



## The Relationship Between Real Agricultural Gross Domestic Product and Agricultural Loans

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### Abstract

The aim of this study is to determine the relationship between the real agricultural gross domestic product, which is one of the economic indicators of rural development and total agricultural loans among agricultural financing instruments. The study covers the years of 1998-2018. The real agricultural gross domestic product and the total agricultural loans data are included in analysis. In this study, to make the right model selection, the Advanced Dickey-Fuller unit root test is used. After determining the unit root levels of the variables by the Advanced Dickey-Fuller unit root test, the Engle-Granger two-stage cointegration and Granger causality tests are performed to determine whether there is cointegration and causality relationships between the variables. The Engle-Granger two-stage cointegration analysis shows that the total agricultural loans and the real agricultural gross domestic product variables act together. Also, Granger causality test result indicates that there is a unilateral causality relationship from the agricultural loans variable to the real agricultural gross domestic product variable. In other words, it can be said that the total agricultural loans affect the real agricultural gross domestic product.

**Key words:** Real agricultural gross domestic product, agricultural loan, rural development

### Reel Tarımsal Gayri Safi Yurtiçi Hasıla ve Tarım Kredileri Arasındaki İlişki Özet

Bu çalışmanın amacı, kırsal kalkınmanın ekonomik göstergelerinden biri olarak dikkate alınan reel tarımsal gayri safi yurtiçi hasıla ile tarımsal finansman araçlarından biri olan tarımsal krediler arasındaki ilişkiyi belirlemektir. Çalışma 1998-2018 yıllarını kapsamaktadır. Reel tarımsal gayri safi yurtiçi hasıla ve toplam tarım kredileri değişkenleri analize alınmaktadır. Bu çalışmada doğru model seçimini yapmak için Advanced Dickey-Fuller birim kök testi kullanılmaktadır. Değişkenlerin birim kök seviyeleri Gelişmiş Dickey-Fuller birim kök testi ile belirlendikten sonra, Engle-Granger iki aşamalı eşbütünlüşme ve Granger nedensellik testleri, değişkenler arasında eşbütünlüşme ve nedensellik ilişkisinin olup olmadığını belirlemek için yapılmaktadır. Engle-Granger iki aşamalı eşbütünlüşme analizi, toplam tarımsal krediler ve reel tarımsal gayri safi yurtiçi hasıla değişkenlerinin birlikte hareket ettiğini göstermektedir. Ayrıca, Granger nedensellik testi, tarımsal krediler değişkeninden reel tarımsal gayri safi yurtiçi hasıla değişkenine tek taraflı bir nedensellik ilişkisi olduğuna işaret etmektedir. Diğer bir deyişle, toplam tarımsal kredilerin reel tarımsal gayri safi yurtiçi hasılayı etkilediği söylenebilir.

**Anahtar kelimeler:** Reel tarımsal gayri safi yurtiçi hasıla, tarımsal kredi, kırsal kalkınma

## 1. INTRODUCTION

Agriculture is not only seen as an economic activity, but also as a field of activity that is evaluated together with social, regional, ecological and health protection purposes. In other words, besides the economic functions of agriculture such as nutrition, self-sufficiency, supply of raw materials to industry, it also has functions such as protection of social structure, rural heritage and environment, improving quality of life through quality production and maximizing the benefits of consumers (Turkish Statistical Institution, 2008). These features are also convenient for the concept of rural development. This is because important proportion of the rural population consists of the agricultural population. Therefore, agricultural and rural development are considered together.

The term rural development is a widely accepted term in both developed and developing countries worldwide and is the focus of attention (Sevinç, 2018). Rural development is the taking a share of rural society from the development and welfare of the country. Rural development is the level of life that provides better access to resources, and a balanced distribution of welfare and income. It can be said that rural development is a process which has economic, social and cultural dimensions (DPT, 2000).

In the Rural Development Plan 2010- 2013 report (Ministry of Food, Agriculture and Livestock, 2014) is expressed agricultural gross domestic product as one of the indicators selected rural indicators table. Gross domestic product refers to agricultural growth. Agricultural growth is the proportional changes in the final goods and services produced by the agricultural sector in one country from one period to another year (Artık and Abay, 2014).

Artık and Abay (2014) state that agricultural growth is a measure of the welfare level of the agricultural population and therefore, agricultural growth has a great importance for the national economy in terms of quality, sustainability, adequacy and resources. Also, they state that the agricultural growth is a measure of the growth in the agricultural sector, its contribution to the economy is determined by agricultural gross domestic product and agricultural growth speed. The share of the agricultural gross domestic product in the general economy reveals the magnitude of this contribution (Artık and Abay, 2014).

Rehman et al., (2017) claim that agricultural loan is an integral part of the commercialization process of agricultural modernization and the rural economy. And also they explain that easy and cheap loan is the fastest way to improve agricultural production. Therefore, meeting loan requirements is an important issue in many developing countries. Agricultural loan is seen as one of the strategic sources of agricultural production which leads to an increase in living standards for the rural agricultural population (Rehman et al, 2017).

Farmers use loan for providing the inputs which they need for crop and animal production, marketing the products which they obtain (such as packaging, transportation), obtaining equipment such as plant, stationary machines, land acquisition, buildings, barns, poultry houses that are needed in the enterprise. However, if a classification is made according to the purposes of the loans that farmers need, it is possible to express them as production and investment loans (Karacan, 1991). Among these loans, production loans can be considered as loans that increase agricultural development and the standard of living of the farmers as they are used to increase the income of the farmers. Because the farmer whose income increases, can reach a better standard of living and use his increased income for saving so, the farmers can turn to new investments. Therefore, production loans can be interpreted as effective tool in rural development.

Desired development in agriculture depends on the total capital investments to be made in the sector and agricultural supports. Investments and subsidies in the sector will increase the agricultural productivity and the agricultural gross domestic product. When the purpose of the agricultural loans is examined, it is understood that they are for the production or investment purposes. Agricultural loans are one of the financial tools needed to use modern production technologies and production methods in agricultural business. Thus, we think that it is important to determine the relationship between agricultural gross domestic product and agricultural loans.

In the literature, there are studies examining the factors affecting agricultural growth (Konya and Singh, 2009; Terin et al., 2013; Dhrifi, 2014; Kaur and Sidhu, 2014; Olgun et al., 2018). And in these studies, the factors affecting agricultural growth are mainly economic factors such as agricultural employment, agricultural exports, agricultural credit utilization, fixed capital investments in agricultural sector and agricultural supports.

Agricultural loans alone are not a variable that affects agricultural gross domestic product. However, modern agricultural practices are essential for increasing production and productivity. Various financial resources are needed for these practices. As in many other sectors, loans are seen as an important financial instrument in the agricultural sector. Therefore, in this study, based on the current literature, it is thought that agricultural loans will be a variable that may affect the change in agricultural gross domestic product. Thus the motivation of this study is to test the relationship between agricultural gross domestic product which is one of the indicators of rural development and agricultural loans which is the tool among the agricultural finance by taking into consideration the data between 1998-2018. The original value of this paper can be expressed as follows. It is one of the few studies on the relationship between agricultural loans and agricultural gross domestic product as a rural development indicator in literature.

The plan of the research is as follows. After the general information is given in the introduction in the study, the next section gives a background on agricultural loan and rural development. Section three presents the material and method for this study. The research findings are included in the fourth part and section five completes with conclusion.

## **2. AGRICULTURAL LOAN AND RURAL DEVELOPMENT**

Agricultural supports and loans play an important role in agricultural enterprises which are one of the important elements of rural development, to reach the scale size in which they can use their resources effectively and efficiently, and to provide the capital they need to engage in production activities (Koçtürk et al., 2013). While agricultural loans are allocated to various economic activities in terms of the priorities of development objectives, the agricultural sector also benefits from this loans for production, investment and finally employment development. Agricultural loan plays a vital role in the modernization of agriculture and rural economic development.

The modernization of agriculture which is process to the introduction of modern technologies the improvement of human resources, the management of natural resources and environment, and agricultural loan continues to be one of the factors that influence this process (Chandio et al., 2018). Financing of agricultural production continues to be the key to the macroeconomic development caused by the agricultural sector, particularly through the provision of loans to small-scale farmers (Anetor et al., 2016). Agricultural development is accepted as the basis of industrial development and thus the general economic development of a country (Ogundeji et al., 2018). Agricultural loan is one of the most important factors facilitating agricultural development in many developing and developed countries (Meijerink and Roza, 2007).

Agricultural loan provides to farmers an opportunity for adequate use of inputs, the adoption of modern technologies and the effective and efficient use of resources (World Bank, 2003). Official loan institutions in rural economy can be grouped such as commercial banks, Republic of Turkey Ziraat Bank and the state institutions that provide financial support to farmers in Turkey. In Turkey, among the share of banks providing loans to agricultural sector Republic of Turkey Ziraat Bank has the share of %80 but, over the years, especially after the mid-2000s, it appears to be an increase in the amount the agricultural loans of private banks.

Rural and agricultural population does not mean the same thing, but recent calculation which has been made taking into account of the population density inputs of Turkey show that rural population of Turkey is around 37% and the share of agriculture in total employment rate is 20% (Yavuz and Dilek, 2019). According to this information, it is understood that the agricultural population includes the agricultural population employed in agriculture, while the rural population includes both the agricultural and non-agricultural activities. Rural development indicators can be analyzed under different headings. It is possible to classify them as social, economic and environmental. As rural development is an important issue especially in terms of its contribution to the economy in Turkey like all over the world.

The effects of various policies or factors on rural development are examined in the literature. It is seen that there are researches conducted in order to reveal the relationship between agricultural loans and rural development by considering various indicators of rural development. Burgess and Pande (2002) investigates the impact of the number of new branches established by the Central Bank of India on rural development with data from 1969 to 1992. Consequently, they state that newly established branches change the production and employment structure and ultimately reduced poverty.

The economies of most developing countries depend on the agricultural sector. Thus, although loans are accepted as an important component of agricultural and rural development programs, it can be considered as an important tool to help small-scale farmers and micro entrepreneurs to increase their income. It is thought that access to loans may not have a direct impact on productivity, but may have a positive and significant indirect impact through the adoption of agricultural technologies, increased capital for farm investments, employed labor and improved health and improved household welfare (Awotide et al., 2015).

Economic theory suggests that farmers facing production-related capital constraints tend to use the input combinations in lower levels in their production activities when compared to farmers not facing production-related capital constraints (Freeman et al., 1998). With this explanation, it is expressed in the literature that access to loans can increase the willingness of the adoption to new technologies, the average income levels, productivity, and the level of welfare of the families which need finance (Dantwala, 1989; Diagne et al., 2000; Mohamed and Temu, 2008; Awotide et al. 2015). Azimi (2013) try to determine the effect of agricultural loans on rural development by taking into account the employment variable as an indicator of rural development in Iran. Ogundeji et al. (2018) state that the facilitating the access of farmers to the loans could rise agricultural and rural development by increasing the net income of the farmers, because the majority of the rural population is dependent on agriculture.

Awotide et al. (2015) research the studies examining the effect of restrictions on loans use. And they state that in rural areas of developing countries, loans constraints have significant negative effects on farm output (Feder et al. 1990; Sial and Carter, 1996), farm investments (Carter and Olinto, 2003) and farm profit (Carter, 1989). Freeman et al. (1998) say that it is important to evaluate the expected earning from productivity increase resulting from the provision of agricultural loans. Egbetunde (2012) claim that commercial bank loans have a positive and significant impact on rural economic growth in Nigeria. Similarly, Obilor (2013) asserts in his study that agricultural loans increase agricultural productivity.

### 3. MATERIAL and METHODS

Rural development has many different dimensions such as importance of rural areas, socio-economic status of rural areas, sectoral economic indicators, environment, quality of life in rural areas and leader approach (Özden et al., 2014). The real agricultural gross domestic product is one of the economic dimension of rural development (Hayami and Rutta, 1970). On the other hand, the agricultural loans are among agricultural financing instruments (Ersoy and Özsoy, 2017).

The aim of this study is to determine the relationship between the real agricultural gross domestic product and total agricultural loans. The study covers the years of 1998-2018, and the data are included to analysis in Turkish Liras (TL). Data frequency is annual. The reason why our study covers the period of 1998-2018 is the base year applications which are made by Turkey Statistical Institute for chained volume data.

In this study, rural development is examined with economic dimension and real agricultural gross domestic product is assumed as one of the indicator of the economic dimension of rural development like Özden et al. (2014), and Hayami and Rutta (1970). On the other hand, total agricultural loans data cover total agricultural loans of Development and Investment Banks, Commercial Banks and Participation Banks. The real agricultural gross domestic product and total agricultural loans data is collected from official websites of Turkish Statistical Institute and Banks Association of Turkey.

When we investigate on time series, it is essential that time series do not contain unit root to make the right model selection. Unit root tests can be used to make the right model selection or can be used to eliminate surprious regression problem. So, working with time series containing unit root can cause surprious regression and in this case, regression estimates do not indicate the real relationship (Gujarati, 1995). To make the right model selection, unit root test is implemented with the Advanced Dickey-Fuller test in this study.

After determining the unit root levels of the variables by Advanced Dickey-Fuller unit root test, Engle-Granger two stage cointegration analysis is performed to detect whether there is cointegration relationship between the variables. In this study, Engle-Granger two stage cointegration analysis is preferred because the variables become the stationary at the first and at the same level.

Engle-Granger two stage cointegration test, as the name implies, is carried out in two stages. In the first stage, error terms are estimated by Ordinary Least Squares method. In the second stage, the unit root test is performed for the error term obtained from Ordinary Least Squares method. If the absolute value of the test statistics obtained from the unit root test is greater than the critical values of the Engle Granger (1987) two stage cointegration test, there is cointegration between the series; if it is small, there is no cointegration.

For example, when we investigate whether there is cointegration between  $r_t^c$  and  $r_t^d$  in the vector  $r_t^x=(r_t^c, r_t^d)$  we make regression estimation with the following equation:

$$r_t^c = \beta_0 + \beta_1 r_t^d + \epsilon_t \tag{1}$$

The next step of the two-stage Engle-Ganger cointegration test, we apply the unit root test to the residuals for the test of the null hypothesis that  $r_t^x$  is not cointegrated and the mathematical representation of the Dickey-Fuller test for the basic hypothesis is as follows:

$$\Delta e_t = \gamma e_{t-1} + \epsilon_t \tag{2}$$

When we establish the equation (2), we compare the critical values of Dickey-Fuller with the critical values of Engle-Granger (1989) and test the validity of the basic hypothesis. After determining the long-term relationship of the variables with the Engle Granger cointegration test, we perform the Granger causality analysis which gives the direction of the relationship between the variables and we present the mathematical representation of the Granger causality hypothesis below. The Granger causality requires that the following hypothesis be rejected in order for the causality relationship to exist.

$$\text{For } C \rightarrow D \quad H_0 : \sum_{i=1}^r \lambda_i = 0 \quad \text{For } C \rightarrow D \quad H_0 : \sum_{i=1}^s \phi_i = 0 \tag{3}$$

Akaike Information Criterion or Schwartz Information Criterion is important in Granger causality analysis; we conduct causality analysis by identifying relevant criteria in this study. We obtain this criterias by regressing the dependent variable with its own lagged values (Yapraklı and Güngör, 2007).

#### 4. RESULTS

In this part of the study, the summary statistics of the variables are given to examine the relationship between real agricultural gross domestic product and total agricultural loans. Then, the time series properties of the related variables are examined with Advanced Dickey-Fuller unit root test, and Engle Granger (1987) two stage cointegration test is used to determine whether there is a cointegration relationship between the variables. Finally, we perform the Granger causality test in order to determine the direction of the relationship between the variables. Summary statistics for the total agricultural loans and the real agricultural gross domestic product variables are presented in Table 1.

According to the summary statistics in Table 1, it is observed that the total agricultural loans variable has higher volatility than the real agricultural gross domestic product variable. Again, it can be seen from Table 1 that the average of the total agricultural loans variable is greater than the average of the real agricultural gross domestic product variable. Following the reporting of summary statistics, Advanced Dickey-Fuller unit root test is performed to determine the unit root levels of the variables and is presented in Table 2.

**Table 1.** The Summary Statistics of the Variables (1,000,000 TL)

Variables	Mean	Standart Deviation	Minimum	Maximum
<b>Total Agricultural Loans</b>	20700	23300	1170	77800
<b>Real Agricultural Gross Domestic Product</b>	83,8	13000	65	108

The Advanced Dickey-Fuller unit root test results presented in Table 2 provide evidence that both the total agricultural loans and real agricultural gross domestic product variables contain unit root at level value and that the variables are stationary in the first differences.

**Table 2.** Advanced Dickey-Fuller Unit Root Test Results

Variables	Level Values		First Difference Values	
	Constant	Constant/ Trend	Constant	Constant/ Trend
<b>Total Agricultural Loans</b>	1.81(0)	-0.842(0)	-4.3(0) <sup>(a)</sup>	-5.44(0) <sup>(a)</sup>
<b>Real Agricultural Gross Domestic Product</b>	0.34(0)	-3.26(0)	-6.92(0) <sup>(a)</sup>	-7.32 (0) <sup>(a)</sup>

After examining the unit root levels of the variables with Advanced Dickey-Fuller unit root test, the Engle Granger two stage cointegration test is used to investigate whether the variables act together in the long term. Table 3 presents the Engle-Granger two stage cointegration test findings.

**Table 3.** Engle-Granger Two Stage Cointegration Test Results

Advanced Dickey-Fuller Test Statistic	Engle-Granger Two Stage Cointegration Test Critical Values		
	%1	%5	%10
-7.17	4.32	3.67	3.28

\*Critical values for the Advanced Dickey-Fuller test are taken from Engle and Yoo's (1987) table.

The results in Table 3 show that there is a long-run relationship between the total agricultural loans and real agricultural gross domestic product variables, since the absolute value of the Advanced Dickey-Fuller test statistic is greater than the critical values of the Engle-Granger two stage cointegration test. In line with these findings, it can be stated that total agricultural loans and real agricultural gross domestic product variables act together. In other words, it is seen from Table 3 that there is a long term relationship between the real agricultural gross domestic product which is one of the economic indicators of rural development, and agricultural loans as agricultural finance instruments.

**Table 4.** Granger Causality Test Results

Dependent Variable-Independent Variable	F Statistic	Probability Value
Total Agricultural Loans -Real Agricultural Gross Domestic Product	11.43	0.00
Real Agricultural Gross Domestic Product-Total Agricultural Loans	2.60	0.12

\*We determine the optimum lag length based on Akaike Information Criterion or Schwartz Information Criterion which are 1.

The findings in Table 4 show that there is a unilateral causality relationship from the agricultural loans variable to the real agricultural gross domestic product variable. Within this scope, we state that the total agricultural loans affect the real agricultural gross domestic product and the total agricultural loans trigger the real agricultural gross domestic product in our causality analysis. Our findings in Table 4 are compliance with the findings of Sidhu et al. (2018). Because, Sidhu et al. (2008) claim that there is a positive relationship between agricultural loans and real agricultural gross domestic product. Moreover, our findings are consistent with theoretical expectations; but also, they are in opposite with the claim of the studied by Terin et al., (2014) on Turkey's economy.

As a result of the cointegration test, the study shows that there is a long-term relationship between total agricultural loans and real agricultural gross domestic product variables. In line with these findings, it can be said that total agricultural loans and real agricultural gross domestic product variables act together. In other words, there is a long-term relationship between real agricultural gross domestic product, which is one of the economic indicators of rural development, and agricultural loans as a means of agricultural financing. However, the direction of the relationship between agricultural loans and agricultural gross domestic product is determined by Granger causality test. According to the findings, the direction of the relationship is from agricultural loans to agricultural gross domestic product. This means that changes in agricultural loans may also lead to changes in agricultural gross domestic product. In the related studies, it is stated that agricultural loans can increase production and investment.

Production and investment loans for modern agricultural activities will lead to an increase in agricultural gross domestic product. Rehman et al. (2017) state that the total loans granted by various institutions positively affect agricultural gross domestic product. In addition, they calculate that a 1% increase in agricultural loans distribution would increase agricultural productivity by approximately 0.66%. Azimi (2013) claim that the agricultural bank positively changes employment and short- and long-term investments. Chandio et al (2016) say that a 1% increase in loans would increase agricultural yield by 0.86%. In their study, Yazdi and Khanalizadeh (2014) find a two-way causality between agricultural economic growth and financial development.

## 5. CONCLUSION

It is known that financial services are effective in the realization of modern production investments of agricultural enterprises. However, financial instruments play a vital role in helping the rural population engaged in agriculture to diversify their livelihoods, become more flexible with changes in the market and thus increase welfare. In this study, the relationship between the real agricultural gross domestic product and agricultural loans is examined. As a result of the analyses, it is find that there is a long term relationship between the real agricultural gross domestic product and the total agricultural loans. On the other hand, we make the causality analysis and we see that the total agricultural loans affect the real agricultural gross domestic product. According to these causality findings, we can say that the total agricultural loans trigger the real agricultural gross domestic product.



For Turkey, it is thought that to examine the relationship between agricultural loans and real gross domestic product is important for literature. Because agricultural gross domestic product has a great defining characteristic for rural development. As a result, it can be said that the loans can play an important role in the financing agriculture in the developing countries. The agricultural loans may also be effective in the financial support of the rural population engaged in agriculture. However, the important point in the use of loan is the correct use of the loan and financial capacity of the farmers. In this respect, it can be stated that conscious loan utilization of farmers will contribute to the increase in real agricultural gross domestic product. As a result, it is accepted in the literature that there is a relationship between the agricultural loans and production, productivity and hence real agricultural gross domestic product which is one of the indicators of rural development. In particular, it can be stated that the informing the farmers about the use of loan or the use of loan under the guidance of a consultant will contribute positively to production, productivity and ultimately the real agricultural gross domestic product. At the same time, accessibility to loans in the agricultural sector may affect agricultural gross domestic product.

## FINAL NOTES

<sup>i</sup> indicates the direction of the causality relationship.

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