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-RESEARCH ARTICLE-

THE RELATIONSHIP BETWEEN AGRICULTURAL PRODUCTION, AGRICULTURAL EXPORTS AND ECONOMIC GROWTH IN TÜRKIYE: COINTEGRATION AND CAUSALITY ANALYSIS

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Abstract

Analyzing the effects of agricultural production on economic growth has a long history in the academic literature. In this sense, agricultural production is recognized as a vital component of economic growth in many studies and plays a central role in the development efforts of developing countries. This study aimed to assess the influence of agricultural production and agricultural product exports on economic growth within the Turkish economy. To achieve this, annual data spanning from 1980 to 2022 were utilized to construct a model, employing the ARDL Bounds Test to discern the long-term cointegration relationship among variables and the Fourier Toda-Yamamoto Causality Test to determine causality relationships. The empirical findings from the ARDL Bounds Test indicate that increases in both agricultural production and agricultural product exports positively impact economic growth. In addition, labor force and fixed capital stock, which are the main variables of the neoclassical growth model function, also have a positive effect on economic growth in the period in question. Moreover, results from the Fourier Toda-Yamamoto Causality Test unveil a two-way causal relationship between agricultural production and GDP, while a one-way causality relationship is observed between agricultural product exports and GDP. Despite the declining share of the agricultural sector in GDP over the years in Turkey, these findings underscore the enduring importance of agriculture in driving economic growth and creating value. As potential solutions to Turkey's balance of payments challenges, strategies such as boosting domestic demand, expanding the domestic market, and augmenting agricultural sector contributions to foreign exchange earnings through agricultural export subsidies are proposed. Furthermore, efforts to mitigate income disparities between the agricultural sector and other sectors could foster socio-economic development in rural areas, thus promoting a more equitable distribution of national income across society.

Keywords: *Agricultural Production, ARDL Bounds Test, Economic Growth.*

JEL Codes: *O40, O13, Q17.*

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TÜRKİYE'DE TARIMSAL ÜRETİM, TARIMSAL İHRACAT VE EKONOMİK BÜYÜME İLİŞKİSİ: EŞBÜTÜNLEŞME VE NEDENSELLİK ANALİZİ[3]

Öz

Tarımsal üretimin ekonomik büyüme üzerindeki etkilerinin incelenmesi, akademik literatürde uzun bir geçmişe sahiptir. Bu anlamda tarımsal üretim, birçok çalışmada ekonomik büyüme için hayati bir bileşen olarak kabul edilmekte ve özellikle gelişmekte olan ülkelerin kalkınma çabalarında merkezi bir rol üstlenmektedir. Bu çalışma, Türkiye ekonomisinde tarımsal üretim ve tarım ürünleri ihracatının ekonomik büyüme üzerindeki etkisini tespit etmek amacıyla gerçekleştirilmiştir. Bu amaca yönelik olarak 1980-2022 dönemi yıllık verileri kullanılarak kurulan modelde, değişkenler arasında uzun dönem eşbütünleşme ilişkisini ortaya koymak amacıyla ARDL Sınır Testi, nedensellik ilişkisini belirlemek amacıyla ise Fourier Toda-Yamamoto Nedensellik Testi analiz aracı olarak kullanılmıştır. ARDL Sınır Testi neticesinde elde edilen ampirik bulgulara göre kurulan modelde, analize dahil edilen değişkenler arasında uzun dönemli ve istatistiki olarak anlamlı bir eşbütünleşme ilişkisi tespit edilmiştir. Buna göre tarımsal üretim ve tarım ürünleri ihracatındaki artışlar ekonomik büyümeye pozitif yönde katkı sağlamaktadır. Ayrıca Neoklasik büyüme modeli fonksiyonunun temel değişkenleri olan iş gücü ve sabit sermaye stoku da söz konusu dönemde ekonomik büyüme üzerinde pozitif bir etkiye sahiptir. Fourier Toda-Yamamoto Nedensellik Testi sonuçlarına göre ise tarımsal üretim ile GSYH arasında çift yönlü, tarım ürünleri ihracatı ile GSYH arasında ise tek yönlü nedensellik ilişkisi bulunmuştur. Elde edilen bulgular Türkiye ekonomisinde yıllar itibariyle tarım sektörünün GSYH içindeki payı önemli ölçüde azalmış olsa da tarımın ekonomik büyümede halen önemli bir belirleyici olduğunu ve katma değer yarattığını göstermiştir. Bu sebeple iç talebin artırılması ve iç pazarın genişletilmesine ek olarak tarımsal ihracat sübvansiyonları ile tarım sektörünün döviz gelirlerine katkısının artırılması Türkiye'nin ödemeler bilançosu sorunlarına da çözüm alternatifi olacaktır. Ayrıca tarım ve diğer sektörlerin toplam gelirden aldığı paylar arasındaki farkların azaltılması ile özellikle kırsal kesimin sosyoekonomik gelişmişliği yükselecek ve milli gelirin toplumsal tabana daha dengeli dağılmasına katkı sağlanabilecektir.

Anahtar Kelimeler: *Tarımsal Üretim, ARDL Sınır Testi, Ekonomik Büyüme.*

JEL Kodları: *O40, O13, Q17.*

"Bu çalışma Araştırma ve Yayın Etiğine uygun olarak hazırlanmıştır."

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1. INTRODUCTION

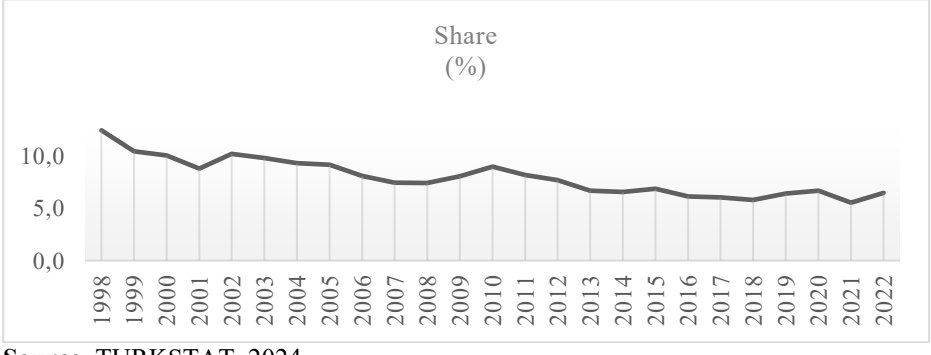
The examination of the effects of agricultural production on economic growth has a long history in the academic literature, dating back to the years dominated by Physiocratic thought in the 18th century. In this sense, agricultural production is widely considered a vital component for economic growth in many studies and plays a central role in the development efforts of developing countries. The agricultural sector within countries' economic structures often contributes to the economy in multifaceted ways, not only ensuring food security but also generating employment, increasing income, promoting savings, and thereby strengthening trade balance with significant macroeconomic impacts (Johnston and Mellor, 1961). Therefore, the impact of agricultural production on economic growth can be regarded as a variable of concern by economic decision-makers and highlighted in the formulation of development strategies.

In contrast to industrialized countries where the agricultural sector is less populous and represents a smaller proportion of national income, the agricultural sectors of developing countries influence a larger population and hold significant importance for national income. According to the FAO's 2016 report, approximately 3.1 billion individuals reside in rural areas globally, with 2.5 billion of them relying on the agricultural sector as their primary source of livelihood. Considering that developing countries produce two-thirds of global agricultural products, it can be argued that this sector plays a critical role for developing countries, housing a significant portion of the world's population.

Concentrating on Turkey, classified as a developing country, statistics from the Turkish Statistical Institute (TURKSTAT) of 2022 reveal that approximately 5 million people are engaged in the agricultural industry. Consequently, the agricultural sector in Turkey exerts a significant impact, constituting approximately 16% of total employment. Although the share of agricultural GDP in total GDP is declining in Turkey, the sector continues to maintain its vitality. Figure 1 illustrates the changes in the share of the agricultural sector within total GDP annually. In 2022, agricultural GDP accounted for approximately 6% of total GDP. This trend is considered normal for developing countries. The high share of high-value technological products in GDP, commonly observed in developed economies, is expected to apply to developing countries over time as well.

The appearance of the share of agricultural GDP within total GDP in Turkey from 1998 to 2022 is depicted in Figure 1.

Figure 1. The proportion of agricultural GDP relative to the total GDP (1998-2022)



Source: TURKSTAT, 2024.

However, as is true for all national economies, the relationship between agricultural production and economic growth in Turkey can be influenced by various factors. Among the prominent factors are policies implemented by policymakers such as incentive and support programs, tax policies, and climate change. Another contribution of agricultural production to economic growth processes occurs through agricultural product exports. The Ministry of Agriculture and Forestry reports that global agricultural product exports rose from $702 billion in 2005 to $1.15 trillion in 2010. Within the subsequent five years, agricultural product exports reached $1.39 trillion in 2015. According to 2020 data, total agricultural product exports worldwide were recorded at $1.6 trillion. During this period, the increase in global agricultural product trade indicates a continuous growth in demand for agricultural products, which have become a significant part of international trade. As of 2020, Turkey ranks approximately 23rd globally in terms of agricultural product export volume, with around $20.75 billion.

Figure 2. Changes in Agricultural Product Exports Over the Years in Turkey

Source: Ministry of Agriculture and Forestry, 2024.

The depicted graph provides a comprehensive overview of Turkey's agricultural export dynamics across different years. It unveils a consistent growth trajectory starting from 2002, with only a minor downturn noted in 2002. Notably, Turkey witnessed a remarkable surge in agricultural product exports, reaching approximately $21 billion in 2020. This impressive growth signifies a substantial fivefold increase over the span of the last two decades.

Figure 3. The Percentage of Agricultural Product Exports Compared To Total Exports (%)

Source: Ministry of Agriculture and Forestry, 2024.

The share of agricultural product exports in Turkey's total exports is a decisive factor in the country's economic structure and external trade balance. The data presented in Figure 3 illustrates Turkey's performance over a twenty-year period. According to the data, the proportion of agricultural product exports in total exports has not undergone significant changes over the years. This ratio, which was 12.99% in 2001, was recorded at 12.21% in 2020. The lowest ratio, at 8.2%, was recorded in 2008, marking the period with the lowest share of agricultural product exports in total exports. Therefore, the presented data indicate that Turkey's share of agricultural product exports has remained stable over time. Turkey has grappled with a current account deficit for many years, and efforts have been made to formulate policies to increase foreign currency resources during this process. In this context, the role of export items becomes even more prominent for the country. Agricultural product exports, constituting approximately 13% of Turkey's total export volume, hold critical importance for increasing the country's foreign currency income and balancing the current account deficit. Hence, it can be asserted that agricultural product exports are a strategic factor for the economy.

Therefore this study aims to develop a model to reveal the impact of agricultural production on economic growth by referencing the Neoclassical and Endogenous Growth Theories. In the model constructed for this purpose, the Gross National Product data of the sample country is included as the dependent variable. In the model, population represents the labor stock as an independent variable, while Gross Fixed Capital Formation represents the capital stock of the country. Another

independent variable, the level of technology included in the model within the context of endogenous growth models, is intended to be represented by the number of patent applications. Since the focus of the study is to determine the impact of the agricultural sector on economic growth, the Crop Production Index and Agricultural Exports are included as independent variables in the model. Finally, to characterize the Turkish economy in the post-1980 period, the ratio of total imports and exports to national income is included in the model as a control variable under the heading Trade.

2. LITERATURE REVIEW

Upon reviewing the literature, it becomes evident that there is a predominant focus on research exploring the impact of agricultural production on economic growth, as well as examining the correlation between agricultural trade and economic growth. These studies seek to evaluate agriculture's contributions to economic expansion and analyze the repercussions of agricultural trade on economic growth using causality tests and cointegration analysis. It is noteworthy that research conducted at the national level frequently exhibits a constrained scope, leading to insufficient scrutiny of the potential economic ramifications arising from agricultural production processes. Table 1 presents the studies conducted in both national and international literature along with their findings.

Tablo 1. Studies from National and International Literature

Author	Examined Period	Countries	Methodology	Findings and Conclusion
Humphries and Knowles (1998)	1960-1985	LDC (Less Developed Countries) countries are used as sample countries.	The Extended Solow-Swan Growth Model is tested using the Non-Linear Least Squares estimation method.	Agricultural growth has a significant and positive impact on productivity increase and overall economic growth.
Gardner (2005)	1960-2001	85 different countries	Time series regression analysis is applied.	No causal linkage exists between agricultural production and economic growth.
Dawson (2005)	1974-1995	62 different LDC countries	Panel cointegration and causality tests are applied	There are notable structural disparities concerning economic growth among less developed countries categorized into low, lower-middle, and upper-middle-income brackets. The influence of agricultural product exports on growth exhibits variation across these distinct country groups.
Awokuse and Xie (2006)	1980-2011	Nine different Developing and	Cointegration tests are applied	It is found that agriculture has the potential to support economic growth, but this effect varies across countries.

		Transition Economies from Three Separate Regions are utilized		
Sanjuán-López, and Dawson (2010)	1970-2004	42 Different countries	Panel cointegration and causality tests are conducted	The existence of a long-term causal relationship between agricultural product exports and growth is identified
Xuezhen at al. (2010)	1952-2007	China	Causality analysis is conducted.	The contribution of agricultural growth has consistently shown an upward trend and is regarded as an indispensable driving force for economic growth.
Sandalcılar (2012)	1987-2007	Türkiye	Error Correction Model (VECM) and causality test are conducted	In the long term, there is no substantial correlation between agricultural exports and economic growth.
Mehrara and Baghbanpour (2016)	1970-2014	34 developing countries	Panel data analysis is performed.	The primary conclusions drawn from the article highlight a robust and positive correlation between industrial exports and economic growth in developing nations, whereas the association between agriculture and economic growth appears to be comparatively weak.
Mahmood and Munir (2018)	1970-2014	Pakistan	Cointegration and Causality Tests are applied	There is a lack of discernible correlation between agricultural product exports and economic growth.
Urriola Canchari at al. (2018)	2000-2016	Peru	Cointegration and Causality Tests are applied.	A unidirectional and enduring relationship between agricultural product exports and economic growth has been confirmed.
Ahmad and Ahmed (2018)	1972-2014	Pakistan	Cointegration and Causality Tests are applied.	The study's findings suggest that economic growth is positively impacted by agricultural exports, non-agricultural exports, and total fixed capital formation.
Abomaye-Nimenibo at al. (2019)	1985-2015	Nigeria	OLS, cointegration, and causality analyses are applied	A noteworthy correlation between agricultural production and economic growth is not evident in Nigeria.
Kulshrestha, and Agrawal (2019)	1961-2017	India	Cointegration and Causality Tests are applied.	Agricultural production directly affects agricultural income and employment. The study identifies a positive association between agricultural production and economic growth.
Kopuk and Meçik (2020)	1998-2020	Türkiye	Cointegration and Causality Tests are applied.	Over the long term, agricultural production and economic growth exhibit cointegration, demonstrating a unidirectional causal relationship from the agricultural sector to GDP.
Runganga and Mhaka (2021)	1970-2018	Zimbabwe	ARDL cointegration test	The existence of short-term relationship is identified. During the

			is applied.	initial phases of economic development, the agricultural sector holds considerable importance.
Agboola at al. (2022)	1981-2016	Nigeria	Cointegration and Causality Tests are applied.	A notable correlation exists between specific agricultural sub-sectors and economic growth.
Mamba and Ali (2022)	1996-2018	Economic Community of West African States (ECOWAS)	Panel Cointegration Tests are applied.	The findings illustrate that agricultural exports have a substantial impact on both agricultural growth and the broader economic growth.
Turan (2022)	1990-2014	Türkiye	Cointegration and Causality Tests are applied.	In the long term, there exists a notable cointegration and causal relationship concerning agricultural exports.
Dinç (2022)	1968-2022	Türkiye	Causality Tests are applied.	A unidirectional causal relationship is observed from the agricultural sector to economic growth.
Kapçak, Çetin and Can (2023)	1990-2018		Hatemi J-Irandoust hidden cointegration test	There is a positive relationship between agricultural energy consumption and economic growth.

As seen in Table 1, agricultural production and agricultural product exports are particularly significant determinants of economic growth in developing and early industrializing countries. However, the number of studies analyzing the contributions of the agricultural sector to economic growth, especially the effects of agricultural product trade on economic growth, is limited at the national level. This limitation in the national literature can be considered a significant gap in terms of determining and implementing agricultural policies and development strategies. To better understand the contributions of the agricultural sector to economic growth and make effective policy decisions, more research and analysis at the national level are needed. In this regard, it is believed that the present study will make a positive contribution to the national literature.

3. DATA, RESEARCH METHOD AND EMPIRICAL RESULTS

This study utilized annual time series data spanning from 1980 to 2022 to assess the influence of agricultural production and agricultural product exports on economic growth within the Turkish economy. The main reason for the data set covering the period from 1980 to 2022 is that, especially after 1980, the Turkish economy entered a process of liberalization and economic integration. Table 2 offers concise details regarding the variables under investigation in the study.

Table 2. Data definitions.

Variable	Corresponding in equations	Source
GDP (constant 2015 US$)	LGDP	World Bank
Population, total	LPOP	World Bank
Gross fixed capital formation (% of GDP)	GFC	World Bank

Patent applications, residents	LPT	World Bank
Crop production index (2014-2016 = 100)	LAGR	World Bank
Agricultural raw materials exports (% of merchandise exports)	EXAGR	World Bank
Trade (% of GDP)	TRD	World Bank

The generated table presents GDP, which represents the aggregate value added by all domestic producers within an economy. Total population (actual population)" represents the total labor force. Additionally, Gross Fixed Capital Formation reflects the capital ratio (K), and Patent applications serve as a proxy for technological advancement. The Agricultural Production Index indicates the level of agricultural production, while Agricultural Raw Material data is presented as a share of total merchandise exports. Lastly, Trade as a percentage of Gross National Income includes the total of exports and imports.

3.1. Model Specification and Research Method

The aim of this study is to examine the impact of agricultural production and agricultural product exports on economic growth in the Turkish economy, utilizing cointegration and causality dimensions. To achieve this objective, the functional representation of the model established is as follows:

$$GDP_t = f(POP_t, GFC_t, PT_t, AGR_t, EXAGR_t, TRD_t) \quad (1)$$

After the logarithmic transformation of non-ratio variables in the analysis, the basic equation of the model in its logarithmic form is as follows:

$$LGDP_t = \alpha_0 + \alpha_1 LPOP_t + \alpha_2 GFC_t + \alpha_3 LPT_t + \alpha_4 LAGR_t + \alpha_5 EXAGR_t + \alpha_6 TRD_t + \epsilon_t \quad (2)$$

In determining the independent variables to be included in the model, we first proceeded from the Neoclassical growth model. Cobb-Douglas style proposed by the Neoclassical growth model is as follows:

$$Y = A\ell^{\mu t} K^{\alpha} L^{1-\alpha} \quad (3)$$

Equation (3) represents the production function where "Y" denotes the gross domestic product (GDP), "K" represents the stock of physical and human capital, "L" represents unskilled labor, "A" represents the controllable level of technology, and "$\ell^{\mu t}$" indicates the externality rate. Drawing from the Neoclassical growth model, the "POP" series is included in the model to represent labor force, and the "GFC" series represents physical capital stock.

Based on the assumptions in Solow's (1956) work, the production function formulated in the Neoclassical growth model, subsequent to the historical development of Endogenous growth theories, these approaches have contributed to the internalization of technological development into economic growth theory (Fine, 2000; Lucas JR, 1988; Romer, 1994). Building upon the Endogenous growth theories, the "PT" series is incorporated into the model to represent technological development. Additionally, the "AGR" and "EXAGR" series are included in the model to measure the impact of agricultural production and agricultural product exports on economic growth, while the "TRD" series is included as a control variable. The selection of "TRD" as a control variable is related to Turkey's economy entering a process of economic integration and openness to the world economy in the period following the base year of the study, which is 1980.

During the analysis process of the model, descriptive statistics and time series graphs of the series used in the analysis are first presented, followed by unit root tests. Subsequently, the ARDL Boundary Test is conducted to test the cointegration relationship among the variables in the econometric model, and the Fourier Toda-

Yamamoto causality test is performed to test the causality relationship, and the empirical findings obtained are presented.

3.2. Descriptive Statistics

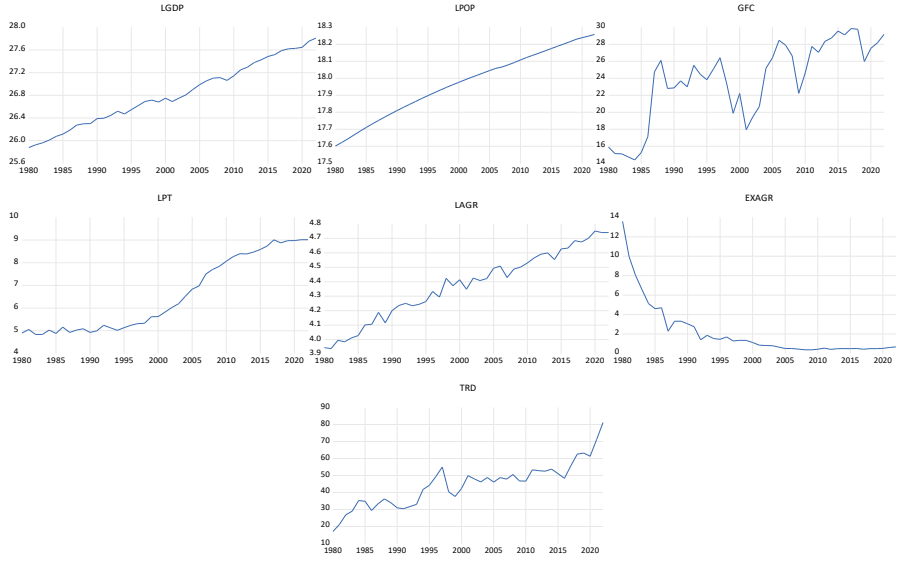
The descriptive statistics of the series used in the study are presented in Table 3.

Table 3: Descriptive Statistics

	LGDP	LPOP	GFC	LPT	LAGR	EXAGR	TRD
Mean	26.819	17.968	23.776	6.547	4.374	2.146	44.670
Median	26.748	17.991	24.746	5.820	4.413	0.854	46.694
Maximum	27.808	18.257	29.857	9.016	4.750	13.587	81.170
Minimum	25.878	17.601	14.395	4.836	3.937	0.368	17.089
Std. Dev.	0.559	0.193	4.710	1.615	0.238	2.817	12.979
Skewness	0.093	-0.267	-0.683	0.407	-0.217	2.405	0.308
Kurtosis	1.898	1.938	2.320	1.458	2.005	8.817	3.339
Jarque-Bera	2.236	2.533	4.176	5.445	2.110	102.109	0.887
Probability	0.326	0.281	0.123	0.065	0.348	0.000	0.641
Observations	43	43	43	43	43	43	43

According to the results presented in Table 2, the variable with the highest volatility among the data used in the study is TRD, while the variable with the lowest volatility is LPOP. Among the series, LPOP, GFC, and LAGR have negative skewness (left-skewed), while LGDP, LPT, EXAGR, and TRD have positive skewness (right-skewed). Furthermore, it is observed that the variables LPT and EXAGR exhibit normal distribution at the 10% significance level. The time series plots depicting the variables utilized in the analysis are presented in Figure 4.

Figure 4. Time Paths of the Variables.



3.3. The Unit Root Test Results

In this study employing time series analysis, the primary method used to assess the stationary nature of the variables within the model was through the application of unit root tests.. The presence of unit roots can often lead to spurious cointegration, which has led to the common practice of initiating analyses with unit root tests in economics and finance research (Herranz, 2017). Initially, the study employed the Augmented Dickey-Fuller (ADF) unit root test, an extension of the Dickey-Fuller (DF) test by Dickey and Fuller (1979), which includes lagged values of the dependent variable. While the ADF test is widely used, it doesn't accommodate structural breaks. However, given that historical time series analyses suggest macroeconomic variables often exhibit nonlinear properties and structural breaks, the study also utilized the Fourier Augmented Dickey-Fuller (FADF) test developed by Enders and Lee (2012). The FADF test incorporates trigonometric sine and cosine functions to address structural breaks. The equations for these unit root tests are provided in Table 4 of the study.

Table 4. Unit Root Tests and Equations

Test	Test Equations
ADF	$Y_t = \alpha + pY_{t-1} + e_t$
FADF	$\Delta yt = c_0 + c_1 \sin\left(\frac{2\pi kt}{T}\right) + c_2 \cos\left(\frac{2\pi kt}{T}\right) + c_3 y_{t-1} + \sum_{i=1}^{p} a_i \Delta y_{t-i} + e_t$

The unit root test results for the included series in the analysis are presented in Table 5.

Table 5. Unit Root Test Results

ADF Results				
	Constant Model		Constant and Trend Model	
Variables	t statistics	p-value	t statistics	p-value
LGDP	0.089	0.961	-2.637	0.266
LPOP	-3.501**	0.013	-3.013	0.141
GFC	-1.871	0.342	-2.693	0.244
LPT	-0.871	0.786	-1.851	0.660
LAGR	-1.231	0.615	-4.919*	0.001
EXAGR	-1.921	0.319	-1.535	0.798
TRD	-0.459	0.889	-2.400	0.374
Fourier ADF Results				
	Constant Model		Constant and Trend Model	
Variables	k	FADF Test statistics	k	FADF Test statistics
LGDP	5	-0.147	1	-4.512**

LPOP	1	-4.190**	2	-3.712
GFC	5	-2.170	2	-3.758
LPT	1	-2.403	1	-2.830
LAGR	4	-1.448	1	-5.246*
EXAGR	1	-6.202*	1	-5.767*
TRD	5	0.189	1	-3.237

Notes: *, ** and *** indicates 1%, 5% and 10% significance levels, respectively.

Based on the outcomes from the ADF unit root test outlined in Table 4, it appears that only the LPOP series is stationary at the initial level in the model with a constant, whereas the LAGR series achieves stationarity at the initial level when both constant and trend terms are incorporated. Meanwhile, the Fourier ADF unit root test reveals that within the constant model, the LPOP and EXAGR series exhibit stationarity at the initial level. However, when both constant and trend terms are included, the LGDP, LAGR, and EXAGR series demonstrate stationarity at the initial level. These results lend support to the notion that macroeconomic variables tend to display trend characteristics and may experience structural breaks.

3.3. The ARDL Results

Following the examination of unit root properties, the study proceeded to employ the ARDL bounds testing approach to explore both long and short-run cointegration relationships among the variables, as per the model equation (Equation 2). This approach, introduced by Pesaran et al. (2001), offers a significant advantage in its capability to accommodate models comprising series with varying levels of stationarity. Consequently, it permits the inclusion of original series in the analysis without necessitating their differencing, thereby preserving the integrity of the original data. The equations utilized in the ARDL model are detailed in Table 6.

Table 6. ARDL Model Equations

Long-run model	$\mathrm{LGDP}_t = \alpha_0 + \alpha_1 \mathrm{LPOP}_t + \alpha_2 \mathrm{GFC}_t + \alpha_3 \mathrm{LPT}_t + \alpha_4 \mathrm{LAGR}_t + \alpha_5 \mathrm{EXAGR}_t + \alpha_6 \mathrm{TRD}_t + \epsilon_t$
Error correction model	$\Delta \mathrm{LGDP}_t = \beta_0 + \sum_{j=1}^{p} \beta_{1j} \Delta \mathrm{LGDP}_{t-j} + \sum_{j=0}^{q} \beta_{2j} \Delta \mathrm{LPOP}_{t-j} + \sum_{j=0}^{m} \beta_{3j} \Delta \mathrm{GFC}_{t-j} + \sum_{j=0}^{n} \beta_{4j} \Delta \mathrm{LPT}_{t-j} + \sum_{j=0}^{v} \beta_{5j} \Delta \mathrm{LAGR}_{t-j} + \sum_{j=0}^{w} \beta_{6j} \Delta \mathrm{EXAGR}_{t-j} + \sum_{j=0}^{b} \beta_{7j} \Delta \mathrm{TRD}_{t-j} + \theta \epsilon_{t-1} + e_t$

The long-run model to the ECM model	$\Delta \text{LGDP}_t = \beta_0 + \sum_{j=1}^{p} \beta_{1j} \Delta \text{LGDP}_{t-j} + \sum_{j=0}^{q} \beta_{2j} \Delta \text{LPOP}_{t-j} + \sum_{j=0}^{m} \beta_{3j} \Delta \text{GFC}_{t-j} + \sum_{j=0}^{n} \beta_{4j} \Delta \text{LPT}_{t-j} + \sum_{j=0}^{v} \beta_{5j} \Delta \text{LAGR}_{t-j} + \sum_{j=0}^{w} \beta_{6j} \Delta \text{EXAGR}_{t-j} + \sum_{j=0}^{b} \beta_{7j} \Delta \text{TRD}_{t-j} + \theta \epsilon_{t-1} + e_t$
ARDL model definition	ARDL(p,q,m,n,v,w,b)
Modifications to obtain the ARDL model	$\psi = \beta_0 - \theta\alpha_0 , \eta_0 = \theta , \eta_1 = -\theta\alpha_1 , \eta_2 = -\theta\alpha_2 , \eta_3 = -\theta\alpha_3 , \eta_4 = -\theta\alpha_4 , \eta_5 = -\theta\alpha_5 , \eta_6 = -\theta\alpha_6$
Reobtaining the long-run coefficients	$\theta = \eta_0 , \alpha_1 = -\frac{\eta_1}{\theta} , \alpha_2 = -\frac{\eta_2}{\theta} , \alpha_3 = -\frac{\eta_3}{\theta} , \alpha_4 = -\frac{\eta_4}{\theta} , \alpha_5 = -\frac{\eta_5}{\theta} , \alpha_6 = -\frac{\eta_6}{\theta}$

The cointegration test results obtained from the unrestricted intercept and trend ARDL model estimated using the equations in Table 6 are presented in Table 7.

Table 7. ARDL Cointegration Test Results

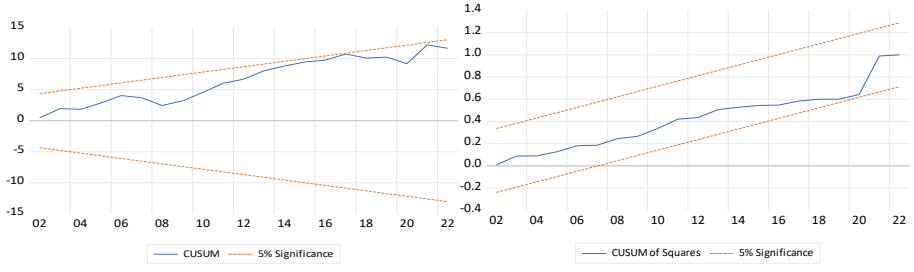
DV | IDV			**Lag length**		**F test statistic**		**Result**
LGDP | LPOP, GFC, LPT, LAGR, EXAGR, TRD			(1,0,0,1,1,2,0)		5.727*		Cointegration
Table of critical values (for k = 6)	%1		%5		%10		
Test	Lower	Upper	Lower	Upper	Lower	Upper	Sources
$F_{overall}$	3.15	4.43	2.45	3.61	2.12	3.23	Pesaran (2001)
Diagnostic Check							
Tests			**F test statistic**			**p-value**	
Jarque-Bera			1.761			0.141	
Ramsey-Reset			2.833			0.108	
Heteroskedasticity ARCH			2.505			0.122	
Breusch-Godfrey LM Test			0.643			0.431	
CUSUM			Stable				
CUSUMSQ			Stable				

Notes: *, ** and *** indicates 1%, 5% and 10% significance levels, respectively. The maximum lag length is chosen as two (2) since the data are used at an annual frequency, and the optimal lag length is determined according to the Schwarz Criterion (SC) information criterion.

The F-test statistic value obtained from the ARDL bounds test for cointegration results presented in Table 6 (5.727) indicates the presence of a cointegration relationship among the variables included in the model at a 1% confidence level. Additionally, the results of diagnostic tests for changing variance, autocorrelation,

normality, and model specification demonstrate that the model is statistically reliable. The results of the Cusum and Cusumsq tests, indicating that the error terms fall within the desired confidence interval, are shown in Figure 5.

Figure 5. The Results of the CUSUM and CUSUMSQ Test.



Once the existence of cointegration between the dependent variable and the independent variables in the ARDL model is confirmed, and the smoothness of the model setup is ensured, the determination of long and short-run coefficients follows. The coefficients obtained are presented in Table 8.

Table 8. Long and Short-Run Estimation Results

Dependent variable = LGDP				
Variables	**Coefficient**	**Std. Error**	**t-statistic**	**Prob.**
Long-run coefficients				
LPOP	1.673849***	0.840636	1.991170	0.059631
GFC	0.020843*	0.004658	4.475100	0.000209
LPT	0.027660	0.028289	0.977775	0.339316
LAGR	1.002706***	0.518256	1.934768	0.066604
EXAGR	0.101744*	0.028681	3.547391	0.001907
TRD	0.005168*	0.002115	2.443791	0.023450
Constant	-8.821520	13.13016	-0.671852	0.509003
Short-run coefficients				
D(LGDP(-1))	-0.072142	0.114415	-0.630531	0.5336
D(LPOP)	-1.122604	2.132153	-0.526512	0.6028
D(GFC)	0.012772*	0.002249	5.678331	0.0000
D(LPT)	0.016519	0.032654	0.505880	0.6170
D(LPT(-1))	-0.028792	0.034199	-0.841891	0.4072
D(LAGR)	0.103965	0.151471	0.686371	0.4983
D(LAGR(-1))	-0.109836	0.129888	-0.845622	0.4052
D(EXAGR)	-0.005808	0.009952	-0.583589	0.5643
D(EXAGR(-1))	-0.004823	0.008970	-0.537718	0.5952
D(EXAGR(-2))	0.001773	0.007852	0.225872	0.8230
D(TRD)	0.000699	0.001148	0.608997	0.5476
Constant	0.061195	0.033466	1.828591	0.0785
ECM(-1)	-0.419737*	0.144455	-2.905665	0.0072

Notes: *,** and *** indicates 1%, 5% and 10% significance levels, respectively

According to the results in Table 8, in the context of long-term cointegration, the signs of labor force, capital stock, agricultural production index, agricultural export, and degree of openness are positive, and their probability values are statistically significant. Thus, during the period in question, a 1% increase in labor force, capital stock, agricultural production, agricultural exports, and total foreign trade would increase economic growth by approximately 1.67%, 0.02%, 1.01%, 0.10%, and 0.01%, respectively, in the long run. As seen, there exists a positive and significant relationship between agricultural production, agricultural exports, and economic growth in the long term.

When examining the short-term coefficients in Table 7, it can be observed that there is only a positive and significant relationship between capital stock and economic growth. Additionally, the value of the Error Correction Term (ECT) represented by ECT (-1) is negative, and its p-value is less than 0.05, indicating statistical significance. Therefore, in the short run, if a deviation occurs in the model, approximately 42% of these deviations are corrected in the first period and approach the long-term equilibrium. The short-term coefficients obtained in the study also support the assumption that the phenomenon of economic growth is long-term.

3.5. Fourier Toda-Yamamoto Causality Test Results

After establishing the cointegration relationships within the model, the analysis progressed to investigate causality. Empirical literature commonly employs two approaches for causality analysis: the Granger causality test (1969) and the Toda-Yamamoto causality test (1995). The selection between these tests depends on the stationarity of the series. Given that the series utilized in this study exhibit stationarity at different levels, the Fourier Toda-Yamamoto Causality Test was employed to assess the causal relationships among the variables. The bidirectional formulation utilized in the classical Toda-Yamamoto causality test is detailed below:

$$Y_t = \omega + \sum_{i=1}^{k} \alpha_{1i} x_{t-i} + \sum_{i=1}^{k} \beta_{1i} Y_{t-i} + \sum_{j=k+1}^{d_{max}} \delta_{1i} x_{t-i} + \sum_{j=k+1}^{d_{max}} \theta_{1i} Y_{t-i} + \varepsilon_{1t} \quad (4)$$

$$X_t = \varphi + \sum_{i=1}^{k} \alpha_{2i} x_{t-i} + \sum_{i=1}^{k} \beta_{2i} Y_{t-i} + \sum_{j=k+1}^{d_{max}} \delta_{2i} x_{t-i} + \sum_{j=k+1}^{d_{max}} \theta_{2i} Y_{t-i} + \varepsilon_{2t} \quad (5)$$

In the traditional Toda-Yamamoto causality test, potential structural changes affecting the common relationship between the series are not accounted for (Özçelik, 2023, p. 42). Consequently, the classical Toda-Yamamoto causality test has undergone refinement over time, culminating in its enhanced version incorporating Fourier functions (Hacker and Hatemi-J, 2006; Nazlioglu et al., 2016; Enders and Jones, 2016). The findings of the Fourier Toda-Yamamoto Causality Test conducted on the established model in this study are outlined in Table 9.

Table 9. Causality test results.

Null Hypothesis	*W-statistics*	*Bootstrap prob.*	*Optimal lag length*	*Optimal frequency*

LGDP → LPOP	0.057	0.970	2	1
LGDP → GFC	8.890	0.620	7	1
LGDP → LPT	**15.731**	**0.080**	7	1
LGDP → LAGR	**15.333**	**0.001**	5	1
LGDP → EXAGR	7.328	0.470	7	1
LGDP → TRD	**16.067**	**0.080**	6	1
LPOP → LGDP	3.223	0.180	2	1
GFC → LGDP	5.520	0.620	7	1
LPT → LGDP	9.631	0.300	7	1
LAGR → LGDP	**24.675**	**0.000**	5	1
EXAGR → LGDP	**15.170**	**0.044**	7	1
TRD → LGDP	3.915	0.760	6	1

The results obtained from the Fourier Toda-Yamamoto Causality Test, as presented in Table 8, indicate a causal link originating from economic growth and extending to technological advancement, agricultural production, and trade openness. Additionally, causality is identified from agricultural production and agricultural product exports to economic growth.

4. DISCUSSION

Agricultural production and exports of agricultural products continue to be an important determinant of economic growth for the Turkish economy. In addition, its geographical advantages keep its agricultural production potential alive. The findings of the study show that the agricultural sector is still successful in creating value added despite the decline in its share in national income. Therefore, micro and regional policies that will increase agricultural production and exports of agricultural products will contribute to sustainable economic growth and reduce balance of payments deficits.

CONCLUSION

This study aimed to empirically investigate the potential impact of agricultural production and agricultural product exports on economic growth within the Turkish economy. Annual time series data from 1980 to 2022 were utilized for this purpose. Drawing from the theoretical frameworks of Neoclassical and Endogenous Growth theories, the explanatory variables for economic growth primarily included labor force, capital stock, and technological development. Furthermore, to align with the study's objective, agricultural production index and agricultural product export variables were incorporated into the model. Additionally, considering Turkey's economic integration and globalization efforts post-1980, the proportion of total foreign trade to national income was included in the model as a control variable.

Based on the study's findings, it was concluded that both agricultural production and agricultural product exports contributed positively to economic growth during the specified period. This result indicates that despite the significant decrease in the share of agricultural production and agricultural exports in the country’s economy

over the years (Figure 1 and 4), the agricultural sector remains a significant determinant of economic growth. The continued contribution of the agricultural sector to economic growth despite the decreasing share of total income demonstrates the relatively high value-added of agricultural production. Therefore, in mitigating fluctuations in GDP due to economic shocks, both domestic and external, experienced by the Turkish economy since 1980, expanding the agricultural sector and narrowing the gap with other sectors, especially industry, will be crucial.

Apart from bolstering domestic demand and the domestic market, the favorable impact of agricultural exports on economic growth holds considerable significance in terms of generating foreign exchange earnings. This is important for Turkey, which has experienced foreign exchange constraints, especially in the 1990s, and has been dealing with balance of payments deficits for the past 40 years. In this context, increasing incentives for agricultural exports can also contribute to reducing the current account deficit.

Turkey is known to have diverse climatic and soil characteristics, with low and high-altitude agricultural lands covering a wide range. With these features, Turkey has significant agricultural production potential. Therefore, increasing the quantity and diversity of agricultural production will revive the processed agricultural products sector, which has a long production chain. This is likely to lead to indirect positive contributions through increased employment, production, and total expenditures. Increasing agricultural production will also lead to socio-economic development, particularly in rural areas, and accelerate prosperity in rural areas. Therefore, with the direct and indirect contributions of agricultural production and agricultural product exports to economic growth, income distribution in the national economy will become more balanced, and the shares of sectors in production will be closer to each other.

In fact, the fact that agricultural production potentials in Turkey exhibit geographically asymmetric characteristics increases the likelihood that regions may have varying levels of impact on economic growth. In this context, an analysis conducted with regional data sets could provide more insightful results. However, the limited availability of data at the regional level is seen as the biggest obstacle to conducting an econometric analysis. Therefore, it is planned to address this shortcoming by including data that incorporate regional dynamics into the study when the necessary conditions are met.

TÜRKİYE'DE TARIMSAL ÜRETİM, TARIMSAL İHRACAT VE EKONOMİK BÜYÜME İLİŞKİSİ: EŞBÜTÜNLEŞME VE NEDENSELLİK ANALİZİ

1. GİRİŞ

Tarımsal üretimin ekonomik büyüme üzerindeki etkilerinin incelenmesi, akademik literatürde uzun bir geçmişe sahiptir ve 18.yy. Fizyokrasi düşünce yapısının hâkim olduğu yıllara kadar uzandığı söylenebilir. Bu anlamda tarımsal üretim, birçok çalışmada ekonomik büyüme için hayati bir bileşen olarak kabul edilmekte ve özellikle gelişmekte olan ülkelerin kalkınma çabalarında merkezi bir rol üstlenmektedir. Ülkelerin iktisadi yapıları içerisinde yer alan tarım sektörü, çoğu zaman sadece gıda güvencesini sağlamakla kalmayıp aynı zamanda istihdam yaratma, gelir artışı, tasarruf sağlama ve dolayısıyla ticaret dengesini güçlendirme gibi önemli makroekonomik etkilerle ekonomi üzerinde çok yönlü katkılar da sunmaktadır (Johnston ve Mellor, 1961). Bu nedenle, tarımsal üretimin ekonomik büyüme üzerindeki etkisinin, iktisadi karar birimleri tarafından önemsenen ve kalkınma stratejilerinin oluşturulması süreçlerinde ön plana çıkarılan bir değişken olarak nitelendirilmesi mümkündür.

Türkiye özelinde bakıldığında 2022 TÜİK verilerine göre yaklaşık 5 milyon kişinin bu sektörde faaliyette bulunduğu görülmektedir. Dolayısıyla Türkiye'de tarım sektörü, toplam istihdamın yaklaşık %16'sını oluşturarak önemli bir etkiye sahiptir. Her ne kadar Türkiye için tarımsal GSYH'nin toplam GSYH'deki payının giderek düştüğü bilinse de tarım sektörünün hayati bir sektör olma özelliğini devam ettirdiği söylenebilir. Bu sebeple tarımsal üretim ve tarımsal ürün ihracatının ekonomik büyüme bağlamındaki tesirinin ölçülmesi ve önemli olmaktadır ve bu önem çalışmanın amacını oluşturmaktadır.

2. YÖNTEM

Bu çalışmada, Türkiye ekonomisinde tarımsal üretimin ve tarımsal ürün ihracatının ekonomik büyüme üzerindeki etkisini ölçebilmek amacıyla 1980-2022 dönemine ait yıllık zaman serileri kullanılmıştır. Bu amaca ulaşabilmek için kurulan modelin fonksiyonel gösterimi aşağıdaki gibidir:

$GDP_t = f(POP_t, GFC_t, PT_t, AGR_t, EXAGR_t, TRD_t)$

Ekonometrik modelde yer alan değişkenler arasında eşbütünleşme ilişkisini sınamak için ARDL sınır testi, nedensellik ilişkisini sınamak için ise Fourier Toda-Yamamoto nedensellik testi gerçekleştirilmiştir.

3. BULGULAR

ARDL sınır testi sonuçları, kurulan modelde değişkenler arasında %1 güven düzeyinde bir eşbütünleşme varlığını gösteren F-test istatistik değerini (5.727)

ortaya koymaktadır. Uzun vadeli eşbütünleşme bağlamında, iş gücü, sabit sermaye stoku, tarımsal üretim endeksi, tarımsal ürün ihracatı ve dışa açıklık derecesi arasında istatistiksel olarak anlamlı pozitif ilişkiler olduğu gözlemlenmektedir. Bu doğrultuda, bu dönemde Türkiye ekonomisinde, iş gücü, sabit sermaye stoku, tarımsal üretim, tarımsal ihracat ve toplam dış ticaretteki her yüzde %1'lik artışın uzun vadeli ekonomik büyümeyi sırasıyla yaklaşık olarak %1.67, %0.02, %1.01, %0.10 ve %0.01 oranında artırdığı görülmektedir. Açıkça görülmektedir ki, tarımsal üretim, tarımsal ihracat ve ekonomik büyüme arasında uzun vadede pozitif ve anlamlı bir ilişki bulunmaktadır.

Fourier Toda-Yamamoto Nedensellik Testi sonuçlarına göre ise ekonomik büyümeden teknolojik gelişmeye, tarımsal üretime ve ticari açıklığa doğru; tarımsal üretimden ve tarım ürünleri ihracatından da ekonomik büyümeye doğru nedensellik ilişkisi tespit edilmiştir.

4. TARTIŞMA

Tarımsal üretim ve tarımsal ürün ihracatı Türkiye ekonomisi için halen ekonomik büyümenin önemli bir belirleyicisi olmayı sürdürmektedir. Ayrıca taşıdığı coğrafi avantajlar tarımsal üretim potansiyelini de her zaman canlı tutmaktadır. Çalışmada elde edilen bulgular tarım sektörünün milli gelirden aldığı payın azalmasına rağmen katma değer yaratmada halen başarılı olduğunu göstermektedir. Bu sebeple tarımsal üretim ve tarımsal ürün ihracatında artışları sağlayacak mikro ve bölgesel politikalar ile hem sürdürülebilir ekonomik büyümeye katkı sağlanabilecek hem de ödemeler bilançosu açıkları azalabilecektir.

SONUÇ

Çalışmada elde edilen bulgulara göre söz konusu dönemde hem tarımsal üretimin hem de tarımsal ürün ihracatının ekonomik büyümeye pozitif yönde katkı sağladığı belirlenmiştir. Bu sonuç ülke ekonomisinde yıllar itibariyle tarımsal üretimin ve tarımsal ihracatın payı önemli ölçüde azalmış olmasına (Şekil 1 ve 4) rağmen tarım sektörünün ekonomik büyüme üzerinde halen önemli bir belirleyici aktör olduğu göstermektedir. Tarım sektörünün toplam gelirden aldığı payın azalmasına rağmen ekonomik büyümeye katkı sağlamaya devam etmesi tarımsal üretiminin göreli olarak yüksek katma değere sahip olduğunu da kanıtlamaktadır. Bu sebeple 1980 sonrası dönemde iç ve dış kaynaklı birçok ekonomik kriz yaşana Türkiye ekonomisinde GSYH'deki iktisadi şoklar kaynaklı dalgalanmaların azaltılmasında tarım sektörünün genişletilmesi ve sanayi başta olmak üzere diğer sektörler arasındaki makasın daraltılması önemli olacaktır. Tarımsal üretimin iç talep ve iç pazar kaynaklı katkısına ek olarak tarımsal ihracatın da ekonomik büyümeye pozitif katkı sağlaması döviz gelirleri bağlamında önemidir. Çünkü Türkiye ekonomisi özellikle 1990'lar boyunca döviz darboğazları yaşamış ve yaklaşık son 40 yıldır da ödemeler bilançosu açıkları ile uğraşan bir ekonomik görünüme sahiptir. Bu bağlamda tarımsal ihracat teşviklerinin artırılması ile cari açığın azaltılması da sağlanabilecektir.

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