An Empirical Analysis of the Relationship Between Agricultural Revenue and Tax Burden

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Abstract

The concept of total tax burden, derived by calculating the ratio of all taxes collected within a specific period to the Gross National Product (GNP), serves as a key indicator of a country's level of development and its fiscal policies. Agricultural revenue holds a significant position within the GNP. Another critical point is the scale of taxes generated from agricultural production. This study aims to empirically analyze the relationship between the tax burden and agricultural revenue. For this purpose, data from the Turkish economy covering the period from 1965 to 2022 has been utilized. The empirical analysis reveals a long-term cointegrated relationship between the series. According to the coefficient estimators, it was found that, for the period covered by the study, there is an inverse relationship between the tax burden and agricultural revenue. In other words, increases in the tax burden have been shown to decrease agricultural revenue.

1. Introduction

For taxpayers, taxes represent a non-reciprocal payment and place a burden on those who pay them. Thus, the tax burden is defined as the proportional relationship between taxes paid and income earned (Egeli and Karakoyun, 2019). The concept of tax burden can be divided into objective and subjective tax burden. The objective tax burden is expressed as the ratio of taxes and similar payments made within a given time to the income earned during that same period. However, it is often challenging to calculate both the exact amount of taxes paid and the exact income earned. Among the reasons for this are the complexities involved in accounting for the share received from public services and the difficulties associated with calculation methods. For these reasons, the issue of tax burden has become a topic of debate (Herekman, 1989). Individuals experience psychological pressure resulting from the taxes they pay, which is known as the subjective tax burden. In the literature, terms like tax pressure and tax strain are also used to refer to this concept (Egeli and Karakoyun, 2019). Calculating the subjective tax burden is even more challenging than calculating the objective tax burden. This is due to varying perceptions of tax among taxpayers, as well as differences in how taxpayers at similar economic levels experience the impact of taxation (Çiçek, 2006).

T: Tax

I: Income

TB: Tax Burden

The tax burden can be formulated as $TB = T / Y$, but since individual income is not the sole source of tax-paying capacity, it would be more accurate to express the tax burden as:

- I: Income
- W: Wealth
- S: Special Circumstances of the Taxpayer
- T: Tax
- TB: Tax Burden

Thus, $TB = T / (W + I + S)$ is a more precise formulation (Özbilen, 2010).

In each country, the total tax burden is defined as the ratio of all taxes collected by the state over a specified period to the gross national product (GNP) (Pehlivan, 2018). The concept of total tax burden, a key indicator in cross-country comparisons, reflects how much of a country's output is paid to the state in taxes (Özbilen, 2010). The type and amount of tax paid to the state are critical for numerous sectors and transactions. The tax burden impacts several areas, including the agricultural, industrial, and services sectors, as well as foreign trade activities such as imports and exports (Ömür, 2021).

The agricultural sector has been a field of considerable focus since the establishment of the republic, serving as a platform for the implementation of various ideas. While some initiatives aimed at enhancing productivity in agriculture have positively impacted agricultural production and efficiency, it has also been observed that certain policies have not yielded the desired outcomes.

Investments in the agricultural sector in Türkiye are made by both the public and private sectors. Fixed capital investments by the government and those by the private sector are of great significance for the agricultural industry (Olgun et al., 2018). The gross agricultural revenue is defined as the monetary equivalent of the physical value of products produced as a result of agricultural activities. The contribution of the agricultural sector to the economy is calculated using the production method for Gross Domestic Product (GDP) estimations by the Turkish Statistical Institute, reflecting the sector's economic impact (Ege, 2011). According to 2018 data, the agricultural gross output in Türkiye amounted to 7 billion TL, contributing 5.8% to GDP. By 2020, agricultural GDP reached approximately 44 billion USD. Examining the tax relationship with the agricultural sector reveals that only 0.4% of individuals engaged in agricultural activities are taxed under the real method, while the remaining 99.6% are taxed via withholding. In terms of tax revenue for 2018, the proportion of income taxes derived from the agricultural sector was approximately 3.3% of total tax revenues (Yılmaz and Doğan, 2024).

Numerous studies have been conducted on the tax burden in both national and international literature. Some of these studies compare the tax burdens of OECD countries with that of Türkiye, while others primarily examine the relationship between tax burden and economic growth.

Marsden (1984) conducted a regression analysis of 20 countries between 1970 and 1979. Their findings indicated that a 1% decrease in the share of tax revenues within national income resulted in a negative effect of -0.36 on economic growth.

Widmalm (2001) investigated 23 OECD countries from 1965 to 1990. In this study, boundary analysis was employed, revealing that an increase in personal income tax negatively affects economic growth.

Lee and Gordon (2005) examined the relationship between tax burden and economic growth across 70 countries. Utilizing panel and regression analysis economic models over the period from 1970 to 1997, they concluded that a 10% reduction in corporate tax rates could increase economic growth by between 1% and 2%.

Öztürk and Ozansoy (2011) analyzed the tax burden on wage income and noted that, while the tax burden in Türkiye has been increasing rapidly, it remains lower than that of European Union countries. Their study found that the heavy tax burden based on production and employment, along with tax exemptions and exclusions, leads to disparities in the tax burdens experienced by public sector employees and those in the private sector.

In a comparative study of OECD countries and Türkiye, Kılıçaslan and Yavan (2017) concluded that Türkiye's tax burden is below the OECD average. They also highlighted concerns regarding the distribution of the tax burden, indicating issues related to tax equity within the system.

Organ and Ergen (2017) explored the relationship between tax burden and economic growth in Türkiye from 1980 to 2015, employing a boundary-testing approach. The study concluded that there is a negative relationship between the two variables in the long term.

In their study examining OECD countries, Tosun (2018) noted that Türkiye's tax burden remains below the OECD average. Furthermore, he concluded that the share of indirect taxes in total tax revenues exceeds that of direct taxes in Türkiye, which hinders the equitable distribution of the tax burden.

Koç (2019) examined the relationship between economic growth and tax burden from 1980 to 2017. Utilizing Johansen's cointegration analysis and an error correction model, the study concluded that an increase in the tax burden also leads to economic growth in the long term.

Çelikay (2020) studied OECD countries and found that variables such as per capita income, trade volume, employment capacity, unemployment, and the industrial sector's economic share positively influence the tax burden. It was noted that a positive relationship exists between unemployment and tax burden due to the principles of the welfare state.

Karaş and Selen (2021) analyzed the relationships between taxes and public borrowing among 36 OECD countries from 1995 to 2018. According to their causality analysis, a long-term relationship between tax burden and debt burden was identified.

Püren (2023) conducted a literature review on tax burden, analyzing 47 studies. It was noted that most of the research focused on objective measures of tax burden, while there is a limited number of studies addressing subjective perceptions of tax burden.

2. Materials and Methods

2.1. Data and variables

This study utilizes time series data covering the period from 1965 to 2022. Data on the variables were obtained from the online databases of the OECD and the World Bank. The E-Views 9.0 software package was employed for estimating the empirical model. Descriptive information regarding the variables is presented in Table 1.

Table 1. Variables used in the model

Variable	Description	Period	Source
AGR	Agricultural revenue (% of GDP)	1965-2022 (Annual)	World Bank (WB)
TXR	Tax burden (% of GDP)	1965-2022 (Annual)	OECD

The mathematical expression of the model is shown in equations (3.1) and (3.2):

$$AGR = f(TXR) \qquad (3.1)$$

$$\textbf{Model: } AGR_t = \beta_0 - \beta_1 TXR_t + \varepsilon_t \qquad (3.2)$$

2.2. Empirical findings

The empirical results obtained from the unit root, cointegration, and coefficient estimators used in the analysis are summarized below.

2.2.1. Unit root test results

Unit root tests play a crucial role in assessing the variability and stationarity levels of time series data and are frequently employed in analyses. The primary reason for this significance is the uncertainty surrounding the presence of unit roots, which can lead to inconsistent test results and potentially biased interpretations (Çelik et al., 2022: 93-94). When a time series exhibits stationarity, the changes within the series tend to stabilize around a constant mean over time, indicating that the variations are not random. Conversely, if a time series contains a unit root, it suggests that the changes in the series either increase or decrease over time, indicating a lack of stationarity. Consequently, the study utilized one of the most employed unit root tests, the Augmented Dickey-Fuller (ADF) test (Çelik et al., 2020: 94).

Table 2. Unit root test results

		Variables	ADF		Variables	ADF	
Level	**Constant**	AGR	-3.240 (0.02)**	**First Differences**	AGR	-6.474	(0.00)***
		TXR	-1.120 (0.70)		TXR	-7.331	(0.00)***
	Constant + Trend	AGR	-1.070 (0.92)		AGR	-7.837	(0.00)***
		TXR	-0.969 (0.93)		TXR	-7.350	(0.00)***

Note: Series are seasonally adjusted. P<0.01*** indicates the stationarity of the series.

Table 2 presents the results of the Augmented Dickey-Fuller (ADF) unit root test for both the constant term and the constant plus trend specifications. At the level values, all variables exhibit the presence of a unit root. However, when the first difference of the variables is taken, it is observed that they become stationary at all significance levels in both the constant and constant plus trend equations.

2.2.2. ARDL bounds test results

The ARDL (Autoregressive Distributed Lag) bounds test is a statistical test used to assess the suitability of the ARDL model. As a regression model, it examines the effects of dependent and independent variables on each other. This bounds test is utilized not only to select the highest-order lags but also to determine the existence of a long-term relationship among the independent variables. The F-test is employed to identify the most appropriate model, incorporating the estimated autoregressive (AR) and moving average (MA) terms for stationarity evaluations. This test was developed by Pesaran et al. (2001) (Pesaran et al., 2001: 290). The ARDL test interprets long-term significance levels at 1%, 5%, and 10% using the F-statistic and conducts a comparison with critical values. If the F-statistic exceeds the upper bound critical value, it indicates the presence of cointegration. Conversely, if the F-statistic is below the lower

bound critical value, it suggests that cointegration does not exist (Narayan and Smyth, 2006: 337).

The ARDL bounds test was employed to identify the presence of cointegration among the series, and the results of the ARDL bounds test are presented in Table 3.

Table 3. ARDL bounds test results

		F Statistic
		10.348
Critical Value	**I(0)**	**I(1)**
10%	3.02	3.51
5%	3.62	4.16
2.5%	4.18	4.79
1%	4.94	5.58

The F-statistic, developed by Pesaran et al. (2001), indicates the presence of a cointegrating relationship between variables when it exceeds the upper critical value at the 5% significance level. According to the results in Table 3, the calculated F-statistic value is 10.348. Since this value surpasses the upper critical value of 5.58, it is concluded that a cointegrating relationship exists among the series.

2.2.3. Parameter estimation results

Accurate estimation of long-term coefficients among the series is crucial, as these coefficients determine the magnitude and direction of the relationships between the variables. Therefore, correctly estimated parameter coefficients are vital in the construction and analysis of the model.

Table 4. Parameter estimation results

	OLS		FMOLS		CCR	
Variables	**Coefficient**	**Probability**	**Coefficient**	**Probability**	**Coefficient**	**Probability**
TXR	-1.876	0.00***	-1.873	0.00***	-1.874	0.00***
Constant Term	51.840	0.00***	51.663	0.00***	51.677	0.00***

Note: $p<0.01$*** indicates that the variables are statistically significant.

When evaluating the results presented in Table 4, the coefficients for the constant term and the independent variable TXR are statistically significant across the OLS, FMOLS, and CCR estimators, with the TXR coefficient exhibiting a negative sign. In terms of interpreting the parameter estimation methods:

• According to the OLS method, a one-unit increase in the tax burden reduces agricultural revenue by 1.876 units.

• According to the FMOLS method, a one-unit increase in the tax burden reduces agricultural revenue by 1.873 units.

• According to the CCR method, a one-unit increase in the tax burden reduces agricultural revenue by 1.874 units.

3. Conclusion

The agricultural sector and high productivity in agricultural production are crucial for national economies. Due to the impact of agriculture-related economic activities on other sectors, countries' agricultural economic practices remain a topic of ongoing discussion. After taxes are paid, individuals often feel the urge to see a return on their tax contributions, which influences their tax payment behavior in subsequent periods. Additionally, understanding how taxes are collected from various sectors and how similar practices are implemented globally is of great importance to taxpayers. Since the Neolithic era, agricultural production and its taxation have influenced agricultural revenue. Changes in agricultural revenue naturally affect the tax burden and reveal the

sectoral impacts of taxation. There is an important situation to know about agricultural revenue. Agricultural revenue does not provide information about the economic situation or social welfare of individuals in the agricultural sector. It only represents a size indicator. Evaluating agricultural revenue together with tax burden allows an idea to be formed about the welfare of individuals in the agricultural sector. Therefore, it is correct to examine the tax burden on a sectoral basis. Data from the OECD and the World Bank from 1965 to 2022 were analyzed using the E-Views 9.0 software for estimating the empirical model. The findings indicate that, according to the OLS method, a one-unit increase in the tax burden reduces agricultural revenue by 1.876 units. In the FMOLS method, a one-unit increase in the tax burden results in a decrease of 1.873 units in agricultural revenue, while the CCR method shows that a one-unit increase in the tax burden leads to a reduction of 1.874 units in agricultural revenue.

Tax rates, along with the equitable distribution and collection of taxes among sectors, are significant. Furthermore, tax practices globally affect not only the agricultural sector but also other sectors. In Türkiye, the reliance on indirect taxes for a substantial portion of tax revenues raises questions about the concept of tax fairness, the existence of a shadow economy, and individuals' inclination toward informality, leading to negative economic consequences. It is essential to examine the sectoral impact of the tax burden, which is a crucial indicator for developed countries, and to seek solutions based on these findings.

In order to increase agricultural revenue, policies that will not negatively affect public finances should be developed in incentives for production. In addition, the correct operation of the control mechanism should be ensured. The sectors that contribute the most to the national income should have higher tax burdens. However, it should not be forgotten that some important sectors can directly affect the basic production and exports in the country. It should be investigated how agricultural-focused incomes and taxes have affected social life and welfare levels throughout the historical process, and these studies should be evaluated together with tax policy.

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