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The Affect Of Agricultural Export And Employment On Economic Growth In Türkiye: Evidence From ARDL Approach

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ABSTRACT

The agricultural sector has historically been significant. However, today, even though the share of the agricultural sector in the total output is lower compared to other sectors in both developed and developing countries, it remains a sector of great importance in terms of both food production and economic indicators. To reveal the economic impacts of the agricultural sector, this study examines the relationship between agricultural exports, agricultural employment, and economic growth in Turkey for the period 1990-2022. In the study, per capita income is used as an indicator of economic growth, the share of agricultural exports in total exports as an indicator of agricultural exports, and the share of agricultural employment in total employment as an indicator of agricultural employment. The ADF and Phillips-Perron (PP) unit root tests and the ARDL bounds testing approach were used as methods in the study. According to the obtained results, there is a cointegration relationship for the model. Based on the long-term coefficients, agricultural exports increase economic growth, while agricultural employment decreases it. According to the short-term results, there is no deviation in agricultural employment, while agricultural exports also statistically significantly and positively affect economic growth in the short term. Turkey should increase agricultural mechanization and shift agricultural employment to other sectors. Furthermore, instead of exporting agricultural products as raw materials, processing them and exporting them as higher value-added products would contribute more to economic growth.

Key Words: Agricultural Exports, Agricultural Employment, Economic Growth, ARDL, Türkiye

Türkiye'de Tarımsal İhracat ve İstihdamın Ekonomik Büyüme Üzerindeki Etkisi: ARDL Yaklaşımından Kanıtlar

ÖZ

Tarım sektörü tarihsel süreçte önemli bir sektör olmuştur. Ancak günümüzde de tarım sektörü gelişmiş ve gelişmekte olan ülkelerde toplam hasıla içindeki payı diğer sektörlere göre düşük olmasına rağmen hem gıda üretimi hem de ekonomik göstergeler açısından önem arz eden bir sektördür. Tarım sektörünün ekonomik etkilerini ortaya koymak adına bu çalışmada tarımsal ihracat ve tarımsal istihdam ile ekonomik büyüme ilişkisini 1990-2022 döneminde Türkiye için incelenmiştir. Çalışmada kişi başına düşen gelir ekonomik büyüme, tarımsal ihracatın toplam ihracat içindeki payı tarımsal ihracat, tarımsal istihdamın toplam istihdam içindeki payı tarımsal istihdam göstergesi olarak kullanılmıştır. Çalışmada yöntem olarak ADF ve Phillips-Peron (PP) birim kök testleri ve ARDL sınır testi yaklaşımı kullanılmıştır. Elde edilen sonuçlara göre model için eşbütünleşme ilişkisi mevcuttur. Uzun dönem katsayılarına göre tarımsal ihracat ekonomik büyümeyi arttırırken, tarımsal istihdam azaltmaktadır. Kısa dönem sonuçlarına göre tarımsal istihdamda herhangi bir sapma söz konusu değilken, tarımsal ihracat kısa dönemde de ekonomik büyümeyi istatistiksel olarak anlamlı ve pozitif etkilemektedir. Türkiye'nin tarımsal makineleşmeyi arttırıp tarımsal istihdamı başka sektörlere kaydırmalıdır. Tarım ürünlerini de ham ihraç etmek yerine işleyip katma değeri daha yüksek ürünler olarak ihraç ederek ekonomik büyümeye daha fazla katkı sağlanmalıdır.

Anahtar Kelimeler : Tarımsal İhracat, Tarımsal İstihdam, Ekonomik Büyüme,ARDL, Türkiye

INTRODUCTION

Economic growth is a crucial element that enhances a country's prosperity and accelerates the development process. Among the factors contributing to economic growth, agriculture holds a significant position (Yılmaz, 2019: 35). The agricultural sector is one of the fundamental sectors of the economic structure in both developing and developed countries. The export potential of this sector has direct effects on economic growth (Demir and Aksoy, 2020: 78).

Agricultural exports are essential for both national and international economic development. On one hand, agricultural exports increase the country's foreign exchange earnings, thereby alleviating current account deficit problems; on the other hand, they improve overall economic balances. Moreover, the competitiveness of agricultural products in foreign markets presents new opportunities for domestic producers and enhances efficiency in the sector (Kara, 2021: 142). This situation contributes to agricultural exports to economic growth more evident (Öztürk, 2018: 56). In this context, increasing agricultural exports significantly contributes to the sustainable growth of the national economy.

The agricultural sector also creates a wide employment area, reducing unemployment in rural areas and increasing social welfare (Güneş, 2017: 89). The contribution of agricultural employment to economic growth is of critical importance, especially in terms of raising the income levels of the population living in rural areas and developing these regions. Employment opportunities provided in the agricultural sector play a role in the sustainability of economic growth (Çelik et al. 2020:460). Indeed, the positive effects of agricultural activities on employment in rural areas ensure that economic development is balanced and inclusive.

In research on the impact of exports on economic growth, the contribution of sectoral exports to growth and the importance of sectoral specialization are emphasized. Particularly in less developed countries, Singer and Prebisch (1950) argued that agricultural exports are critical for national economies, but the terms of trade are disadvantageous for these countries. It is stated that the terms of trade of agricultural production negatively affect national economies in two ways. The first relates to cost increases and the different institutional characteristics of factor markets. The other view is that technical progress benefits the industrial sector more than the agricultural sector (Emami and Mahdi, 2011: 145-160).

This study aims to research the effects of agricultural exports and employment on economic growth within the framework of the Cobb-Douglas production function. According to the Cobb-Douglas model, economic growth is shaped by the interaction of production factors (Cobb and Douglas, 1928: 150). In this model, agricultural exports are one of the factors that have a direct impact on production (Y). Increasing agricultural exports can stimulate economic growth by raising the country's overall income level (Grossman and Helpman, 1991: 30). Moreover, increasing employment (L) in the agricultural sector can positively contribute to economic growth by enhancing labor productivity and, consequently, production (Feenstra and Hanson, 1996: 240). In addition, with the increase in agricultural exports, technology transfer and capital investments (K) may also rise, which can support economic growth in the long term by triggering productivity increases (Romer, 1986: 1002). Therefore, this study aims to provide a theoretical framework to understand the role of agricultural exports and employment in economic growth and to quantitatively analyze these effects.

This study is organized into five sections. After the introduction, the second section presents the literature, the third section presents the data set and methodology, the fourth section presents the findings and discussion, and the last section presents the conclusions and recommendations.

LITERATURE REVIEW

Export is considered the driving force of trade, and trade is regarded as the fundamental dynamic of economic growth. An increase in exports can contribute to the expansion of trade volume and, consequently, to the rise in GDP growth rates. There is a broad literature examining the nexus between economic growth and export. Studies on the effects of agricultural exports on economic growth are generally divided into positive and negative effects. Among the positive effects are the studies by Grossman and Helpman (1991) , Öztürk (2018), Yılmaz (2019), Demir and Aksoy (2020), and Kara (2021). These studies show that agricultural exports stimulate economic growth by increasing the country's GDP and improving overall economic balances by raising foreign exchange earnings. On the other hand, studies by Emami and Mahdi (2011) and Singer and Prebisch (1950) discuss that agricultural exports can limit economic growth, particularly in cases where terms of trade are disadvantageous, and create negative effects due to low added value. These different approaches indicate that the impacts of agricultural exports on economic growth may vary contingent on the country's conditions and trade dynamics. Furthermore, when examining other studies in the literature, Adalet (2004) investigates the affiliation between agricultural exports and economic growth using a multiple regression model for developing countries. It has been observed that agricultural exports significantly contribute to economic growth, especially in developing countries. These effects manifest in the form of foreign exchange earnings and employment growth. Dawson (2005) examining the effect of agricultural exports on economic growth across 62 countries during the period from 1974 to 1995. Fixed effects and random effects models were applied in this study. The analysis results demonstrated how significant agricultural exports are for economic growth, suggesting that agricultural exports can be described as a driver of growth. It was proven that agricultural exports make a substantial contribution to economic growth. Faridi (2012) used the Johansen cointegration method to estimate the nexus between Gross Domestic Product (GDP), agricultural exports, and non-agricultural exports in Pakistan for the period 1972-2008. The study found that agricultural exports do not affect economic growth, while non-agricultural exports positively contribute to the country's economic growth. Mehrara and Baghbanpour (2016) researched the contributions of agricultural exports and industrial to economic growth in emerging economies. Covering 34 developing countries from 1970 to 2014, their panel data analyses concluded that the nexus between economic growth and industrial exports is positive and statistically significant, whereas the relationship between agricultural exports and economic growth is weak. Demir (2022) examined the effects of Turkey's agricultural exports and goods and services exports on economic growth using data from 1988 to 2018. Linear and quantile regression methods were used, and the normal distribution of the data was run using Kolmogorov-Smirnov and Shapiro-Wilk tests. The study emphasized the significant impact of raw agricultural product exports on the Turkish economy, highlighting the importance of considering external demand in agricultural production and taking steps to increase productivity. Kara et al. (2024) examined the relationship between exports and economic growth at a sectoral level, focusing on the contributions of agricultural and industrial export products to the Turkish economy. Using the VAR and Johansen cointegration test, the study investigated the impact of agricultural and industrial exports on economic growth. The results indicated that both agricultural and manufacturing exports positively influence economic growth, with manufacturing exports contributing more significantly.

Some studies,in others, found a negative relationship between agricultural exports and growth. For instance, Sandalcılar (2012) examined the relationship between economic growth and export in Turkiye and the validity of the export-led growth hypothesis. Using quarterly data from 1987 to 2007, the study analyzed the relationship among economic growth, agricultural exports, non-agricultural exports, and total exports using cointegration, error correction model (VECM), and the Toda-Yamamoto model. The analysis showed that the export-led growth hypothesis holds in Turkey, indicating strong unidirectional causality from exports to economic growth in both the short and long run. Shan and Farooq (2015) researched the contribution of agricultural exports to economic growth specifically in Pakistan. Applying empirical tests using data from 1972 to 2008, the study's findings suggest that the effect of raw material-based agricultural exports on economic growth is insignificant. Kyaw (2017) studied the effect of agricultural exports' main products on economic growth in the Association of Southeast Asian Nations (ASEAN) countries. The study utilized fixed effects and random effects regression models. The analysis results revealed a statistically significant negative linkage between primary agricultural commodity export and economic growth. In contrast, non-agricultural exports were displayed to have a strong and positive impact on economic growth. Siaw et al. (2018) investigated the relationship between agricultural exports and economic growth in Ghana using the ARDL approach for the period 1990Q1-2011Q4. The analysis results demonstrated that cocoa exports have a significant positive effect on economic growth both in the long-run and short-run. However, pineapple and banana exports were found to have negative effects on economic growth. Aslan (2022) examined the impact of Turkey's agricultural product exports on economic growth using annual data from 1982 to 2020. Through the ARDL model analysis, the long-term coefficients identified in the analysis results showed that the coefficient for agricultural product exports was statistically insignificant. This indicates that agricultural product exports do not contribute to the export-led growth hypothesis in the agricultural sector.

Other group studies researched the causality nexus between agricultural export and economic growth. Yetiz and Özden (2017) examined the causality relationship between Turkey's GDP and the agriculture, industry, and services sectors using annual data from 1968 to 2015. Engle-Granger causality analysis was employed for this purpose. According to the analysis findings, a one-way Granger causality relationship was found from the agricultural sector to GDP, industry, and services sectors; however, it was determined that the agricultural sector is not influenced by the other sectors. Öz and Daş (2019) examined the connection between agricultural production and economic development using annual data from 1991 to 2017 for both developed and developing countries. In their study using Granger Causality analysis, no causality relationship was found. However, it was shown that income has a positive short-term effect on agricultural productivity. Kopuk and Meçik (2020) researched the effects of Turkey's manufacturing and agricultural sector trade values on economic growth using data from 1998 to 2020. According to the causality test, a two-way causality relationship between the agricultural sector and manufacturing industry and a one-way causality towards GDP were identified. These results indicate that investments in both the manufacturing industry and the agricultural sector contribute to economic growth. Turhan and Erdal (2022) investigated the connection between agricultural employment and economic growth in Turkey from 1990 to 2019. The study examined gross domestic product (GDP), employment, and agricultural employment data. Stationarity analysis and causality tests were applied to analyze the model. It was found that there is a unidirectional causality linkage from agricultural GDP to agricultural employment, and from agricultural employment to total employment. Erdinç and Aydınbaş (2023) examined the affiliation between economic growth and agricultural product exports in Turkey from 1990 to 2020, employing the structural break time series analysis method. The results of the Toda-Yamamoto causality test indicated a bidirectional causality relationship between agricultural product exports and per capita income.

Studies on the effects of agricultural employment on economic growth present both positive and negative outcomes. Research by Lewis (1954), Gollin, Parente, and Rogerson (2002), Syrquin (1988), and Timmer (1988) argue that high employment rates in the agricultural sector can limit economic growth due to low productivity and inefficient resource utilization. These studies suggest that surplus labor in the agricultural sector hinders transitions to the industrial sector, thereby slowing overall economic growth. Conversely, studies by Güneş (2017), Çelik (2016), Binswanger and McIntire (1987), Johnston and Mellor (1961), and Ranis and Fei (1961) indicate that agricultural employment reduces unemployment in rural areas, enhances social welfare by increasing production and productivity, and positively contributes to economic growth. These positive effects are particularly crucial for rural development and increasing income levels. Özdemir and Yıldırım (2013) ran the Granger causality linkage between employment and economic growth using the wavelet approach for the period from January 2005 to April 2013. They found a unidirectional causality from growth to employment in the original series, while bidirectional causality was observed as frequency decreased. However, the empirical findings did not support the causality nexus between the variables. Biyase and Bonga-Bonga (2015) examined the relationship between economic growth and employment in the context of South Africa. Using Structural VAR (SVAR) analysis, they examined three key variables: economic growth rate, employment rate, and total investments, with total investments used as a control variable. The study analyzed annual data from 1970 to 2008. The results indicated that the employment rate had a very weak response to economic growth. Consequently, the hypothesis that growth does not create employment was deemed valid in the South African context. Görmüş (2019) utilized microdata from the Turkish Household Labor Force Survey to examine gender differences in the linkage among demographic, agricultural employment, and employment-related variables using contingency table analysis and chi-square tests. The results indicated that women were employed in agriculture at a higher rate than men, but they were disproportionately affected by precarious forms of employment such as unpaid family labor, part-time work, temporary or seasonal employment, and informal employment compared to men. Aigheyisi and Edore (2021) explored the impact of economic growth on employment in the service sector in Nigeria. They employed the ARDL approach and included variables reflecting trade openness, inflation, and financial sector development alongside economic growth in their model. The findings demonstrated that economic growth positively influenced employment in the service sector in both the short and long terms in Nigeria. Dinç (2022) analyzed the impact of the agricultural employment, industrial, and service sectors on economic growth in Turkey from 1968 to 2020. Employing Bootstrap Toda-Yamamoto Causality Analysis, the study identified a unidirectional causality relationship from agriculture to growth. A mutual relationship was discovered between the service sector and economic growth, whereas no causality relationship was detected between the industrial sector and economic growth. Telli Üçler (2022) compared sectoral employment rates and economic growth in Turkey from 1992 to 2020. The study applied Granger Causality tests to the agricultural, industrial, and service sectors, revealing a causality relationship between employment in the service and industrial sectors and economic growth, while no causality was found between agricultural employment and growth. Baskak (2023) analyzed the impact of sectoral employment rates on the economies of Turkic Republics that gained independence in 1991, covering the period from 1991 to 2019. Utilizing second-generation panel data analysis, the study employed variables of Gross Domestic Product (GDP), and employment rates in the agricultural, industrial, and service sectors. The findings indicated a causality relationship from GDP to employment in the agricultural, industrial, and service sectors, as well as from employment in the agricultural and industrial sectors to GDP.

When similar studies in the literature are analyzed, it is seen that the effects of agricultural exports and agricultural employment on growth are analyzed with time series and panel data methods. It can be said that the studies reveal different results as negative and positive relationships. However, no study examines the effect of agricultural exports and agricultural employment on economic growth together. At this point, it can be said that it differs from other studies. It is expected that parallel results will be obtained with the literature.

MATERIAL and METHOD

This study aims to discover the impact of agricultural exports and employment on economic growth. The economic growth indicator used is GDP per capita (constant 2015 US$), the dependent variable. The model includes agricultural exports (% of merchandise exports) and agricultural employment (% of total employment) as independent variables. The logarithm of the GDP variable has been taken to ensure a more accurate representation of the model.

The dataset in this study is sourced from the World Bank database, covering the period from 1990 to 2022 with annual frequency. The longest possible time frame for the data was selected to provide a comprehensive analysis. Descriptions of the variables can be found in Table 1.

Table 1. Descriptions of the variables

Variables	Explain	Period	Source
GDP	GDP Per Capital (constant 2015 USD)	1990-2022	World Bank
AGREX	Agricultural raw materials exports (% of merchandise exports)	1990-2022	World Bank
AEMP	Employment in agriculture (% of total employment)	1990-2022	World Bank

To visualize the trends of all variables over the period covered by the study, graphs for all variables are presented in Figure 1. It is observed that the economic growth indicator shows a general increasing trend. The variable AGREX, representing agricultural exports, and the variable EMP, representing agricultural employment, generally exhibit a declining trend.

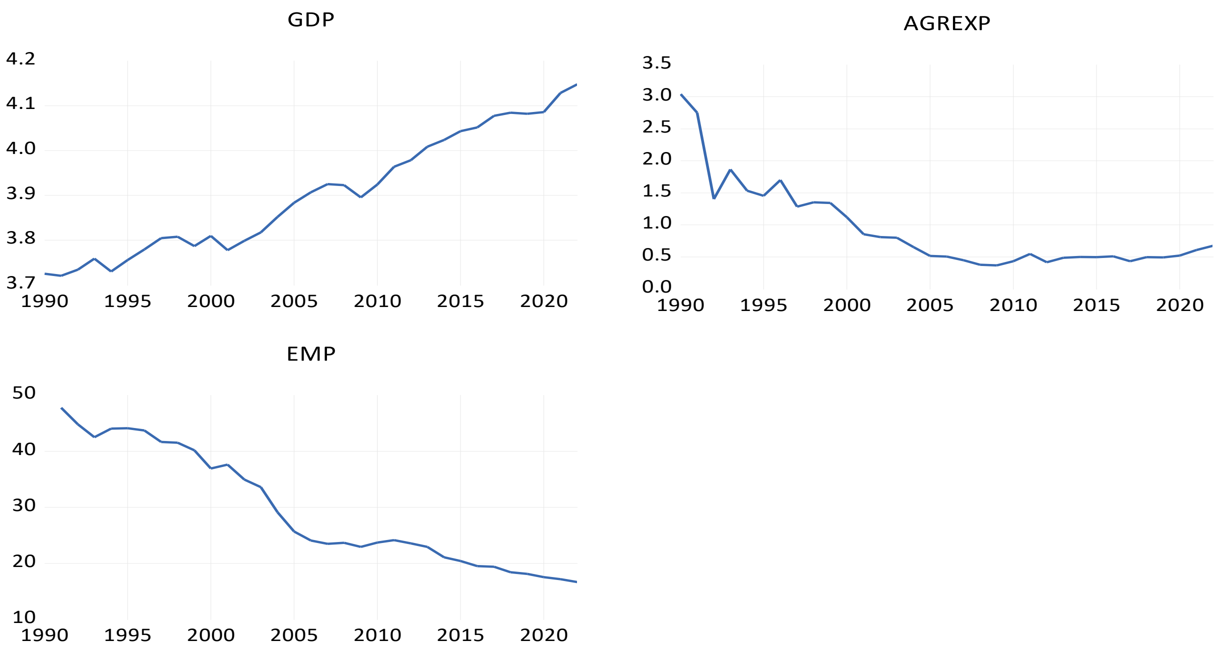

Figure 1. Trends of all variables

In econometric analyses using time series data to determine whether variables have unit roots, the starting point is to establish the stationarity levels of these variables. In other words, it addresses the question of whether the variables exhibit unit roots. To answer this question, there are several important unit root tests established in the literature. In this study, the Augmented Dickey-Fuller (ADF) test introduced by Dickey and Fuller (1981) and the Phillips-Perron (PP) test introduced by Phillips and Perron (1988) have been employed.

Dickey and Fuller (1981) assumed in their unit root test that there is no correlation among the error terms at all steps. If there is a correlation among the error terms, the lagged values of the dependent variable will appear on the right-hand side of the equation to address this issue. The test statistic for the ADF test under different scenarios is obtained using Equations 1, 2, and 3 sequentially.

$$\Delta y_t = \delta Y_{t-1} + e_t \quad (1)$$
$$\Delta y_t = \beta_0 + \delta Y_{t-1} + e_t \quad (2)$$
$$\Delta y_t = \beta_0 + \beta_1 t + \delta Y_{t-1} + e_t \quad (3)$$

If there is autocorrelation in the error term (error term) in Equation 3, then this equation is restructured as Equation 4. In this equation, lagged difference terms are used, and the number of these terms is usually determined empirically. The fundamental purpose of restructuring the equation in this way is to include terms in the model that will ensure the error term is free from autocorrelation.

$$\Delta y_t = \beta_0 + \beta_1 t + \delta Y_{t-1} + \alpha \sum_{i=1}^{m} \Delta Y_{t-i} + e_t \quad (4)$$

Phillips and Perron (1988) perform nonparametric tests alongside each ADF test using a unit root test. These are referred to as Z-tests. Monte Carlo studies have shown that the PP test tends to reject the unit root hypothesis when there is a negative moving average. However, when there is a positive moving average, the PP test tends to perform well. Economic theory can sometimes provide insight into this distinction. In the absence of such prior knowledge, it is advisable to conduct both tests in a complementary manner (Bozkurt, 2013, 43-44). The test statistic for the PP test is obtained using Equation 6.

$$\Delta y_t = \beta_0 + \beta_1 t + \delta Y_{t-1} + e_t \quad (5)$$

In time series analysis, cointegration methods hold significant importance, and various tests can be employed. Pesaran, Shin, and Smith (2001) developed the Autoregressive Distributed Lag (ARDL) bounds test, which is a flexible method that can be used under the condition that variables are not I(2). One of the major advantages of this test is that it does not require variables to be stationary at the same level. The formulation of the cointegration model between variables can be expressed as shown in Equation 6.

$$\Delta Y_t = \alpha + \beta_1 Y_{t-1} + \beta_2 X_{t-1} + \sum_{i=1}^{p} \gamma_i \Delta Y_{t-i} + \sum_{j=1}^{q} \delta_j \Delta X_{t-j} + e_t \quad (6)$$

In Equation 7, α and β represent the cointegration parameters, γ denotes the lag lengths, and ϵ stands for the error term. This model captures both short-run and long-run relationships and provides reliable results even with small samples. The ARDL bounds test is a preferred method, especially when variables exhibit different levels of stationarity in datasets (Gülmez, 2015). In a study investigating the relationship between economic growth, agricultural exports, and agricultural employment in Turkey, the long-run relationship as formulated in Equation 6 was examined using the equality presented in Equation 7, following the ARDL bounds test approach.

$$\Delta GDP_t = \beta_t + \beta_1 GDP_{t-1} + \beta_2 AGREX_{t-1} + \beta_3 AEMP_{t-1} + \sum_{i=1}^{p} \alpha_{1i} GDP_{t-i} + \sum_{i=1}^{p} \alpha_{2i} AGREX_{t-i} + \sum_{i=1}^{p} \alpha_{3i} AEMP_{t-i} + \varepsilon_t \quad (7)$$

In Equation 8, $t - i$ represents the appropriate lag length calculated according to the Akaike Information Criterion, while β and α test the long-run relationship between variables. In the study, the short-run relationship using the error correction model of the ARDL bounds test was investigated with the equality shown in Equation 9.

$$\Delta GDP_t = \alpha_0 + \sum_{i=1}^{p} \alpha_{1i} GDP_{t-i} + \sum_{i=1}^{p} \alpha_{2i} AGREX_{t-i} + \sum_{i=1}^{p} \alpha_{3i} AEMP_{t-i} + \varphi ECT_{T-1} + \varepsilon_t \quad (8)$$

In Equation 9, α\alphaα represents short-term changes. The error correction term (ECT) is a short-term variant that indicates the speed of adjustment towards equilibrium deviations and typically follows a normal distribution between -1 and 0. If statistically significant, this indicates that deviations in the short term are corrected towards equilibrium in the long term. The model's adherence to a normal distribution is examined using CUSUM and CUSUMQ charts, while autocorrelation issues are checked using the Breusch-Godfrey LM test. The problem of varying variance is tested using the Breusch-Pagan-Godfrey test.

The ARDL bounds test approach determines whether the null hypothesis $H_0 = \beta_1 = \beta_2 = \beta_3 = 0$ is accepted or rejected based on the F-statistic. If the F-statistic exceeds the upper bound value, the null hypothesis is rejected, indicating a long-run relationship among the variables. Conversely, if the F-statistic is below the lower bound value, it suggests no long-run relationship between the variables (Pesaran et al., 2001).

FINDING AND DISCUSSION

Table 2 presents the unit root test results for the variables constituting the study's model. According to the results obtained, the variable LGDP, representing economic growth, contains a unit root at levels in both ADF and PP unit root tests. Taking the first difference of GDP makes it stationary at the 1% significance level for both constant and constant plus trend models, according to both test statistics. The variable AEXP, representing agricultural exports, is stationary at levels in the ADF test for the constant model and at levels for both the constant and constant plus trend models in the PP test. AEXP becomes non-stationary in levels but stationary in the first difference for the non-stationary model. The variable AEMP, representing agricultural employment, is not stationary at levels according to both ADF and PPP unit root tests for both constant and constant plus trend models, but it becomes stationary after taking the first difference. Based on the unit root test results, the variables constituting the model are stationary at levels I(0) and I(1). In other words, they are not stationary in the same order. In econometric empirical analysis, cointegration tests are applied after unit root test results. Since the variables are stationary at different levels and do not satisfy the condition of being I(2), empirical analyses will be conducted using the ARDL approach (Çelik, 2022:8).

Table 2. Unit Root Tests Results

		Level		First Difference	
	Models	**ADF**	**PP**	**ADF**	**PP**
LGDP	C	0.634	19.583	-56.600***	-63.831***
		[0.988]	[0.999]	[0.000]	[0.000]
	C+T	-24.617	-23.578	-57.073***	-83.125***
		[0.343]	[0.393]	[0.000]	[0.000]
LAEXP	C	-	47.583***	-	-
		39.764***	[0.000]	-	-
		[0.004]			
	C+T	-12.123	34.634*	-120.149***	-
		[0.885]	[0.060]	[0.000]	-
AEMP	C	-15.360	-14.650	-44.067***	-43.846***
		[0.502]	[0.537]	[0.000]	[0.001]
	C+T	-10.483	-13.671	-43.892***	-43.708***
		[0.921]	[0.850]	[0.008]	[0.008]

Notes: C: Constant model. C+T: Constant and trend model. *** and * denote significance at the p<0.01 and p<0.1 levels, respectively.

Before proceeding with the implementation of the ARDL approach, it is necessary to determine the appropriate lag length. The results for the appropriate lag length are shown in Table 2. According to the Akaike Information Criterion (AIC), the lag length is 3, while according to the Schwarz Information Criterion (SIC), it is 1. However, since AIC is supported by other information criteria and is considered stronger than others, the lag length chosen is 3 (Lütkepohl, 2006; Salman et al., 2022; Çelik, 2022).

Table 3. Lag Length Determination Results

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-30.010	NA	0.001	2.276	2.418	2.320
1	61.191	157.244	6.78e-0	-3.392	-2.826*	-3.215
2	66.209	7.6143	9.14e-0	-3.117	-2.127	-2.807
3	84.256	23.647*	5.20e-0*	-3.741*	-2.327	-3.298*

Note: The * symbol indicates the appropriate lag length for each information criterion.

The study's model was examined using the ARDL approach based on the appropriate lag length. Cointegration results are presented in Table 3. The F-statistic value is 5.811520, indicating a cointegrating relationship among the variables constituting the model at the 5% significance level. In other words, there is a long-run relationship among the variables in the model.

Table 4. ARDL Bounds Test Approach Results

Test Statistics	Value	K
F-statistic	5.811520**	4
	Critical Bound Values	
Significant Levels	**I(0) Bound**	**I(1) Bound**
%1	5.15	6.36
%5	3.79	4.85
%10	3.17	4.14

Note: ** denotes significance at the 5% level, respectively.

The ARDL bounds test approach was examined in terms of diagnostic statistic tests including Breusch-Pagan-Godfrey, Breusch-Godfrey LM, Jarque-Bera, and Ramsey RESET, and the results are shown in Table 5. In these tests, the probability (p-value) values for serial correlation, heteroskedasticity, specification errors, and normality of distribution should exceed 0.05. Therefore, it is observed that the probability (p-value) values of the diagnostic statistics meet the required condition. In other words, the model exhibits no serial correlation, no heteroskedasticity issues, no specification errors, and follows a normal distribution.

Table 5. Diagnostic Statistics Tests

Tests	X^2 (P-Value)	Results
Breusch Godfrey LM	0.497	No serial correlation
Breusch Pagan Godfrey	0.777	No heteroskedasticity
Ramsey RESET Test	0.668	No specification error
Jarque-Bera Test	0.056	Errors are normally distributed

Through the analysis employing the ARDL approach, cointegration relationships were established and after confirming the necessary assumptions, long-run coefficients were estimated. These coefficients are presented in Table 5. It was found that agricultural exports (AGREX) significantly and positively affect economic growth at the 1% level of significance. Specifically, a 1% increase in agricultural exports leads to a 0.246% increase in economic growth. In other words, a positive relationship between agricultural exports and economic growth was identified. These findings are consistent with Kara et al. (2024) and Erdinç and Aydınbaş (2019), who also found significant links between agricultural exports and economic growth. Previous studies by Balassa (1985) and Michaely (1977) have highlighted the foreign exchange earning effects of agricultural exports and their role in rural income growth, thereby promoting economic growth. These studies emphasize that agricultural exports contribute to infrastructure development, technology transfer, and increased employment, supporting economic growth.

On the other hand, agricultural employment (EMP) was found to have a statistically significant negative impact on economic growth at the 1% level of significance. This implies that agricultural employment negatively affects economic growth. This result is consistent with other literature. Early studies by Kuznets (1955) and Lewis (1954) argued for a reduction in the share of agricultural employment during economic development, suggesting that a shift of labor from agriculture to industry and services would accelerate economic growth. Lewis' dual-sector model posited that countries with high agricultural employment experience slower economic growth until labor shifts away from agriculture. Johnston and Kilby (1975) found that high agricultural employment countries faced hindered economic growth due to low productivity and limited capital accumulation. These studies underscored that inefficiencies and technological deficiencies in the agricultural sector could adversely impact overall economic growth. Gollin, Parente, and Rogerson (2002), as well as Dercon and Gollin (2014), suggested that high levels of employment in agriculture could restrict sufficient labor supply to non-agricultural sectors, thereby slowing down economic growth. Additionally, the low educational and skill levels among agricultural workers were seen as barriers to economic growth.

In conclusion, this literature review summarizes various studies indicating that countries with high agricultural employment may experience adverse effects on economic growth. Factors such as low agricultural productivity, limited technological innovations, and low education levels in the sector are highlighted as potential impediments to overall economic growth. These findings suggest that investments in and shifts of labor to non-agricultural sectors could promote economic growth.

Table 6. ARDL Long-Run Coefficient Results (1.3.0)

Variables	Coefficient	t-statistic	P-value
AGREXP	0.246***	5.266	0.000
A"EMP	-0.021***	-9.344	0.000
R-squared	0.556	F-statistic	7.854
Adjusted R-squared	0.485	Prob.(F-statistic)	0.000

Note: *** , denotes significance at the 1% level, respectively. Lag lengths were determined according to the Akaike Information Criterion.

The short-term error correction results of the model are also shown in Table 6. According to the results obtained, the error correction term is statistically significant at the 1% level. The coefficient of the error correction term, which ranges between -1 and 0, is -0.389 and statistically significant. This coefficient indicates that deviations in the model are corrected towards equilibrium approximately 2.5 years later. The ARDL model (1.3.0) was estimated for these findings. Here, the appropriate lag length for the variable representing agricultural employment (AEMP) is 0, indicating that changes in agricultural employment in the short term have an immediate effect without any delay. In other words, there is no deviation in the short term for agricultural employment. On the other hand, the variable representing agricultural exports (AGREXP) is statistically significant at the 1% level and positively associated.

Table 7. ARDL Short-Term Error Correction Results (1.3.0)

Variables	Coefficient	t-statistic	P-value
Cons	1.700***	4.398	0.000
D(AEXP)	0.105***	4.124	0.000
D(AEXP)(-1)	0.033**	2.560	0.017
D(AEXP)(-2)	0.045***	4.380	0.000
CointEq(-1)	-0.389***	-4.353	0.000

Note: *** and ** denote significance at the 1% and 5% levels, respectively.

The stability of the coefficients in both short-term and long-term estimates of the model was assessed using the CUSUM and CUSUM2 tests. As shown in Figure 2, the distributions of CUSUM and CUSUM2 indicate that the coefficients lie within the critical bounds. This implies that the coefficients exhibit a stable distribution.

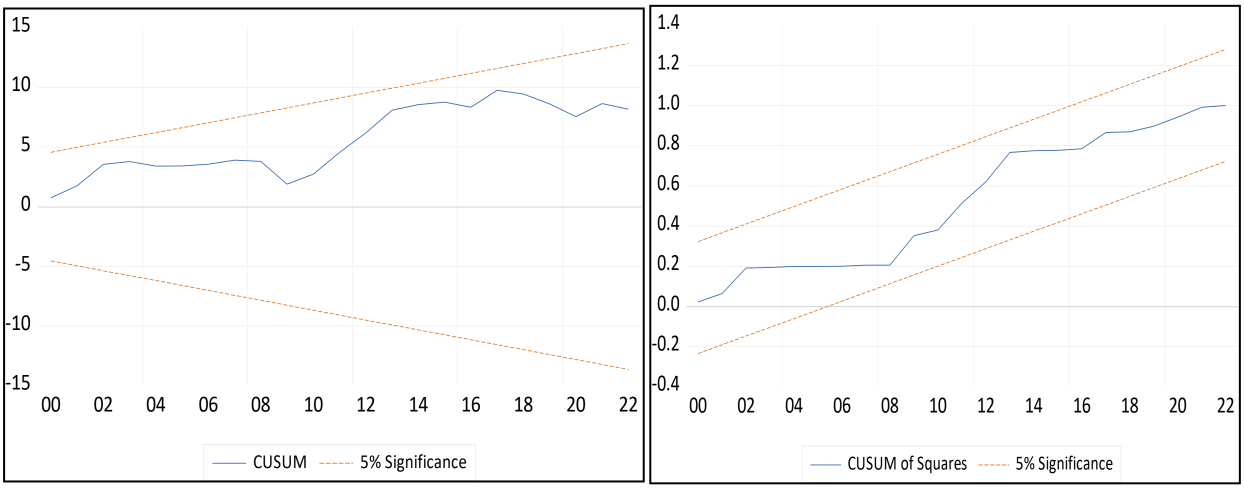

Figure 2. CUSUM and CUSUM^2 Results

CONCLUSION AND RECOMMENDATIONS

In this study, the impact of agricultural exports and agricultural employment on economic growth was investigated for the Turkish economy using data from the period 1990-2022. The methods employed include the ADF and PP unit root tests, as well as the ARDL bounds testing approach. According to the results obtained, the agricultural export variable is stationary at the level in the ADF test with a constant model, and in the PP test, it is stationary at the level for both constant and constant with trend models. Other variables exhibit unit roots at the level and become stationary at the first difference. Due to the different levels of unit root test results for the variables, the ARDL bounds testing approach was used. The findings reveal a long-term cointegration relationship between the variables in the model. Agricultural exports have a statistically significant and positive effect on economic growth, while a statistically significant and negative relationship is found between agricultural employment and economic growth.

The results concerning the relationship between agricultural exports and economic growth indicate that the export-led growth hypothesis is valid for agricultural exports in Turkey. In other words, a positive relationship from agricultural exports to economic growth is observed. Agricultural exports contribute to long-term growth by supporting rural development. Income from agricultural exports can support the development of rural infrastructure and human capital. The adoption of sustainable agricultural practices can support the conservation of natural resources and economic growth (Pingali, 2007). However, agricultural exports can contribute to improving the foreign trade balance and controlling inflation. Export revenues support economic stability by reducing current account deficit problems. A stable export sector can reduce volatility in the growth process (Prebisch, 1950). It is understood that exports resulting from increased agricultural production in Turkey have a significant impact on growth. On the other hand, the negative impact of agricultural employment on economic growth can be explained by the increase in agricultural mechanization, leading to a decrease in agricultural employment. It may also be related to low rates of technological progress in the agricultural sector. Indeed, in economies where technological innovations in agriculture are limited, increasing agricultural employment may not increase sectoral productivity. This may slow down growth in the long run (Gollin, Parente, and Rogerson, 2002). However, this negative relationship can be interpreted as suggesting that the workforce employed in agriculture should transition to other sectors, and increased agricultural mechanization would be more beneficial in terms of productivity and growth. Therefore, it can be stated that mechanization in agriculture would be more advantageous for productivity enhancement.

Turkey is a country with high agricultural potential. Supporting agriculture, processing the products obtained for export, and maintaining dynamic agricultural policies are of great importance. In parallel, an increase in agricultural exports would bring foreign currency into the country and positively impact the trade balance. Agricultural production should be carried out with modern mechanization. Farmers lacking adequate means should be supported in acquiring machinery and equipment, enabling the workforce to shift to other sectors and modern agriculture to be practiced.

This study has the following limitations. Since the results of the study were obtained with data from Turkey for the years 1990-2022, the results may not be generalizable to other countries. In addition, agricultural exports and employment depend on climatic conditions, environmental factors, and the development of non-agricultural sectors. These variables could not be included in the study due to lack of data.

It can be suggested that future studies should remove these limitations and do the following: Although the ARDL model is suitable for analyzing short-term and long-term relationships between variables, it does not determine the direction of causality with certainty. In addition, it is based on linear relationships and may be inadequate in capturing nonlinear relationships. This deficiency can be overcome by using more complex and dynamic methods in the future.

Disclosure statement

The authors declare that they have no conflicts of interest

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