values for each category transition is illustrated in Figure 7. In each bar graph, the colored bars represent the export values (left-side graphs) and import values (right-side graphs) in 2023 for products which transitioned from their respective categories in 2002 to their corresponding categories in 2023. Accordingly, 9 animal products, which shifted from category C in 2002 to category A in 2023, constitute the largest portion of the export

value of category A in 2023, even surpassing the export value of products that have consistently remained in category A.

These products which were originally classified in category C in the early 2000s but gradually progressed to category A overtime are as follows: 020711, 020712, 020714 and 020725- "Meat and edible offal; of the poultry..", 030321 and 030211- "Fish; trout..", 030420 and 030410-"Fish; fillets fresh, chilled or frozen", and 030377- "Frozen sea bass". These products account for 57% of category A exports and 48% of total exports in the animal product group. When combined with the two additional products shifted from category D to category A, 030329- "Salmonidae, frozen" and 040700- "birds' eggs, in the shell, fresh, preserved or cooked", the data suggests a notable increase in the production and specialization in fish and poultry products over time, consistent with the growth in exports. Notably, 040700 alone accounts for 28% of the total trade surplus in animal products, with a net surplus of $367 million.

Table 6

The shifts in Products Mapping: A Comparison of 2002 and 2023

	Animal Products						Plant Products						Processed Food Products					
2002 \ 2023	A	B	C	D	No Trade	Total	A	B	C	D	No Trade	Total	A	B	C	D	No Trade	Total
A	9		2	2	4*	**17**	52	3	12	6	8*	**81**	32	1	8	4		**45**
B				1		**1**	1	2		2	1*	**6**		1		1		**2**
C	9		32	18	7*	**66**	10	2	40	19	3*	**74**	8		32	18	1*	**59**
D	2		20	24	1*	**47**	9	12	27	70	4*	**122**	8	2	16	44		**70**
No Trade	1		29	23	4*	**57**		2	6	10		**18**			7	5	1*	**13**
Total	**21**		**83**	**68**	**16***	**188**	**72**	**21**	**85**	**107**	**16***	**301**	**48**	**4**	**63**	**72**	**2***	**189**

Source: Author's own computation.

***** The non-traded products in 2023 resulted mainly from revisions to the HS2002 list in recent years. Some 6-digit product codes were removed, making them appear non-traded, though their content may still be tracked under different codes in the updated lists.

The products that have consistently remained in category A throughout all years include: 030269-" Fish; fresh or chilled..", 030235- "Fish; bluefin tunas", 030549- "Fish; smoked", 030760- "Molluscs; snails (other than sea snails), 040630- "Dairy produce; cheese, processed (not grated or powdered), and 050800- "Animal products; coral and similar materials..". Looking at the non-traded animal products, which had moved into other groups in Figure 7, it can be clearly observed (from the right-side graph) that the majority of these products have shifted to category D, causing increased imports and comparative disadvantage. The main products which are the subject of this shift are as follows: 010210- "Cattle; live, pure-bred breeding animals", 020120- "Meat; of bovine animals, cuts with bone in..". Before 2010, meat products were not allowed to be imported. However, with the amendment to customs duties on April 30, 2010, the importation of slaughtered animals and red meat was reintroduced after a long hiatus. This regulatory change aimed to ease the upward pressure on market prices caused by supply shortages amid rising demand for red meat (Çiçek and Doğan, 2018: 2). On the other hand, the category D import values is driven mainly by the shift from category C products of 2002. The leading animal product by import value in 2023 is 010290- "Cattle (non-breeding)" – accounting for 44% of the total import share. This product was also among those that shifted from category C in 2002 to category D in 2023.

Overall, the detailed product-level analysis suggests that robust exports of fresh chilled fish, fish fillets, and poultry products have been the primary drivers of the increase in net exports within the animal products category, effectively offsetting the rising imports of live bovine animals and their meat since 2010.

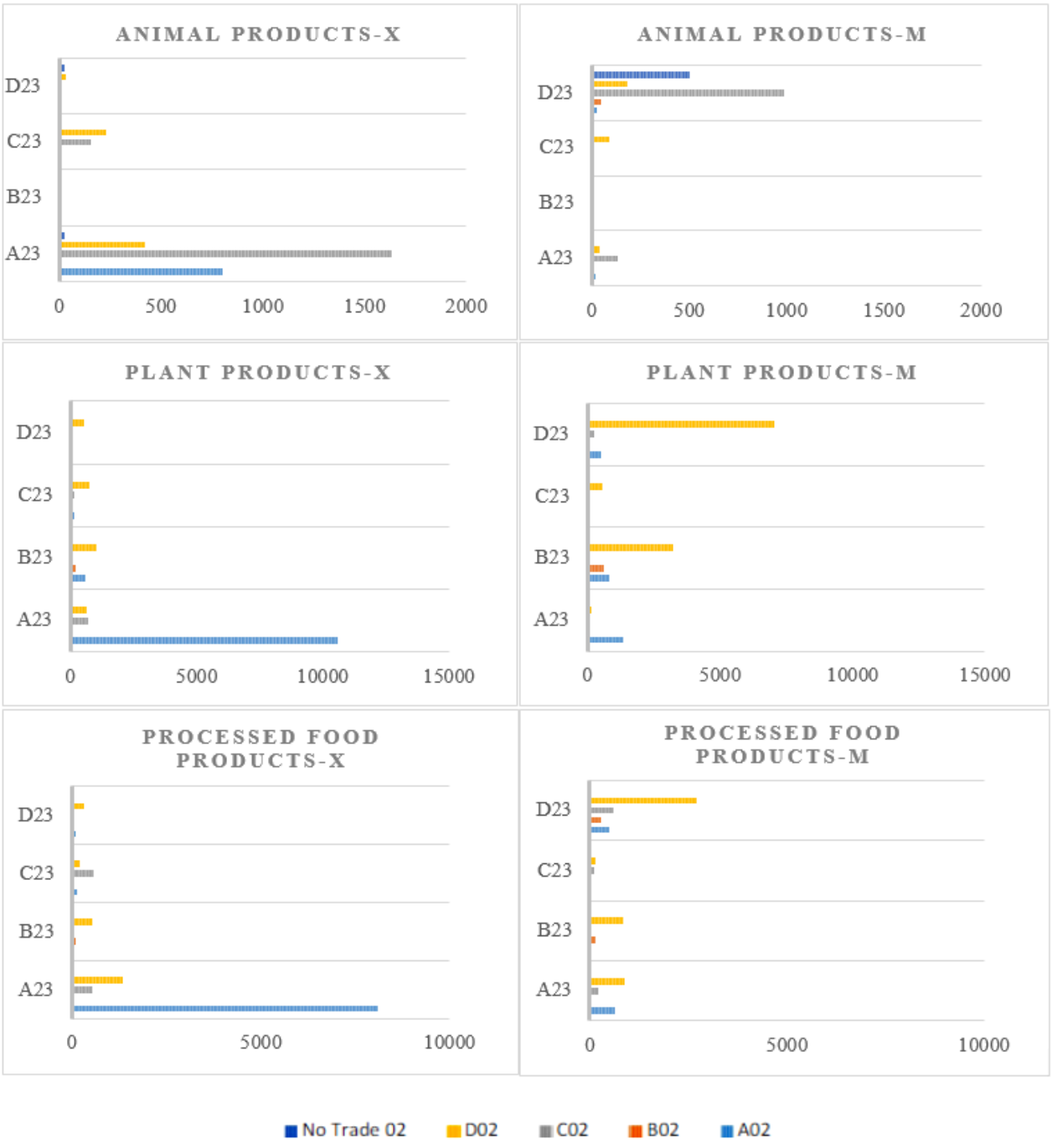
In the case of plant products, excluding those moved to the non-traded category, category A shows stagnation. Although more than half of the products remain in category A, 3 have shifted to category B, 12 to category C and 6 to category D. These outflows are offset by the inflow of 1 product from category B, 10 from category C and 9 from category D into category A. Although fewer products have shifted from category A to category B compared to those moving to other categories, their trade values are comparatively higher, as illustrated in Figure 7. These products include 071340- "Lentils, shelled, dried", 150420- "Fish fats and oils and their fractions", and 071190- "Other vegetables and mixed vegetables".

In spite of those products shifted from category A, by 2023, category B also acquired 12 products that were under category D in 2002, reflecting a shift from comparative disadvantage to a comparative advantage position, though it still results in a trade deficit. This is a distinctive result for plant products, not seen in either animal or processed food products. This finding is further reinforced by the category transition results in Figure 7, which indicate that 12 products that moved from category D in 2002 to category B in 2023 constitute the largest share of category B's import value in 2023. These products which account for 68% of category B imports and 22% of total imports in the plant products group, are as follows: 151211- "crude sunflower seed or safflower oil..", 120600- "sunflower seeds..", 100630- "rice...", 100820- "millet", 100830-"canary seed", 080212- "fresh or dried almonds", 080231 and 080232 "fresh or dried walnuts", 080410-"fresh or dried dates", 080132-" fresh or dried cashew nuts", 130120-"gum Arabic" and 130232-"thickeners..". This transition also indicates a concentration, as 151211 – "crude sunflower seed or safflower oil..." alone accounts for 51% of the import value of products that shifted from category D to category B. At first glance, this may appear to be progress, as the transition from category D to category B suggests a gain in comparative advantage, albeit accompanied by a trade deficit. In fact, this is not due to the significance of 151211 in Türkiye's export specialization. Instead, it stems from the fact that a significant portion of vegetable oil exports occurs under the inward processing regime.

Türkiye exports an average of 500 thousand tonnes of sunflower oil annually, along with small quantities of cotton, rapeseed, and palm oil. Under this regime, crude sunflower oil and sunflower seeds can be imported, processed, and then re-exported as crude or refined sunflower oil without entering the domestic market (TAGEM, 2021, 106). Therefore, considering imports of 151211 – "crude sunflower seed or safflower oil..." alongside exports of 151219 -"sunflower seed or safflower oil and their fractions, other than crude" provides a clearer understanding. Throughout the analysis period, 151219, which valued at $1.05 billion of sunflower oil exports, has consistently remained in category A. Türkiye imports 151211 products under the inward processing regime and then re-exports them as either 151211 or 151219. This case illustrates that in a globalized economy, a country's export performance does not always reflect its production and specialization patterns. Moreover, the classification derived from products mapping results should not be interpreted as an indication of achievement without a deeper understanding of sector dynamics.

Figure 7

Export and Import Shares of Category Transitions (in millions of dollars)



Source: Author's own computation.

On the other hand, the export value share of plant products is largely distributed across various items, reflecting Türkiye's diverse export basket within this group. 37 products have consistently remained in category A throughout all years. The leading export products are ordered as follows: 110100- "Wheat or meslin flour", 151219-"sunflower seed or safflower oil and their fractions, other than crude", 080222-"hazelnuts or filberts (corylus spp.)", 100590-"maize (corn), other than seed", 100110-"durum wheat", 080520-"mandarins

(including tangerines and satsumas), clementines, wilkings..", 071340-"dried lentils, shelled..", 070200-"tomatoes, fresh or chilled", 150910-"olive oil and its fractions..", 080620- "dried grapes", 081310-"dried apricots", 080550-"lemons, limes, fresh or dried", 080420-"figs, fresh or dried". These products constitute 55% of total plant product exports. Most of these products belong to category A, with the exception of 100590 and 071340. 100590 moved to category C after a prolonged period in category D, while 071340 shifted to category B from category A, indicating a downturn in foreign trade balance, despite the continued comparative advantage.

Furthermore, examining the top four most imported products in 2023 reveals that 100190- "meslin and wheat other than durum", 120100- "Soya beans; whether or not broken", and 151190- "palm oil and its fractions" were consistently classified in category D, except 151211- "crude sunflower seed or safflower oil.." which shifted from category D to category B. These products collectively accounted for 51% of imports in the plant products main group in 2023. All these agricultural products serve as raw materials for processed food products, such as pasta, animal feed, and vegetable oil. Consequently, growth in the production and export of processed food products drives higher demand for these raw materials. Additionally, the substantial import levels of sunflower seeds and soya beans stem from the insufficiency of domestic oilseed and fodder crop production to meet Türkiye's consumption needs.

As presented in Table 6, 32 of 45 processed food products classified as category A in 2002 retained their status in 2023, representing a retention rate of 71%. This proportion is notably higher than that observed for plant and animal products, suggesting a more stable and resilient trade performance in processed food products over the analysis period. Figure 7 further illustrates that 81% of category A's export value in 2023 consists of products that were already in category A in 2002. Examining the leading export products of 2023 for processed food, the top three items have consistently remained in category A. These include 200819- "Nuts and other seeds..", 170490- "Sugar confectionery..", and 190219- "pasta, uncooked (excluding that containing eggs)..". Together, they accounted for 21% of the total export value in 2023. Ranked fourth is 210690- "Food preparations; n.e.s.", which moved from category D to category A in 2023. Following this are 190590- "Bakers' wares, n.e.s." and 180690- "Chocolate and other food preparations containing cocoa, n.e.s.", both of which have consistently remained in category A.

Besides, 14% of category A's export value in 2023 is attributed to the products that shifted from category D. These outperforming products are as follows: is 210690- "Food preparations; n.e.s.", 230990- "Dog or cat food..", 180631- "Chocolate and other food preparations containing cocoa", 170230- "Glucose and glucose syrup..", 210112- "Preparations with a basis of extract", 190420- "Food preparations; obtained from cereal flakes..", 170260- "fructose, other than chemically pure fructose, 170219-"lactose and lactose syrup..". These products began to shift the category A after 2010, possibly due to the gradual depreciation of TL.

Regarding imports of processed food products, the previous section highlighted a steady decrease in the import value share of category D—from 88% to 58% over the analysis period. Figure 7 illustrates that this decline mainly results from the transition of certain category D products into categories A and B. Although limited in number—eight shifting to category A and two to category B—these products generated higher import values than the original items in those categories. This transition indicates a pattern in which Türkiye has gained a comparative advantage in 10 products, although trade deficits persist for two of them. Among these products, 230400- "Oil-cake and other solid residues, resulting from the extraction of soya-bean oil", and 210690- "Food preparations; n.e.s." are also the first two most imported products in the processed products category. While 230400 transitioned from category D to category B over the past three years, 210690

followed the same progression, moving from category D to category B and further advancing to category A in 2023. Notably, 230400 alone accounts for 82% of the import value of all category B products in 2023.

Accordingly, it can be argued that the rise in the foreign trade surplus for processed food products, as illustrated in Figure 3 in Section 4, can be attributed not only to the growth in exports of category A products but also to the attainment of a positive trade balance in certain products following their transition from category D to categories B and A.

By 2023, significant shifts also occurred within the category C of processed food products. Specifically, 66% of the products classified under category C in 2002 had moved to category D, based on their 2023 import values. This shift, involving 18 products, represented 14% of category D's total imports in 2023. Among the products moving from category C to category D, 230330- "Brewing or distilling dregs and waste", 220290- "Non-alcoholic beverages; n.e.s", 220720- "Ethyl alcohol and other spirits", 220421- "still wine" and 220710-" Undenatured ethyl alcohol" stand out in terms of import values. On the other hand, 8 products shifted from category C to category A, and this transition accounted for 5% of category A's export value in 2023. the top-performing products in terms of export value that transitioned from category C to category A include 220210- "Waters; including mineral and aerated,", 190230- "pasta (excluding stuffed), cooked or otherwise prepared", 210500- "Ice cream and other edible ice", 200990- "Juices; mixtures, unfermented", and 160420- "fish minced or in forms..".

Consequently, in an effort to identify the general upgrading trajectories of product categories based on trade volumes, Figure 7 illustrates that animal and processed food products predominantly shift from category D to category A, whereas plant products tend to move mainly from category D to category B. This outcome is as a result of the concentration of trade volume in a few products, even though, across all product groups, more products shift from category D to C than to B or A.[9] It can be argued that, in general, the higher number of products shifting from category D to C is a predictable result, outlined in part 4, which suggests that Türkiye prioritizes the domestic market before focusing on exports, leading to an improvement in the trade balance before gaining a comparative advantage. However, for a specific number of high trade volume products, Türkiye experiences a shift from D to B and A, which might indicate an export processing regime where products bypass the local market and/or are directed exclusively toward exports as in the case of 151211– 'crude sunflower seed or safflower oil...'

On the other hand, the cross-tabulation results from Table 6 are also illustrated in Annex Figure 1 which classifies products into four categories based on their 2002 products mapping results and then presents the distribution of these products across the main product groups on a scatter plot, based on their 2023 products mapping scores for each category. When examining the distribution of 2023 scores in category A products from 2002, it can be noted that the scores for processed food products are largely concentrated in the upper right corner of category A, while the scores for plant products are more dispersed, even within category A. This figure indicates that the share of products keeping their position in category A is not only greater for processed food products than for plant products, but also their index values are concentrated at the higher end of category A. However, a similar trend is observed for category D products, where the proportion of products remaining in this category (63%) for processed food products is higher than for other

[9]When considering the number of products instead of trade volume, most category D products have primarily upgraded to category C rather than category B, progressing toward category A, although these shifts are not reflected in overall trade volumes as these products are many in number, but few in value. Another shared trend across major product groups reveals that while most category C products remained in the same category, there were more instances of them downgrading to category D (and losing their net exporter status) than upgrading to category A (and gaining comparative advantage). This pattern is also not reflected in trade volumes, as these products account for a relatively small share of trade value.

major product groups, and their index values are concentrated at the lower end of category D. A combined analysis of category A and category D products reveals that processed food products are more polarized than other major product groups, with the best-performing products improving further, while the worst-performing ones deteriorate even more.

Conclusion

This study provides a comprehensive analysis of Türkiye's agricultural trade performance over two decades by shedding light on key trends and structural shifts in three main product groups; animal products, plant products and processed food products in a comparative fashion.

In the last decade, the Turkish economy experienced a gradual rise in the share of agricultural exports to GDP, which signals a positive trend toward greater international integration of the sector. The trajectory of Türkiye's agricultural foreign trade between 2002 and 2023 reveals that total exports consistently exceeded total imports each year, resulting in a sustained surplus in the agricultural trade balance. However, it becomes apparent that the increase in imports has outpaced that of exports since 2002, which causes a stagnation in net trade flows. The main source of this stagnation is the plant products group which comprised 50% of the total agricultural export value and 62% of the agricultural import value in 2023.

A major driver of this trend is the neoliberal restructuring of Türkiye's agricultural production, specialization patterns, and trade structure over the past 25 years. As production has increasingly centered on processing imported agricultural raw materials, both within and beyond the scope of the inward processing regime, Türkiye's agricultural trade balance since the 2000s has shown consistent surpluses in processed food products, alongside a downward trend in raw and unprocessed agricultural goods.

This observation is further supported by the products mapping analysis, which highlights Türkiye's outperforming and stagnating products in global agricultural trade at a disaggregated product level within a comparative advantage framework.

Overall, the analysis suggests that the upward trend in the net exports of the animal products category has been mainly driven by the robust exports of fresh chilled fish, fish fillets, and poultry products, effectively offsetting the rising imports of live bovine animals and their meat since 2010. Additionally, most of these high-export performance products are among 9 animal products which shifted from products mapping category C in 2002 to category A in 2023, even surpassing the export value of products that have consistently remained in category A. This suggests that production and specialization in these products have increased over time, aligning with the growth in exports.

In the case of plant products, it is recognized that the positive impact of the growing trade surplus in category A was mostly offset by the rising trade deficit in category B and D during the period under consideration. The increased significance of category B on both export and import value shares is driven by the transition mainly from category D and partly from category A to category B. This is a distinctive result for plant products, not seen in either animal or processed food products. This transition also indicates a concentration, as crude sunflower seed and safflower oil (HS 151211) alone accounts for 51% of the import value of products that shifted from category D to category B. Nevertheless, it rather stems from the fact that a significant portion of vegetable oil exports occurs under the inward processing regime, which allows for the importation of crude sunflower oil and sunflower seeds, and after processing, re-exportation as crude or refined sunflower oil without entering the domestic market. Therefore, considering imports of 151211 alongside exports of 151219 -"sunflower seed or safflower oil and their fractions, other than crude", provides

a clearer understanding. Türkiye imports 151211 products under the inward processing regime and then re-exports it as either 151211 or 151219. This case illustrates that in a globalized economy, a country's export performance does not always reflect its production and specialization patterns. Moreover, the classification derived from products mapping results should not be interpreted as an indication of achievement without a deeper understanding of sector dynamics.

Moreover, the top four imported plant products in 2023, most of which consistently fell into category D (excluding 151211) and accounted for 51% of plant product imports, primarily served as raw inputs for processed goods like pasta, animal feed, and vegetable oil. As the production and export of processed foods expand, so does the demand for these inputs. High import volumes of sunflower seeds and soybeans, in particular, reflect the shortfall in Türkiye's domestic production of oilseeds and fodder crops to satisfy national consumption.

Among the main product groups, processed food products demonstrate comparatively strong performance. While the trade balance for the least competitive group D has remained relatively stable over the period, the trade balance for the top-performing group A shows a clear upward trajectory. Regarding export value shares, although the number of category A products is relatively modest, their total export value reached nearly $10 billion in 2023, accounting for 83% of total processed food product exports. There is also a steady decrease in the import value share of category D from 88% to 58% over the analysis period. This decline mainly results from the transition of certain category D products into categories A and B. Accordingly, it can be argued that the rise in the foreign trade surplus for processed food products can be attributed not only to the growth in exports of category A products but also to the attainment of a positive trade balance in certain products following their transition from category D to categories B and A.

The sustained success of processed food exports reflects the efficiency of Türkiye's modern agricultural sector; however, reducing import dependency on traditional products, such as oilseeds, fodder crops, cattle, and cereals, mainly cultivated by labor-intensive farmers in disadvantaged regions, remains a major strategic challenge for ensuring both the sustainability of these producers and the country's overall food security.

An overall assessment across all three product groups suggests that Türkiye is undergoing a broad shift from category D to C for a majority of the products analyzed, indicating a tendency to prioritize the domestic market before targeting exports—resulting in improvements in the trade balance before achieving comparative advantage. In contrast, for a smaller set of high trade volume products, the shift from category D to B and A points to a possible export-oriented production strategy, where goods bypass the domestic market and are primarily intended for export.

Furthermore, when examining the distribution of 2023 scores in category A and D products from 2002, it can be noted that processed food products are more polarized than other major product groups, with the best-performing products improving further, while the worst-performing ones deteriorate even more.

Lastly, the conducted study is not without limitations and requires continuation. Future research could further explore the underlying drivers of these shifts, incorporating additional economic and policy variables to deepen the analysis. Overall, this study provides critical insights that can inform trade policies and strategies aimed at strengthening Türkiye's position in the global agricultural market.

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Appendix

Annex Table 1

The Export Value of Agricultural Products in Each Category (in millions of dollars)

Animal Products	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
A	187	199	243	262	279	344	356	543	626	1065	1173	1615	1914	1407	1498	1699	1848	1974	1861	2905	3437	2880
B	1	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C	47	59	66	87	104	164	159	185	227	240	373	353	366	324	324	463	514	371	312	254	365	404
D	12	10	15	19	23	22	14	51	13	17	11	35	41	41	43	35	40	63	34	62	85	90
Plant Products	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
A	1892	2490	2930	4115	4091	4557	5216	5292	5962	6944	7002	7730	7548	7769	7574	7023	7585	7798	8018	9786	11246	11939
B	22	14	20	47	43	37	163	91	74	292	141	215	655	234	283	709	613	692	987	1081	1427	1936
C	49	71	141	139	194	147	205	167	202	302	284	244	319	306	343	383	346	223	248	369	467	1116
D	18	18	28	52	45	53	69	166	259	132	184	809	840	996	1085	1080	586	689	728	885	1249	611
Processed Food Products	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
A	1411	1722	2245	2723	2791	3219	4007	3795	4244	4919	5439	6185	6853	6158	5638	5846	6332	6328	6796	7969	9279	9983
B	12	18	22	24	154	250	15	37	39	67	48	459	447	389	409	424	491	57	54	412	689	615
C	67	176	205	245	281	298	274	259	300	348	495	413	487	345	408	603	477	687	711	593	1233	911
D	35	57	84	116	42	47	130	115	95	102	72	221	340	425	400	342	445	844	829	685	388	492

Source: Author's own computation based on WITS data.

Annex Table 2

The Import Value of Agricultural Products in Each Category (in millions of dollars)

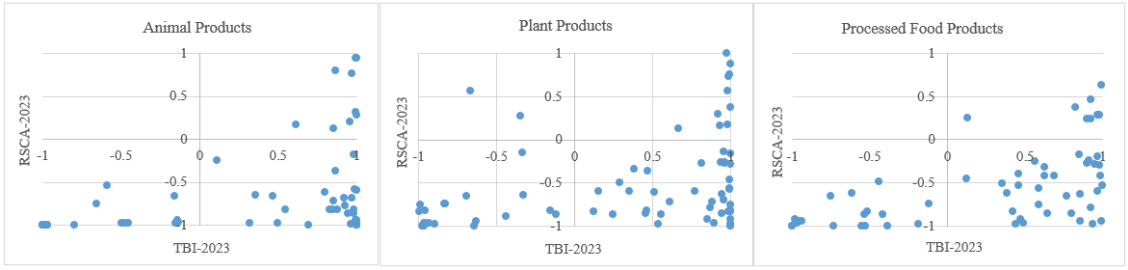
Animal Products	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
A	26	31	43	38	29	30	33	17	39	55	52	266	275	90	105	131	107	179	142	131	211	188
B	5	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C	3	5	6	9	3	21	37	21	64	67	67	96	98	99	84	106	122	56	48	79	90	142
D	65	83	116	143	172	213	246	249	780	1755	1173	653	461	730	878	1567	2220	914	628	525	502	1706
Plant Products	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
A	71	87	75	119	133	155	184	329	426	227	370	582	295	787	958	545	791	796	628	811	1520	1512
B	67	198	238	271	204	354	697	390	380	809	507	665	1060	431	720	1078	1314	1567	2507	3067	3911	4787
C	6	11	15	23	72	28	26	20	18	60	64	49	149	71	86	71	62	59	52	127	148	648
D	1091	1577	1477	1561	1712	2751	5258	3347	3658	5196	5176	6000	7476	6292	5368	6018	5273	6466	6239	7687	10171	7895
Processed Food Products	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
A	50	39	68	84	98	114	400	384	475	588	589	1008	906	597	490	534	597	597	523	840	1131	1739
B	24	61	31	72	244	280	28	74	46	171	58	507	502	477	475	789	770	98	90	880	1510	978
C	10	13	20	47	82	103	93	63	63	89	187	138	218	111	151	228	157	238	248	178	714	272
D	589	799	1148	1095	934	1300	1748	1460	1734	1932	2478	3183	3255	3043	3201	3109	2923	3652	4069	3401	3257	4152

Source: Author's own computation based on WITS data.

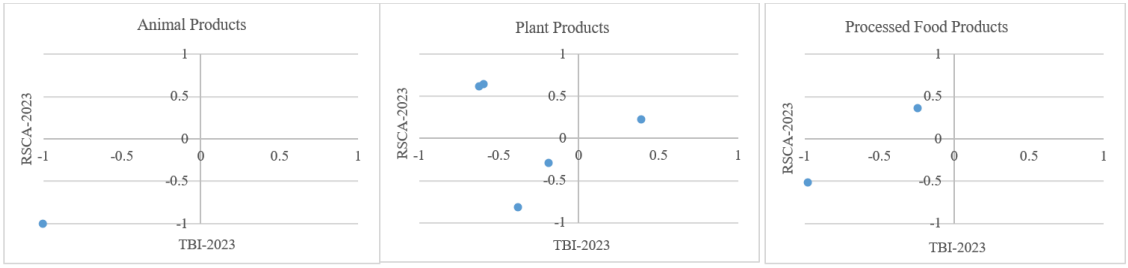
Annex Figure 1

The shifts in product categories from 2002

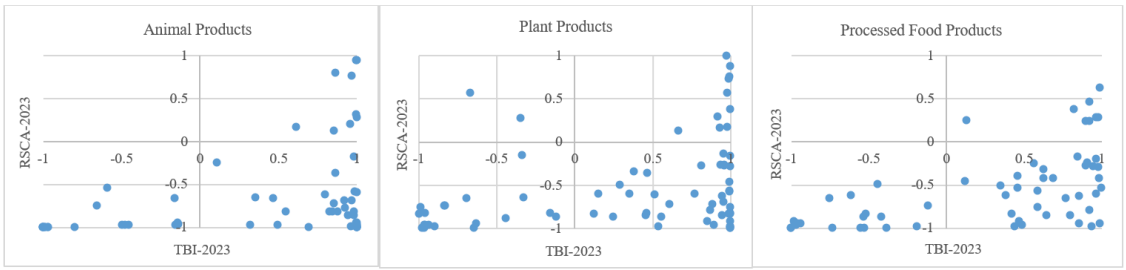
Category A Products



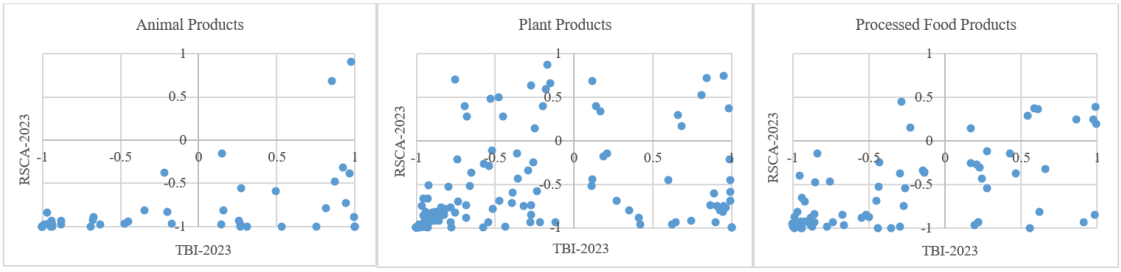
Category B Products



Category C Products



Category D Products



Source: Author's own computation and illustration based on WITS data.