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THE ANALYSIS OF COMPONENTS AFFECTING TAX PERFORMANCE IN TURKEY AND THE ESTABLISHMENT OF PROVINCIAL LEVEL TAX PERFORMANCE INDEX[1]

Türkiye'de Vergi Performansını Etkileyen Bileşenlerin Analizi ve İl Düzeyi Vergi Performansı İndeksinin Oluşturulması

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ABSTRACT
The main source of financing public expenditures in Turkey is tax revenues. Especially in recent years, the development of the country's economy, the increase in national income per capita, the migration of the population to cities, and other socio-economic reasons have increased the demand for public investments and expenditures. This situation makes the country's tax performance of taxes, which is the main source of expenditure, an important indicator in terms of public finance. The measurement and evaluation of tax performance are important for determining the fiscal policy to be implemented in a country. The main objective of this study is to measure Turkey's tax performance at the provincial level for the 15-year period between 2006-2020 by revealing what indicators can measure Turkey's tax performance and which factors affect these indicators. For this purpose, Turkey's tax regions were formed by using clustering analysis together with the tax indicators determined in the research. In the study, a performance measurement method based on a mathematical model was developed to measure the performance of the tax regions formed as a result of clustering, and as a result, a provincial tax performance index for Turkey's 2006-2020 period was created. Finally, the relationship between the provincial tax performance index and various economic, demographic, sociocultural, financial, and technological variables is revealed.

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ÖZ
Türkiye'de kamu harcamalarının finansmanında başlıca kaynak kalemi toplanan vergi gelirleridir. Özellikle son yıllarda ülke ekonomisinin gelişmesi, kişi başına düşen milli gelirdeki artış, nüfusun şehirlere göçü ve diğer sosyo-ekonomik nedenler kamu yatırımları ve harcamalarına olan talebi artırmıştır. Bu durum, ana harcama kaynağı olan vergilere ait ülke vergi performanslarını kamu maliyesi açısından önemli bir gösterge haline getirmektedir. Nitekim vergi performansının ölçümü ve değerlendirilmesi, bir ülkede uygulanacak olan maliye politikasının belirlenmesi açısından önem arz etmektedir. Bu araştırmanın temel amacı, Türkiye'nin vergi performansını ölçebilecek göstergelerin neler olduğunu ve bu göstergeleri hangi faktörlerin etkilediğini ortaya koyarak Türkiye'nin 2006-2020 yılları arasındaki 15 yıllık dönemine ait il düzeyi vergi performansını ölçmektir. Bu amaç doğrultusunda araştırmada belirlenen vergi göstergelerle birlikte kümeleme analizi kullanılarak Türkiye'nin vergi bölgeleri oluşturulmuştur. Araştırmada ayrıca kümeleme sonucu oluşturulan vergi bölgelerinin performansını ölçmek için matematiksel modele dayanan performans ölçüm metodu geliştirilmiş ve bunun sonucunda Türkiye'nin 2006-2020 dönemine ait il düzeyi vergi performansı indeksi oluşturulmuştur. Son olarak il düzeyi vergi performansı indeksi ile çeşitli ekonomik, demografik, sosyokültürel, finansal ve teknolojik değişkenlerle ilişkisi ortaya çıkarılmıştır.

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1. INTRODUCTION

Most developing countries are increasingly focusing on domestic resource mobilization for economic development. In this context, tax performance is of great importance, especially for a developing country, as it is the main source of domestic resource mobilization. Many developing countries often face difficulties in raising tax revenues to the desired level and attach great importance to formulating the most appropriate fiscal policy to increase revenue. As a developing country, Turkey finances a large portion of its public expenditures through tax revenues. In this context, the tax performance of the country is of great importance as it is the main source of expenditure. Compared to other countries at a similar stage of economic development, Turkey's tax performance is not satisfactory. One of the major reasons for this is that the economic, social, and cultural regional differences in the country have significantly affected the functions that constitute tax revenues. Therefore, a comprehensive regional research and analysis of Turkey's tax performance is needed to increase domestic resource mobilization.

Measurement and evaluation of tax performance are important for determining the fiscal policy to be implemented in a country. Because taxes constitute the most important source of public revenues used to finance public expenditures (Mucuk & Alptekin, 2008: 172). Research in this field plays an important role in shaping fiscal policies and developing strategies and programs (Erdoğan & Sağbaş, 2016: 64).

Tax performance is the values obtained by indicators that contain important and useful information about the effects of tax activity, expressed as an index, a ratio, or a comparison, monitored at regular intervals, and compared with one or more criteria (Bunescu, 2015: 45). There are different approaches used to measure tax performance. In this study, the indicators that determine tax performance are discussed within the framework of static and dynamic approaches and tried to be determined together with the literature. The most important objective here is to analyze the concept of tax performance correctly and to reveal the most appropriate indicators to help governments easily formulate future expenditure plans and to provide a more comfortable estimation of the budget balance (Özsevinç & Yılmaz, 2014: 1). This study focuses on the concept of tax performance and tries to reveal the indicators used in measuring performance together with the literature. In the study, an index methodology was created using tax performance indicators and Turkey's provincial level tax performance was tried to be revealed with this methodology.

2. THE CONCEPT OF TAX PERFORMANCE

Tax performance is the most important indicator that determines the effectiveness of a country's fiscal policy. For this reason, research on the measurement of tax performance plays an important role both in relevant public institutions and in related scientific fields. Tax performance is a value that consists of certain indicators and emerges as a result of the measurement of these indicators by mathematical, econometric and statistical methods. Although the concept of tax performance has been used with different meanings in studies to determine this value, according to the accepted view in the literature, the tax performance of a region is determined by measuring the tax capacity and tax effort of that region (Lotz & Morss, 1967; Bahl, 1971; Chelliah, 1971; Bird, 1976; Chelliah & Narain, 1982; Tanzi, 1992; Shin, 1969; Leuthold, 1991; Stotsky & Woldermariam, 1997; Piancastelli, 2001; Teera, 2003; Teera & Hudson, 2004; Bird et al, 2006; Gupta, 2007; Glenday, 2008; Bird et al., 2008; Eltony, 2002; Pessino & Fenochietto, 2010; Castro & Camarillo, 2014; Feridhanusetyawan & Ree, 2014). The reason why these two indicators are used extensively in research is that they provide a picture of tax performance in each region and show the potential taxation area in the region (Wang et al., 2009: 205). The potential tax level is

defined as the maximum level of tax revenue that a country can achieve (Mawejje & Sebudde. 2019: 120).

When evaluated in a way to reveal a country's tax potential, tax performance is defined by Arslaner (2018: 299) and Hazman (2019: 5650) as ensuring tax efficiency in public revenues by utilizing the full available taxation potential of countries without confiscating people's income or increasing tax rates.

There are different definitions of tax performance in the literature. Rakıcı and Aydoğdu (2017: 222) defined tax performance as "ensuring maximum tax capacity by taking into account the optimal combination of justice and efficiency criteria" and emphasized that tax capacity and tax effort should be calculated to determine tax performance. Özdemir (2019: 394) defines tax performance as "the performance in the process from the moment all taxable events occur in a country until the moment of collection of the relevant tax" and states that tax performance includes tax capacity and tax effort together. Akkaya et al. (2019: 106-107) stated that tax performance, which is considered as one of the most important economic indicators showing the economic power of a country, can be evaluated by comparing potential tax revenues with actual tax revenues.

According to the studies, tax performance, which is evaluated with tax capacity, tax effort, tax collection rate and tax burden, focuses on the result in a certain period and enables comparison between countries (or regions). With these features, the concept of tax performance is a static analysis approach that emphasizes the outcome (Yay, 2005: 3). However, apart from revealing the situation over time, there is also a need for indicators that exhibit a dynamic approach to collect descriptive data of the region whose tax performance is measured, to make the data meaningful, to reveal the main themes based on these data, and to reach normative conclusions to determine what should happen in future periods.

3. TAX PERFORMANCE INDICATORS

Tax performance is used in different meanings in the literature due to the nature of the performance concept. Because performance is a multidimensional concept that is shaped depending on the content or objective of the research (Shoham, 1998: 61; Sonnentag and Frese, 2002: 5). Performance measurement is a process to determine the extent to which an organization has achieved its goals and objectives. This process involves the continuous collection of data on the progress made on a particular issue. Indicators are needed for continuous data collection, evaluation, and analysis of tax performance.

In this study, tax performance indicators are determined within the framework of both static and dynamic approaches. This is because the static approach represents the measurements and evaluations made to reveal the potential, while the dynamic approach represents the measurements and evaluations that reveal the development and change processes (Swingewood, 1998: 65; Palut, 2005: 29). Chelliah (1971: 301-302; 311) stated that tax burden, tax effort, and tax capacity indicators exhibit a static approach in comparing the tax performance of developing countries with other countries and evaluating the tax potential at a certain point in time. However, since static indicators are insufficient to show the change in the tax performance of countries, it is stated that these indicators should be used together with dynamic indicators such as tax elasticity. Some studies supporting Chelliah's view (Teera & Hudson, 2004: 795; Twerefou et al., 2010:40-41; Appiah, 2013: 45; Musa et al., 2016: 22; Edeme et al., 2016: 135), it has been stated that in order to determine whether a country is making efforts to increase tax revenues in a certain period, tax performance indicators such as tax buoyancy, which measure the revenue/GDP sensitivity and response of the tax system, should be used in a dynamic sense. Based on the literature, this study uses the tax performance indicators shown in Figure 1.

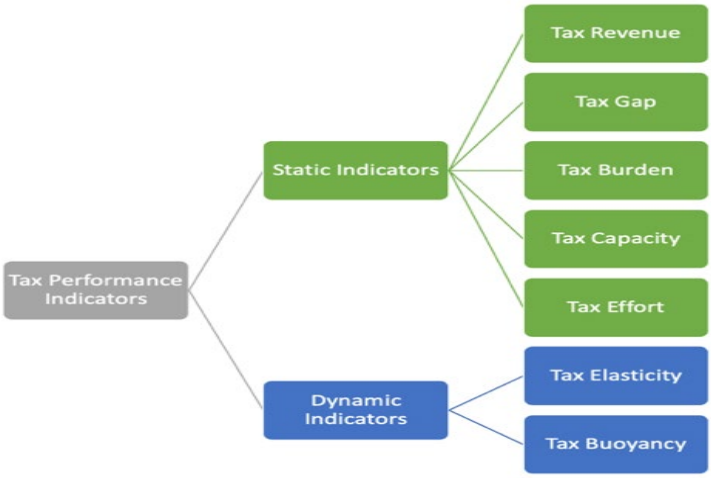

Figure 1. Tax Performance Indicators

Source: Created by the authors.

The combined use of tax performance indicators can be used not only to assess past performance but also to make decisions on what can be done in the future. However, the accuracy of indicators depends on the availability of data sources and the use of the right analysis techniques (Karaaslan, 2015: 89). Tax performance calculations made with the right analyses not only show the ranking of a region but also guide efforts for improvement by revealing where the main problem stems from.

In this study, in order to make an accurate analysis and evaluation of Turkey's tax performance and to provide the highest contribution to the research, five indicators, namely tax revenue, tax gap, tax burden, tax capacity, and tax effort, will be selected within the framework of the static approach, while two indicators, namely tax elasticity and tax buoyancy will be used within the framework of the dynamic approach, as shown in Figure 1. It will be possible for these indicators to show the tax performance of the country in an explanatory manner by evaluating the periodic and regional parameters.

4. LITERATURE REVIEW

Measuring the tax performance of countries is a challenging, complex, and debated topic, both in theory and practice. However, there are some basic performance measures and comparative criteria accepted in the literature (Le et al., 2012: 2). Tax revenue, tax burden, tax capacity, and tax effort indicators are mainly used to measure tax performance. In one of the first studies in the literature, Clark (1945: 375) evaluated performance using the ratio of tax revenue to gross domestic product, i.e. tax burden. In the study by Lotz and Morss (1967), which is considered the first statistical study in the literature, tax burden, tax capacity, and tax effort indicators were used to measure the tax performance of countries. Studies by Tait et al. (1979), Tanzi (1987), Leuthold (1991), Ghura (1998), Teera and Hudson (2004), Bird et al. (2006), Pessino and Fenochietto (2010), Dioda (2012), Amoh (2019) have similarly evaluated tax performance with the burden, tax capacity, and tax effort.

In some studies, additional indicators such as tax elasticity, tax buoyancy and tax gap are also used to assess tax performance. Mansfield (1972) measured Paraguay's tax performance with tax elasticity and tax buoyancy indicators, while Tanzi (1981: 57) calculated the tax performance of Sub-Saharan Countries using the tax buoyancy indicator. Thac and Lim (1984: 451) tried to reveal the tax performance of Papua New Guinea for the period 1965-77 by combining tax capacity and tax effort and tax elasticity and tax buoyancy indicators

under two different approaches. In another study, Garikai (2009: 2) emphasized the importance of the tax buoyancy indicator for tax performance in terms of both quality and quantity, while Bonga et al. (2015) used tax flexibility and tax buoyancy indicators as dynamic measures of tax performance. Castro and Camarillo (2014) calculated the tax gap indicator in addition to the tax capacity and tax effort indicators in their study to measure the tax performance of OECD countries. Similarly, Khwaja and Iyer (2014), in their study evaluating the tax performance of 61 countries in the Eastern Europe and Central Asia region, included the tax gap indicator in addition to the tax burden, tax capacity, and tax effort indicators. Kibret and Mamuye (2016: 13) used the "tax gap" indicator in their assessment of Ethiopia's tax performance.

In these studies, the determinants of tax performance are generally economic variables such as per capita income, gross domestic product (GDP), foreign trade volume, the sectoral weight of agriculture and mining, and population indicators (Frank, 1959; Bird 1964; Lotz and Morss, 1967; Tanzi, 1968; Shin 1969). Inflation and debt indicators were later added to the economic variables in the literature (Tanzi, 1977; Leuthold, 1991; Tanzi, 1992). In the 2000s, demand-side factors such as corruption, quality of governance, rule of law, etc. started to be used as variables in studies on tax performance measurement (Ghura, 1998; Fauvelle-Aymar, 1999; Bird et al., 2006; Gupta, 2007; Bird et al., 2008; Le et al., 2008; Dioda, 2012). In some studies, socio-demographic variables are also used (Ansari, 1982; Fauvelle-Aymar, 1999; Piancastelli, 2001; Castro & Camarillo, 2014).

In addition, the grading of performance has also been an important topic in the studies in the field, and the grading of tax performance has generally been done in the form of country comparisons (Shin, 1969; Piancastelli, 2001; Pessino and Fenochietto, 2010). In these comparisons, tax capacity and tax effort of countries have been calculated and ranked by classifying them in economic terms such as developed countries, developing countries, and underdeveloped countries (Williamson, 1961; Chelliah, 1971; Leuthold, 1991; Gupta, 2007; Bird et al., 2008) and regional terms such as African continent countries and Asian continent countries (Tanzi, 1992; Stotsky & Woldermariam, 1997; Eltony, 2002; Mkandawire, 2010; Drummond et al., 2012). In some studies, tax performance has been rated by calculating tax capacity and tax effort by using the data of regions within the borders of a country (Sen & Tulasidhar, 1988; Sobarzo, 2004; Wang et al., 2009; Shang, 2016; Hassan et al., 2016; Garg et al., 2017).

While tax capacity and tax effort indicators were calculated in some of the studies on Turkey (Berksoy, 1984; Saraçoğlu, 2004; Günay, 2007; Dursun, 2008; Atsan, 2017; Saruç et al., 2018; Yıldırım, 2020), "tax elasticity" and "tax buoyancy" were calculated in others (Atabey et al., 2009; Akar & Şahin, 2015; Yıldırım & Demir, 2021). On the other hand, region-based and province-level literature is quite limited (Çelik, 2006; Şimşek, 2013; Öz & Kutbay, 2015; Sağdıç, 2015; Çelikay, 2016; Kızıltan, 2018). Studies in Turkey have generally found that the variables that affect tax performance most are income per capita (positively), share of agriculture in GDP (negatively), export ratio (positively), and trade openness (positively).

5. AIMS AND OBJECTIVES

The main objective of this study is to measure Turkey's tax performance at the provincial level for the 15-year period between 2006 and 2020 with the determined indicators and to construct Turkey's province level tax performance index.

The objectives determined to achieve the aim of the research can be listed as follows:

- To reveal the tax performance indicators and the components affecting these indicators by analyzing the theoretical and empirical literature,

- To use cluster analysis to eliminate heterogeneity at the provincial level according to tax performance indicators and to ensure homogeneity,
- To evaluate provincial-level tax performance in terms of different indicators with the clusters formed,
- To create a provincial-level tax performance index score,
- To reveal the relationship between the tax performance index score at the provincial level and economic, demographic, sociocultural, financial, and technological variables.

6. RESEARCH APPROACH

Tax performance is one of the most important indicators in determining the effectiveness of countries' fiscal policies. When measuring the tax performance of a region, the right metrics and methods should be used to achieve the goals and objectives. The static approach theory, which shows instantaneous performance, and the dynamic approach theory, which shows the effect over time, gain importance here. While determining all these, it is thought that by utilizing a country's dynamics and preferring the inductive approach instead of the deductive approach, meaningful results will be achieved in performance measurement.

In this study while trying to reveal Turkey's tax performance, it is aimed to reveal the components affecting the overall performance at the provincial level and evaluate the overall tax performance of the country with the results obtained. Contrary to the literature, this purpose has led to the preference for an inductive approach in the research.

The research aims to identify the main themes based on the descriptive and detailed data collected to measure tax performance, provide a meaningful structure to the data, and reach normative conclusions with the structures. In line with this objective, the inductive approach was preferred because it facilitates detailed observation of the data and provides more general and summarized ideas and directs the researcher to freely analyze and evaluate the data without being under the influence of any conceptual approach.

In the research, quantitative approaches were preferred because they are appropriate for the aims and objectives. Almost all of the variables used in the measurement of tax performance indicators consist of numerical data. Therefore, statistical methods were used within the framework of the quantitative approach to ensure that the research findings are analyzed at a reliable, valid, and generalizable level.

While quantitative research methods can be used to measure tax performance from an objective perspective, subjective perspectives are also needed in the evaluations made to make sense of the parameters obtained. This will also contribute to the inductive approach adopted in the research by allowing more specific explanations to be made, in contrast to the deductive generalization-based nature of quantitative research methods. For this, the qualitative analysis should also be utilized in the evaluation of the quantitative results obtained. Because, while quantitative research is the process of transforming the data obtained by using certain measurement tools in research into generalizable and universal information using various statistical methods, qualitative research focuses on the best way to express the detail and depth of the knowledge of the phenomenon under study rather than the generalized or universal dimensions of knowledge (Baltacı, 2019: 371). In this way, the validity and reliability of the results obtained in the research will be ensured and will allow these results to be compared with other studies.

Despite all the approaches adopted in research, measuring, and assessing a country's tax performance, examining the factors affecting performance may not provide sufficient evidence to tell the whole picture or inform policymakers. This is because it is not known whether the country has reached its tax capacity or the desired level of tax revenue (effort)

and whether political decision-makers are putting maximum effort into tax collection (Chigome, 2020: 204-205). Despite this, the research will make important contributions to the regional analysis of Turkey's tax performance, the measurement of the tax performance index based on regional variables, and the shaping of tax policies to be determined by decision-makers with the evaluations put forward.

7. RESEARCH METHODS

The main aim of this research is to reveal Turkey's tax performance regionally and to create a province-level tax performance index. For this purpose, seven indicators have been selected to reveal Turkey's tax performance. Thus, a data set of 1.215 observation units obtained from the data of 81 provinces in Turkey for the years 2006-2020 was formed. While this data set led to the emergence of many variables in the research, a process consisting of three stages was developed to realize a healthy measurement due to a large amount of data.

In the first stage of the research, tax performance indicators are prepared at the provincial level in Turkey. All tax performance indicators are calculated with five-year average data for the 2006-2020 period. Thus, three-period performance data were obtained. The equations given in Appendix 1 were used in the calculations. The data organized in Excel were then transferred to the SPSS 22 program. Before clustering analysis, transformation according to z-score was performed.

In the second stage of the research, new tax regions were created as a result of the classification made by using cluster analysis and discriminant analysis methods according to the tax performances calculated at the provincial level in Turkey. While the cluster analysis method provides a simple way to organize a large data set for easier understanding and to obtain information more efficiently, the discriminant analysis is preferred as a suitable method to check the accuracy of the clusters formed (Allahverdi & Alagöz, 2019: 448-450). The results obtained enabled easier analysis and interpretation by homogenizing the heterogeneous data at the provincial level (Allahverdi et al., 2021: 42).

In the last stage of the research, a province-level tax performance index was created. Thus, a comparable value was obtained, such as Turkey's macroeconomic indicators, demographic, sociocultural, financial, etc. indicators. The most important objective here is to reveal the most appropriate tax performance by analyzing tax performance correctly, thus helping governments to easily formulate future expenditure plans and to predict the budget balance more easily (Özsevinç & Yılmaz, 2014: 1).

7.1. Cluster and Discriminant Analysis

Cluster analysis is used in practice as a method used for research and identification purposes rather than drawing a statistically significant conclusion. Cluster analysis is a very useful research method in terms of seeing the effect of many variables on the object of observation and at the same time a large number of units (Doğan, 2008: 108).

The most important step in cluster analysis is to obtain a measure of distance or similarity between the data. The similarity or distance of the data is related to their position in space. Data that are less similar or distant from each other in terms of their position in space are grouped in the same cluster.

Euclidean distance measure was preferred in this research. Euclidean distance is defined as the square root of the sum of the squares of the differences between the coordinates of the points. Euclidean distance, which is the most widely used distance measure to calculate the distances between objects in cluster analysis, is based on the length of a straight line drawn between two points (Sarıgül, 2014: 46).

$$d(x_i, x_j) = \sqrt{\sum_{k=1}^{p} (x_{ik} - x_{jk})^2} \quad (1)$$

The function d(x_i,x_j) is a non-negative function and expresses the distance between observation vectors xi and xj (Çakmak et al., 2005: 4). In Equation (1), i=1,2,.....,n; j=1,2,.....,n and k=1,2,...,p. n is the number of units and p is the number of variables.

The distances of n units in the data matrix with respect to p variables are expressed by the D matrix. The elements of the D matrix are d_((i,j))s, which express the distance between unit i and unit j (Cengiz & Öztürk, 2012: 72).

Clustering methods are methods that utilize distance, similarity or dissimilarity matrices to create homogeneous and heterogeneous groupings of units or variables (Özdamar, 2018: 295). The most widely known or accepted clustering methods are categorized into two groups as hierarchical and non-hierarchical methods (Yılmaz, 2011: 46-47). Hierarchical clustering method was chosen since the number of clusters was not certain in the study. Hierarchical clustering method is a method that aims to combine variables at certain levels by considering their similarities (Özdamar, 2018: 295). In the combinatorial hierarchical method, each unit or each observation is initially considered as a cluster. Then, the two closest clusters are combined into a new cluster. Thus, the number of clusters is reduced by one at each step. This process can be represented by a dendrogram or tree graph (Atbaş, 2008: 15-16).

In this study, discriminant analysis was used to test the accuracy of cluster analysis results. Discriminant analysis is a statistical technique that allows the researcher to examine the differences between two or more groups of objects according to several variables at the same time. This analysis helps by analyzing the differences between the groups and showing in which group a new object to be added will be placed (Klecka, 1980: 7-8). The objectives of separation analysis can be summarized as follows (Alpar, 2017: 671):

- To find the linear combinations that will allow to separate groups from each other,
- With the help of the combinations/functions found, assigning a new observation to the group to which it belongs with the least error,
- To determine which of the variables included in the study contribute more to the prediction of group membership.

Discriminant analysis aims to develop a discrimination criterion that will ensure that groups are different from the overall mean or mean vector according to their mean vectors. Discriminant analysis is applied in two different ways according to whether the covariance matrices of the groups are similar or not (Özdamar, 2018: 349-350);

a) Linear Discriminant Analysis: It is the discriminant analysis applied if the covariance matrices of the groups are equal or homogeneous.
b) Quadratic Discriminant Analysis: It is the discriminant analysis applied if the covariance matrices of the groups are different (heterogeneous).

In the study, it was first checked whether the covariance matrices of the groups formed by cluster analysis were equal. Box's M test was applied to check whether the covariance matrices were equal. With this test, the initial hypothesis (H0) "the covariance matrix between groups is homogeneous" is tested (Johnson & Wichern, 2004: 310-311). If the result is at the 95% or 99% significance level, the null hypothesis is rejected. Thus, the alternative hypothesis (H1) (the covariance matrix between groups is heterogeneous) is accepted. The results obtained give information about which of the "linear model" or "quadratic model" will be used in the separation analysis. Which model was used in the study is indicated in the findings.

7.2. Data and Sources Used in the Research

As a result of the literature review, seven main indicators were selected for tax performance indicators. Since tax elasticity and tax buoyancy, tax capacity and tax effort are complementary indicators, the number of main indicators is five. The variables used in the clustering analysis are as follows.

Table 1. Variables Used in Cluster Analysis

Variables	Code	Sub-Variables	Code
Variables Related to Tax Revenue	TR	Share of Tax Revenue	VGP
		Tax Collection Rate	VTO
Variables Related to Tax Burden	TB	Indirect Tax Burden	DVY
		Direct Tax Burden	DZVY
Variables Related to Tax Gap	TG	Tax Gap by GDP	VAG
		Tax Gap by Tax Revenue	VAT
Variables Related to Tax Elasticity and Tax Buoyancy	TEB	Tax Elasticity	VE
		Tax Buoyancy	VC
Variables Related to Tax Capacity and Tax Effort	TCE	Tax Capacity	VK
		Tax Effort	VG

Five main variables and ten sub-variables associated with these main variables were used in this study. In the clustering of 81 provinces, each main variable used together with its sub-variable group. In this way, the tax performance of the provinces is classified based on the indicators produced, and the aim is to ensure the formation of homogeneous tax regions for the performance indicators.

In the analysis, the data of variables covering the years 2006-2020 are used in three periods (2006-2010, 2011-2015, and 2016-2020), and the averages of these periods are calculated at the provincial level.

For the provincial-level calculations, the provincial-level general budget revenue data published by the Ministry of Treasury and Finance, Directorate of Accounting is used. For each year of the 2006-2020 period, a data matrix with provincial-level variables was created in a Microsoft Excel spreadsheet. While the first column of the data matrix contains the provinces, the amounts of provincial fiscal indicators used as variables are included from the first row. The number of data used to calculate the indicators is 34020, and a clustering analysis was performed with the indicators formed from these data. The number of data used for cluster analysis is 2430, and all data were shared in the appendix 2 of the study. SPSS 22 software was used for all analyzes.

The extreme values of the variables used in the study have a negative impact on the clustering. In such cases, it is appropriate to standardize the data (Özdamar, 2018: 293). To this end, the data were standardized by converting them into Z-scores (Equation 3) to minimize outliers prior to cluster analysis.

8. ANALYSIS FINDINGS

In this research, ward method was preferred as the combining method in hierarchical clustering and Euclidean distance was preferred as the distance method to determine the proximity of variables to each other. Accordingly, the SPSS 22 package program was given the command to manually cluster from 5 to 15. The results obtained were compared with the dendrogram graph (see Appendix 3) and the distance agglomeration table (see Appendix 4)

of the provinces. Accordingly, to evaluate the performance of the indicators determined in the research to the same degree, a cluster of eight was selected as the common cluster number. According to the results obtained, the number of provinces placed in clusters and the distribution of provinces are shown in Table 2.

Table 2. Number of Provinces in Clusters

Cluster	Number of Provinces	Distribution Percentage
1	4	5%
2	15	19%
3	8	10%
4	15	19%
5	5	6%
6	8	10%
7	19	23%
8	7	9%
Total Provinces	**81**	**100%**

According to the Table, while the least number of provinces is collected in the first cluster, the highest number of provinces is collected in the seventh cluster. The number of provinces in this cluster constitutes 23% of the total provinces. While 60% of the provinces are grouped in three clusters (cluster 7, 2 and 4), the remaining 40% are grouped in five clusters. In the research, clusters with a single province were merged with the closest provinces and re-clustered. For example, Istanbul, Kocaeli and Izmir are clustered alone. These provinces were combined with the closest provinces Ankara, Zonguldak, Hatay and Mersin to form a new cluster.

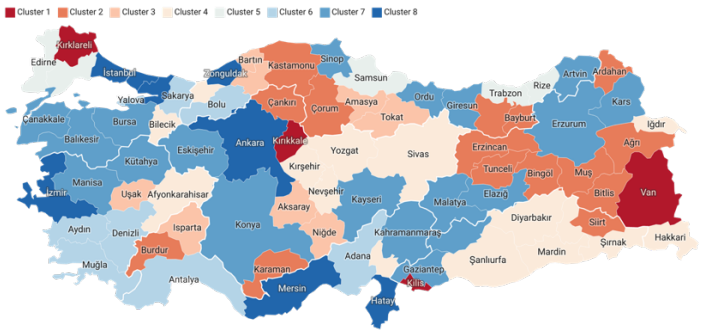

Figure 2. Cluster Distribution of Provinces in Turkey[1]

As seen in Figure 2, neighboring provinces as well as provinces from different regions are combined in the same cluster. GDP, population, and per capita income of the provinces in the clusters are shown in Table 3.

Table 3. GDP, Population and Per Capita Income of Clusters (2006-2020, Average)

Indicators	Clusters	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6	Cluster 7	Cluster 8
	Number of Provinces	4	15	8	15	5	8	19	7
GDP		1,35%	3,14%	2,56%	6,33%	4,26%	10,26%	18,96%	53,15%
Per Capita Income (TRY)		19.358	18.122	19.806	17.212	24.780	26.554	21.048	32.037
Population		1815242	4085098	2867608	9041152	3665531	8594933	18005075	28656876

Table 3 shows that the eighth cluster consisting of 7 provinces has the highest GDP share, the highest per capita income and the highest population, the first cluster consisting of 4

[1] The website "https://app.datawrapper.de/" was used to draw this map.

provinces has the lowest GDP share and the lowest population, and the cluster with the lowest per capita income is the fourth cluster consisting of 15 provinces.

8.1. Validation of Cluster Analysis Results

To determine the accuracy rate in the distribution of the sets, "discriminant analysis" was used in the study. In discriminant analysis, it can be determined whether the objects in the clusters are distributed correctly or not with discriminant functions (Doğan, 2008: 108). In discriminant analysis, the separation of groups is applied according to the equality or similarity of covariance matrices. Accordingly, Box's M Test results were examined first. According to the results of Box's M test;

H0: Covariance matrix between groups is homogeneous

H1: The covariance matrix between groups is heterogeneous

hypotheses were tested. Accordingly, if the null hypothesis is accepted, "multiple linear discriminant analysis" will be used in the analysis, and if the alternative hypothesis is accepted, "multiple quadratic discriminant analysis" will be used. The results of the discriminant analysis performed in the SPSS 22 package program are as follows.

Table 4. Box's M Test Results

Test Results[a]		
Box's M		829,281
F	Approx.	3,784
	df1	140
	df2	2879,870
	Sig.	,000

Tests null hypothesis of equal population covariance matrices of canonical discriminant functions.
a. Some covariance matrices are singular and the usual procedure will not work. The non-singular groups will be tested against their own pooled within-groups covariance matrix. The log of its determinant is -1,705.

According to Table 4, the null hypothesis is rejected. In other words, the covariance matrix of the clusters is not homogeneous (p<.000). Therefore, "multiple quadratic discrimination method" was selected and applied in the discrimination analysis. The results of the correct classification percentages of the clusters in the discriminant analysis are as shown in Table 5.

Table 5. Correct Classification Percentages of Provinces According to Discriminant Analysis Results

Classification Results[a]											
		Clusters	Predicted Group Membership								Total
			1	2	3	4	5	6	7	8	
Original	Membership	1	4	0	0	0	0	0	0	0	**4**
		2	0	15	0	0	0	0	0	0	**15**
		3	0	0	8	0	0	0	0	0	**8**
		4	0	0	0	13	0	0	2	0	**15**
		5	0	0	0	0	5	0	0	0	**5**
		6	0	0	0	0	0	8	0	0	**8**
		7	0	0	0	0	0	0	19	0	**19**
		8	0	0	0	0	0	0	0	7	**7**
	%	1	100,0	,0	,0	,0	,0	,0	,0	,0	**100,0**
		2	,0	100,0	,0	,0	,0	,0	,0	,0	**100,0**
		3	,0	,0	100,0	,0	,0	,0	,0	,0	**100,0**
		4	,0	,0	,0	86,7	,0	,0	13,3	,0	**100,0**
		5	,0	,0	,0	,0	100,0	,0	,0	,0	**100,0**
		6	,0	,0	,0	,0	,0	100,0	,0	,0	**100,0**
		7	,0	,0	,0	,0	,0	,0	100,0	,0	**100,0**
		8	,0	,0	,0	,0	,0	,0	,0	100,0	**100,0**

a. 97,5% of original grouped cases correctly classified.

According to the results obtained from the separation analysis, the correct placement rate of provinces into clusters was 97.5%. These results indicate that the combinations made in the clustering analysis contain a high level of accuracy.

8.2. Variance Analysis of Variables

Since the covariance matrix between the groups was not homogeneous according to the results of the discriminant analysis, the "Kruskal Wallis Test" was applied to determine whether there was a difference between the clusters in terms of variables. This test, which is a nonparametric alternative to one-way analysis of variance, allows comparison for three or more groups with continuous variables (Kalaycı, 2016: 106). In this analysis, the effect size of variables is also determined (Alpar, 2016: 322).

Table 6. Kruskal Wallis Test Results

Variables	Sub-Variables	χ^2	df	p	Effect Size (ε^2)
Tax Revenue Indicators (TR)	VGP 1	49,956	7	0,000*	0,624
	VGP 2	48,962	7	0,000*	0,612
	VGP 3	50,524	7	0,000*	0,632
	VTO 1	52,497	7	0,000*	0,656
	VTO 2	56,416	7	0,000*	0,67
	VTO 3	58,586	7	0,000*	0,732
Tax Burden Indicators (TB)	DVY 1	47,706	7	0,000*	0,596
	DVY 2	42,812	7	0,000*	0,535
	DVY 3	44,762	7	0,000*	0,56
	DZVY 1	50,315	7	0,000*	0,629
	DZVY 2	41,785	7	0,000*	0,522
	DZVY 3	40,416	7	0,000*	0,505
Tax Gap Indicators (TG)	VAG 1	55,038	7	0,000*	0,688
	VAG 2	52,295	7	0,000*	0,551
	VAG 3	44,141	7	0,000*	0,552
	VAT 1	52,536	7	0,000*	0,657
	VAT 2	57,972	7	0,000*	0,664
	VAT 3	58,786	7	0,000*	0,735
Tax Elasticity and Tax Buoyancy Indicators (TEB)	VE 1	31,519	7	0,000*	0,394
	VE 2	31,779	7	0,000*	0,397
	VE 3	8,46	7	0,294	0,106
	VC 1	31,853	7	0,000*	0,398
	VC 2	31,963	7	0,000*	0,4
	VC 3	8,505	7	0,290	0,106
Tax Capacity and Tax Effort Indicators (TCE)	VK 1	51,99	7	0,000*	0,595
	VK 2	50,195	7	0,000*	0,594
	VK 3	48,242	7	0,000*	0,582
	VG 1	31,631	7	0,000*	0,381
	VG 2	23,157	7	0,002*	0,267
	VG 3	21,014	7	0,004*	0,291
*$p<.01$					

According to Table 6, except for the third period data on tax elasticity and tax vigor, all data have a significant effect on the clustering of provinces. According to the chi-square and degree of influence values, the most ineffective variables in separating provinces are tax elasticity, tax buoyancy and tax effort variables, while the most effective variables are tax collection rate, tax gap, tax capacity and tax burden variables.

8.3. The Establishing a Performance Measurement Method for Clusters

The average values of the variables used in clustering were calculated to reveal the performance score of the clusters. These average values were evaluated using an eight-point scale as shown in Table 7, and the performance degree and performance score of each cluster were created according to the scale. The performance score was calculated with the formula

shown in Equation 2. With these scores, the rank of each cluster was determined and an aggregate evaluation was provided for the performance improvement over the years. In addition, these scores were used as coefficients in the calculation of the provincial index.

Table 7. The Performance Score Table to be used in Cluster Assessment

Performance Scale	Performance Level	Performance Score
Best performance	8	1,000
2. best performance	7	0,875
3. best performance	6	0,750
4. best performance	5	0,625
4th worst performance	4	0,500
3rd worst performance	3	0,375
2nd worst performance	2	0,250
Worst performance	1	0,125

$$Performance\ Score = \frac{1}{Number\ of\ Clusters} \times Performace\ Level \qquad (2)$$

For example, the performance score of the cluster with the fourth best performance is calculated as follows;

$$Performance\ Score = \frac{1}{8} \times 5 = 0{,}625$$

As can be seen from Table 7, the cluster members with the best average value will receive a full score of "1", while the cluster members with the worst average performance value will receive 0.125 points. In this way, after the performance scores of each cluster are determined, the total and average score distribution is used to evaluate Turkey's province-level tax performance.

8.4. Evaluation of Cluster Performances

The periodic scores obtained by the clusters evaluated according to tax performance indicators are shown in Table 8.

Table 8. Total Performance Scores of Clusters

Periods	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6	Cluster 7	Cluster 8	Standard Deviation
2006-2010	5,5	4,5	4,75	3,63	7,38	4,75	6,13	8,38	1,591
2011-2015	3,5	5,38	5	4,38	8	5,5	5,38	7,88	1,573
2016-2020	2,88	4,63	4,38	2,88	8,63	6,5	6	9,13	2,386
Total Score	***11,88***	***14,5***	***14,13***	***10,88***	***24***	***16,75***	***17,5***	***25,38***	
Indicators	**Cluster 1**	**Cluster 2**	**Cluster 3**	**Cluster 4**	**Cluster 5**	**Cluster 6**	**Cluster 7**	**Cluster 8**	**Standard Deviation**
Tax Revenue	2,13	2,63	2,5	1,63	4,88	3,75	3,5	6	1,476
Tax Burden	2,88	0,75	2,88	1,75	5	4,38	3,38	6	1,714
Tax Gap	1,88	5,25	3,75	1,88	4,63	2,13	4	3,5	1,292
Tax Elasticity and Tax Buoyancy	1,75	3,88	1,88	4,13	4,88	3,25	3,38	3,88	1,084
Tax Capacity and Tax Effort	3,25	2	3,13	1,5	4,63	3,25	3,25	6	1,413
Total Score	***11,88***	***14,5***	***14,13***	***10,88***	***24***	***16,75***	***17,5***	***25,38***	

When the clusters are evaluated according to the indicators, it is seen that the closest values are tax elasticity and buoyancy, while the most distant values are tax burden. Looking at the periodic performance of the indicators used in tax performance evaluation, it is

observed that the cluster performances were closer in the 2011-2015 period, but the performance difference between the clusters became evident in 2016-2020.

Although the distribution of indicators across clusters differs, the total score distribution is equal. Accordingly, the eighth and fifth clusters have the highest performance in tax revenue, while the fourth and first clusters have the lowest performance.

While the eighth and fifth clusters have the highest performance in tax burden, the second and fourth clusters have the lowest performance. In the tax gap indicators, the fifth and seventh clusters have the highest performance, while the first and fourth clusters have the lowest performance with equal scores. In the tax elasticity and tax buoyancy indicators, the highest-performing clusters were the fifth and fourth clusters, while the lowest-performing clusters were the first and third clusters. Finally, the clusters with the highest performance in tax capacity and tax effort are the eighth and fifth clusters, while the clusters with the lowest performance are the fourth and second clusters.

Table 9. Sub-Indicators and Periodic Performance Scores of Clusters

Sub-Indicators	Periods	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6	Cluster 7	Cluster 8
Tax Collection	2006-2010	0,5	0,125	0,375	0,25	0,75	0,875	0,625	1
	2011-2015	0,5	0,125	0,25	0,375	0,75	0,875	0,625	1
	2016-2020	0,25	0,125	0,375	0,5	0,75	0,875	0,625	1
Tax Collection Rate	2006-2010	0,5	0,75	0,625	0,125	0,875	0,25	0,375	1
	2011-2015	0,25	0,75	0,5	0,125	0,875	0,375	0,625	1
	2016-2020	0,125	0,75	0,375	0,25	0,875	0,5	0,625	1
Indirect Tax Burden	2006-2010	0,875	0,125	0,5	0,25	0,75	0,625	0,375	1
	2011-2015	0,75	0,125	0,375	0,25	0,875	0,625	0,5	1
	2016-2020	0,375	0,125	0,5	0,25	0,875	0,75	0,625	1
Direct Tax Burden	2006-2010	0,375	0,125	0,5	0,25	0,75	0,875	0,625	1
	2011-2015	0,25	0,125	0,5	0,375	0,875	0,75	0,625	1
	2016-2020	0,25	0,125	0,5	0,375	0,875	0,75	0,625	1
Tax Gap (by GDP)	2006-2010	0,625	1	0,875	0,375	0,5	0,25	0,75	0,125
	2011-2015	0,375	1	0,75	0,5	0,625	0,25	0,875	0,125
	2016-2020	0,125	1	0,625	0,375	0,875	0,5	0,75	0,25
Tax Gap (by Tax Collection)	2006-2010	0,5	0,75	0,625	0,125	0,875	0,25	0,375	1
	2011-2015	0,125	0,75	0,5	0,25	0,875	0,375	0,625	1
	2016-2020	0,125	0,75	0,375	0,25	0,875	0,5	0,625	1
Tax Elasticty	2006-2010	0,375	0,5	0,125	1	0,75	0,25	0,875	0,625
	2011-2015	0,125	0,875	0,5	1	0,75	0,625	0,25	0,375
	2016-2020	0,625	0,375	0,25	0,125	0,875	0,75	0,5	1
Tax Buoyancy	2006-2010	0,375	0,5	0,125	0,875	0,75	0,25	1	0,625
	2011-2015	0,125	1	0,5	0,875	0,75	0,625	0,25	0,375
	2016-2020	0,125	0,625	0,375	0,25	1	0,75	0,5	0,875
Tax Capacity	2006-2010	0,5	0,125	0,375	0,25	0,625	0,875	0,75	1
	2011-2015	0,25	0,125	0,5	0,375	0,75	0,875	0,625	1
	2016-2020	0,5	0,125	0,25	0,375	0,75	0,875	0,625	1
Tax Effort	2006-2010	0,875	0,5	0,625	0,125	0,75	0,25	0,375	1
	2011-2015	0,75	0,5	0,625	0,25	0,875	0,125	0,375	1
	2016-2020	0,375	0,625	0,75	0,125	0,875	0,25	0,5	1
Total		***11,88***	***14,5***	***14,13***	***10,88***	***24***	***16,75***	***17,5***	***25,38***

In the 2006-2020 period, cluster eight and cluster five showed the highest performance, while cluster four and cluster one member provinces showed the lowest performance. In the 2011-2015 period, unlike the previous period, the cluster with the highest performance was the fifth cluster, followed by the eighth cluster. Table 8 shows that the fifth cluster outperformed the eighth cluster in tax gap (relative to GDP), tax elasticity, and tax buoyancy. In this period, the clusters with the worst performance are the first cluster and then the fourth

cluster, again different from the previous period. The fourth cluster outperformed the first cluster in direct tax burden, tax gap, tax elasticity and buoyancy, and tax capacity indicators. Another noteworthy issue is the decrease in the performance score differences between clusters. This led to equality in the performance of the seventh cluster and the second cluster.

In the third period, the performance differences between clusters were higher than in the previous periods. In this period, the best performance was realized in the eighth and fifth clusters, while the lowest performance was realized in the first and fourth clusters with equal scores. In this period, the score differences between the highest and lowest-performing clusters widened compared to the second period. Table 8 shows that the variables that cause this are tax gap, tax elasticity, and buoyancy.

8.5. Tax Performance Index Creation Steps

In this study, Turkey's tax regions were created by cluster analysis and the performance of each tax region was evaluated. The results obtained from the performance evaluation are used to construct Turkey's provincial tax performance index using the following steps. The steps to construct the index are designed by utilizing the works of Mohanty and Mishra (2016: 254-260), Bunn and Asen (2021: 51-53), and Sarıgül (2021: 87).

Step 1: The performance scores (wit) obtained from the clusters are multiplied by the raw data of the provinces' tax indicators (xit). The aim here is to reveal the province-level impact of the cluster's performance.

$$Weighted\ Data\ (Xw_{it}) = w_{it} * X_{it} \quad (3)$$

it; value of province i at time t

Step 2: All data were converted into a Z score using the formula in Equation 3 The purpose of calculating the Z score is to convert the data into a fixed form of calculation.

$$z_{it} = \frac{Xw_{it} - \mu}{\sigma} \quad (3)$$

Where "z_{it}" is the Z score of provinces i at time t, "Xw_{it}" is the weighted data of province i at time t, "μ" is the mean of the weighted dataset, and "σ" is the standard deviation of the weighted dataset.

Step 3: All data is set to a minimum of 1. The aim of this process is to eliminate negative values and ensure that all data have positive values. To eliminate negative values, first, the lowest Z score is multiplied by (-1). Then (1) is added to this value.

For example, Bayburt has the lowest Z-score for the first period tax revenue share (-0.219). This value multiplied by (-1) is 0.219. Adding (1) to this value yields 1.219. Then, 1,219 is added to the Z score of each province to obtain the adjusted Z-score. This determines the worst score in each subcategory as (1). For Bayburt province, it is (- 0.219 + 1.219 = 1).

Step 4: The highest value of each sub-indicator was taken as 100 and other data were transformed accordingly. Thus, all data are evaluated over 100 points. For this, the adjusted Z-score of each province in all subcategories is divided by the highest adjusted Z-score in that category.

For example, the highest adjusted Z-score in the tax revenue share sub-indicator for the 2006-2010 period belongs to Istanbul with 9.177. Istanbul's final subcategory score is 100. Accordingly, Ankara's adjusted Z score of 3.3618 is converted to a score of 100 as follows;

$$\frac{3,3618}{9,177} \times 100 = 36,63$$

Step 5: After converting the provincial data into 100 points for each category, indicator indices (Xgiit; X indicator index of province i in period t, n; number of sub-indicators) are periodically constructed with Euclidean distance links. Thus, the periodic effect of sub-indicators will be reflected in the main indicators.

$$Xgi_{it} = \sqrt{\frac{(1-X1gi_{it})^2+(1-X2gi_{it})^2+\cdots+(1-Xngi_{it})^2}{n}} \quad (5)$$

For example, the index score of Ankara for the tax revenue indicator for the period 2006-2010 is calculated as follows;

$$\text{Tax Revenue Indicator Index}_{Ankara,2006-2010} = \sqrt{\frac{(1-36,63)^2+(1-90,59)^2}{2}} = 23,575$$

For example, the index score of Ankara province for the tax gap indicator for the period 2016-2020 is calculated as follows;

$$\text{Tax Gap Indicator Index}_{Ankara,2016-2020} = 1 - \sqrt{\frac{(1-77,70)^2+(1-58,88)^2}{2}} = -66,944$$

Step 6: In this step, a province's tax performance index (TPI) is created by taking the periodic average of the indicator indices created according to the previous step.

$$TPI_{it} = \frac{Xgi1_{it}+Xgi2_{it}+\cdots+XgiN_{it}}{N} \quad (6)$$

For example, the tax performance index of Ankara province is calculated as follows;

$$TPI_{Ankara} = \frac{32,71+37+37,31}{3} = 35,67$$

In this step, the periodic index of each province was also calculated to assess the periodic change of the indicators.

All calculations to create the tax performance index can be reviewed on the file shared in the Appendix 5.

8.5. Tax Performance Index Scores at the Provincial Level in Turkey

The province-level tax performance index score distribution obtained as a result of the steps detailed above is given in Table 10 below.

Table 10. Tax Performance Index (TPI) Scores at the Provincial Level in Turkey (2006-2020)

Rank	Provinces	TPI		Rank	Provinces	TPI		Rank	Provinces	TPI
1	İstanbul	51,42		28	Kahramanmaraş	22,68		55	Kastamonu	19,39
2	Kocaeli	44,40		29	Antalya	22,66		56	Muş	19,30
3	Izmir	37,12		30	Iğdır	22,41		57	Bingöl	19,21
4	Ankara	35,67		31	Batman	22,20		58	Bilecik	18,59
5	Mersin	33,20		32	Diyarbakır	22,00		59	Bitlis	18,55
6	Hatay	32,56		33	Giresun	21,98		60	Konya	18,03
7	Rize	31,48		34	Sinop	21,87		61	Ardahan	17,93
8	Zonguldak	30,16		35	Sivas	21,61		62	Erzincan	17,72
9	Tunceli	26,70		36	Afyonkarahisar	21,60		63	Çorum	17,65
10	Edirne	26,03		37	Gümüşhane	21,55		64	Adıyaman	17,56
11	Yalova	25,80		38	Erzurum	21,50		65	Aksaray	17,39
12	Tekirdağ	25,67		39	Osmaniye	21,50		66	Isparta	17,25
13	Artvin	25,25		40	Şanlıurfa	21,32		67	Düzce	17,17
14	Muğla	24,93		41	Balıkesir	20,83		68	Siirt	17,06
15	Çanakkale	24,66		42	Karaman	20,67		69	Burdur	16,97
16	Kırşehir	24,60		43	Ağrı	20,61		70	Bartın	16,13
17	Kars	24,56		44	Sakarya	20,51		71	Mardin	15,99
18	Nevşehir	24,54		45	Çankırı	20,16		72	Gaziantep	15,53
19	Trabzon	24,32		46	Manisa	20,03		73	Kırıkkale	15,41
20	Elazığ	23,65		47	Yozgat	19,89		74	Karabük	14,69
21	Denizli	23,58		48	Ordu	19,87		75	Van	14,33
22	Adana	23,54		49	Malatya	19,73		76	Tokat	13,75
23	Bolu	23,45		50	Kayseri	19,62		77	Kırklareli	13,56
24	Samsun	23,29		51	Bursa	19,60		78	Niğde	13,40
25	Bayburt	23,19		52	Hakkari	19,52		79	Amasya	13,21
26	Şırnak	23,08		53	Kütahya	19,46		80	Kilis	13,02
27	Aydın	22,99		54	Eskişehir	19,42		81	Uşak	12,14

When the table is analyzed, the province with the highest tax performance index score in Turkey is Istanbul with 51.42, followed by Kocaeli, Izmir, Ankara, and Mersin. The province with the lowest tax performance index score is Uşak with 12.14. The average score of all provinces is 21.80. Turkey's 34 provinces are above, and 47 provinces are below the calculated average score.

To make a better assessment, the tax performance index score was grouped into quintiles of 20% using the Jamovi Program. According to the data obtained here, provinces in the first quintile are characterized as "very low performing", provinces in the second quintile as "low performing", provinces in the third quintile as "medium performing", provinces in the fourth quintile as "high performing" and provinces in the last quintile as "very high performing".

Table 11. Descriptive Statistics of Tax Performance Index Score Groups

Groups/ Performance	Number of Provinces	Mean	Min.	Max.	Standard Deviation	Shapiro-Wilk Normality Test	
						W Value	P Value
Very Low	17	15,12	12,14	17,39	1,7333	0,921	0,156
Low	16	18,83	17,56	19,73	0,8068	0,846	0,012
Medium	16	20,97	19,87	21,98	0,7325	0.906	0.099
High	16	23,26	22,00	24,56	0,7777	0,958	0,634
Very High	16	31,23	24,60	51,42	7,8013	0,817	0,005

According to the grouping, there are 17 provinces in the very low category and 16 provinces in the other categories. According to Shapiro-Wilk results, the tax performance index score in all groups shows a normal distribution. According to the standard deviation data, the group with the highest score difference between provinces is the very high category and the group with the lowest score difference between provinces is the medium category. The appearance of the grouped provinces on the map of Turkey is shown in Figure 3 below.

Figure 3. Grouped Provincial Level Tax Performance Index Scores

According to the map in figure, most of the provinces in the very high category are in the west of Turkey, while the provinces in the very low category are scattered. The very high category includes six provinces from the Marmara region, three provinces from the Black Sea region, two provinces each from the Mediterranean, Aegean, and Central Anatolia regions and Tunceli province from the Eastern Anatolia region. The very low category includes five provinces from the Black Sea region, four provinces from the Southeastern Anatolia region and three provinces from the Central Anatolia region.

The medium category with the most balanced score distribution includes four provinces each from the Black Sea and Central Anatolia regions, two provinces each from Eastern Anatolia, Aegean, and Marmara regions, and one province each from the Mediterranean and Southeastern Anatolia regions.

When evaluated by clusters, all provinces in the eighth cluster, which performs the best, are in the very high category. This category includes three provinces from the fifth cluster, two provinces each from the sixth and seventh clusters, and one province each from the second and fourth clusters. No province from the first and third clusters was included in this category.

The highest contribution to the very low category came from the third and first clusters. Eight provinces from the third cluster and four provinces from the first cluster were included in this category. No province from the fifth, sixth, and eighth clusters is included in this category.

9. DISCUSSION OF RESULTS

The relationship between the provincial-level tax performance index score and some economic, demographic, sociocultural, financial, and technological variables is determined by calculating correlation coefficients. Before the correlation analysis, the logarithm of all variables was taken. In the analysis using the Pearson correlation method, the dependent variable is the provincial-level tax performance score, and the independent variables are the indicators.

Table 12. Correlation Analysis Results

Indicators	*Variables*	*Correlation Value (r)*	P-Value (p)
Economic	Gross domestic product (GDP)	0,495***	<,001
	Agriculture (% of GDP)	-0,539***	<,001
	Manufacturing (% of GDP)	-0,033	0,772
	Service (% of GDP)	-0,045	0,688
	Per Capita Income	0,406***	<,001
	Openness	0,293**	0,008
	Export (% of GDP)	0,243*	0,029
	Import (% of GDP)	0,285**	0,01
	Public Expenditure (% of GDP)	-0,26*	0,019
	GINI	0,165	0,142
	Price Index Increase Rate	-0,153	0,172
	Informal Employment Rate	-0,269*	0,015
	Employees Ratio	0,469***	<,001
Demographic	Population	0,424***	<,001
	Age Dependency Ratio	-0,279*	0,012
	Urbanization	0,259*	0,02
Socio-Cultural	Literacy Ratio	0,247*	0,026
	Library Users	0,476***	<,001
	Cars Per 1000 People	0,125	0,264
Financial	Credit Card Spending (% of GDP)	0,123	0,274
	Overdraft Spending (% of GDP)	0,016	0,889
	Vehicle Loans (% of GDP)	0,296**	0,007
	Housing Loans (% of GDP)	0,246*	0,027
	Consumer Loans (% of GDP)	-0,082	0,469
Technological	Internet – Broadband Subscriptions	0,451***	<,001
*** p < .05, ** p < .01, *** p < .001**			

In the correlation analysis using a total of 25 different variables, a significant relationship was found between 17 variables and the province-level tax performance index score, while no significant relationship was found with eight variables. The values obtained as a result of the analysis are analyzed in detail below.

Relations with Economic Indicators

A total of 13 variables were used in the correlation analysis between the tax performance index at the provincial level in Turkey and the economic indicators. The results are as follows;

- There is a positive and significant relationship between GDP and tax performance index. Accordingly, tax performance in Turkey increases with the increase in income at the provincial level. This is due to the fact that an increase in income leads to an increase in tax capacity and tax base. The general conclusion of many studies is that tax capacity increases with the level of economic development (Terra, 2003:7). Karabulut and Şeker (2018) emphasized that the most effective variable for tax revenue is gross domestic product. Yıldırım and Demir (2021: 2733) found a positive and significant relationship between economic growth and tax revenues in 26 regions of Turkey for the period 2004-2019.

In Turkey, tax performance decreases when the share of agriculture in GDP increases. The effect of agriculture on tax performance is negative and significant. The growth of agriculture shrinks the tax base. This is because it is difficult to tax farmers who practice subsistence agriculture. In addition, the agricultural sector has a smaller value-added tax base. In addition, governments may be reluctant to tax domestically grown and consumed food, and the agricultural sector has an effective policy preference against taxation (Bahl, 1971: 588-589). The largely informal agricultural sector is difficult to tax (Ghura, 1998: 8).

Karagöz (2013), in his study investigating the determinants of tax revenue in Turkey, found that the share of agriculture has a significant negative effect on tax revenue. In the study conducted by Atsan (2017: 224-226) with the data of Turkey between 1984-2012, it was found that the share of agriculture is negative and significant. Çelikay (2016: 528) used the data of 26 Statistical Regional Units of Turkey covering the years 2004-2011 and found that the share of agriculture negatively affects tax capacity. Sağdıç (2019), in his study on the factors determining the tax revenues of 26 statistical regional units in Turkey, concluded that the effect of the agricultural sector is negative.

- There is a significant and positive relationship between per capita income and tax performance index score. Accordingly, as per capita income increases at the provincial level, tax performance also increases. Tax collection for a country generally increases as the per capita income level of the country increases (Le et al., 2008: 2). Per capita income is an indicator of excess taxable income as a result of economic development. A higher per capita income, reflecting a higher level of development, implies a higher capacity to pay taxes and a higher capacity to collect taxes (Chelliah, 1971: 294). Per capita income is effective on tax revenues, as it is effective on almost all economic variables (Ekici, 2009: 208).

- According to the findings, there is a positive and significant relationship between trade openness and tax performance. As trade openness increases, tax performance of the province also increases. When the share of exports and imports are analyzed separately, it can be said that both have a positive and significant relationship with tax performance. Farhadian-Lorie and Katz (1989: 4) argue that trade taxes have historically been the main source of government revenue in the early stages of economic development because they are easier to collect. Hence, import and export shares are an important determinant of tax revenues. Trade taxes are also an important source of government revenue in the process of economic development. Because these taxes are easier to collect than income taxes or consumption taxes when tax administration is inadequate and tax transactions are limited (Teera and Hudson, 2004: 786). Aydıner (2018) analyzed the effect of export revenues on tax revenues. In the study, the relationship between export revenues of 26 statistical regional units for the period 2008-2017 and the internal tax revenue collected from the regions was analyzed. According to the results of the study using the panel data method, it was found that the increase in export revenues and the number of export firms made a significant contribution to the tax revenue collected from the regions. In the study conducted by Saruç et al. (2018: 422-423), it was determined that the factors affecting per capita tax revenue in Turkey are exports and imports by using the data of 79 provinces in Turkey for the period 2010-2014.

- There is a negative and significant relationship between province-level public expenditures and tax performance index score. Accordingly, tax performance decreases in regions where public expenditures increase, while in the opposite case, performance increases. In his study on the determinants of tax revenues of 26 statistical regional units in Turkey, Sağdıç (2019) found that the effect of public expenditures is negative. The reason for obtaining the same result in our study and Sağdıç's (2019) study is the use of regional data specific to Turkey. Accordingly, especially in the eastern and southeastern regions of Turkey, expenditure rates have been higher than the rates of other regions due to terrorist incidents. The tax performance of these regions is lower than other regions. However, studies using Turkey's general (total) tax indicators and public expenditure data (Terzi & Oltutular, 2006; Aysu & Bakırtaş, 2018; Yıldız & Demirkılıç, 2022) indicate that there is a positive relationship between public expenditures and tax revenues. They stated that public expenditures increase as the level of development increases and create pressure to mobilize tax revenues (Von Haldenwang & Ivanyna, 2010: 7; Cyan et al., 2013: 12).

- There is a positive and significant relationship between province-level employee ratio and tax performance. Income and earnings taxes have the second largest share in Turkey.

When detailed data are analyzed, it is seen that 90% of these revenues are composed of income taxes levied on employees. Therefore, while an increase in the labor force increases tax revenues in principle, it also positively affects tax performance in general. In the study conducted by Çelikay (2016: 528), according to the data of 26 Statistical Regional Units in Turkey covering the years 2004-2011, an increase in unemployment rate decreases tax capacity. Again, Öztürk et al. (2019) found that the increase in unemployment rate in Turkey has a negative impact on tax revenues.

- The informal economy is seen as one of the most important obstacles for Turkey to increase its tax revenues (Şener, 2006: 346-347; Özpehriz, 2008: 1-2). The informal economy leads to unfair competition between taxpayers and non-taxpayers, negatively affects the efforts to pay taxes and creates a tendency for the formal economy to go unrecorded (Armağan, 2007: 243). In the study, a negative and significant relationship was found between the unregistered employment rate, which is used as an indicator of the informal economy, and the provincial level tax performance index score. According to this result, to improve Turkey's provincial or regional tax performance, policies to reduce informality should be developed. Öztürk et al. (2019) investigated the impact of major economic variables on tax revenues in Turkey and found that the informal economy negatively affects tax revenues. According to Le et al. (2012: 15), the size of the informal economy may be another important variable that determines the tax base of countries. As the size of the informal economy increases, governments may not be able to collect taxes efficiently due to the difficulty in tracking profits, income, sales, etc. Therefore, it is expected to have a negative impact on tax collection.

- There is no significant relationship between the share of manufacturing and services in gross domestic product and tax performance. There is no significant relationship between the GINI coefficient, which is known as the provincial level income distribution index, and the rate of increase in the wholesale price index, which is used as an inflation indicator, and provincial level tax performance.

Relations with Demographic Indicators

Three variables were used in the correlation analysis with the demographic indicators. While the population variable and urbanization variables have a positive and significant effect on tax performance, the age dependency variable has a negative and significant effect. Accordingly, tax performance decreases when the age dependency ratio increases at the provincial level.

Tax performance is expected to be positively affected by the increase in consumption and expenditure in regions with high population density (Shin, 1969: 214-215). Population density should have a positive effect on tax revenues because it tends to reduce the administrative costs of collecting taxes and controlling tax evasion (Ansari, 1982: 1039).

According to the literature, urbanization creates new needs and demands for public services. On the other hand, it facilitates tax collection by increasing the government's ability to collect taxes (Tanzi, 1987: 218). Urbanization also enables taxpayers to comply with the tax law as it facilitates access to education (Al-Hakim, 2008; Ahmed et al., 2016). Karagöz (2013), in his study aiming to investigate the determinants of tax revenue in Turkey, found that the rate of urbanization is significantly affected positively. In another study, Öztürk et al. (2019) found a positive and significant relationship between urbanization and tax revenues.

On the other hand, contrary to the literature (Dioda, 2012: 19), tax performance in Turkey decreases as the share of people over 65 in the population increases. People over 65 years of age are no longer able to work (pensions are the main source of income), which has a negative impact on tax performance due to reasons such as reduced expenditures.

In the literature, demographic factors are found to be an important determinant of tax revenues. Khujamkulov (2016: 9) found that the higher the population growth rate, urbanization size, population density and youth population ratio, the higher the tax performance. Mahdavi (2008: 611) argues that revenues from certain types of taxes will increase with the extent of urbanization and population density. Moreover, the increase in the elderly population may also increase social security contributions, insurance premiums and wealth taxes. However, the first negative effect of this situation is the decrease in the income tax collected from this group (Mahdavi, 2008: 611).

Relations with Sociocultural Indicators

Three variables were used in the analysis with sociocultural indicators. Among these variables, a positive and significant relationship was found between the literacy ratio and library users variables and tax performance. However, the relationship with the cars per 1000 people inhabitants at the province-level was not found to be significant.

The average education level of the population is considered among the socio-demographic variables that may affect taxation in the empirical literature. Pessino and Fenochietto (2010: 78) found that countries with higher public expenditure on education have higher tax effort. According to Dioda (2012: 19), higher levels of education enable citizens to better understand and comply with tax laws, have better access to official procedures, and have greater awareness of their responsibility or obligation to pay taxes.

Relationships with Financial Indicators

Five variables were used in the correlation analysis with financial indicators. Among these variables, only a positive and significant relationship was found between the vehicle loan and housing loan utilization rate variables and tax performance. Accordingly, an increase in the amount of vehicle and housing loan utilization increases the tax performance of a province.

Among the other variables, there is no significant relationship between credit card utilization rate, overdraft utilization rate and consumption credit utilization rate variables and tax performance. This result supports the study by Ertürk and Yurtsever (2020). According to the results of the study conducted with Turkey's 2014-2018 monthly data, a positive and significant relationship was found between personal loans and indirect taxes (Ertürk & Yurtsever, 2020: 432).

First, personal loans or overdrafts used by citizens have a direct impact on tax revenues as they give rise to bank and insurance transaction tax. According to the relationship determined, the special consumption tax, value added tax and motor vehicles tax paid for the vehicle purchased as a result of the use of vehicle loans also make a direct contribution. Likewise, housing loans have an indirect contribution to tax revenues in terms of taxes paid for the expenses incurred for housing, as well as direct contributions in terms of tuition fees, real estate tax and environmental tax.

Relations with Technological Indicators

The number of internet broadband subscriptions at the provincial level was used as a technological indicator. According to the findings, the tax performance increases as the number of internet subscriptions increases in the provinces. In other words, there is a positive and significant relationship between the two variables. This result supports previous research findings (Hotunluoğlu & Özçağ, 2012; Kirli, 2014; Koyuncu et al., 2016: 79; Yıldız, 2017; Yıldız, 2020).

Increased use of the Internet will help increase tax revenues both in terms of reducing the cost of tax collection and transaction costs and in terms of reducing informality in tax by using it as a means of payment (Yıldız, 2020: 201).

10. CONCLUSION

Tax revenue performance of tax revenues, which is an important source of revenue in the budgetary system of states, has attracted the attention of the scientific world, and numerous studies have been presented in the literature measuring and evaluating the tax performance of countries through various indicators. Tax performance is a value composed of certain tax indicators of a country or region, which is obtained by measuring these indicators using mathematical, econometric and statistical methods. The determination of such a value helps to reveal the existing potential and to determine the potential performance that exists but is not used.

In this study while trying to reveal Turkey's tax performance, it is aimed to reveal the components affecting the overall performance of all regions and evaluate the overall tax performance of the country with the results obtained. For this purpose, an index methodology was developed and applied at the provincial level for Turkey in order to analyze the factors affecting Turkey's tax performance indicators and to assess the potential effects of different components of the tax structure.

The conditions required for the index calculation were met in the study. The most important of them is the existence of comparable time points and indicators. In the index calculation, the performance values obtained from the clustering analysis were evaluated over 100 points by combining five main indicators for three time periods (2006-2010, 2011-2015, and 2016-2020). After the calculations, the relationship between the provincial tax performance index and various economic, demographic, sociocultural, financial, and technological variables is revealed.

The tax performance index can be used to identify the factors that influence strong and weak performance, to identify the factors that influence performance in regions with strong tax policies, to analyze in detail the reasons for low performance, and to help improve performance. For this reason, it would be useful to calculate the tax performance index regularly in future studies on an annual basis with up-to-date data on the indicators. In addition, it is proposed to determine the causal relationships between the tax performance index as a dependent variable and the economic, demographic, socio-cultural, financial and technological variables at the provincial level in Turkey.

In order to better measure regional tax performance, more data should be published in the relevant countries. It is also recommended that working groups be established within the relevant ministry to conduct measurements based on performance indicators and to collaborate with academia.

According to the results and assessments of the research in Turkey, it is considered necessary to take some measures, such as income-increasing schemes, due to the weak efficiency of tax collection and insufficient capacity in the current tax policy. In addition, it is necessary to increase the efficiency of provincial tax administrations, prevent unregistered tax jurisdictions in the regions, and make provisions to increase tax capacity by developing new tax jurisdictions. Studies on tax performance indicators focus on supply-side factors, especially macroeconomic variables. Therefore, the impact of demand-side factors such as bureaucratic efficiency, corruption, and political efficiency, which reflect the culture of the regions, should be analyzed and included in the methodology of assessing tax performance. Developing and measuring indices of tax performance requires continuous data collection. Accordingly, a wide-ranging open data policy is needed in all public institutions and organizations, especially at the provincial level for indicators of relevant institutions that publish statistics publicly.

Establishing a methodology for a tax performance index will contribute to the literature on topics such as conducting regional comparisons in taxation, which is an indispensable concept of the economy; monitoring changes in performance over time; evaluating the

impact of tax policies and tax administrations; assessing regional tax culture, tax morale, and tax compliance; measuring the proper use of resources and efficiency of public spending; and evaluating the equitable distribution of the tax burden.

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Appendix 1: Formulas Used for Tax Indicators Calculations

All calculations were made at province level.

$$Share\ of\ Tax\ Revenue = \frac{Tax\ Collection}{Total\ Tax\ Collection} \times 100$$

$$Tax\ Colleciton\ Ratio = \frac{Total\ Tax\ Base}{Total\ Tax\ Collection} \times 100$$

$$Indirect\ Tax\ Burden = \frac{Total\ Collection\ of\ Indirect\ Taxes}{GDP} \times 100$$

$$Direct\ Tax\ Burden = \frac{Total\ Collection\ of\ Direct\ Taxes}{GDP} \times 100$$

$$Tax\ Gap\ (by\ GDP) = \frac{(Total\ Tax\ Base - Total\ Tax\ Colleciton)}{GDP} \times 100$$

$$Tax\ Gap\ (by\ Total\ Tax\ Collection) = \frac{(Total\ Tax\ Base - Total\ Tax\ Colleciton)}{Total\ Tax\ Collection} \times 100$$

$$Tax\ Elasticity = \frac{\%\Delta Tax\ Revenue}{\%\Delta GDP}$$

$$Tax\ Buoyancy = \frac{\%Tax\ Revenue}{\%GDP} \times \frac{GDP}{Tax\ Revenue}$$

$$Tax\ Capacity = \int (Agriculture\ (\%\ of\ GDP), Manufacturing\ (\%\ of\ GDP), Service\ (\%\ of\ GDP), Public\ Expenditure\ (\%\ of\ GDP)\ Export\ (\%\ of\ GDP), Import\ (\%\ of\ GDP), Population, Urbanization, Age\ Dependency\ Ratio)$$

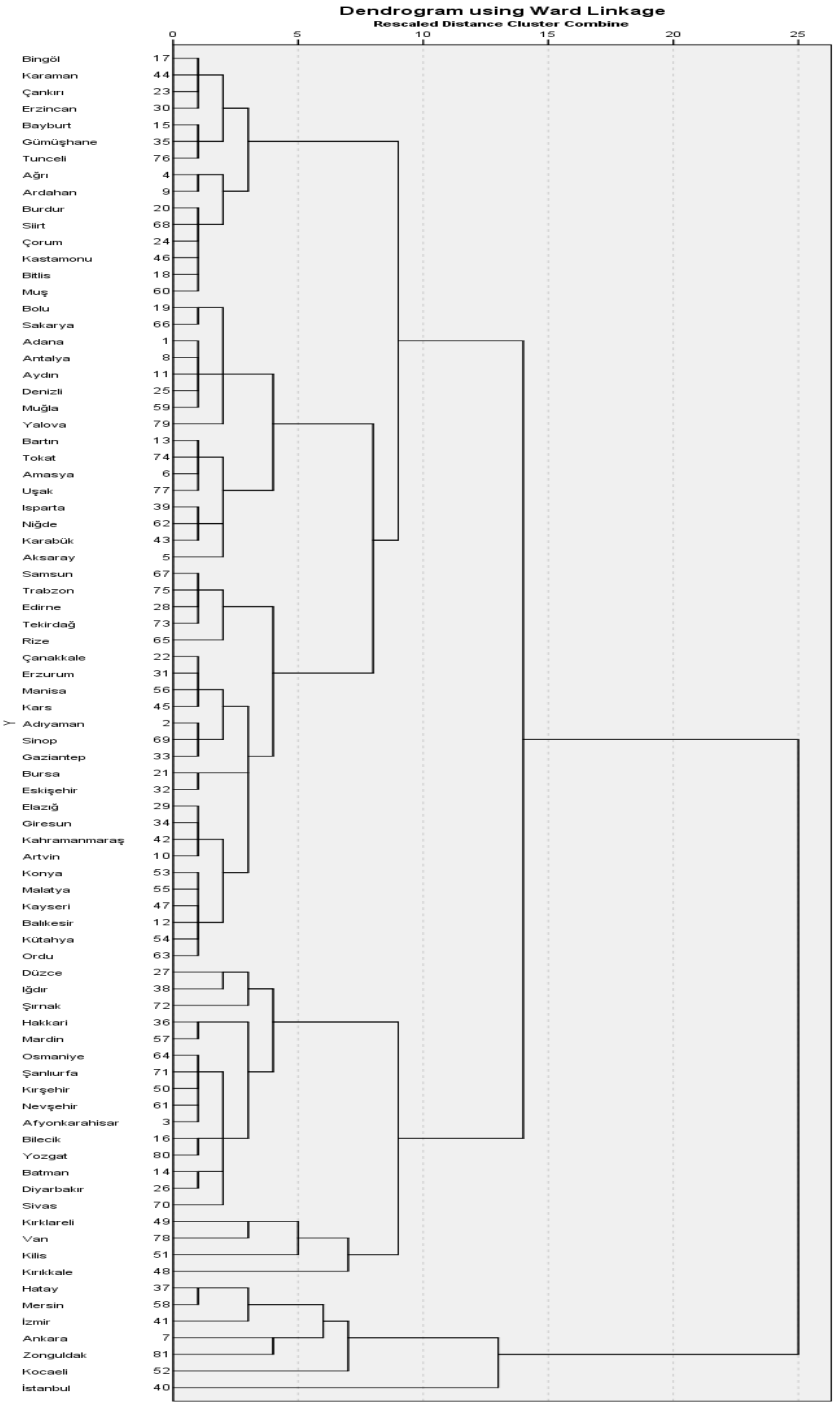
$$Tax\ Effort = \frac{Tax\ Burden}{Tax\ Capacity}$$

Appendix 2: The Data Used in the Clustering Analysis and the Construction of the Tax Performance Index

Note: Click on the link below to download the data.

https://docs.google.com/spreadsheets/d/1L4b6_C2zx37BguTUatSW4GyEm5deATA6/edit?usp=share_link&ouid=113778915140316028082&rtpof=true&sd=true

Appendix 3: Dendrogram Graph



Appendix 4: Distance Agglomeration Table

Agglomeration Schedule						
Stage	Cluster Combined		Coefficients	Stage Cluster First Appears		Next Stage
	Cluster 1	Cluster 2		Cluster 1	Cluster 2	
1	17	44	0,604	0	0	22
2	24	46	1,24	0	0	33
3	13	74	1,912	0	0	23
4	29	34	2,601	0	0	19
5	53	55	3,311	0	0	11
6	67	75	4,039	0	0	39
7	23	30	4,821	0	0	22
8	6	77	5,648	0	0	23
9	50	61	6,485	0	0	26
10	1	8	7,362	0	0	30
11	47	53	8,262	0	5	13
12	20	68	9,177	0	0	44
13	12	47	10,098	0	11	42
14	15	35	11,023	0	0	36
15	2	69	11,968	0	0	40
16	14	26	12,913	0	0	55
17	18	60	13,866	0	0	33
18	22	31	14,826	0	0	27
19	29	42	15,805	4	0	34
20	64	71	16,807	0	0	29
21	28	73	17,825	0	0	39
22	17	23	18,852	1	7	47
23	6	13	19,895	8	3	58
24	54	63	20,941	0	0	42
25	11	25	22,044	0	0	30
26	3	50	23,168	0	9	29
27	22	56	24,297	18	0	38
28	19	66	25,472	0	0	49
29	3	64	26,725	26	20	48
30	1	11	27,991	10	25	46
31	39	62	29,266	0	0	45
32	36	57	30,546	0	0	66
33	18	24	31,845	17	2	44
34	10	29	33,144	0	19	53
35	4	9	34,514	0	0	56
36	15	76	35,902	14	0	47
37	21	32	37,364	0	0	60
38	22	45	38,852	27	0	50
39	28	67	40,38	21	6	54
40	2	33	41,911	15	0	50
41	37	58	43,497	0	0	64
42	12	54	45,17	13	24	53
43	16	80	46,914	0	0	48
44	18	20	48,678	33	12	56
45	39	43	50,481	31	0	51
46	1	59	52,298	30	0	49
47	15	17	54,173	36	22	65
48	3	16	56,099	29	43	59
49	1	19	58,22	46	28	52
50	2	22	60,44	40	38	63
51	5	39	62,681	0	45	58
52	1	79	64,955	49	0	69
53	10	12	67,237	34	42	60
54	28	65	69,576	39	0	70
55	14	70	72,003	16	0	59
56	4	18	74,562	35	44	65
57	27	38	77,204	0	0	61
58	5	6	80,152	51	23	69
59	3	14	83,12	48	55	66
60	10	21	86,295	53	37	63
61	27	72	89,629	57	0	68
62	49	78	93,149	0	0	71
63	2	10	96,716	50	60	70
64	37	41	100,301	41	0	72
65	4	15	104,156	56	47	77
66	3	36	108,141	59	32	68
67	7	81	112,789	0	0	72
68	3	27	117,709	66	61	76
69	1	5	122,82	52	58	75
70	2	28	128,146	63	54	75
71	49	51	134,323	62	0	73
72	7	37	141,558	67	64	74
73	48	49	149,58	0	71	76
74	7	52	157,877	72	0	78
75	1	2	167,644	69	70	77
76	3	48	178,283	68	73	79
77	1	4	189,752	75	65	79
78	7	40	205,372	74	0	80
79	1	3	222,667	77	76	80
80	1	7	253,861	79	78	0

Appendix 5: Regression Analysis Results

One of the tax performance indicators used in the study is tax capacity. Tax capacity shows the taxation area that a region can reach during a period according to its economic, demographic, and sociocultural structure. According to the literature, tax capacity can be determined by econometric models. In this study, regression analysis was used to calculate the tax capacity at the provincial level in parallel with the literature. In the analysis, tax burden was used as the dependent variable and the Agriculture, Manufacturing, Services, Public Expenditures, Exports, Imports, Population, Urbanization, and Age Dependency Ratio were used as independent variables.

THE ANALYSIS OF COMPONENTS AFFECTING TAX PERFORMANCE IN TURKEY AND THE ESTABLISHMENT OF PROVINCIAL LEVEL TAX PERFORMANCE INDEX

Araştırma ve Yayın Etiği Beyanı

Yazar(lar) verilerin toplanmasında, analizinde ve raporlaştırılmasında her türlü etik ilke ve kurala özen gösterdiklerini beyan ederler.

Yazar Katkıları:

Yazar(lar) çalışmanın gerek literatür gerekse veri toplama, analiz ve analiz bulgularının değerlendirilmesinden oluşan tüm sürece eşit oranda katkı sağlamışlardır.

Çıkar Çatışması:

Yazar(lar) çıkar çatışması bildirmemiştir