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ANALYSIS OF THE COMPETITIVENESS OF TURKEY'S AGRICULTURAL SECTOR AND THE CONSISTENCY AMONGST ALTERNATIVE MEASURES

Ahmed ABOUD, Mehmet Arif ŞAHİNLİ

Ankara University, Faculty of Agriculture, Department of Agricultural Economics, Ankara, Turkey, Phones: (+90) 541 797 99 78, (+90) 312 596 14 77, E-mails: ahmediac@yahoo.com, sahinliarif@gmail.com

Corresponding author: sahinliarif@gmail.com

Abstract

In international trade and economics, comparative advantage index is one of the key instruments for measuring competitiveness. This study examined the static and dynamic agricultural sector competitiveness of Turkey by the RCA and NRCA indices. The dynamics of the competitiveness indices were estimated by OLS regression, Markov matrices, and trend analysis. The study, further, analyzed the consistency between the RCA, NRCA, and RSCA indices. The results revealed that, Turkey, generally obtains strong competitiveness in the crop sectors whilst it has weak competitiveness in livestock and processed food sectors. Turkey achieved competitiveness in 6 and 13 sectors, respectively. It revealed a convergent pattern of agricultural competitiveness with high stability of the uncompetitive and weak competitive sectors. Turkey's agricultural export strategy and competitiveness pattern are based on natural-resource-intensive and traditional agricultural products. Turkey obtained the gaining trends in 6 and 16 agricultural sectors, respectively. The RCA, NRCA, and RSCA indices are strongly consistent in identifying the degrees of competitiveness and in determining whether or not the country obtains competitiveness.

Key words**:** *agriculture, competiveness, static, dynamic, consistency*

INTRODUCTION

International agricultural trade plays a critical role in the distribution of food and industrial raw materials to consumers worldwide. International agricultural trade has become a very important element in the economies of most developing countries across the world. Since the year 2000, trade in agro-food products has experienced significant growth. As world markets responded to a more rules-based trading environment, falling tariffs, and reductions in trade-distorting producer support, in real terms, growth rate of close to 8% recorded between 2001 and 2014, relative to 2% recorded between 1990 and 2000. At the same time, global agricultural production has also continued to increase [15]. Turkey is the 27th largest export economy in the world. In 2017, Turkey engaged in a total export value of $166 billion and total imports of $214 billion, resulting in a negative trade balance of $48.6 billion. In 2017, Turkey's GDP was $851 billion and its GDP per capita was $10.499. Turkey's largest agricultural exports includes staple food products ($7.10 billion), vegetable products ($7.36 billion), wood products ($766 million), animal products ($2.23 billion) [2]. In the last decade, Turkey has emerged as an important exporter of agricultural products for both the Middle East and other markets [18]. In recent centuries, the concept of trade competitiveness has been embedded in the traditional trade theories relating to comparative advantage, which asserts that if there exist relative difference in the opportunity costs of producing goods among countries, then there is potential for gains to be derived from specialization and trade [19]. This is responsible for the application of various comparative advantage indexes in measuring the static competitiveness trade sectors within a given market. However, recent theoretical and empirical international trade studies have stressed on the significance of researching into both the static and dynamic trade performances due to the unstable and changing economies, politics, strong technology development, and the

global economic linkages [9]. This is particularly useful for developing countries such as Turkey, whose food and agricultural sectors presents great potentials to boost economic growth and development. Competitiveness is defined by the traditional economic theory based on Smith's concepts of absolute advantage Ricardo's comparative advantage which evaluates the concept by basic production indicators such as productivity, price, and cost. However, due to the inaccessibility of productivity, price, and cost data, scholars have developed measuring models for the empirical studies based on the revealed trade data. Centered on the traditional trade theory and [3] Balassa (1965) established the revealed comparative advantage (RCA) index. By using export flow data, the RCA estimates the ratio of a country's export share of a given commodity in the international market to the country's export share of all other commodities. Following the establishment of the RCA index, some economists have identified a number of constraints of the RCA namely; the distribution of the RCA indicators is asymmetric and non-normal; the RCA is static and does not present the dynamics of comparative advantage over time, amongst others [9]. In spite of castigations and controversies over the effects of trade mishaps due to government interruption and the inability to ascertain the sources of comparative advantage, many scholars and authors have asserted that the RCA index, when appropriately utilized, still gives useful manifestation of the comparative advantages in agricultural sectors. The RCA is also amongst the most cited and utilized measures to investigate comparative advantage in several empirical studies such as [9] [6] [14] [12] and [1]. Other RCA variants have been established to vanquish the weaknesses of Balassa's RCA. Among others alternatives are the, RCA log [20], Symmetrical Revealed Comparative Advantage (SRCA) [13], Weighted Revealed Comparative Advantage (WRCA) [16], Additive Revealed Comparative Advantage (ARCA) [10]. Despite the fact that these indices developed some aspects of RCA's limitations, none of them could be applicable to comparison between spaces (commodities or geographical regions) and time. To deal with the limitations of RCA and some other alternative comparative advantage indices, [21] transformed RCA index into a Normalized Revealed Comparative Advantage (NRCA). NRCA possesses properties that can indicate ranking and makes it comparable in terms of comparative advantage across commodities, countries, and time spans. It is expected to show a country's trade pattern, thus enabling identification of commodity types that have good potential in a given market and at a specific time. NRCA index value for each commodity from each country as a whole is set at neutral or zero. This asserts to the assumption that no country has a comparative advantage for all commodities [7]. The NRCA index has demonstrated to be capable of revealing the extent to which a country has comparative advantage in a commodity in a more precise and consistent manner than the other alternative comparative advantage CA indices. Thus, the NRCA index provides a useful tool for quantitative regional research, especially for studies on regional comparative advantage [21]. The main objective of the study is to analyse the competitiveness of Turkey's agricultural sectors and to test the consistency amongst alternative measures. The specific objectives are to; 1. Measure the static agricultural comparative advantage indexes of Turkey by using the RCA and the NRCA indices. 2. Assess the dynamics of the trade competitiveness indicators over time by three ways: OLS method (using RSCA and NRCA), Markov matrix, and trend analysis. 3. Test the consistency among RCA, RSCA and NRCA indices.

MATERIALS AND METHODS

Data source

International agricultural trade data covering the period 2006 to 2017 were collected for this study. This data was obtained from the International Trade Centre (ITC)'s Trade Map application. Trade Map is based on the Harmonized System.

Research Design

A quantitative research approach was adopted for this study. This study calculates the comparative advantages at 2-digit with 28 selected agricultural commodity groups over the period 2007–2017. The agricultural commodity groups represent their respective sector. In this write-up the commodity HS codes were used to identify the respective sector. The Harmonized System (HS) is an international nomenclature defined by the World Customs Organization (WCO) for the classification of products. It allows participating countries to classify traded goods on a common basis for customs purposes. At the international level, the Harmonized System for classifying goods is a six-digit code system for classifying goods [11]. This study determines and analyses the static and dynamic agricultural competitiveness of Turkey in the world market using international agricultural export data.

Static Agricultural Competitiveness

Revealed Comparative Advantage (RCA) and Normalized Revealed Comparative Advantage (NRCA) indexes were selected for the computation of the static agricultural competitiveness.

RCA index: This study adopted Balassa's Revealed Comparative Advantages (RCA) index, which is the most widely used indices. Revealed comparative advantage (RCA) indices offer a useful way of analyzing a country's comparative advantage, based on demonstrated (i.e. actual) export performance. According to Balassa, RCA is the relative share of a country's export of a given product in the world export of the same product, divided by the overall share of the country in total world exports. That is to say, the revealed comparative advantage index of product j exported from country i (RCA_{ij}) is expressed as follows:

$$RCA_{ij} = \left[\frac{X_{ij}}{X_i}\right] / \left[\frac{X_{wj}}{X_w}\right] \text{ or } RCA_{ij} = \left[\frac{X_{ij}}{X_{wj}}\right] / \left[\frac{X_i}{X_w}\right]$$

where:

RCA_{ij}: Revealed comparative advantage index of product j exported from country i;
X_{ij}: Exports of product j from country i;
X_{wj}: World exports of the product j;
X_i: Exports of country i;
X_w: World exports.

The value of RCA falls within the ranges of 0 and + ∞, where comparative-advantage-neutral point stands at 1. Where the RCA value is > 1 implies that the country possesses comparative advantage in the product. In such conditions, the higher the Positive RCA value, the stronger the comparative advantage. For instance, RCA index of 1.1 implies that the country's share of the commodity's exports is 10% higher than its share of the total exports. Where the RCA value is < 1, implies a comparative disadvantage in the product. It should be noted that the RCA index asymmetrical, thus both sides of its neutral point cannot be compared.

NRCA index: [21] Yu et al (2009) formulates the Normalized Revealed Comparative Advantage (NRCA) index as a deviation of the actual export value from the expected export of a country. As attested by the scholars, the concept of the normalized revealed comparative advantage index is to measure the degree of deviation of a country's actual export from its comparative advantage-neutral level such that it indicates its relative scale with respect to the world export market. Thus, enabling its comparability across commodity and country. A country's export of commodity **j** at the comparative-advantage-neutral point, $\widehat{X}_{ij}$ is derived from the comparative-advantage-neutral point of the RCA index as expressed below:

$$RCA_{ij} = \left[\frac{\widehat{X}_{ij}}{X_i}\right] : \left[\frac{X_{wj}}{X_w}\right] = 1$$

From the RCA formular, $\widehat{X}_{ij}$ is characterized by $X_i X_{wj}/X_w$. The deviation of the actual export, X_{ij}, and comparative-advantage-neutral point (expected export), $\widehat{X}_{ij}$ can be expressed as: $\Delta X_{ij} = X_{ij} - \widehat{X}_{ij} = X_{ij} - \frac{X_i X_{wj}}{X_w}$

After the normalization of ΔX_{ij} by the world total export, X_w, the NRCA index is obtained as follows:

$$NRCA_{ij} = \frac{\Delta X_{ij}}{X_w} = \frac{X_{ij}}{X_w} - \frac{X_i X_{wj}}{X_w X_w}$$

The value of NRCA falls within the ranges of -0.25 to 0.25. The comparative-advantage-

neutral point is zero (0) when the actual export is equivalent to the expected export of the country. Economically the values of NRCA index are interpreted as follows: NRCA > 0 signifies that, the value of commodity j's actual export from country i is higher than its expected export (at comparative advantage neutral point) of the commodity, hence country i has comparative advantage in the commodity j. NRCA < 0 signifies that, the value of commodity j's actual export from country i is lower than its expected export (at comparative advantage neutral point) of the commodity, hence country i has comparative advantage in the commodity j. The higher the NRCA value, the higher comparative advantage it possesses, likewise the lower the NRCA value, the lower comparative advantage it possesses in a given market. In accordance with [21], [9], this study magnifies the NRCA values by multiplying them by multitudes of a constant 10,000 to facilitate the presentation of the results without affecting the result.

Dynamic agricultural competitiveness: In analyzing the dynamics of the agricultural competitiveness, [9], emphasized that there are at least three types of dynamics of comparative advantage (CA) indicators: The stability of the distribution of competitiveness indicators from one period to another; OLS regression method was used to calculate this parameter. The mobility and stability of competitiveness indicators for each year of the period; Markov matrix method was used to calculate this parameter. And the trends of the competitiveness indicators over the period and in the future; for which Trend analysis was used in the analysis of this parameter.

The OLS regression method: Following [5] and [5], the stability of the distribution of the trade performance indices from one period to the next is analyzed by using OLS method which was first utilized by [4] in the context of specialization. The OLS regression of comparative advantage dynamics may be presented as follows:

$$CA_{ij}^{t2} = \alpha_i + \beta_i CA_{ij}^{t1} + \varepsilon_{ij}$$

where:

CA: the agricultural comparative advantage indices;

t_1 and t_2: the initial years and final years;

j: the agricultural sector under study;

α: constant;

β: regression coefficient;

εj : residual term.

The CA value at time t2 for the agricultural sector j represents the dependent variable which is tested against the independent variable of the CA value at time t1 for the agricultural sector j. In this study, the regression is assumed to be linear in parameters and the residual εij is normal and identically distributed. The regression result is interpreted as follows; The β = 1 correlates to an unchanged pattern of the competitiveness from t1 to t2. β > 1 correlates to the state where the country obtains comparative advantage in sectors with initial strong competitiveness and losses comparative advantage in sectors with initial weak competitiveness. β < 1 correlates to the state where, sectors with initial weak competitiveness gain comparative advantage, whilst sectors with initial strong competitiveness lose comparative advantage. β = 0 correlates to the state where, there is no relation between the CA indicators in two periods. β < 0 correlates to the state where, the competitiveness positions of the agricultural sectors are reversed. In other words, those CA indicators which were initially below the average value will finally end up above the average, and vice versa. According to [5] and [9], another feature of the regression analysis is to test whether the degree of competitiveness changes over time and whether β > 1 is not a necessary condition for growth in the overall specialization pattern. It can be shown that [8]: $\frac{\sigma_i^{t2}}{\sigma_i^{t1}} = \frac{|\beta_i|}{|R_i|}$

where: R is the correlation coefficient from the regression model and σ is the standard deviation of the dependent variable.

The dispersion of a given distribution is unchanged when β = R. If β > R (equivalent to the increase in the dispersion), then the degree of the specialization rises. If β < R (equivalent to the decrease in the dispersion), then the degree of specialization falls.

RSCA index: The asymmetric problem, however, violates the assumption of normality of the error term in the regression analysis, which makes the t-statistics unreliable. The values of the NRCA indicators are in (-0.25, 0, +0.25), thus it eliminates the asymmetric problem. However, the values of the RCA indicators are in (0, +∞), the distribution thus violates the assumption of normality of the error term in the regression analysis. Additionally, using the RCA indicator in regression analysis gives much more weight to values that are above one, as compared to observations that are below one. To deal with the asymmetric problem, [5] transformed the RCA index into the Revealed Symmetric Comparative Advantage index (RSCA) bearing the same economic implications as follows: $\text{RSCA} = \frac{\text{RCA}-1}{\text{RCA}+1}$

The RSCA value ranges from -1 to + 1. The RSCA index translates the values from the intervals of RCA index (0, 1]; [1, +∞) into (-1, 0]; [0, +1). The main advantage of this index is that it makes below the unity the same weight as changes above the unity.

Markov matrix (M index): The mobility and stability of the competitiveness values for every year of the period is assessed by the analyses of the mobility degree of CA by the mobility index (M index). The index identifies the degree of mobility throughout the entire distribution of the CA values and facilitates direct cross-sections comparisons over the full period. The M index, following [17], assesses the trace of the transition probability matrix. This M index, thus, directly captures the relative and medium magnitude of diagonal and off-diagonal terms, and the equation of M index can be shown as follows:

$$\mathbf{M} = \frac{\mathbf{n} - \mathbf{tr}(\mathbf{P})}{\mathbf{n} - \mathbf{1}}$$

where:

M is Shorrocks index,

n is the number of classes,

P is the transition probability matrix, and

tr(P) is the trace of P.

The higher values of M index indicate greater mobility while the lower values of M index show lower mobility of the CA value among the classes of comparative advantages. The zero value of M index means the perfect immobility.

Trend analysis: The research finally employed the trend analysis to examine and predict the CA trend of a particular agricultural sector over the period and in the future. This tool identifies the CA gaining, losing, or maintaining trends in an agricultural sector based on comparing the changes of the CA values over time. The time trend model can be presented as follows:

$$\mathbf{CA_{ij}^{t} = \alpha_{ij} + \beta_{ij} t + \varepsilon_{ij}^{t}}$$

where:

α_{ij} is a constant;

β_{ij} is the regression coefficient showing the CA trend;

t is the time index; and

εtij is a residual term.

Turkey's CA in agricultural sector j can be considered stable if the estimated β_{ij} is close to zero (with the significance level of 10 percent).

The value of $\beta_{ij} > 0$ indicates a trend in gaining the competitive advantage while the value of $\beta_{ij} < 0$ means a trend in losing the competitive advantage.

RESULTS AND DISCUSSIONS

Measuring the static agricultural competitiveness

This section of the study determines the static agricultural sector competitiveness of twenty-eight (28) selected agricultural sectors of Turkey over the period 2006 to 2017. The static competitiveness is evaluated by their Revealed Comparative Advantage (RCA) and Normalized Revealed Comparative Advantage (NRCA) indices.

Table 1. Turkey's competitiveness indices by RCA and NRCA

No	Hs Code	Agriculture Sector/Product Group	RCA 2006	RCA 2017	NRCA 2006	NRCA 2017
1	01	Live animals	0.082	0.176	-0.080	-0.092
2	02	Meat and edible meat offal	0.061	0.490	-0.380	-0.322
3	03	Fish and crustaceans, mollusks and other aquatic invertebrates	0.518	0.751	-0.182	-0.150
4	04	Dairy produce; birds' eggs; natural honey; edible products of animal origin, not elsewhere ...	0.301	0.913	-0.198	-0.038
5	05	Products of animal origin, not elsewhere specified or included	0.881	0.601	-0.004	-0.021
6	06	Live trees and other plants; bulbs, roots and the like; cut flowers and ornamental foliage	0.366	0.458	-0.059	-0.057
7	07	Edible vegetables and certain roots and tubers	2.571	1.541	0.361	0.200
8	08	Edible fruit and nuts; peel of citrus fruit or melons	6.329	3.759	1.682	1.645
9	09	Coffee, tea, maté and spices	0.440	0.385	-0.075	-0.162
10	10	Cereals	0.562	0.119	-0.131	-0.462
11	11	Products of the milling industry; malt; starches; inulin; wheat gluten	4.948	7.974	0.215	0.624
12	12	Oil seeds and oleaginous fruits; miscellaneous grains, seeds and fruit; industrial or medicinal ...	0.509	0.325	-0.094	-0.337
13	13	Lac; gums, resins and other vegetable saps and extracts	0.112	0.188	-0.020	-0.030
14	14	Vegetable plaiting materials; vegetable products not elsewhere specified or included	3.424	2.330	0.008	0.007
15	15	Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal ...	1.605	1.166	0.162	0.084
16	16	Preparations of meat, of fish or of crustaceans, molluscs or other aquatic invertebrates	0.154	0.253	-0.147	-0.184
17	17	Sugars and sugar confectionery	1.305	1.353	0.054	0.087
18	18	Cocoa and cocoa preparations	1.641	1.216	0.089	0.053
19	19	Preparations of cereals, flour, starch or milk; pastrycooks' products	1.698	2.549	0.138	0.559
20	20	Preparations of vegetables, fruit, nuts or other parts of plants	4.346	3.398	0.721	0.755
21	21	Miscellaneous edible preparations	1.374	1.108	0.074	0.038
22	22	Beverages, spirits and vinegar	0.301	0.311	-0.286	-0.403
23	23	Residues and waste from the food industries; prepared animal fodder	0.041	0.299	-0.185	-0.250
24	40	Raw hides and skins (other than furskins) and leather	1.400	1.512	0.285	0.481
25	41	Articles of leather; saddlery and harness; travel goods, handbags and similar containers; articles ...	0.493	0.906	-0.088	-0.012
26	44	Wood and articles of wood; wood charcoal	0.423	0.628	-0.383	-0.258
27	51	Silk	1.908	1.265	0.074	0.018
28	52	Wool, fine or coarse animal hair; horsehair yarn and woven fabric	3.659	3.384	0.813	0.688
		MAXIMUM	6.329	7.974	1.682	1.645
		AVERAGE	1.480	1.406	0.084	0.088
		COMPETITIVE (COMPARATIVE ADVANTAGED) SECTORS (RCA>1) (NRCA>0)	13	13	13	13
		UNCOMPETITIVE (COMPARATIVE DISADVANTAGED) SECTORS (RCA<1) (NRCA<0)	15	15	15	15

Source: Author's calculations.

Table 1 presents Turkey's agriculture sector competitiveness by RCA and NRCA indices. The results indicate that, in 2017, Turkey experienced the strongest competitiveness by RCA index in sector HS11 (Products of the milling industry; malt; starches; inulin; wheat gluten) with RCA index of 7.974, likewise, by NRCA index, obtained the strongest competitiveness in sector HS08 (Edible fruit and nuts; peel of citrus fruit or melons) with an index value of 1.645. In the same year, the next top 5 competitive sectors by RCA in descending order were HS08, HS20, HS52, HS19 and HS14 with RCA index values of 3.759, 3.384, 3.659, 2.549 and 2.330 respectively. Likewise by NRCA index were HS20, HS52, HS11, HS19 and HS40 with NRCA index values of 0.755, 0.688, 0.624, 0.559 and 0.481 respectively. There were relative differences between the sectors that

appeared as top 6 competitive sectors by RCA and NRCA indices in 2017. In ascending order of competitiveness, the top 5 weakest agriculture sectors in Turkey by RCA indices were; HS10, HS01, HS13, HS16 and HS23 with corresponding indices 0.119, 0.176, 0.188, 0.253 and 0.299 respectively. However, by NRCA index, were; HS10, HS22, HS12, HS02 and HS44 with corresponding indices -0.462, -0.403, -0.337, -0.322 and -0.258 respectively. There were relative differences between the top 5 weakest agriculture sectors by RCA and NRCA indices in 2017. By RCA indices, Turkey was competitive in thirteen (13) agriculture sectors in both 2006 and 2017 with average RCA values of 1.480 and 1.406 respectively. Likewise by NRCA indices, Turkey was competitive in thirteen (13) agricultural sectors in both 2006 and 2017 with average NRCA values of 0.084 and 0.088 respectively. Within the country's set of attained comparative advantage indices, the RCA and NRCA values were put into five classes by quartile method according to their degree of competitiveness (Table 2). This classified degree of competitiveness as comparative disadvantage, weak comparative advantage, medium comparative advantage, strong comparative advantage and super-strong comparative advantage groups.

Table 2. Classification and interpretations of Turkey's RCA and NRCA values with their respective counts

Categories	**Interpretation**	**RCA VALUES**			**NRCA VALUES**		
		Range	2006	2017	Range	2006	2017
Class 1	Comparative disadvantage	≤ 1	15	15	≤ 0	15	15
Class 2	Weak comparative advantage	≤ 1.393	2	5	≤ 0.034	1	2
Class 3	Medium comparative advantage	≤ 2.439	5	3	≤ 0.098	4	4
Class 4	Strong comparative advantage	≤ 4.290	3	4	≤ 0.500	5	2
Class 5	Super-strong comparative advantage	> 4.290	3	1	> 0.500	3	5

Source: Author's own calculations based on data from ITC trade map (2019.)

According to degree of competitiveness by RCA index, in 2006, Turkey had three (3) super-strong competitive agriculture sectors, three (3) strong competitive agriculture sectors, five (5) medium competitive agriculture sector, two (2) weak competitive agriculture sectors and fifteen (15) uncompetitive agriculture sectors. However in 2017, there were only one (1) super-strong competitive agriculture sector, four (4) strong agriculture sector, three (3) medium competitive agriculture sector, five (5) weak competitive agriculture sector and fifteen (15) uncompetitive agriculture sectors. Even though there were equal numbers of competitive and uncompetitive sectors in 2006 and 2007, there were relative variations in the number of observations under each class of competitiveness. This indicates changes in the RCA values over time. According to degree of competitiveness by NRCA index, Turkey in 2006 had three (3) super-strong competitive agriculture sectors, five (5) strong competitive agriculture sectors, four (4) medium competitive agriculture sector, one (1) weak competitive agriculture sectors and fifteen (15) uncompetitive agriculture sectors. However in 2017, it indicated five (5) super-strong competitive agriculture sector, two (2) strong agriculture sector, four (4) medium competitive agriculture sector, two (2) weak competitive agriculture sector and fifteen (15) uncompetitive agriculture sectors. There were relative variations in the number of observations under each class of competitiveness between the NRCA values of 2006 and 2017. Even though there were equal

number of competitive and uncompetitive sectors in 2006 and 2007, there were relative variations (declining trend of competitiveness) in the number of observations under each class of competitiveness. Hence, changes in the RCA values over time. Between the volume of observations recorded for each class of competitiveness by RCA and NRCA indices, there were noticeable variations. However, there were equal numbers of competitive and uncompetitive sectors across both RCA and NRCA values as well as for both 2006 and 2017 observations. In summary, by RCA indices, all top 5 competitive sectors belong to the natural resource based traditional crop subsector (HS08, HS20, HS52, HS19 and HS14). However, by NRCA indices, except for one animal product sector (HS40- Raw hides and skins (other than furskins) and leather), Turkey recorded all top five competitiveness in the crops subsectors. Namely; sectors (HS20, HS52, HS11, HS19 and HS40)-2017. The result implies that, Turkey was able to maintain competitiveness in the same number of sectors between 2006 and 2017 by both RCA and NRCA indices. The nature of the competitive sectors may also imply that, Turkey's agricultural export strategy is based on natural resource-intensive and traditional agricultural products. This natural resource-intensive export strategy may be important at the initial phase of economic development and globalization. However, it may not be appropriate and effective for the sustainable development of the country's economy in the medium and long terms.

Analysis of the dynamics of the comparative advantage indicators of the agriculture sector: This section analyses the dynamics of the various comparative advantage indices under this study. This is to reveal how the pattern of competitiveness and export strategy of the countries evolved over time.

The general pattern of agriculture sector competitiveness (RSCA and NRCA) by OLS method: The values of the NRCA indicators are in the range; (-0.25, 0, +0.25), thus it eliminates the asymmetric problem. However, the values of the RCA indicators are in the range; (0, +∞). This distribution therefore, violates the assumption of normality of the error term in the regression analysis. To deal with this RCA asymmetric problem, the RCA values were converted to the revealed symmetric comparative advantage (RSCA) index, whose values are in the range; (-1, 0, +1) whiles maintaining the same economic implications. The RSCA index translates the values from the RCA intervals of (0, 1]; [1, +∞) into (-1, 0]; [0, +1). Following Hoang et al (2017), in order to reveal and explain detail changes in competitiveness pattern from one period to another, three periods were created for the regression analysis namely; (2006-2011, 2012-2017 and 2006-2017).

Table 3. The OLS estimation results for Turkey's RSCA indicators over the three periods

2006-2011			2012-2017			2006-2017		
β	R	β/R	B	R	β/R	β	R	β/R
0.926	0.938	0.987	0.876	0.978	0.895	0.760	0.897	0.847

Source: Author's own calculations based on data from ITC trade map (2019).

Results of the estimation for the RSCA (Table 3) indicators over all three periods produced the values of $0<\beta<1$. This signifies a convergent pattern of Turkey's agricultural sector competitiveness. This implies that, Turkey loses competitiveness in the agricultural sectors which had initial strong competitiveness whilst it gains competitiveness in the agricultural sectors which had initial weak competitiveness. The estimation results also indicated values of $\beta/R < 1$ ($\beta < R$) over the three periods. This signifies a process of de-specialization in Turkey's agricultural export competitiveness during the entire period. The possible explanation for this pattern is that, since Turkey's agricultural competitiveness pattern is based on the production and trade of natural resource intensive products, a fall in aggregate demand or price of that product may result in the diversion of resources into the production of an alternative natural resource-based

product. This may imply that Turkey may be exploring other new promising sectors which are causing a diversion of certain limited resources.

Table 4. The OLS estimation results for Turkey's NRCA indicators over three periods

2006-2011			2012-2017			2006-2017		
β	R	β/R	B	R	β/R	β	R	β/R
1.024	0.962	1.064	1.048	0.989	1.060	0.997	0.933	1.068

Source: Author's own calculations based on data from ITC trade map (2019).

The estimation results for the NRCA indicators (Table 4) produced the values of $\beta > 1$ for 2006-2011 and 2012-2017. However, the general period 2006-2017 recorded the value $\beta < 1$, but with a value very close to 1 (0.997). This indicates a divergent pattern in agricultural competitiveness for the periods; 2006-2011 and 2012-2017. However, the general estimation for the period 2006-2017 may suggest an approaching convergent pattern. The production of value $\beta/R > 1$ for all three periods implies an increase in the overall specialization trade pattern. In other words, Turkey gains the increasing competitiveness in the initial strong competitive sectors whilst it loses the competitiveness in the initial weak competitive sectors. This result of the NRCA, however, seems to be contrary to those of the RSCA indicators.

The mobility and stability of the competitiveness indicators by Markov matrix: The RCA and the NRCA values are classified into five groups including the comparative disadvantage, weak comparative advantages, medium comparative advantages, strong comparative advantages and super-strong comparative advantage groups (Table 2). The boundary of uncompetitive RCA and NRCA values are maintained as one group whilst the competitive groups are sub-divided into 4 classes of weak, medium, strong and super-strong comparative advantage groups by quartile method (Table 2). Let pij (i , j = 1, 2, 3, 4, 5) denote a one-step transition probability, that is the transition probability for the agricultural sectors that are in class i of year t moving to class j of year t + 1. The stability and mobility of the RCA indicators are investigated by using the Markov transition probability matrix and mobility index for values of the RCA and NRCA values from 2017 to 1 year in the future. The values along the diagonal line of the Markov matrix show the probability of the agriculture sectors remaining persistently in the initial class. The other values of the Markov transition probability matrix provide further information pertaining to the mobility of the RCA values. Specifically, they show the probabilities of agriculture sectors moving from one class to another from the year t to the year t+1. A 5 x 5 matrix was constructed for this mobility and stability analysis.

Table 5. The M-Shorrocks and Markov transition matrix for the Turkey's RCA values

RCA CLASSES		Class 1	Class 2	Class 3	Class 4	Class 5
M-Shorrocks	Class 1	0.54	0.18	0.11	0.14	0.04
0.87	Class 2	0.18	0.54	0.11	0.14	0.04
Average stability	Class 3	0.11	0.54	0.18	0.14	0.04
30.20%	Class 4	0.14	0.54	0.18	0.11	0.04
Average mobility	Class 5	0.04	0.54	0.18	0.11	0.14
17.45%						

Source: Author's own calculations based on data from ITC trade map (2019).

The result indicates that there is an average probability of the RCA indicators remaining in their initial class (values along the diagonal). The sectors within the uncompetitive as well as those within the weak competitive class showed the highest probabilities (54% each) of remaining stable and persistent in their initial classes. In other words, the sectors with initial comparative disadvantage seem to stay comparative disadvantage whilst the sectors with initial weak competitiveness maintain to be weakly

competitive. There is also a high (54%) probability of the sectors in classes 3, 4 and 5 moving backwards to class 2. The average stability of the sectors in their initial class is 30.20% whilst the average mobility to other classes is 17.45%. The M-Shorrocks index of 0.87 generally, shows a relatively high degree of mobility between the classes in the Markov matrix (Table 5).

Table 6. The M-Shorrocks and Markov transition matrix for the Turkey's NRCA values

NRCA Classes		Class 1	Class 2	Class 3	Class 4	Class 5
M-Shorrocks	Class 1	0.54	0.07	0.14	0.07	0.18
0.91	Class 2	0.07	0.54	0.14	0.07	0.18
Average stability	Class 3	0.14	0.54	0.07	0.07	0.18
27.14	Class 4	0.07	0.54	0.07	0.14	0.18
Average mobility	Class 5	0.18	0.54	0.07	0.14	0.07
18.21						

Source: Author's own calculations based on data from ITC trade map (2019).

The result in Table 6 indicates average stabilities in the NRCA indicators over time. The sectors in class 1 and class 2 obtained the highest probabilities of stabilities with 54% each. In other words, there exists a 54% probability of the initial uncompetitive and weak competitive agricultural sectors steadily continuing to stay in their class over time. There is also a high (54%) probability of the sectors in classes 3, 4 and 5 moving backwards to class 2. The average probability of stability or diagonal elements is 27.14% whilst the average value of mobility or off-diagonal elements is 18.21%. The M-Shorrocks index of 0.91 confirms a high degree of mobility of the NRCA indicators.

Trend of the RCA and NRCA indicators: This section analyses the trend of agriculture sector competitiveness over the period 2006-2017 for Turkey. Using the RCA and NRCA values, a trend analysis was performed to examine the comparative advantage trend of the various agricultural sectors over the period 2006-2017 and to predict the direction of trends in the future.

Result of a trend analysis for Turkey's RCA indicators during the period of 2006–2017 illustrates that the country had the gaining trends in sixteen (16) agricultural sectors with $\beta > 0$ and the losing trends in twelve (12) agricultural sectors with $\beta < 0$. The sectors of HS11, HS19, HS04, HS02 and HS41 obtained the most growing trend in comparative advantage. This implies that Turkey has a strong tendency to continue obtaining a stronger comparative advantage in these sectors in the future. However, during the same period, the sectors of HS08, HS14, HS07, HS51 and HS52 incurred the most decreasing trends in comparative advantage (Table 7).

Table 7. Turkey's gaining and losing trends of the agriculture sector competitiveness by the RCA indicators

HS CODE	COMMODITY	β	P-VALUE	R^2	RCA 2006	RCA 2017
HS 11		0.279	0.000	0.761	4.948	7.974
HS 19		0.105	0.001	0.697	1.698	2.549
HS 04		0.061	0.000	0.884	0.301	0.913
HS 02		0.044	0.002	0.626	0.061	0.490
HS 41		0.035	0.000	0.883	0.493	0.906
HS 15		0.026	0.336	0.093	1.605	1.166
HS 18		-0.031	0.045	0.344	1.641	1.216
HS 52		-0.032	0.083	0.271	3.659	3.384
HS 51		-0.074	0.000	0.841	1.908	1.265
HS 07		-0.101	0.000	0.862	2.571	1.541
HS 14		-0.133	0.085	0.268	3.424	2.330
HS 08		-0.175	0.002	0.625	6.329	3.759
	GAINING TREND COMMODITIES	16				
	LOOSING TREND COMMODITIES	12				

Source: Author's own calculations based on data from ITC trade map (2019).

Table 8. Turkey's gaining and losing trends of the agriculture sector competitiveness by the NRCA indicators

HS CODE	COMMODITY	β	P-VALUE	R^2	NRCA 2006	NRCA 2017
HS 19		0.047	0.000	0.932	0.138	0.559
HS 11		0.037	0.000	0.884	0.215	0.624
HS 04		0.019	0.000	0.832	-0.198	-0.038
HS 08		0.017	0.307	0.104	1.682	1.645
HS 20		0.016	0.059	0.312	0.721	0.755
HS 40		0.016	0.004	0.574	0.285	0.481
HS 09		-0.007	0.001	0.674	-0.075	-0.162
HS 22		-0.007	0.048	0.337	-0.286	-0.403
HS 52		-0.008	0.097	0.251	0.813	0.688
HS 12		-0.017	0.000	0.719	-0.094	-0.337
HS 07		-0.019	0.005	0.563	0.361	0.200
HS 10		-0.020	0.035	0.372	-0.131	-0.462
	GAINING TREND COMMODITIES	13				
	LOOSING TREND COMMODITIES	15				

Source: Author's own calculations based on data from ITC trade map (2019).

The trend analysis result of the NRCA values over the period 2006-2017 reveals that Turkey obtains the gaining trends in thirteen (13) agricultural sectors with $\beta > 0$ and the losing trends in fifteen (15) agricultural sectors with $\beta < 0$. The country had the most increasing comparative advantages in the sectors of HS19, HS11, HS04, HS08 and HS20. It also predicts that Turkey has the tendency to continue on the path of obtaining stronger comparative advantage in these sectors in the future. Conversely, Turkey has the most decreasing comparative advantages in the sectors of HS10, HS07, HS12, HS52 and HS22 (Table 8).

In general, by the RCA indicators over the study period, Turkey had relatively more agriculture sectors with a gaining trend of competitiveness as compared to number of sectors with a losing trend of competitiveness. Conversely by the NRCA indicators, Turkey had relatively more sectors with losing trends than sectors with gaining trend. The Preparations of cereals, flour, starch or milk; pastry cooks' products (HS19) and Products of the milling industry; malt; starches; inulin; wheat gluten (HS11) sectors experienced one of the most gaining trends by both RCA and NRCA indicators whiles the Edible vegetables and certain roots and tubers (HS07) and Wool, fine or coarse animal hair; horsehair yarn and woven fabric (HS52) sectors are amongst those who experienced the most loosing trends by both indicators.

CONCLUSIONS

The results show that, in 2017, Turkey obtained the strongest RCAs in sectors; HS11, HS08, HS20, HS52, HS19 and HS14 with RCA index values of 7.974, 3.759, 3.384, 3.659, 2.549 and 2.330 respectively. Likewise achieved the strongest NRCAs in sectors; HS08, HS20, HS52, HS11, HS19 and HS40 with NRCA index values of 1.645, 0.755, 0.688, 0.624, 0.559 and 0.481 respectively. In the same year, Turkey by the RCA indices, achieved competitiveness in 13 agricultural sectors constituting 1 super-strong competitive sector, 4 strong competitive sectors, 3 medium competitive sectors and 5 weak competitive sectors whiles it remained uncompetitive in 15 sectors. By the NRCA indices, it also gained competitiveness in 13 agricultural sectors constituting 5 super-strong competitive sector, 2 strong competitive sector, 4 medium competitive sectors, and 2 weak competitive sectors whiles it remained uncompetitive in 15 sectors. Overall, by both indices, except for 1 animal product sector (HS40), Turkey recorded all top five competitiveness in the crops subsector. Namely; the starch/cereal products, edible fruits and nuts, preparations of vegetables and fruits, silk industry and the preparations of cereals and starch subsectors. In other words, Turkey has agricultural export strategy and competitiveness pattern based on the natural resource intensive and traditional agriculture sectors. OLS estimation for the RSCA values

shows that over the study period, Turkey displayed a convergent pattern in the agricultural sector competitiveness. In other words, the country loses the competitiveness in the initial strong competitive sectors whilst it gains the competitiveness in the initial weak competitive sectors. The estimation result also implies a general de-specialization pattern. However, OLS estimation for the NRCA values results in a divergent pattern in agricultural competitiveness. In other words, Turkey gains the increasing competitiveness in the initial strong competitive sectors whilst it loses the competitiveness in the initial weak competitive sectors. The estimation result also did indicate a general specialization pattern. Markov matrices for both Turkey's RCA and the NRCA, also generally indicated that the comparative disadvantage (uncompetitive) sectors and weak comparative advantage sectors are the most stable to remain in their initial class. However, sectors in the medium to super strong comparative advantaged classes showed a high probability of moving to the weak comparative advantage class. The trend analysis reveals that, by the RCA indices, Turkey obtains the gaining trends in 16 agricultural sectors and a losing trend in 12 sectors. By the NRCA indices, it obtains the gaining trends in 13 agricultural sectors and a losing trend in 15 sectors. The dynamic analysis also proves that, in general, Turkey's export strategy and comparative advantage pattern are relatively dependent on the natural-resource-intensive and traditional agricultural sectors mostly the crop subsectors over time. Though there has been a significant positive difference in the competitiveness rankings of their strongest competitive commodities between the period 2006 and 2017 which may be considered as a small improvement of the export and economic growth pattern, the natural-resource intensive and traditional products are the strongest competitive and main export agricultural sectors of the country. The natural-resource-intensive export strategy is important in the initial period of economic development and globalization but not appropriate and effective in the medium and long terms. Therefore, Turkey need to restructure its sectors by implementing effective and efficient agricultural production strategies by focusing on high value-added, technology and capital intensive and market-oriented products based on the regional and global integration process.

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