Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development
Vol. 24, Issue 1, 2024
PRINT ISSN 2284-7995, E-ISSN 2285-3952

THE IMPACT OF TECHNOLOGY TRANSFER ON SESAME EXPORT COMPETITIVENESS: INSIGHTS FROM TURKEY AND UZBEKISTAN

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Abstract

This study examines the trade relationship between Turkey and Uzbekistan, particularly in sesame exports, with the aim of strengthening Uzbekistan's competitiveness. Based on the theory of comparative advantage and using key indicators such as the Revealed Comparative Advantage (RCA) Index, the Revealed Symmetric Comparative Advantage (RSCA) Index, and the Normal Revealed Comparative Advantage (NRCA) Index, this study highlights the robust competitiveness of Turkey in exporting agricultural machinery designed specifically for sesame production. Through a comprehensive analysis of these indices, the study highlights Turkey's particular strength in this sector, sheds light on its comparative advantage and emphasises the country's strategic position in the global market for sesame-related agricultural machinery. However, Uzbekistan currently lacks competitiveness in sesame exports. The study underlines the key role of effective technology transfer, especially in machinery exports from Turkey, in improving Uzbekistan's position. Econometric models show the significant impact of exchange rates and domestic demand on Uzbekistan's sesame exports. The study's findings highlight ways to improve the efficiency of agricultural machinery exports between the two countries. This provides policymakers with valuable insights to strengthen sustainable trade relations and increase the volume of agricultural exports.

Key words**:** *agricultural machinery technology transfer, sesame export, comparative advantage, export competitiveness*

INTRODUCTION

In global trade, the pursuit of comparative advantage serves as a driver of growth and competitiveness [11]. Nations specialise in areas in which they excel, as proposed by the basic concept of international trade theory [21].

This study examines the relationship between trade between Turkey and Uzbekistan and how it can enhance the competitiveness of Uzbekistan's sesame exports. Sesame, a valuable export for Uzbekistan, has an untapped potential due to its limited competitiveness [23].

Our analysis examines the dynamics of sesame trade between Turkey and Uzbekistan, taking into account technology transfer and machinery exports. Effective transfer could catalyse improvements in Uzbekistan's sesame exports.

To measure the competitive advantage of machinery exports and to compare sesame exports, we use the RCA, RSCA and NRCA indices [2, 7, 36]. Using a model, we establish a link between Uzbekistan's sesame exports and Turkey's machinery. By extending the scope of the comparative advantage literature, our study sheds new light on the intricacies of the Turkey-Uzbekistan sesame trade. Agricultural machinery exports from Turkey emerge as a catalyst for improving Uzbekistan's sesame competitiveness. The cornerstone of sustainable growth is effective technology transfer. The paper's structure includes a literature review in Section 2, a description of the methodology in Section 3, presentation of the data in Section 4, and a brief summary of the findings and their implications in Section 5. The paucity of relevant articles stems from the specific focus of the study - the application of comparative advantage theory to the niche context of the sesame market between Turkey and Uzbekistan. This specificity limits the pool of relevant literature in the WOS database, and the collected articles are categorised according to their country of origin. For example, [18] scrutinised the agricultural potential of Ukraine and its contribution to the economy through foreign exchange inflows. The study revealed the benefits of foreign trade and identified potential opportunities for exports.

[33] dissected the European and Ukrainian agri-food sectors, identifying the comparative advantages of each country and suggesting strategies to enhance competitiveness.

[5] explored the impact of climate change on comparative advantage, highlighting the importance of groundwater and the trade elasticity of water in vulnerable countries.

[6] assessed China's grape industry, highlighting the modest global competitiveness of Chinese grape products. [17] challenged the belief in Japan's import restrictions on primary agricultural products, pointing instead to an active facilitation of imports.

[1] looked at Latin American renewable energy initiatives, emphasising the shaping of biofuel policies by comparative advantage. [14] evaluated Canada's interprovincial milk quotas through the lens of comparative advantage theory.

[26] navigated trade prospects between Indonesia and Chile, revealing untapped potential despite aligned comparative advantages. [29] examined the determinants of trade between Australia and China, highlighting the central role of comparative advantage. [12] Fen and Latif (2014) analysed trade between Canada and China, revealing untapped potential despite growing trade.

[4] assessed the revealed comparative advantages of Bosnia and Herzegovina. [3] traversed the trade relationship between New Zealand and India, highlighting indicators of trade intensity and comparative advantage.

[19] formulated strategies to boost trade between India and Pakistan, including the removal of barriers and facilitation measures. [35] examined trade trends between China and India, highlighting policy implications. Reference [22] analysed the dynamics of the United States' services trade with China and India, identifying sector-specific factors that determine comparative advantage. The study cited as [10] examined the dynamics of agricultural trade between China and Ghana and highlighted Ghana's comparative advantage in this context, while this literature review highlights a notable gap in understanding the nuanced dynamics of comparative advantage within the sesame trade between Turkey and Uzbekistan. This observation highlights the need for further scholarly exploration and empirical research in this specific area. In this context, our study emerges as a novel and essential contribution to this area of research as it aims to examine the trade relationship between Turkey and Uzbekistan, particularly in sesame exports, to strengthen Uzbekistan's competitiveness based on technology transfer incorporated in agricultural machinery and using the comparative advantage indices.

MATERIALS AND METHODS

RCA Analysis

In this study, we discussed the role of trade with Turkey in the competitiveness of Uzbekistan's sesame exports. We are looking at the trade situation in sesame and related fields from Turkey to Uzbekistan, we see that there have been no exports of sesame seeds and derivatives from Turkey to Uzbekistan so far. In addition, Uzbekistan’s sesame production technology includes agricultural machinery exported from Turkey. In this respect, Turkey's role can be important for Uzbekistan's sesame exports to become competitive. In this framework, an effective technology transfer from Turkey to Uzbekistan can make Uzbekistan's sesame exports competitive.

In the preliminary analysis, the identification of Turkey's export competitiveness in machinery related to sesame agriculture and industry serves as a crucial step in delineating its comparative advantage. Furthermore, an examination of the competitive structure encompassing Turkey's and Uzbekistan's exports of sesame products is imperative. In order to rigorously assess and measure their comparative advantage at the product level, this study uses three different indices: the RCA index [2], the RSCA index [7] and the NRCA index [36].

The Relative Comparative Advantage (RCA), also known as the Balassa index, is emerging as a key indicator for understanding the export competitiveness of an industry, as illustrated by examining export market shares. The RCA is derived by comparing a country's world market share in a specific good with its total share in all traded goods. According to the RCA index, a country achieves specialisation in the export of a particular product if its market share in that product exceeds the average, or if the weight of the product in the country's export portfolio exceeds the total weight of exports [28].

The RCA index identifies the region's most important export destinations and product categories [15]. The size of a country's economy or industry is neutralized in the RCA index, allowing meaningful comparisons between economies and allowing different industries to perform on a global scale [31]. RCA indices are calculated using Balassa's (1965) methodology as follows:

$$RCA_j^i = \frac{E_j^i / E^i}{E_j / E} \qquad (1)$$

In Equation 1, is the export of good j by country i; is the export of all goods by country i; is the export of good j by all countries in the world; and is the export of all goods by all countries. If the Relative Comparative Advantage (RCA) is greater than one, it indicates the existence of a comparative advantage for country i, suggesting an endogenous strength in the production and export of the specific good, denoted good j. Conversely, an RCA below one indicates a comparative disadvantage for country i in the production and export of good j. The advantage of using the RCA is its ability to take into account the endogenous advantages associated with the specific good, denoted good j. Conversely, an RCA of less than one indicates a comparative disadvantage for country i in the production and export of good j. The advantage of using the RCA index lies in its ability to take into account the endogenous advantages associated with a particular export good, thus contributing to a more nuanced understanding of a country's trade dynamics. However, Balassa's RCA index has been criticized for ignoring some of its effects and showing asymmetric values [32]. To solve the problem of asymmetric values, [7] introduced the RSCA by modifying the RCA index as follows:

$$RSCA_j^i = \frac{(RCA_j^i - 1)}{(RCA_j^i + 1)} \qquad (2)$$

The Revealed Symmetric Comparative Advantage (RSCA) index takes values in the range from -1 to +1, where the RCA index values in the intervals [0, 1] and [1, +∞] are replaced by [-1, 0] and [0, +1] respectively, while retaining comparable economic implications. Consequently, RCA values between 0 and 1 indicate a country's comparative export advantage, while RSCA values between -1 and 0 indicate a country's comparative disadvantage. The inherent symmetry and zero-centred distribution of the RSCA mitigates potential bias and ensures a balanced representation of a country's comparative advantage or disadvantage across different export commodities [7]. [36] developed an alternative measure of RCA to overcome various weaknesses of Balassa's RCA index such as asymmetry, non-normality and unstable mean [8].

The (NRCA) index measures the extent to which a country's realised exports deviate from its comparative advantage neutral threshold, taking into account the relative size of the global export market dynamics [36]. NRCA is symmetric and its value ranges from -0.25 to 0.25, with 0 serving as the point of comparative-neutral disadvantage. Moreover, NRCA reflects the relative nature of comparative advantage because the sum and average of NRCA scores of a country or a good are constant and equal to zero. Moreover, NRCA values can be compared across countries, goods and time [34]

In particular, the consistency of NRCA over time is also valuable for using time series analysis to assess competitiveness [27]. NRCA is defined as follows:

$$NRCA_j^i = \left(\frac{E_j^i}{E} - \frac{E_j \times E^i}{E^2} \right) \qquad (3)$$

NRCA greater than 0 indicates that actual exports of good j by country i are higher than expected exports. An NRCA value less than 0 means that the actual exports of good j by country i are lower than the expected exports [36].

Econometric Methodology: Product Level Export Model

After determining the export competitiveness situation for Turkey and Uzbekistan in the relevant products, we assumed that the link between Uzbekistan's exports of sesame products and the machinery used in sesame farming/industry exported from Turkey is determined by the following equation-4. The export function in equation 4 is constructed using a theoretical framework similar to [13] and [37].

$$EX^{UZ}_{1207,t} = \beta^{'} x_t + \varepsilon_t \qquad (4)$$

where: $EX^{UZ}_{1207,t}$ is the variable representing Uzbekistan's exports of sesame products with code HS-12.07(40) (sesame exports as a percentage of total exports.). x_t is the set of other relevant theoretical variables observed. β is the parameter vector and ε_t is the error term, which is assumed to be normally distributed. The main variables in the set x on which $EX^{UZ}_{1207,t}$ depends are the effective exchange rate ($/som), world demand (average of the world industrial production index) and the industrial production index (Uzbekistan), which is considered to represent domestic demand pressure as in [37].

The resulting model is called the "Benchmark Model. The other variables in cluster x are control variables. Respectively, these variables are the export values of machinery used in sesame cultivation and industry exported by Turkey to Uzbekistan (the ratio of agricultural machinery exports to total exports in the relevant HS code). These products are classified under HS codes 84.32, 84.33, 84.38 and 84.79 respectively ($EX^{TR}_{8432,t}, EX^{TR}_{8433,t}, EX^{TR}_{8438,t}$, and $EX^{TR}_{8479,t}$). The model in which the control variables are included is called the "Control Model."

The main purpose of doing this is to determine the impact of exported agricultural machinery with these HS-codes on sesame exports in Uzbekistan (Table 1).

Table 1. HS Codes for Machinery Used in Uzbekistan

	Machinery	HS code
1	Plows	
2	Pre-planting tillage cultivators	
3	Sesame seed drill	84.32
4	Intermediate hoe cultivators	
5	Fertilizer machine	
6	Sesame harvester	84.33
7	Sesame stone sorting sieve	
8	Sesame light grain sieve	
9	Sacking packaging unit	
10	Sesame peeling line	84.38
11	Tahini Line	
12	Tahini halva line	
13	Croquant line	
14	Oil extraction line	
15	Sesame Field sieve (coarse sieve)	84.79
16	Sesame calibration sieve	

Sesame Agriculture and Industry

Dynamic Least Squares (DOLS) Approach

It encompasses the temporal sequence of variables specified in equation 4, which poses potential estimation challenges arising from the underlying data structure. As a result, academic discourse in recent years has often focused on conventional cointegration methods for the contemporary analysis of the interrelationships between macroeconomic variables. However, due to the endogeneity problem that arises in the estimation process and the inability to interpret the long-run coefficients obtained, the traditional co-integration methods used to reveal the long-run relationships between variables have been replaced by FMOLS developed by [16], CCR developed by [24] and DOLS developed by [30].

These cointegration methods, like the traditional cointegration methods, are based on the condition that the series used are stationary at difference. However, the possibility of interpreting the coefficients obtained is an important advantage. In addition, it is able to produce reliable results in small samples.

FMOLS tries to eliminate this problem by using kernel estimators of the parameter that causes endogeneity problem. In addition, FMOLS uses the co-variance matrix of error terms to eliminate problems arising from long-run correlations between cointegration equations and stochastic processes.

The DOLS method takes into account the first difference of the explanatory variables, allowing lags to be included in the estimation. In addition, it provides an asymptotically efficient estimator that eliminates feedback effects in the cointegration equation. The DOLS method can be expressed by equation (5) below:

$$EX^{UZ}_{1207,t} = \beta x'_t + d_{1t}\phi_1 \sum_{j=q}^{r} \Delta x'_{t+j}\delta + \hat{\varepsilon}_{1t} \qquad (5)$$

where: q and r allow for differencing the explanatory variables, which allows to eliminate the long-run correlation between the error terms.

The estimation process yields parameter estimates with an asymptotic distribution.

Data and Analysis

We used annual frequency data to calculate the RCA index values for Turkey and Uzbekistan's exports of related products. Turkey data covers 2002-2021, while Uzbekistan data covers 2017-2021. We obtained these data from "trademap.org". The frequency of the series included in the export function in Equation 4 is monthly. We also obtained these data from "comtrade.un.org".

The three different RCA index values calculated to measure and evaluate the competitive structure of exports of agricultural machinery used in Turkish sesame agriculture and industry are shown in Figure 1.

According to Figure 1, we can say that Turkey has become competitive especially after the second half of the 2010s in products coded HS-84.32 and HS-84.38 among the agricultural machinery used in sesame agriculture and industry. In products coded HS-84.33 and HS-84.79, Turkey did not have a comparative advantage between 2002 and 2021.

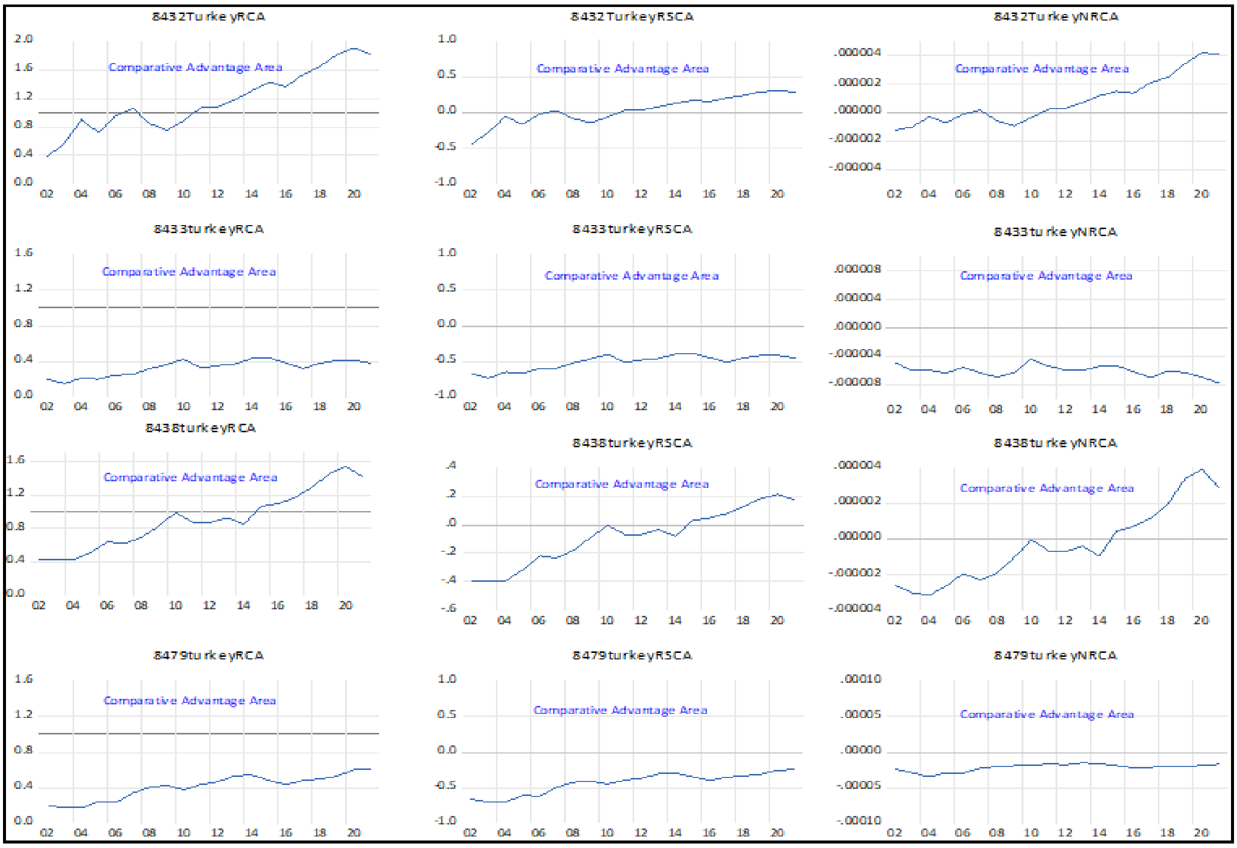

Fig. 1. RCA Analysis of Machinery Used in Sesame Agriculture and Industry for Turkey
Note: For all three indices, above the gray line represents periods of comparative advantage.
Source: Own results.

The similar structure of all calculated RCA indices makes the analysis robust. In addition, we also measured the competitive structure of Turkey and Uzbekistan in sesame exports (HS-code 12.07(40)) with three different RCA index values. These values are shown in Figure 2 and Figure 3.

According to Figures 2 and 3, Turkey is in a competitive position in sesame exports between 2002-2021. However, Uzbekistan is not in a competitive position in sesame exports between 2017-2021.

All three calculated index values show similar results.

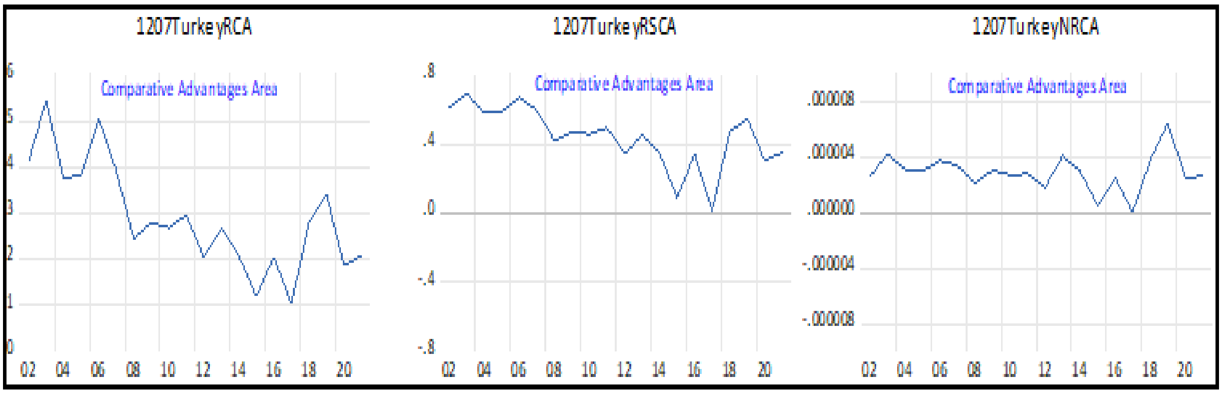

Fig. 2. Turkey Sesame Product RCA Analysis
Note: For all three indices, above the gray line represents periods of comparative advantage.
Source: Own results.

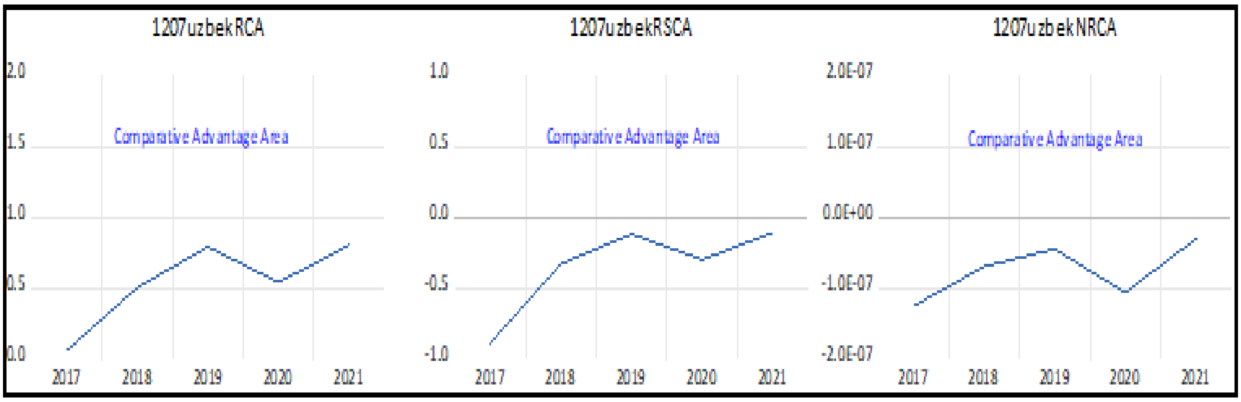

Fig. 3. Uzbekistan Sesame product RCA Analysis
Note: For all three indices, above the gray line represents periods of comparative advantage.
Source: Own results.

After determining the competitive levels in the exports of sesame products and sesame agricultural/industrial goods, we proceeded to the estimation of the link between Uzbekistan's exports of sesame products and sesame agricultural machinery exported from Turkey.

Before estimating the relevant model, we investigated the stationarity properties of the series in the model. We conducted standard unit root tests: ADF [9], PP [24], and KPSS [20] to examine the stochastic properties of these variables. The unit root tests results are presented in Table 2.

Test results in Table 2 show that, $EX^{UZ}_{1207,t}$ WD_t $EX^{TR}_{8432,t}, EX^{TR}_{8433,t}, EX^{TR}_{8438,t}, ve\ EX^{TR}_{8479,t}$ variables are stationary at level according to ADF, PP and KPPS tests. $Exch_t$ ve IP^{UZ}_t variables are not stationary at level in all tests.

After examining the unit root processes of the variables, the export function estimated by OLS and DOLS methods. The estimation results are as shown in Table 3.

Table 2. Linear Unit Root Tests

		ADF Test		PP Test		KPSS Test	
		Constant	*Constant and Trend*	*Constant*	*Constant and Trend*	*Constant*	*Constant and Trend*
Uzbekistan Sesame Exports	$EX^{UZ}_{1207,t}$	-3.610***	-3.600***	-3.353**	-4.271**	0.610	0.097
Uzbekistan Effective Exchange Rate	$Exch_t$	-1.019	-1.005	-1.811	-1.777	0.042***	0.032***
Uzbekistan Industrial Production Index	IP^{UZ}_t	-2.010	-2.055	-2.408	-1.238	0.451***	0.295**
World Demand	WD_t	-3.899**	-3.564***	-3.093***	-3.555***	0.411	0.484
Turkey Export Values by HS Codes	$EX^{TR}_{8432,t}$	-3.569***	-3.571***	-3.979***	-3.968***	0.323	0.302
	$EX^{TR}_{8433,t}$	-5.625***	-5.564***	-5.478***	-4.782***	0.540	0.218
	$EX^{TR}_{8438,t}$	-3.348**	-3.564**	-2.093***	-2.555***	0.214	0.484
	$EX^{TR}_{8479,t}$	-5.956***	-5.661**	-4.513***	-5.927***	0.245	0.342

Notes: The lag length for the ADF test is chosen according to the AIC criterion. The PP and KPSS tests are computed using the Bartlett kernel with the Newey-West bandwidth. The null hypothesis tested in the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests is non-stationarity within the series, while the null hypothesis tested in the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test is stationarity against the alternative hypothesis of a unit root. Significance levels denoted by ***, ** and * respectively indicate statistical significance at the 1%, 5% and 10% levels.
Source: Own results.

Table 3. Product Level Export Model Estimation Results

Depended Variable: $EX^{UZ}_{1207,t}$	Benchmark Model		Control Model	
	OLS	**DOLS**	**OLS**	**DOLS**
C	0.640*** (0.177)	1.053*** (0.252)	0.702*** (0.157)	1.116*** (0.254)
Exch	-0.097*** (0.025)	-0.137*** (0.024)	-0.098*** (0.022)	-0.159*** (0.015)
IP^{UZ}_t	0.020* (0.010)	0.045 (0.029)	0.015 (0.011)	0.053 (0.038)
WD_t	0.033 (0.029)	-0.001 (0.252)	0.026 (0.030)	0.053 (0.078)
$EX^{TR}_{8432,t}$			0.219 (0.389)	0.817 (0.046)
$EX^{TR}_{8433,t}$			-0.579 (0.565)	-3.080** (1.371)
$EX^{TR}_{8438,t}$			-0.066 (0.198)	-0.892 (0.838)
$EX^{TR}_{8479,t}$			0.471*** (0.223)	0.701 (0.527)
R^2	0.42	0.63	0.49	0.92
Prob(F)	0.000		0.000	
Breusch-Godfrey Test	14.128		13.292	
White Test	20.810***		41.410	

Note 1: The values in parentheses are the standard errors of the parameters.
Note 2: Diagnostic tests of the OLS models revealed that there is no autocorrelation problem in both models, but there is a problem of variance in the base model. In order to correct this problem, the standard errors of the base model were estimated with the HAC (Newey-West) covariance method.
Note 3: ***, ** and * indicate statistical significance at 1%, 5% and 10% levels, respectively.
Source: Own results.

The (OLS) results from the benchmark model, as detailed in Table 2, show that both the exchange rate and domestic demand pressure have a statistically significant impact on Uzbekistan's sesame exports. However, the Dynamic Ordinary Least Squares (DOLS) results indicate that only the exchange rate has statistical significance, implying a discernible impact on Uzbekistan's sesame exports.

The sign of the coefficients is consistent with the theoretical expectation. In addition, world demand has no significant effect on

Uzbekistan's sesame exports. We believe that this finding is consistent with our RCA analysis findings on Uzbekistan's sesame exports. The fact that Uzbekistan does not have a competitive structure in sesame product exports shows us that it has an inefficient structure in its foreign trade.

OLS results of the control model in Table 2 show that the exchange rate has a significant effect on Uzbekistan's sesame exports. This finding is similar to the DOLS results. The sign of this coefficient is also consistent with the theoretical expectation. In the control model, we do not find a significant effect of domestic demand pressure and world demand on Uzbekistan's sesame exports. When the effect of the control variables is analyzed, the OLS results show that among the machines used in sesame cultivation/industry exported from Turkey, only the machines coded HS-8479 have a significant and positive effect on Uzbekistan's sesame exports. Other control variables did not have a significant effect. According to the DOLS results, only HS-8433 coded machines have a significant and negative effect on Uzbekistan's sesame exports. Clearly, these findings may be an indication that agricultural machinery exports between Turkey and Uzbekistan are not efficiently secured. In particular, we think that giving weight to products coded HS-84.32 and HS-84.38, in which Turkey is competitive in exports, may help Uzbekistan to achieve competitiveness in sesame product exports.

[10], focusing on the bilateral agricultural product trade between China and Ghana, highlighted the importance of exploring untapped opportunities and implementing measures to enhance agricultural trade cooperation. We think that this finding is in line with your study's emphasis on the potential for technology transfer from Turkey to Uzbekistan to improve the competitiveness of Uzbekistan's sesame exports.

Comparing the relevant literature with the study findings, despite the different research objectives, both the literature and our findings show the importance of comparative advantage in shaping trade relationships. Moreover, it also recognizes the potential for trade relationships to boost exports based on relevant strengths. The literature review emphasizes the importance of factors such as climate change, water resources, and renewable energy initiatives in shaping comparative advantage and trade patterns. Our study identifies the exchange rate as the most influential factor affecting Uzbekistan's sesame exports, while domestic demand pressure also plays a role. The findings of our study are consistent with the literature's emphasis on the importance of considering specific factors and control variables in the analysis of comparative advantage.

Overall, while the literature review highlights limited studies directly addressing the specific topic of your research, several studies provide relevant insights that overlap with our findings. These studies emphasize the importance of exploring untapped potential, increasing competitiveness in specific products, and implementing measures to enhance trade cooperation. Building on and in line with these empirical findings, our study serves to enrich the scholarly understanding of comparative advantage and trade dynamics in the sesame market, and in particular to shed light on the intricate dynamics that characterize the trade relationship between Turkey and Uzbekistan.

CONCLUSIONS

This study systematically examines the impact of trade dynamics between Turkey and Uzbekistan on strengthening the competitive position of Uzbekistan's sesame exports. By incorporating insights from the relevant literature on comparative advantage in agricultural trade and applying a comprehensive methodological approach, our research provides nuanced insights into the unique dynamics characterising sesame exports between these two countries. The literature review underscores the central role of comparative advantage in shaping bilateral trade relations and fostering economic growth, thereby contributing to the scholarly discourse on international trade dynamics. Several studies have investigated the determinants and outcomes of comparative advantage across countries in different agricultural sectors, emphasizing the importance of comprehensive competitiveness assessment, export structure analysis, and technology transfer. Consistent with the literature, our findings provide valuable insights into the factors affecting Uzbekistan's sesame exports and the potential role of trade with Turkey in improving competitiveness. Our analysis highlights the key role played by Turkish agricultural machinery exports in influencing Uzbek sesame production technology, and highlights the latent potential for technology transfer to enhance competitiveness in this sector. Using three different Revealed Comparative Advantage (RCA) indices, our assessment examines Turkey's export competitiveness specifically in agricultural machinery tailored for sesame farming and industry, thereby identifying strategic areas of comparative advantage.

This methodological approach contributes to a nuanced understanding of the complex dynamics governing the technological landscape and export competitiveness in the context of sesame production between Turkey and Uzbekistan. Our findings reveal that Turkey's competitiveness in exports of agricultural machinery related to sesame agriculture and industry increased in the second half of the 2010s, especially in products coded HS-84.32 and HS-84.38. However, Turkey does not have a comparative advantage in HS-84.33 and HS-84.79 coded products between 2002 and 2021. These results, which are consistently supported by all calculated indices, provide a robust assessment of Turkey's competitive position. We also examined the competitive structure of Turkey and Uzbekistan in sesame exports by considering the three RCA indices. The analysis revealed that Turkey maintained its competitive position in sesame exports between 2002 and 2021, while Uzbekistan lacked competitiveness in the same period. These findings, supported by all calculated indices, underline the need for Uzbekistan to improve its competitive position in sesame exports. The econometric analysis investigates the determinants of Uzbekistan's sesame exports and Turkey's potential role in this regard. Our models showed that exchange rate and domestic demand pressure significantly affect Uzbekistan's sesame exports. We also found that only agricultural machinery coded HS-8479 has a significant and positive impact on Uzbekistan's sesame exports, while agricultural machinery coded HS-8433 has a significant and negative impact.

These results suggest that there may be room for improvement in the efficiency of agricultural machinery exports between Turkey and Uzbekistan. The findings emphasize the importance of considering comparative advantage and agricultural machinery technology transfer in improving Uzbekistan's competitiveness in sesame exports. Policy-makers and stakeholders can use these findings to formulate strategies aimed at promoting sustainable trade relations and increasing agricultural exports.

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