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RESEARCH ARTICLE

Relationship between Organic Agriculture And GDP Per Capita, Economic Growth, and Unemployment: Panel Data Analysis

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ABSTRACT

The increase in the world population recently has also increased the need for agricultural products. The need for food products has made it necessary to obtain more products per unit area. At this point, producers have focussed on the use of hormones, chemicals, and fertilisers to increase productivity and meet the demand for cheap food, and the process that increases production in the short term has become a threat to human health in the long term. Over time, the negative effects of chemicals on humans and the environment were observed, forcing producers to seek new methods. This process has led to independent studies on organic agriculture in every country. In this study, the effects of organic agriculture on some economic variables were revealed. In this context, the analyses focus now the variables of area allocated to organic agriculture on a regional basis, production amount and number of producers affected GDP per capita, economic growth, and unemployment in Turkey between 2003 and 2021. The scientific dimension of the study was prepared using data obtained from domestic and foreign literature and the electronic database of the Ministry of Food, Agriculture and Livestock. In this study, in which panel data analysis was used, EViews 12 programme was employed. For the variables used in the study, the geographical region cross-section dependence was determined, and the stationarity of the series was examined with the CIPS (Cross-Sectionally Augmented IPS) unit root test. As a result of the study, it was determined that organic production amount, number of organic farmers, and organic production area did not have a significant effect on economic growth and unemployment. Organic production area and the number of organic farmers had a positive and significant effect on GDP per capita, but the amount of organic production did not have a significant relationship.

Keywords: Organic agriculture, Economic growth, Unemployment, Turkiye
JEL Classification: Q13, Q16, Q17

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1. Introduction

The growth in the world population has increased the demand for food products. The need for food products has necessitated obtaining more yield from each unit of land. In this context, producers have turned to artificial supplements such as hormones, chemical fertilisers, and pesticides to increase efficiency and meet the demand for affordable food. The shift in production and consumption models in the name of economic growth, along with the extensive use of additives, has escalated environmental pollution and posed risks to human health. Over time, the negative effects of these chemicals on humans and the environment have become evident, prompting producers to seek new methods (Anaç and Çiçekli, 2012, p. 45). This has generated an agricultural production process that questions the techniques and inputs used in farming and is sensitive to escalating environmental issues. This process has fostered independent studies on organic farming in many countries (İlter, Aksoy and Altındışli, 2012, p. 4).

Organic farming is defined as certified products that are inspected throughout all stages from production to consumption, adopting an environmentally friendly and human-centric production system, devoid of any chemical inputs harmful to the ecosystem, and ensuring the continuity of soil fertility (Hutchins and Greenhalgh 1997; Ak, 2004; Honkanen, Veerplanken and Olsen, 2006; Er and Başalma, 2008, p. 13). Organic farming aims to produce healthy foods that serve the purpose of maintaining natural balance and advocates for production through natural fertilisation (Atiker, 2004, p. 1; Merdan, 2014, p. 7). While there are numerous definitions of organic farming that are similar or closely related, a common characterisation is that organic farming encompasses production systems friendly to all living beings and the environment, disallowing the use of harmful antibiotics, chemical drugs, and fertilisers. Organic farming is not merely limited to soil cultivation; it upholds sustainable principles extending from packaging to marketing. In addition, organic farming significantly contributes to the natural order, especially in conserving biological diversity, minimising factors leading to climate change, and preventing toxic substances (Demir and Gül, 2004, p. 1).

Organic farming practises protect both human and environmental health and to practise sustainable production that does not harm the organic structure of the soil. In organic farming activities, less yield is obtained per unit area compared with other farming methods (Demirci et al., 2002; Karabaş and Gürler, 2011; Eryılmaz and Kılıç, 2018). Indeed, because chemical inputs are not used in organic farming, there are greater yield losses, and practitioners face various technical challenges. This situation results in organic product prices being higher than those of traditional products.

Organic farming activities create new employment opportunities at every stage from production to consumption. In this context, producers are provided with both financial and social support in rural areas. Organic farming offers opportunities to rural economies at various scales in line with sustainable development goals. The objectives aligned with sustainable development include eradicating poverty in all its forms, promoting economic growth, and strengthening sustainable farming (Özbağ, 2010, p. 2).

This study reveals the relationship among organic farming, economic growth, gross domestic product (GDP), and unemployment. The necessary data to present organic farming in Turkey within the framework of economic discipline were obtained from the electronic database of the Ministry of Agriculture and Forestry (GTHB). The EViews 12 programme has been used for the analysis of the obtained data. Geographic cross-sectional dependence has been identified for the variables used in the study, and the stationarity of the series has been examined with the CIPS (Cross-Sectionally Augmented IPS) unit root test. There are limited studies in the literature regarding the relationship between organic farming and economic concepts in Turkey. This study also addresses gaps in the literature.

2. Organic Farming in Turkey

In the globalising world, advancements in agricultural production techniques and applications within the market economy have led to rapid industrialisation based on science and new technology. At this juncture, industrialised countries

have started using developed organic farming techniques to mitigate the destruction caused by traditional farming methods and to render agricultural production systems sustainable. This emerging situation has facilitated the development of organic farming activities in Turkey, a country significant for its farming (Merdan, 2014, p. 67). While farmers have pioneered the advancement of organic farming in the United States and many European countries, in Turkey, the introduction and adoption of organic farming have been driven by specialised European organic farming companies (Demiryürek, 2004).

In developing countries, organic products are produced for export based on the demand from abroad. A similar situation applies to Turkey. In Turkey, the production of organic agricultural products, initially starting with seedless raisins and dried figs in the Aegean Region in the 1980s, aimed to create export potential. From the 2000s onwards, with the formation of local demand, the production of organic farming has shifted towards meeting domestic market needs (Atış, 2005, p. 172; Fidan, 2017, p. 1). To this end, initiatives have been undertaken to increase local demand, and particularly supermarket-based efforts have been made to present such products to consumers. However, these initiatives have fallen short of expectations because of the higher prices of organic agricultural products compared to conventional ones. Subsequently, stores specialising in the sale and marketing of organic products have been established in major cities and regions with a high concentration of foreign population (Aksoy, 2001, pp. 14-16).

The inception of organic farming activities in the Aegean Region of Turkey has influenced the establishment of all related organisations, such as organic product enterprises, control, and certification companies, in İzmir (Aksoy and Altındişli, 1997). The Aegean Exporters' Association has been authorised to facilitate the export of organic products and to consolidate export-related information under one roof (Aksoy, 2001, p. 4). The Ministry of Food, Agriculture and Livestock and the Ecological Agriculture Organisation Association (ETO) are also among the authorised institutions contributing to the development of organic farming (Yürüdür, Kara, and Arıbaş, 2010, p. 405).

3. Conceptual Framework Regarding the Economic Dimension of Organic Farming in Turkey

Following the acceleration of organic farming in Turkey in the 1990s, academics began conducting economically oriented studies on organic farming. Akgüngör (1996) conducted the first domestic study in this area in the Salihli district of Manisa and the Kemalpaşa district of İzmir. This study examined the yield values obtained in the production of organic seedless dried grapes. The findings suggested that in Kemalpaşa, both yield and production costs were high, whereas in Salehi, yield was low and production costs were high. The second study, conducted in Manisa by Olhan (1997), included 59 producers. Merdan and Kaya (2013) authored the third study. The economic analysis of organic agriculture was conducted in this study. The analysis revealed that Turkey has highly fertile areas and significant potential for organic agriculture. Durmaz (2010) conducted another study. The economic analysis of organic agriculture in Turkey in general and the role of organic agriculture in the economy of Adana province, in particular, are discussed in this study. The analysis shows that organic agriculture in Turkey does not receive the attention it deserves and that its production is export-oriented. Çınaroğlu and Akçacı (2019) o-authored study. The economic dimension of the market for organic agricultural products in Turkey in general and in Kilis province in particular was evaluated in this study. The assessment reveals that Turkey, especially the Kilis province, has not sufficiently utilised its organic agriculture potential and has not yet been able to mobilise its organic agriculture advantages. Considering these facts, it is recommended that awareness of organic agriculture should be improved in the minds of producers and consumers.

The study found that after transitioning to organic production, yield decreased, but income increased. Most of the studies conducted for economic analysis have concluded that the yield is generally lower in organic farming. However, some studies have also found that depending on the type of crop, yield could be higher in organic farming. In the context of production costs, varying outcomes have been reported. While some studies an increase in the costs associated with organic farming, others indicate a decrease. The most significant

and common finding identified in these studies is that the prices of organic products are considerably high, resulting in greater profits for producers engaged in organic farming (Table 1).

Studies that highlight the organic contribution to the national economy have been conducted by Turhan et al. (2008), Yazıcı et al. (2011), Erkoyuncu (2008), Engindeniz and Yücel (2003), Tanrvermiş et al., (2004), Olgun et al., (2008), Bülbül and Tanrıvermiş (2002), and Tanrıvermiş et al., (2004). The common point of the studies in the literature is that the efficiency obtained from organic agriculture is quite low and the costs are high. Low productivity values and high labour costs also increase product prices. In this case, the net income from organic products decreases. According to a study conducted by Demirci et al. (2002), the yield of some organic products (seedless raisins, olives, cotton, barley and wheat) is 5-20% lower than that of conventional products, and their sales prices are 10-15% higher. In the research, it was stated that the price advantage in organic products does not always compensate for yield losses, and the net profit loss due to low yield and high unit costs is 25-60%. The evaluation results regarding the economy of organic agriculture in Turkey according to yield, cost, price, and net income are summarised in Table 1. In studies conducted on the yield values of organic agriculture in Turkey, it is seen that all products except hazelnuts, olives, dried figs, and filtered flower honey have negative values. In terms of cost values, only peaches, hazelnuts, tomatoes, greenhouse cucumbers, and seedless raisins have negative costs. In terms of price evaluation, tomato and flower honey have the highest value in the market (Table 1).

Table 1: Findings of studies conducted on the economics of organic farming in Turkey

Researchers	Field of Study	Investigated Product	Yield (%)	Cost (%)	Price (%)	Net Income (%)
Bülbül and Tanrvermiş (2002)	Ordu-Samsun	Hazelnut	24.20	-15.20	-	20.00
Engindeniz and Yücel, (2003)	İzmir-Menderes	Greenhouse Cucumber	-30.86	-9.63	50.00	28.16
Tanrıvermiş et al.., (2004)	Afyon-Konya	Cherry	-22.80	22.60	15.71	11.85

Table 1: Continued

Tanrıvermiş et al.., (2004)	Konya-Akçaşehir	Strawberry	-21.70	1.25	10.60	27.93
Bektaş and Miran, (2005)	Aydın	Dried Fig	0.26	19.53 (*)	5.69	0.73 (**)
Bektaş and Miran (2006)	İzmir-Manisa	Seedless Dried Grape	-4.76 -	-1.45 (*)	6.89	4.04 (**)
Birinci and Er, (2006)	Bursa-Karacabey	Peach	-40.98	-31.74	41.03	-
Erkoyuncu, (2008)	Ankara-Beypazarı	Tomato	-27.74	-8.98	50.00	36.53
Turhan et al., (2008)	Çanakkale	Tomato	-55.96	82.11	128.15	167.38
Olgun et al., (2008)	İzmir-Aydın-Çanakkale	Olive	34.38	0.84	28.03	15.11
Adanacıoğlu, (2009)	İzmir-Aydın-Manisa	Cotton	-11.39	22.31	11.69	-40.91
Yazıcı et al., (2011)	Antalya	Pomegranate	-15.61	-	-	50.37
Şahin et al., (2011)	Malatya	Apricot	-25.35	-	-	-7.35
Saner et al., (2012)	İzmir-Kemalpaşa	Strained Flower Honey	2.71	-	100.00	-
Çınaroğlu and Akçacı (2019)	Kilis	Olive, Grape	-	-	-	-

Note: (*) variable costs, (**) calculated considering gross margin.

In the domestic literature, there is only one study titled "panel data analysis on economic variables of organic farming." In a study by Ateş in 2020, the relationship between organic farming and GDP was analysed. Because of the analysis, it was observed that the increase in the number of organic producers and the area allocated to organic farming positively affected agricultural GDP. In the foreign literature, there are several studies on the economic variables of organic agriculture. Zanoli, Gambelli and Solfanelli (2023) addressed the first study in the literature (2013) from the UK perspective. Panel data analysis was used in their study, and the years 2007-2009 were taken as the basis. The tendency of farmers to comply with the rules of organic agriculture was discussed in the study, and it was determined that the tendency of animal producers to comply with the rules was higher than that of plant producers. The second of these studies was by Viitaharju, Kujala and Törmä (2017) in Finland. This study analyzes the impact of organic agriculture on GDP and unemployment. The study concluded that organic agricultural activities positively affected GDP, whereas unemployment rates decreased slightly because of the decrease in traditional agricultural activities.

The third study in the literature is Rehman et al. (2017) in Pakistan. This study analysed the impact of organic livestock activity on agricultural GDP. The study results indicated that milk, egg, fat, and mutton variables positively affected agricultural GDP.

4. The Place of Organic Farming in the Economy of Turkey

In this study, the role of organic farming in the Turkish economy is examined in terms of production, consumption, and foreign trade. In the study, efforts have been made to provide the most up-to-date data, and the year 2019, which contains the latest data, has been used as the base.

4.1. Production Dimension of Organic Farming

In the early years of organic farming in Turkey, traditional export products such as dried figs and grapes began to be produced. Over time, the number of products has rapidly increased, and hazelnuts, apricots, walnuts, pistachios, apples, cotton, lentils, olives, tomatoes, strawberries, cherries, peppers, chickpeas, onions, wheat, medicinal, and aromatic plants have also been added to the list (Merdan, 2014, p. 69). This number has continuously increased and, as of 2020, has reached 248.

Organic farming, considered one of the most significant elements of agricultural development in Turkey, has entered an upward trend recently. In Turkey, organic farming has shown significant growth in recent years because of the increase in production amount, the number of producers, and the number of products. When analysing the long-term change, it is observed that the number of producers engaged in organic farming activities has increased by 4.23 times over the 18 years from 2002 to 2020, while the amount of production has increased by 5.26 times. The number of products, which was 150 in 2002, has increased by 1.65 times, reaching 248 different products in 2020 (Table 2). Based on these findings and considering the number of producers, production amount, and number of products in Turkey, it is possible to say that the organic market, which has gained importance in line with consumer demands, is growing.

Table 2: Statistics on Turkey's Number of Organic Farmers, Amount of Production, and Number of Products (2002-2020)

Years	Number of Producers	Amount of Production (Tonnes)	Number of Products
2002	12.428	310.125	150
2003	14.798	323.981	179
2004	12.806	378.803	174
2005	14.401	421.934	205
2006	14.256	458.095	203
2007	16.276	568.128	201
2008	14.926	530.225	247
2009	35.565	983.715	212
2010	42.097	1.343.737	216
2011	42.460	1.659.543	225
2012	54.635	1.750.127	204
2013	60.797	1.620.387	213
2014	71.472	1.642.235	208
2015	69.967	1.829.291	197
2016	67.878	2.473.600	225
2017	75.067	2.406.606	214
2018	79.563	2.371.612	213
2019	74.545	2.030.465	213
2020	52.590	1.630.252	248

Source: www.tarimorman.gov.tr.

4.2. Consumption Dimension of Organic Farming

While the consumption of organic food is increasing day by day in high-income countries, in less developed and developing countries, producers engaging in export-oriented organic farming activities due to high profitability negatively affect organic consumption. The findings obtained from the conducted studies reveal that the price consumers in Turkey are willing to pay for organic products is considerably higher than that for the alternatives.

Two significant conclusions have been reached in the studies conducted on organic product consumption. The first is the identification of the potential demand for organic products, and the second is consumers being informed about organic products. At this juncture, the action required is either to boost demand or to reduce supply. Since the objective is not to cut supply, necessary precautions

should be taken to develop policies aimed at increasing demand. When examining factors that influence demand, an increase in consumer income, along with shifts in consumer tastes and preferences in favour of the producer, can contribute to increased demand. Moreover, through effective advertising and marketing strategies, organic product makers can shape the demand for organic products (Merdan, 2014, p. 82).

Looking at Turkey as a whole, it has been observed that excluding some developed regions like Istanbul, Ankara, and Izmir, the habit of purchasing organic products is not widespread among consumers. This situation can be attributed to the high prices of organic products and consumers not having sufficient knowledge about organic farming (Aydın, Emir, and Demiryürek, 2015: 202). In studies focussed on consumer tendencies, emphasis is generally placed on taste, price, absence of additives, and lack of Genetically Modified Organisms (GMO) in organic products. (Turan and Demircan, 2021, p. 154; Kekeç and Seçer, 2021, p. 87; İnan, Bekar, and Urlu, 2021, p. 220).

4.3. Trade of Organic Agricultural Products in Turkey

In the early 1980s, organic production in Turkey, which was initially focussed solely on exports, evolved in response to foreign demand, leading to changes in both the amount and variety of organic products. Foreign individuals and organisations provided during the initial years of organic production, consultancy, inspection, and certification services. Starting in the 1990s, although in limited numbers, Turkish experts began to emerge in the field of organic farming, eventually becoming representatives of foreign companies in Turkey (İslam, 2013).

A significant portion of organically produced products in Turkey are sold in foreign markets; some are used in the production of processed goods, and others are directly consumed (Emeksiz et al., 2005). In recent years, with the increase in domestic consumption demand and consumer awareness, the domestic market has shown a rising trend, although not as rapidly as the foreign market. The distribution of organic products in the domestic market is facilitated through a

specific marketing network that connects producers to supermarkets or directly to consumers (Tetik, 2012: 51).

4.3.1. Organic Product Export

The majority of organically produced products in Turkey are exported. Foreign demand, with a focus on order-based production networks primarily driven organic production quantities in Turkey (Kırmacı, 2003). While export values in Turkey have fluctuated from 2002 to 2020, they have consistently shown an upward trend. The export amount, which was 19,183 tonnes in 2002, reached 75,904 tonnes in 2019. Similarly, the export value of organic products has shown a fluctuating but increasing trend. In 2002, the generated amount was $30,877, while in 2019, it reached $203,142 (Table 3). In the context of this study, organic products that were initially exported as raw materials have been increasingly exported as processed goods in recent years, contributing to the growth of organic export revenue.

Table 3: Export Values in Turkey Over the Years

Years	Amount (Tonnes)	Amount (Thousand dollars)
2002	19.183	30.877
2003	21.083	36.933
2004	16.093	33.076
2005	9.319	26.230
2006	10.374	28.237
2007	9.347	29.359
2008	8.629	27.260
2009	7.566	27.505
2010	3.593	15.880
2011	3.371	15.529
2012	6.258	24.704
2013	10.495	46.020
2014	15.553	78.780
2015	13.549	69.230
2016	16.819	77.831
2017	61.989	215.288
2018	111.691	361.129
2019	75.904	203.142

Source: www.tarimorman.gov.tr.

A list of the most exported organic plant products in Turkey in 2019 is provided in Table 4. Wheat ranks first among the exported organic plant products, with 31,194.53 tonnes and revenue of $11,913,987.26. Fruits, grapes, figs, hazelnuts, and apricots, in that order followed (Table 4).

Table 4: The most exported organic plant products in Turkey (2019)

Product Name	Amount (Tonnes)	Amount ($)
Wheat	31,194.53	11,913,987.26
Fruits	16,733.92	65,242,625.00
Grape	9,536.31	27,895,275.66
Fig	6,895.86	40,306,275.00
Hazelnut	4,440.76	31,964,563.27
Apricot	3,744.10	14,727,473.00
Vegetable	1,146.61	1,694,270.52
Others	850.03	2,198,960.80
Corn	815.38	2,983,475.42
Olive	178.22	394,232.08
Spices	137.75	1,850,383.93
Pistachio	85.87	1,566,455.26
Total	75,798.79	202,7377,977.2

Source: www.tarimorman.gov.tr.

4.3.2. Importation of Organic Products

In Turkey, the importation of organic products is steadily increasing, and the range of products is expanding. A variety of products are imported, including soybeans and flour, coffee, chocolate, beeswax, liquorice root, coconut, flaxseed, dates, sunflower oil, walnuts, chickpeas, cotton, and dried fruits, among others (Merdan, 2014, p. 77).

When examining Turkey's import activities on a product basis, according to the data for 2019, soybeans take the first place with 1,518 tonnes. Soybeans are primarily imported from Ethiopia. In the second place, with 716 tonnes, liquorice root is observed. Liquorice root is imported from Georgia and Kazakhstan. In third place, date palms rank with 598 tonnes. This plant is imported to Turkey from countries such as the United States, France, the Netherlands, the United Kingdom, Germany, Algeria, Israel, Iran, Pakistan, Tunisia, and Saudi Arabia. Following the

dates, the subsequent products in order are flaxseeds, dried apples, sesame seeds, coconuts, dried apricots, banana puree, and apple vinegar (Table 5).

Table 5: Turkey's organic import values for 2019 (top ten products)

Product Name	Quantity (Tonnes)	Imported Country
Soybean	1.518	Ethiopia
Liquorice	716	Georgia, Kazakhstan
Date	598	USA, France, Germany, Pakistan, Saudi Arabia, Tunisia, Algeria, Netherlands, UK, Iran, and Israel
Linseed	276	Kazakhstan
Dried Apple	137	Kyrgyzstan
Sesame Seed (Raw)	112	Uganda
Coconut	89	Netherlands, Germany, Sri Lanka,
Dried Plums	63.7	England, Argentina, and France
Banana Puree and Flake	42	Ecuador, France
Apple Cider Vinegar	40	Germany

Source: www.tarimorman.gov.tr.

5. Methodology

5.1. Subject and Purpose of the Study

This study examines the effects of organic farming on certain economic variables. The study analysed how variables related to the area allocated to organic farming, organic production amount, and the number of producers engaged in organic farming between 2003 and 2021 at a regional level in Turkey influenced gross domestic product (GDP), economic growth, and unemployment. Panel data analysis was employed in this study, utilising the EViews 12 software. Geographical region cross-sectional dependence was assessed for the variables used in the study, and the stationarity of the series was examined using the CIPS (Cross-Sectionally Augmented IPS) unit root test.

In the data preparation phase, it is essential for all series to be included in the model to be stationary. Unit root tests were conducted to assess the stationarity of the series. After conducting unit root tests, the study model was constructed. This study determines the economic effects of organic farming in Turkey and to

provide guidance for researchers who intend to conduct similar studies in the future.

5.2. Data Collection Technique of the Study

In the preparation of this study, scientific and periodical publications were reviewed, and the gathered information and documents were compiled in accordance with scientific research methods. The scientific data for this study were obtained from the electronic database of the Ministry of Food, Agriculture, and Livestock (GTHB).

5.3. Scope and Data Set of the Study

The data used in the research covers the years 2003–2021 and includes a regional assessment from a geographical perspective. EViews 12 software was utilised in this study, and panel data analysis was conducted. The variables used in the analysis and their descriptions are presented in Table 6.

Table 6: Variables Used in the Analysis and Their Descriptions

Variable Code	Purpose of Use	Variable Name
GROWTH	Dependent variable	Economic Growth (%)
GDP	Dependent variable	GDP (USD)
UNEMPLOYMENT	Dependent variable	Unemployment (%)
AOP	Independent Variable	Amount of Organic Production
NOF	Independent Variable	Number of Organic Farmers
AOF	Independent Variable	Area of Organic Farming

Panel data analysis is widely used in various fields, including economics, sociology, political science, health research, psychology, and education. It is particularly valuable in microeconomic studies where there are a substantial number of units (e.g., regions, countries, companies) In studies that examine the activities of countries over time, macroeconomic panel data analysis is often employed (Baltagi, 2006).

A normality test based on the p-values of the Jarque-Bera test statistic was conducted. Jarque-Bera test is a goodness-of-fit measure used to assess deviations from a normal distribution, which is derived from the transformation of kurtosis and skewness measurements. The null hypothesis (H_0) in this test assumes that the errors follow a normal distribution. When $p < 0.05$, the null hypothesis is rejected, indicating that the data do not follow a normal distribution.

Table 7: Descriptive Statistics for the Variables

Variables	Min.	Max.	Mean	SD	J-B	p
GROWTH	-4.70	11.00	4.61	3.71	3.16	0.206
GDP	4684	12488	9564.89	2021.74	2.12[1]	0.344
UNEMPLOYMENT	9.20	14.00	11.07	1.29	5.60[3]	0.061
AOP	12140	1081655	195480	252916	5.48[3]	0.064
NOF	91	29852	6707.90	7897.09	1.07[2]	0.586
AOF	2831	379373	64107.69	76101.99	2.18[2]	0.335

[1]: Square root transformation
[2]: Logarithmic transformation
[3]: Inverse transformation

When examining the Jarque-Bera test statistics in Table 7, it was determined that the variables GDP, UNEMPLOYMENT, OPA, NOF, and OPA have a normal distribution after appropriate transformations ($p > 0.05$).
To determine the direction of the relationships between the variables used in the study, correlation coefficients were calculated. The Pearson correlation coefficients obtained from the analysis of the variables are shown in Table 8.

Table 8: Correlation Coefficients between Variables

Variables	1	2	3	4	5	6
GROWTH	1	-0.160*	-0.348**	-0.099	-0.137	-0.129
GDP		1	-0.382**	0.266**	0.292**	0.351**
UNEMPLOYMENT			1	0.108	0.091	0.030
AOP				1	0.645**	0.760**
NOF					1	0.656**
AOF						1

Note: *: $p<0.05$; **: $p<0.01$

In the correlation method, where the degree of correlation between independent variables is considered, it can be said that in the literature, correlations of 80% or lower are in line with common practise. When examining

Table 8, it can be observed that the correlation between pairs of independent variables is less than 0.80. It was determined that among the dependent variables, only the GDP variable has a relationship with the independent variables.

When cross-sectional dependence is present in series, the Breusch and Pagan (1980) and Pesaran (2004) tests are employed. The second-generation unit root tests used to detect cross-sectional dependence include Breusch and Pagan (1980) LM, Bias-corrected scaled LM test, Pesaran (2004) CD, and Pesaran (2004) scaled LM test. The use of these tests is determined by examining the relative situation of the cross-sectional dimension "N" and the time dimension "T." Accordingly, it is stated in the literature that it would be more appropriate to use the Pesaran (2004) CD test when N>T and the Breusch and Pagan (1980) LM test when T>N.

In practise, since our cross-sectional dataset consists of regions (N=7) and our time-dependent dataset is determined by the number of periods (T=19), the Pesaran (2004) CD test, which is considered appropriate for cases where T>N, is more suitable for testing cross-sectional dependence. The null hypothesis H_0 used for the cross-sectional dependence test is "there is no dependence between the sections." If the probability values obtained from the analysis are $p<0.05$, H_0 will be rejected. In this case, it is concluded that there is cross-sectional dependence among the variables that constitute the panel data analysis. Therefore, cross-sectional dependence will be considered in the selection of unit root tests to be applied.

Table 9: Cross-Sectional Dependence Test Results

	Model 1			Model 2			Model 3		
Variables	**sd**	**Value**	**p**	**sd**	**Value**	**p**	**sd**	**Value**	**p**
Breusch-Pagan LM	21	379.31	0.000	21	271.86	0.000	21	383.82	0.000
Pesaranscaled LM		54.21	0.000		37.63	0.000		54.90	0.000
Bias-Correctedscaled LM		54.01	0.000		37.43	0.000		54.71	0.000
Pesaran CD		19.47	0.000		16.31	0.000		19.59	0.000

Note: *p<0.05; **p<0.01
(Dependent Variable: Economic Growth), Model 2 (Dependent Variable: GDP), and Model 3 (Dependent Variable: Unemployment)

Upon examining Table 9, it is observed that the p-value corresponding to the test statistic obtained in the Pesaran CD test is less than 0.05 ($p<0.05$) in all three models. In other words, there is cross-sectional dependence in the series. This result indicates that a change occurring in any of the variables included in the model also affects the other variables. Considering the findings obtained, second-generation panel unit root tests will be utilised within the empirical model in which panel data analysis is employed.

5.4. Findings and Remarks

The fact that panel unit root tests take into account both the time and cross-sectional dimensions of the data reveals that they are statistically more robust than time series unit root tests that consider only the time dimension (Hadri, 2000; Levin, Lin & Chu, 2002; Im, Pesaran, & Shin, 2003; Pesaran 2007).

In this study, geographical region cross-sectional dependence was identified for the variables used in the panel data. The stationarity of the series was tested by performing a unit root test using the CIPS (Cross-Sectionally Augmented IPS) test, a second-generation unit root test (Pesaran, 2007). The CIPS test allows for conducting a unit root test among the series included in the panel. The null hypothesis (H_0) suggests that they contain a unit root (i.e., they are not stationary), and when $p<0.05$, the hypothesis is rejected, indicating that they do not contain a unit root (i.e., they are stationary). The results of the unit root test conducted for the variables are shown in Table 10.

Table 10: CIPS Pesaran Unit Root Test Results

		Level		First difference	
Variables	**Lag**	**t**	**p**	**t**	**p**
GROWTH[1]	1	-6.190	0.000	-6.802	0.000
GDP[1]	1	-2.101	0.018	-6.494	0.000
UNEMPLOYMENT[1]	1	-4.155	0.000	-6.346	0.000
AOP	1	-2.941	0.000	-5.192	0.000
NOF	1	-3.068	0.000	-4.991	0.000
AOF	1	-2.662	0.000	-4.766	0.000

Note: [1]A singular unit root test was conducted.

According to the results in Table 10, it has been determined that the variables do not contain a unit root at level and are stationary at level. Consequently, there was no need to consider the first difference in the series.

5.4.1. Model Specification

In this study, the likelihood ratio (LR) test is used to test the fixed-effects model against the random-effects model. The H_0 hypothesis is expressed as "a fixed-effects model is not necessary" (Tatoğlu, 2018). The Lagrange Multiplier (LM) test was conducted to detect random effects. In the test examining random effects over cross-sections, time, and cross-section/time, the H_0 hypothesis (no effect) is tested (Breusch and Pagan, 1980). In the model's application, considering our variables, the Hausman test statistics with an X^2 distribution are used to determine the appropriate model. The test results related to the selection between fixed- and random-effects models are shown in Table 11.

Table 11. Fixed Effect/Random Effect Test Results

LR test	**Model-1[1]**	**Model-2[2]**	**Model-3[3]**
F (6; 123) / p	0.663/0.679	4.848/0.000	0.300/0.935
X2 (6) / p	4.237/0.645	28.233/0.000	1.932/0.925
	Random	Fixed	Random
LM test			
Unit	2.667	0.001	121.78**
Time	386.41**	330.21**	14.03**
Unit and Time	389.07**	330.21**	132.81**
	Fixed/Random	Fixed/Random	Random
Hausman test			
X^2	3.981	29.089	1.800
sd	3	3	3
p	0.263	0.000	0.614
	Random	Fixed	Random

Note: *p<0.05; **p<0.01
(Dependent Variable: Economic Growth), Model 2 (Dependent Variable: GDP), and Model 3 (Dependent Variable: Unemployment)

Based on the likelihood ratio (LR) test results used to test the fixed effects model against the random effects model, the hypothesis "a fixed effects model is

not necessary" has been accepted for Models 1 and 3 but rejected for Model 2. Accordingly, the LR test results a random-effects model for Models 1 and 3 and a fixed-effects model for Model 2. In the LM test, according to the Breusch-Pagan statistic, the hypothesis of no random effects was accepted for Models 1 and 2, whereas the hypothesis "there is no random effect in time and cross-section" has been rejected. In Model 3, the hypothesis "there is no random effect in cross-section, time, and cross-section/time" has been rejected. According to the X2 test statistic obtained in the Hausman test, a random effects model is suitable for Models 1 and 3, while a fixed effects model is suitable for Model 2.

In models, the presence of heteroskedasticity, inter-unit correlation, or autocorrelation affects the validity of F and t statistics, R^2, and confidence intervals (Tatoğlu, 2018). Since the GLS method offers weighting and covariance error corrections, it is a more efficient method than OLS under varying variance or autocorrelation (Baltagi, 2005; Greene, 2003). Cross-section weights, White Diagonal, White Cross-Section weights, and the Swamy-Arora (SA) estimator are preferred estimators when the sample size is small (Baltagi & Song, 2006).

Table 12: Model Autocorrelation, Heteroscedasticity, and Cross-sectional Correlation

Condition Examined	Test	Model-1[1]	Model-2[2]	Model-3[3]
Autocorrelation	Durbin-Watson	1.766	0.772	0.985
Cross-sectional Autocorrelation	Pesaran CD	19.893**	16.314**	19.590**
Heteroscedasticity	Wald	1.581	-5.341**	-16.884**

Note: *p<0.05; **p<0.01
(Dependent Variable: Economic Growth), Model 2 (Dependent Variable: GDP), and Model 3 (Dependent Variable: Unemployment)

5.4.2. Model Testing

In Model 1, within the random effects model, there is no issue of heteroscedasticity, and while there is no autocorrelation within the units, a problem of cross-sectional autocorrelation is present, as indicated in Table 12. To address this, the Period SUR (PCSE) method has been used to adjust the panel standard errors, and subsequently, the Swamy-Arora weighted Panel EGLS was applied.

In Model 2, within the fixed effects model, there is an issue of heteroscedasticity as well as problems of autocorrelation both within and between the units, as illustrated in Table 12. To rectify this, the White Diagonal method was employed to correct the panel standard errors, followed by the application of Cross-Section Weights Panel EGLS (Greene, 2003; Kyriazis and Anastassis, 2007).

In Model 3, which utilises the random effects model, there is heteroscedasticity and inter-unit autocorrelation but no intra-unit autocorrelation, as indicated in Table 12. To address these issues, the White Cross-Section method was applied to correct the panel standard errors, subsequently leading to the implementation of Swamy-Arora Weighted Panel EGLS (Wooldridge, 2002; Arellano, 1987).
The results of the Panel EGLS are presented in Table 13.

Table 13: Model Results

Model	Independent Variables	Dependent Variables	Coefficients	Standard Error	t	Probability (p)	VIF
1	C	GROWTH	10.419	4.998	2.084	0.039	
	AOP		47176.46	156611.5	0.301	0.763	4.522
	NOF		-0.303	0.373	-0.810	0.419	4.291
	AOF		-0.294	0.451	-0.654	0.514	4.969
	F=0.965; p=0.965; R^2=0.021; ΔR^2=0.001						
2	C	GDP	-221.889	41.538	-5.341	0.000	
	AOP		-821818.3	1338426.0	-0.614	0.540	3.149
	NOF		6.552	2.937	2.230	**0.027**	2.388
	AOF		10.893	3.082	3.533	**0.000**	2.491
	F=6.315; p=0.000; R^2=0.316; ΔR^2=0.266						
3	C	UNEMPLOYMENT	-1.508	0.071	-20.982	0.000	
	AOP		3106.49	2499.83	1.242	0.216	2.564
	NOF		0.003	0.004	0.667	0.505	1.915
	AOF		-0.006	0.006	-1.095	0.275	2.613
	F=0.947; p=0.419; R^2=0.021; ΔR^2=0.001						

Examining Model 1, where economic growth is the dependent variable, it is observed that the F-test is not significant (p>0.05), the explained variance is at 0%, and no variable has a significant impact on economic growth (p>0.5). In other

words, it was determined that the amount of organic production, the number of organic farmers, and the area of organic production do not have a significant effect on economic growth.

In Model 2, where the dependent variable is per capita income, the F-test was found to be significant ($F=6.31$; $p<0.05$), indicating the model's validity. The variables of organic production, number of farmers, and area of production account for approximately 27% ($R^2=0.316$) of the variation in per capita income. Examining the t-values for coefficient significance reveals that both the area under organic production ($t=2.23$; $p<0.05$) and the number of organic farmers ($t=3.53$; $p<0.05$) exert a positive and statistically significant impact on per capita income, while the amount of organic production does not have a significant impact ($p>0.05$).

When examining Model 3, in which unemployment is the dependent variable, it's found that the F-test is not significant ($p>0.05$), the explained variance is at the 0% level, and none of the variables have a significant impact on unemployment ($p>0.5$). In other words, it was determined that the amount of organic production, the number of organic farmers, and the area of organic production do not have a significant effect on unemployment.

Conclusion and Evaluation

Turkey is an agricultural country with a vast range of products. In recent years, the demand for organic products has rapidly increased with the controlled and certified production and presentation of agricultural products healthily. Nowadays, many consumers are willing to pay a higher price for products they believe are reliable and of high quality. In this context, increasing organic farming activities with the objective of safeguarding the environment and promoting the well-being of humans, plants, and animals will yield positive results.

In addition to its positive outcomes, organic farming has several negative consequences, particularly for developing countries like Turkey. The shift from

traditional farming, which involves excessive use of synthetic fertilisers and pesticides, to organic farming leads to a decrease in yield as conventional methods are completely abandoned. Along with this drawback, there is a certain transition period in organic farming, which demands advanced farm management skills. In this context, for less developed and developing countries, producing an adequate amount of organic products to meet the continuously increasing demands of the population might not be easily achievable in the near future.

Organic farming, considered one of the most significant elements of agricultural development in Turkey, has been on a rising trend recently. Organic farming in Turkey has shown significant progress because of increases in the amount of production, the number of products, and the number of producers. When examining the long-term transformation over the 18 years from 2002 to 2020, the number of producers engaging in organic farming activities increased by 4.23 times, the amount of production grew by 5.26 times, and the variety of products rose by 1.65 times.

In Turkey, a significant portion of organically produced products are sold in foreign markets, some are used in the mixtures of manufactured products, and some are consumed directly. With the recent increase in domestic consumption demand and consumer awareness, there is a growing trend in the domestic market, albeit not as rapid as that in the foreign market. The introduction of organic products to the domestic market is carried out either through a specific marketing network from producers to supermarkets or directly from producers to consumers.

This study examined organic farming activities within the framework of economic policy. In summary, the findings indicate that the amount of organic production, the number of organic farmers, and the area of production have a significant impact on economic growth. It might be assumed that organic farming, which yields fewer products per unit compared with conventional farming, could impede economic growth. On the other hand, it is observed that the area of organic production ($t=2,23$; $p<0,05$) and the number of organic farmers ($t=3,53$;

p<0,05) have a positive and significant influence on per capita income, whereas the amount of organic production does not have a (p>0,05) significant effect. Furthermore, it has been established that the amount of organic production, the number of organic farmers, and the organic production area does not significantly affect unemployment.

Within the scope of the findings obtained in the study, although the positive aspects of organic agriculture in terms of human and environmental health are recognised, it is considered that the continuation of this activity does not benefit the discipline of economics in terms of economic growth and unemployment but only has a positive effect on per capita income.

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