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Global warming, ageing of population, reduction of energy consumption, immigration flows, optimization of land use, technological innovation

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The identification of rurality at Nuts-3 level in Turkey

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Abstract
Rural-urban interactions have become an even more important issue with global changes and developments. These areas, where population density and agricultural production are low, have a complex social, economic and natural structure that cannot be handled from a single perspective. This situation necessitates a multidimensional approach to rural areas and rurality. The study aims to address the socio-demographic and economic structure of Turkey's provinces with a multidimensional approach and to analyze them comparatively. The data set of the study consists of 14 socio-demographic and 15 economic variables used in defining rural-urban areas. Three different clustering analysis methods (K-means, Ward, Two Step) were used in the study in which SPSS program was applied. As a result of the analyzes made with three clustering methods, the spatial distribution of the ruralness levels of the provinces was mapped and the variables that lead to cluster formation were determined. The results of these cluster analyses conducted with different methods at the NUTS-3 level in Turkey include a methodological discussion and a comparative determination. Although there are spatial differences as a result of the analysis of rurality with both socio-demographic and economic variables, the general similarity of the clusters formed by the three methods is significant. As a result, these processes, which are carried out comparatively with alternative clustering methods, are important in determining rural and urban areas and guide the production of healthy decisions and policies for the problems and potentials of settlements.

Keywords
Rurality; Cluster analyzes; Turkey; NUTs-3.

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1. Theoretical framework

The distinction and relationship between city and countryside is one of the important issues of regional integration in Europe (Öğdül, 2010). Regional development requires interactions and influences between urban and rural development, two non-homogeneous geographical economic entities. Urban-rural synchronized development reflects the attempts of two types of socio-economic units and human settlements with different characteristics to integrate their development and coexist in an interdependent region and smoothly balance the urban-rural economy (Gao, 2012; Chen et al., 2016). Innovations in agricultural-industrial production, climate change and developments in transportation-communication technologies affect urban and rural areas in different ways. These developments have a strong impact on urban-rural interactions (Van Leeuwen, 2015). Due to these developments, it has been understood that the distinction between urban and rural areas is not as clear as it was in the past and it is no longer easy to make a distinction (Copus, 2010; Coombes & Raybold, 2004; Gulumser et al., 2011).

Rurality is important from a cultural, social, political or economic perspective, and especially for the future and sustainability of rural areas (ESDP, 1999). Early definitions of rurality were based on sociological theories that emphasized inherent differences between urban and rural communities (Van Leeuwen, 2015). According to Wirth (1938), urban lifestyle differs from rural life according to three variables: size, density and heterogeneity. Cities are traditionally defined as centers of services and employment, including administrative, commercial, educational and entertainment functions, and are connected to their surroundings through roads and other modes of transportation (Öğdül, 2010).

The built environment of rural areas differs significantly from urban areas in terms of the existence and regulation of land uses (Morrill et al., 1999). As a general definition, rural areas are defined as non-urban areas that are the location of agricultural activities (Gülümser et al. 2010). However, defining rural areas as non-urban areas or areas where agriculture and physical landscape are important is inadequate to describe today's complex reality (Labrianidis, 2006). Sociologically, the concept of rural defines a social structure whose dominant source of income is agriculture, where reproduction and production relations are determined through the ownership of agricultural production tools, and spatially refers to an area where population density is very low (Urry, 1999; in Tübitak, 2015). However, technological, economic and social developments, network relations that emerged as a result of these developments, natural structure differences, and the diversity of indicators that will define rural areas show that rural cannot be combined in a single definition.

Although urban-rural interactions are nowadays considered to be less important, this is not the case. In recent years in particular, the relationship between urban areas and their countryside has become a recurrent theme in European rural policy debates (Copus, 2010). The urban-rural dichotomy has led to two opposing ideas for many years in the past. One was the anti-urban view, which idealized and regretted the disappearance of rural life, and the other was the urban view, which saw urbanization as the engine of progress, innovation and modernization. This situation has also left its mark on spatial planning policies (Davoudi & Stead, 2002). It soon became clear that the idea of a bipolar rural-urban dichotomy was unrepresentative of the real world (Cloke, 1977). Subsequently, rural indices have sought to measure the diversity of rural environments by identifying specific localities along a spectrum between rural and local extremes, rather than looking for an area that is uniquely urban or rural (Harrington & O'Donoghue, 1998).

The publication of the European Spatial Development Perspective (ESDP) in the late 1990s marked a revival of interest in urban-rural relations (Copus, 2010). In the new EU discourse, rurality is defined in relation to the city and in a way that distributes the countryside into a new European regional economy (Hadjimichalis, 2003). This focus on the urban-rural continuum is confirmed by the visible and invisible flows of people, capital, goods, knowledge and technology between urban and rural areas (Davoudi & Stead, 2002).

Due to social, economic and technological developments and the interaction of various non-quantitative factors that affect rural development in particular, rural areas are experiencing significant temporal change (Li et al.,

2015). Recognizing the diversity of rural areas is an important element of rural development policy. In order to develop and implement effective rural strategies and policies in rural areas, it is necessary to recognize these differences, identify their strengths and weaknesses, and develop strategies that combine them. In addition, social and economic problems arising from the abandonment of land, agriculture and livestock activities in rural areas (Pirlone et al., 2017). These problems in rural areas need to be solved. This requires accurate identification on the one hand and specific tools for ad hoc policy interventions on the other. It is therefore necessary to identify the differences between the various local realities through appropriate methods of analysis (Balestrieri, 2014). Therefore, a better understanding of the needs of both urban and rural populations, the magnitude of interactions between them and the identification of vulnerable groups are important for the future (Van Leeuwen, 2015).

Classifying rural areas and distinguishing between rural and urban areas is not an easy task. Although "agricultural and rural development" is among the main policy areas, there is no universally accepted method for classifying urban and rural regions. (Gülümser et al., 2010). However, effective rural development policies should be based on an accurate classification of the main characteristics of territorial types (Bogdanov et al., 2008). The first step beyond the simple urban-rural dichotomy involves the introduction of a category of transitional space that recognizes a gradual series of states between the most urban and the most rural locations (Hugo et al., 2003). At this point, rural typology studies are carried out to understand rural areas in depth, to define/limit rural areas or to form the basis for rural planning/policies (Cloke, 1977; OECD, 1994; Boscacci et al., 1999; Schmidt-Thomé, 2005; Öğdül et al., 2007; Scholz, 2009).

Indicator development is a necessary but difficult step in defining and delimiting rural areas (Bryden, 2002). The widest diversity in typology studies is seen in the indicators and variables used and the measurement of these variables (Beyazlı et al., 2017). Although quantitative criteria have limited reliability, international organizations (such as the OECD and EUROSTAT) have often used these criteria to define rural areas because of their practicality in interregional or interstate comparisons (Labrianidis, 2006). Population density has traditionally been used to describe rural areas in Europe (Ballas et al., 2003). The NUTS -3[1] and NUTS-5 level definitions published by the OECD are based on the variables "rural population" and "population density" (OECD, 1994; Pizzoli & Gong, 2007) while EUROSTAT's studies are based on "population density". The 2005 ESPON project and RUFUS typology also used "population density" and "land use" variables to typologize urban and rural areas (Scholz, 2010).

Due to the statistical and political inadequacy of the OECD's univariate definition of rural areas based solely on the indicator "population density", many variables have been adopted with different typologies (OECD, 1994). In general, various ways of classification and definition have been derived in the literature to measure differences in the degree of rurality, including population density, rate of population loss or increase, settlement size, local economic structure, accessibility, infrastructure and landscape (Ballas et al., 2003; Baum et al., 2004; Bryden, 2002; Labrianidis, 2006; Plessis, 2001; Albrecht, 2006).

Urban-rural classifications have evolved over time from simple density approaches based on functional relationships between rural and urban areas to more complex classifications (Bryden, 2002). Due to recent developments, the degree of urbanity and rurality based on multiple classifications has begun to be discussed in the development of policies on urban and rural areas, instead of the strictness/clarity of the distinction between rural and urban areas (Cloke, 1977; OECD, 1993; ESPON, 2004; EUROSTAT, 2005).

An increasing number of multivariate statistical analyzes have been conducted in rural contexts (Cloke, 1977; Ibery, 1981; Kostowicki, 1989; Openshaw, 1985; Errington, 1990). The first steps towards multiple definitions were taken at the European Statistical Conference in 1964 (UN, 1969). The rurality index was developed in a

[1] The Nomenclature of Territorial Units for Statistics (NUTS) is a statistical classification method developed by the European Union Statistical Office (Eurostat) since the 1970s to ensure that regional statistics are produced according to a single spatial classification in the European Union. In Turkey, NUTS has started to be used as the implementation basis of regional development policies.

1971 study in Wales to improve the rating and definition of rural areas (Cloke, 1977). In a multiple classification attempt in Indonesia, rurality was defined according to population, the proportion of households engaged in agriculture and the urban facility (Hugo et al., 2003). In addition, Malinen et al. (1994) presented a classification for rural Finland, while Cromartie and Swanson (1996) provided a classification for the United States (Hugo et al., 2003). Leavy et al. (1999) classified rural areas of Ireland using census data. Additionally, based on 1991 population data, the "Rurality Index for Small Areas" was created for rural Spain (Ocana-Riola & Sanchez-Cantalejo, 2005). Long et al. (2009) also established the evaluation indicator system of rurality degree index to distinguish the rurality degree of different species in China. Despite Turkey's rural potential, the government has started some initiatives to solve the rurality problem as part of its efforts to harmonize with the EU.

Based on the above-mentioned theoretical analysis, the study aims to address and comparatively analyze the socio-demographic and economic structure of the rural areas of Turkey with a multidimensional approach. In the study, firstly, the theoretical framework of rural areas and rurality is explained. Following the theoretical definitions, the method of the study (different cluster analyzes in accordance with the comparability purpose of the study), variable selection process and data set are included in the methodology section. Finally, a comparison of the rurality levels of the provinces revealed by socio-demographic and economic variables and different clustering methods is included.

2. Methodological framework

2.1 The dataset

Rural areas are characterized by their social, economic and environmental diversity. Rural areas suffer socially from migration and population aging, economically from high poverty and dependence on agriculture, naturally from environmental risks (Francini, 2020). Therefore, in the development of spatial typologies to characterize rural areas, multivariate analysis is most widely used, given that various social, economic and demographic dimensions must be taken into account (Bogdanov et al., 2008).

- *Socio-demographic Variables: Human intervention in land use is shown* by population size and density, growth rate and migration variables (Leavy, 1999). Population density is an indicator of the relative importance of built land and human interference with the natural landscape (Bengs & Schmidt-Thome, 2005). Although population density has traditionally been used to define rural areas in Europe, low population density is not always associated with rural populations (Ballas et al., 2003). Age structure is an important indicator of rurality and population aging is a common phenomenon (Cloke, 1977; OECD, 1993). Cloke (1977) stated that the aging population is more pronounced in rural areas and the elderly dependency ratio is higher. On the other hand, an age structure leaning towards the 15-45 age group indicates non-rural tendencies. Moreover, variables indicating the share of dependent persons in the total population of a region are to understand the importance of demographic composition, which differs significantly between urban and rural areas (Van Leeuwen, 2015). Finally, education level is a significant measure in determination of human resources and human capital skill levels. In rural areas, workers have lower skills, education and specialization levels when compared to urban areas (Pizzoli & Gong 2007).
- *Economic Variables*: To define the economic profile of the area, employment, production, value added and land use by sectors are taken into account (Bryden, 2002; FAO, 1986, 1993, 2005). Primarily, the correlation between land cover and GDP is an adequate indicator of land use efficiency/productivity, hence, of sustainability (Gløersen et al., 2006). It was reported that predominantly rural regions have low per capita GDP (Zheliazkov et al., 2015). Also, industrial specialization or diversity is an indicator of the level of economic development. And concentration in agriculture reflects a rural structure, while the diverse industrial distribution denotes an urban structure (Bryden, 2002). The internal structure of industries (i.e., business size, workforce type, changes, etc.) also provides clues about development potential, economic development, and

susceptibility to change. The self-employment rate is higher in rural areas (Zheliazkov et al., 2015). Finally, combination of new rural economy industries (tourism and services, recreation, specialized commerce, etc.) could be observed in modern rural areas (Bryden, 2002). Many applied studies have been examined in the process of establishing the theoretical framework for the definition/classification of rural areas and determining variables. However, due to space constraints, the most frequently mentioned studies in the national and international multiple classifications of rurality are included in Tab.1.

Variables	Cloke, 1977	Ballas et al., 2003	Baum et al., 2004	Bogdanov et al., 2006	Ocaña & Sánchez, 2005	Gülümser et al., 2010	Ögdül, 2010	Scholz & Herrmann, 2010	Vincze & Mezei, 2011	Li et al., 2015	Van Leuween, 2015	Pizzolli, 2017
Population		X					X					X
Population density	X	X		X	X		X	X	X	X	X	X
Population change	X			X		X		X	X			
Rate of urbanization/Share of rural population							X			X	X	
Population by age groups and gender	X			X					X			
Size of household										X		
Crude birth/death rate		X				X				X		
Dependency ratio					X		X		X	X		
Demographic vitality				X								
Share of young people			X	X	X					X		
Share of aged people	X			X	X					X		
Gross domestic product		X						X				
GDP per capita		X	X								X	
% primary- secondary- tertiary sector				X								
Total employment							X				X	X
Share of employment in agriculture		X	X		X	X	X	X		X	X	X
Share of employment in manufacturing		X				X	X	X				
Share of employment in services		X	X			X	X	X		X		
Total gross value added by sector								X				
Share of agriculture in total gross value added		X										
Patent applications		X										
Firm density			X									
Number of hotels/ beds per person		X									X	
Number of branch banks							X					
Job	X											
Education level			X	X		X				X		
Illiteracy rate							X			X		
Average income and income inequality						X	X		X			
Total or long-term unemployment rate		X	X	X				X				
% Households/persons with social payments				X								
% Self employees			X									
Retirement index					X							
In or out migration rate	X			X						X		
Share of ethnic minorities			X									

Tab.1 Variables used in the classification of rurality

Turkey's NUTS-3 level socio-demographic and economic data availability, theoretical context and methodological requirements were evaluated together and a data set was created. Considering the aim of comparative classification of rurality with socio-demographic and economic data depending on the heterogeneous structure of rural areas, a multivariate process was followed at the NUTS-3 level.

Considering the diversity and uniqueness of rural areas, it can be said that the variables used in different typologies are numerous. (Gülümser et al., 2010). However, one of the most important factors affecting variable

selection is the availability of data. In this study, which was conducted based on two contexts at the provincial level, 14 socio-demographic variables and 15 economic variables were used for 2018. Variables were obtained from the data sets of the Turkish Statistical Institute (TUIK) including regional and provincial levels. In this context, the data obtained or produced within the scope of the study is as follows (Tab.2).

Socio-demographic variables	Economic variables
Population	Gross domestic product per capita
Rural population	Rate of agricultural GDP *
Annual population growth rate	Rate of industry GDP *
Population density	Rate of service sector GDP *
Rate of rurality*	Rate of imports per capita
Rate of youth dependency	Rate of exports per capita
Rate of elderly dependency	Rate of domestic import *
Rate of active population* (22-44 age)	Rate of exports export *
Rate of population over 65	Rate of agricultural production in the country *
Average household size	Agricultural production per agricultural population *
Gross birth rate	The number of animals per hectare *
Gross death rate	Rate of organic production *
Infant mortality rate	Rate of organic farmer *
Rate of literacy	Rate of entrepreneurs in agriculture sector by province*
	Rate of agricultural entrepreneurs in the total *

Tab.2 Variables describing the rurality and used in the study and data sources (Turkey Statistics Institute, 2018) [2]

The determinants of rurality may vary between countries with different social backgrounds. Therefore, the choice of variables used to construct the index should be based on the context and social structure of the areas under study. And it should be reviewed and updated periodically over time (Prieto-Lara & Ocan˜a-Riola, 2010).

2.2 Methodology

In rural areas, a variety of problems need to be addressed, thus requiring on one side specific tools for a correct identification and on the other side ad hoc policy interventions. It is therefore necessary to identify the differences within the various local realities through appropriate analysis methods (Balestrieri, 2014).
In response to growing interest in the issue of regional differences, geo-statistical techniques of identifying, classifying and grouping different types of rural areas are increasingly incorporated into rural development policy design processes (Coombes, 1996; DoELG, 2002). These analyzes often focus on producing a classification or typology of rural areas based on the assessment of demographic, economic and other factors in order to facilitate policy development. In this context, cluster analysis was used in this study, which comparatively reveals rurality with various methods with the help of socio-demographic and economic data. Reasons such as "being an exploratory method", "being able to produce meaningful results from multivariate data sets", "enabling comparative analysis" and "monitoring spatial reflections" were effective in the use of cluster analysis within the scope of the study. K-means method (non-hierarchical clustering), ward method (hierarchical clustering) and two-step clustering (hybrid method) were used in the study. Thus, as a result of different clustering methods, settlements with similar rural characteristics will be identified.
Cluster analysis is a statistical method to "partition a set of observations into a distinct number of unknown groups or clusters in such a manner that all observations within a group are similar, while observations in different groups are not similar" (Timm, 2002). Copus (1996) identified one of the advantages of the methodologie as their capacity to tackle large numbers of variables easily and their adequacy for explorative data analysis. The degree of similarity in one group is defined by the distance between the observations within a multidimensional co-ordinate system where each axis represents one feature. According to its characteristics,

[2] It was created by the author using the data obtained from Turkey Statistics Institute system.

each region is definitely positioned in this multidimensional space. The closer to each other regions are, the more likely they are to be grouped into the same cluster (Baum et al., 2004). Furthermore, aggregative approaches to cluster analysis lead to useful and sometimes unexpected information about data patterns (Copus, 1996). The following could be suggested when hierarchical and non-hierarchical methods are detailed:

— *Nonhierarchical or non-agglomerative methods:* These start with an a priori decision to form groups and are based on seed points equal to the desired group count (Rogerson, 2001). To obtain valid and significant results in the analysis, two conditions should be met. These are selection of significant variables and accurate determination of the cluster size (Punj & Stewart, 1983). After the variables are determined, one of the main criteria developed to determine the cluster size (Tatlıdil, 1992; Çakmak et al., 2005) is calculated with the formula k = (N/2)1/2 where N is the number of observations.

— *Agglomerative or hierarchical methods:* In these methods, the number of clusters is equal to the number of observations, which are then merged into larger clusters. The method aims to combine the observations into increasing sizes of clusters, using a measure of similar distances (Ballas et. al, 2003). The main approach is that the number of clusters is reduced one by one by merging two existing clusters. In the first step, each region represents a single cluster. After the last step, all regions are included in one cluster. A dendrogram visualises the steps in a hierarchical clustering procedure (Hair et al. 1998). According to Baum et al., 2004 the elbow criterion that creates a sudden jump upwards in the agglomeration coefficients, the dendrogram, various statistical values of the clusters, and the plausibility of the grouping are means of deciding on the number of clusters.

— *Two Step Cluster analysis:* This method was developed to cope with the problems in K-means algorithm. This algorithm produces solutions with a mixture of continuous and categorical variables. The SPSS algorithm leads to an optimal number of automatically determined clusters; however, since cluster analysis does not test the hypothesis, the researcher needs to check the accuracy of the solution. Cluster quality bar represents the silhouette coefficient, which is a measure of both cohesion (i.e., the similarity of the elements in a cluster), separation (i.e., the difference of the clusters) and ranges between –1 and 1 (Raggi et.al, 2013; Bacher et al., 2004). As a result, revealing so far unknown regional structures and coherences and, thus, contributing to new insights it can motivate argumentations of regional policy and contribute to initiate political effects (Baum et al., 2004).

3. Description of rural clusters

At this stage of the study, three different clustering methods, the results of the method and the spatial distribution of the clusters are included. In the study where standardized socio-demographic and economic data were used, K-Means, Ward and Two-Step cluster analyzes were performed with the help of SPSS 25.0 software. As a result of the first analyses, the socio-demographic variables "infant mortality rate" and the economic variables "number of animals per hectare" and "rate of agricultural entrepreneurs in the total" are not significant. For this reason, these variables were removed from the data set and not used in cluster analyses. In the study, the rural structures of the settlements are summarized based on different cluster analyzes and socio-demographic and economic dimensions. These analyzes provide comparative and spatial analyzes of the rurality of the settlements.

3.1 K-Means method (non-hierarchical clustering)

Socio-demographic Clustering: It was aimed to determine the rurality levels of the settlements with 13 primarily selected socio-demographic variables using the K-means method. The number of clusters required for analysis was obtained from the formula $k = (N/2)^{1/2}$. The number of clusters for Türkiye, which has 81 provinces (k), has been determined as 6. Clusters were formed as a result of the analysis conducted in 5

iterations. According to the ANOVA table f values (sig.), the most effective variable in determining the clusters was "population density" (Fig.1 and Tab.3). "Annual population growth rate" in Cluster 4, "population density", "total population" and "active population rate" in Cluster 6, "youth dependency", "average household size" and "crude birth rates" in Cluster 2 attract attention. Finally, it is seen that the variables of "rural population", "rurality rate" and "elderly dependency ratio" are high in Cluster-1. Finally, in order to make comparisons between clusters and variables, the cluster value of each variable is given in Tab.3.

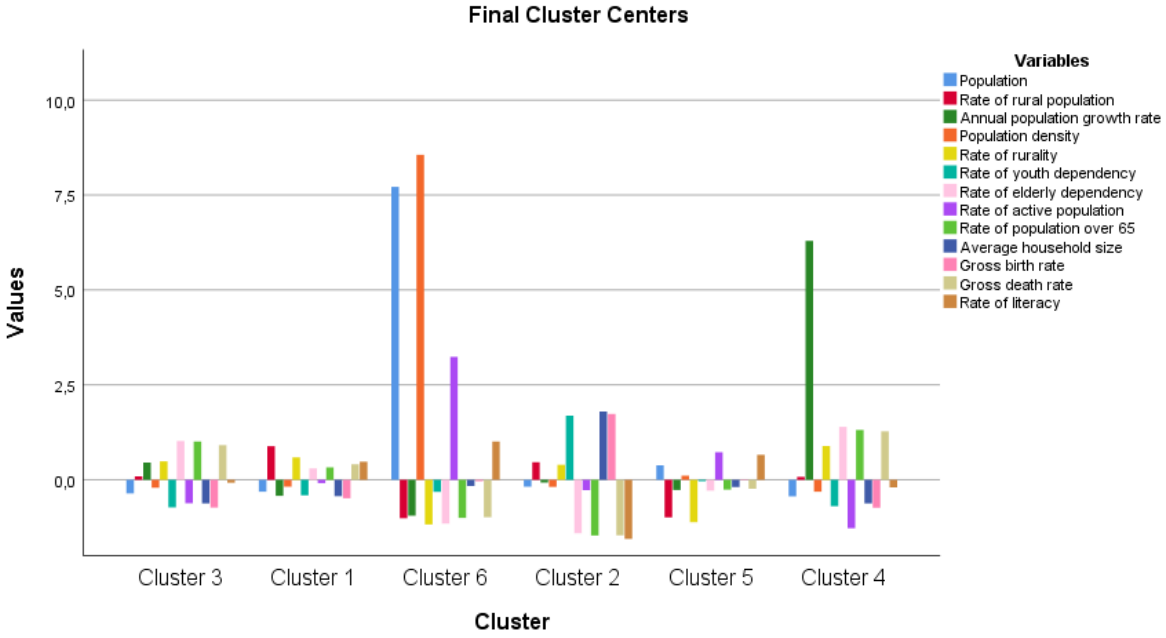


Fig.1 Socio-demographic clustering (K-means cluster analysis)

Variables	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6
1.Population	-0.31537	-0.18424	-0.36026	-0.43700	0.37863	7.71591
2. Rate of rural population	0.88324	0.46240	0.08906	0.07548	-0.99397	-1.01367
3. Annual population growth rate	-0.42480	-0.07575	0.45100	6.29448	-0.27021	-0.94864
4. Population density	-0.18536	-0.18973	-0.20971	-0.31312	0.10625	8.55924
5. Rate of rurality	0.59066	0.39202	0.48397	0.88897	-1.11967	-1.17636
6. Rate of youth dependency	-0.40848	1.68925	-0.72834	-0.69586	-0.03944	-0.32015
7. Rate of elderly dependency	0.29796	-1.40749	1.01793	1.39290	-0.28676	-1.15618
8. Rate of active population	-0.08768	-0.27649	-0.62062	-1.27693	0.72586	3.23554
9. Rate of population over 65	0.32301	-1.46881	1.00612	1.30912	-0.25924	-1.00402
10. Average household size	-0.43400	1.79725	-0.62350	-0.62558	-0.19321	-0.16735
11. Gross birth rate	-0.48578	1.73370	-0.73267	-0.73812	-0.01528	-0.03780
12. Gross death rate	0.40860	-1.46216	0.91092	1.27609	-0.23966	-0.98693
13. Rate of literacy	0.47318	-1.55985	-0.07887	-0.20022	0.65866	1.00793
variable value	lowest					highest

Tab. 3. Final cluster centers values of socio-demographic variables (K-Means)

Economic Clustering: After socio-demographic clustering, economic clustering analysis was conducted with 13 economic variables defining rurality and belonging to 2018. In the analysis carried out with 6 iterations, all variables were significant. As a result of the cluster analysis, 6 economic structure clusters were formed. The most effective variable in determining the clusters was "gross domestic product per capita". As seen in Figure 2, Cluster-6 has the highest values in many variables, especially "domestic imports and exports per capita", "total GDP", "service sector GDP". Moreover, it is seen that the variables "rate of agricultural GDP" and "agricultural production", which reflect the economic structure of the rural areas, are high in Cluster-1, while "organic production" rates are high in Cluster-3. (Fig.2 and Tab.4).

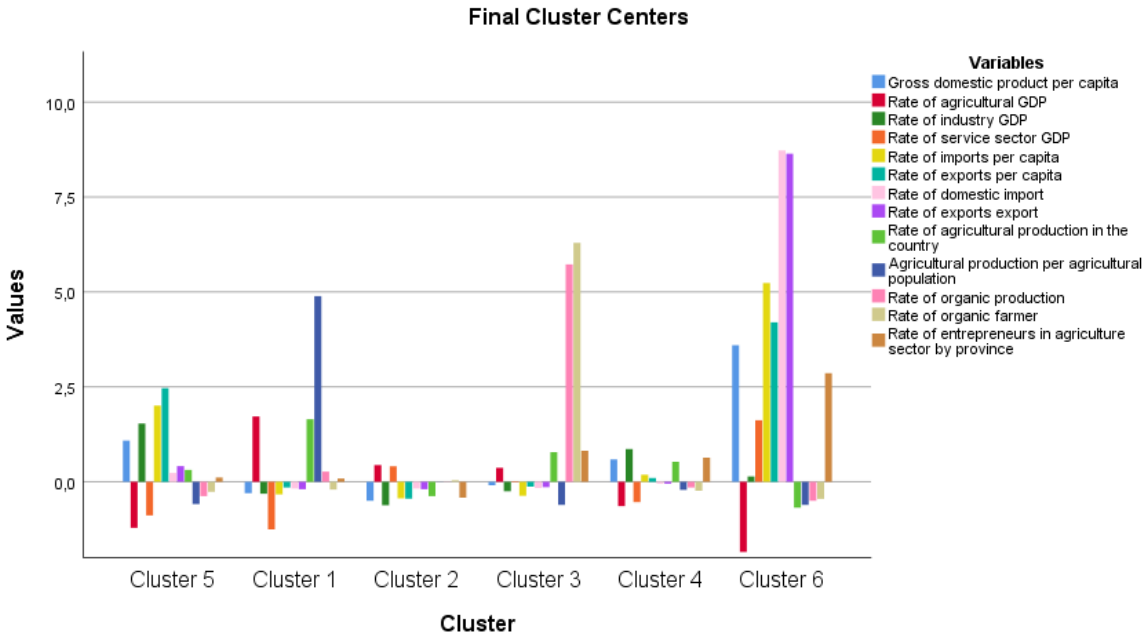


Fig.2 Economic clustering (K-means cluster analysis)

	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6
1. Gross domestic product per capita	-0.30089	-0.50146	-0.09172	0.59065	1.08178	3.59600
2. Rate of agricultural GDP	1.71831	0.44091	0.36582	-0.64111	-1.21459	-1.85092
3. Rate of industry GDP	-0.31328	-0.61931	-0.25040	0.86021	1.53333	0.13952
4. Rate of service sector GDP	-1.25573	0.40714	-0.01873	-0.53746	-0.88783	1.62053
5. Rate of imports per capita	-0.33210	-0.43963	-0.37131	0.18518	2.00340	5.23346
6. Rate of exports per capita	-0.15166	-0.44494	-0.12956	0.09881	2.46245	4.19905
7. Rate of domestic import	-0.17833	-0.17831	-0.16506	-0.04986	0.22880	8.72612
8. Rate of exports export	-0.19910	-0.19911	-0.14082	-0.04999	0.40950	8.63993
9. Rate of agricultural production in the country	1.64583	-0.37886	0.77765	0.52350	0.30955	-0.68449
10. Agricultural production per agricultural population	4.88745	0.00228	-0.60876	-0.21460	-0.58571	-0.60876
11. Rate of organic production	0.26787	0.00332	5.72656	-0.15209	-0.37807	-0.49971
12. Rate of organic farmer	-0.20528	0.04111	6.29366	-0.24018	-0.26671	-0.45082
13. Rate of entrepreneurs in agriculture sector by province	0.08609	-0.42022	0.81552	0.63477	0.11177	2.85742
variable value	lowest					highest

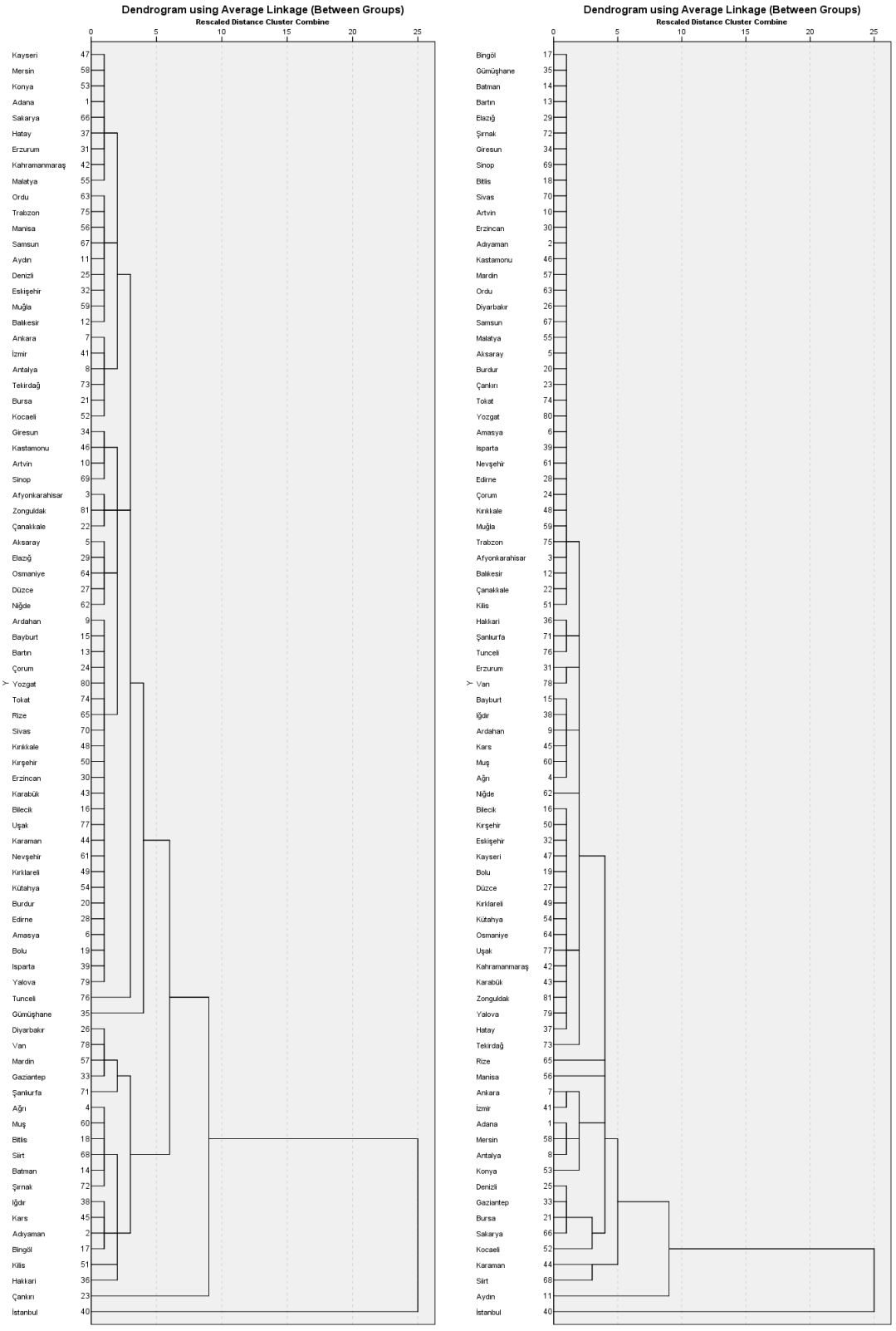
Tab.4 Final cluster centers values of economic variables (K-Means)

3.2 Ward Method (Hierarchical Clustering)

After revealing the socio-demographic and economic structures of rurality with the K-means clustering method, rurality was also discussed with the hierarchical clustering method. Secondly, Ward cluster analysis was used in the study where rurality and rural classification were discussed with different clustering methods. At this stage, standardized socio-demographic and economic data from 2018 were used. Dendrograms were created using squared Euclidean distance as distance measurement. Dendrograms obtained in the analysis reveal socio-demographic variables, distances and relationships between provinces.

Socio-demographic and economic clustering: According to the socio-demographic dendrogram, 17 clusters emerged at 1 unit distance, 8 clusters at 2 units distance, 6 clusters at 3 units distance, and 3 clusters at 4 units distance. As a result of the cluster analysis made with economic data, there are 18 at 1 unit distance, 10 at 2 unit distance, 8 at 3 unit distance, 4 at 4 unit distance. Considering the "Agglomeration Schedule" of the

analysis and the number of settlements in the clusters, the most accurate number of clusters for the analysis is 6 for the socio-demographic structure and 8 for the economic structure (Fig.3).



(a) **(b)**

Fig.3 (a) Socio-demographic and (b)economic clustering according to Ward cluster analysis

3.3 Two-Step clustering (Hybrid method)

In this step, which was carried out with standardized 2018 data, the number of clusters was first determined by the program. The number of clusters (2) created for both variable groups is insufficient to reflect the rural diversity in the country. In the next stage, cluster analysis was performed by the author by determining different cluster numbers. As a result of the analyzes and the highest cluster quality values, 4 clusters emerged for the socio-demographic structure of rurality and 5 clusters for the economic structure of rurality.

According to the two-step cluster analysis conducted with the socio-demographic variables of rurality, the most important variable in determining the cluster was "population density". The least significant variable is "Annual population growth rate". When the clusters are examined, it is seen that 43.2% of the provinces are in Cluster 1, 19.8% are in Cluster 3, 35.8% are in Cluster 3 and 1.2% are in Cluster 4. The table-4 also includes the mean values of the variables that are effective in the differentiation of the clusters. According to these values, Cluster 2 has the highest "average household size", "gross birth rate" and "rate of youth dependency" values. Cluster-4 has the highest values in terms of "population density", "total population" and "active population". Finally, "gross death rate", "rate of elderly dependency" and "rate of rurality", which are the most basic indicators of rurality, are highest in Cluster-1 (Tab.4).

Variables (importance)	Cluster 1	Cluster 2	Cluster 3	Cluster 4
1.Population density (1.00)	-0.21	-0.15	0.04	8.56
2.Population (0.67)	-0.34	-0.14	0.22	7.72
3.Gross birth rate (0.45)	-0.71	1.72	-0.09	-0.04
4.Rate of population 65 over	0.87	-1.46	-0.20	-1.00
5.Averege household size (0.48)	-0.60	1.74	-0.23	-0.17
6.Rate of youth dependency (0.40)	-0.67	1.69	-0.10	-0.32
7.Rate of elderly dependency (0.35)	0.87	-1.40	-0.23	-1.16
8.Gross death rate (0.37)	0.84	-1.44	-0.19	-0.99
9.Rate of literacy (0.32)	0.13	-1.45	0.60	1.01
10.Rate of rurality (0.30)	0.59	0.29	-0.83	-1.18
11.Rate of active population (0.17)	0.52	-0.24	0.65	3.24
12.Rural population (0.19)	0.44	0.37	-0.70	-1.01
13. Annual population growth rate (0.02)	0.27	-0.10	-0.24	-0.95
variable value	lowest			highest

Tab.4 Socio-demographic clustering according to Two Step clustering

Variables (importance)	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5
1.Rate of domestic import	-0.14	-0.18	-0.03	0.16	8.73
2. Rate of exports export	-0.16	-0.20	-0.00	0.21	8.64
3. Rate of entrepreneurs in agriculture sector by province	0.08	-0.41	-0.02	2.62	2.86
4. Rate of industry GDP	0.09	-0.65	1.24	-0.00	0.14
5. Rate of agricultural production in the country	0.97	-0.41	-0.09	2.51	-0.68
6. Rate of imports per capita	-0.43	-0.44	0.66	0.30	5.23
7. Rate of service sector GDP	-1.05	0.46	-0.88	0.68	1.62
8. Gross domestic product per capita	-0.02	-0.52	0.65	0.85	3.60
9. Rate of exports per capita	-0.11	-0.45	0.64	0.31	4.20
10. Rate of agricultural GDP	0.94	0.42	-0.81	-0.69	-1.85
11. Rate of organic production	2.00	-0.05	-0.43	0.09	-0.50
12. Rate of organic farmer	1.82	-0.05	-0.34	-0.05	-0.45
13. Agricultural production per agricultural population	1.73	-0.04	-0.19	-0.61	-0.61
variable value	lowest				highest

Tab.5 Economic clustering according to Two Step clustering

Similarly, in the cluster analysis conducted with 13 economic variables, the most important variable in determining the cluster was "rate of domestic import" and the least important variable was "agricultural production per agricultural population". 55.6 % of the provinces were in cluster 2, 28.4% of the provinces were in cluster-3, 7.4% of the provinces were in clusters 1-4, and 1.2% of the provinces were in cluster-5. The "import and export rates" of the provinces in Cluster-5 are higher than those in other clusters. "Organic

production" and "rate of agricultural GDP", which are variables reflecting the economic structure of rural areas, are in Cluster-1, while "rate of agricultural production in the country" is highest in Cluster-4 (Tab.5).

3.4 The Definition of Rural Spatial Distribution

The spatial and comparative classifications obtained with clustering conducted with three methods based on the socio-demographic and economic variables are presented in Fig.4 and Fig.5. Based on the comparative socio-demographic analysis (Fig.4),

- 6 significant clusters were formed with the K-means and Ward clustering method, and 4 significant clusters were formed with the Two-step method;
- In Ward and Two-step analyses, more homogeneous clusters due to spatial proximity are observed.
- As expected, Istanbul province forms a cluster on its own in all three analyses. It is also described as the most urban area depending on the variables;
- It is one of the regions with high urbanization in Cluster-5, which includes many provinces with metropolitan status. It is continuous in the southern and western parts of the country and partly in the inner regions;
- Apart from Istanbul, Çankırı province also shows a single cluster feature in socio-demographic terms according to K-means analysis, while Gümüşhane, Tunceli and Çankırı show a single cluster feature according to Ward analysis;
- The region on the Kars-Şanlurfa line in the southeast of the country shows a similar structure in terms of socio-demography in all three methods. The region can be defined as a region with high rurality that shows continuity and homogeneity within the country.

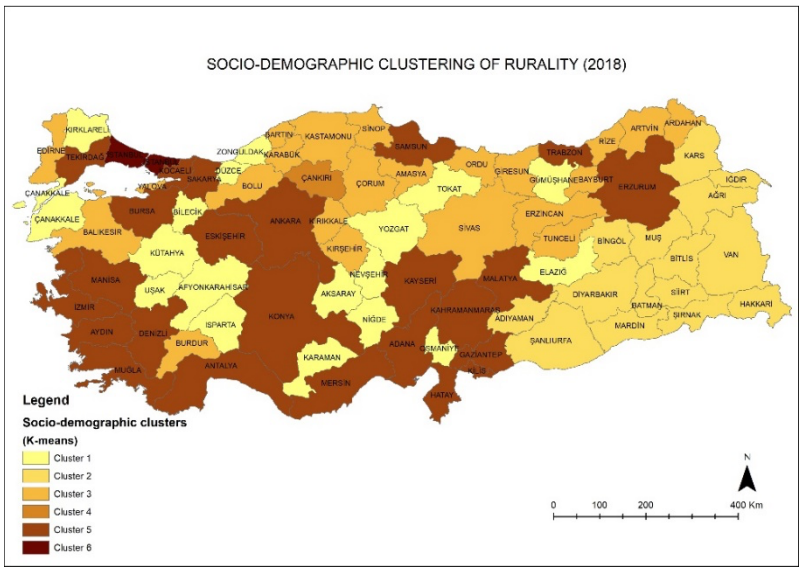
As a result, in this step where rurality is addressed with socio-demographic variables and three different methods, clusters and continuities are observed in similar settlements.

Similarly, when comparative evaluations were made with the economic variables of rurality, the following findings emerged (Fig.5):

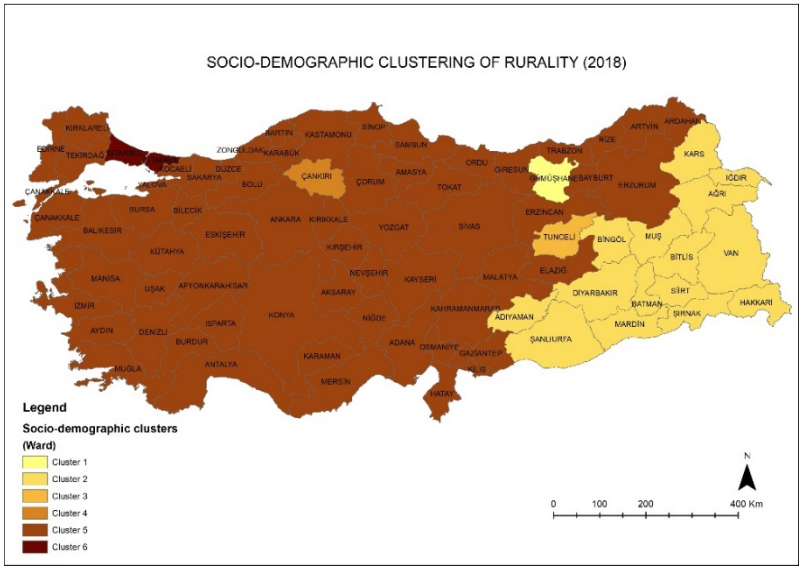
- 6 significant clusters were formed with the K-means clustering method, 8 with the Ward clustering method and 5 with the Two step method;
- In three different clustering analyses conducted with economic variables, more homogeneous clusters are observed in terms of spatial proximity. In these analyses based on economic structure, it is seen that the country is divided by a diagonal axis. Almost half of the country is in a single cluster in all three analyses and shows similar economic characteristics;
- As in the socio-demographic structure, Istanbul forms a separate cluster in the economic context. It is defined as the most urban region depending on economic variables;
- In addition, Karaman-Siirt provinces, where the "Rate of agricultural GDP" is high, show a cluster characteristic with high rurality in both kmenas and ward analyses;
- Similar to Karaman and Siirt provinces, Aydın, where "organic product" variables are high, also shows a separate cluster feature;
- In addition, Manisa and Rize provinces also show single cluster characteristics according to Ward analysis;
- Karaman, Siirt, Manisa, Manisa, Niğde, Rize and Siirt provinces, which have high rurality due to agricultural value and potential, show similar economic characteristics in Two step analysis. In addition, these settlements can also be defined as settlements with high rurality;
- Cluster 4-5 according to Kmeans analysis, Cluster 4-5 according to Ward analysis and Cluster 4 according to Two step analysis show urban economic structure characteristics.

As a result, similarities and continuities are observed in similar settlements in this step where the economic variables of rurality are handled with three different methods.

K-Means Cluster Analysis



Ward Cluster Analysis



Two-Step Cluster Analysis

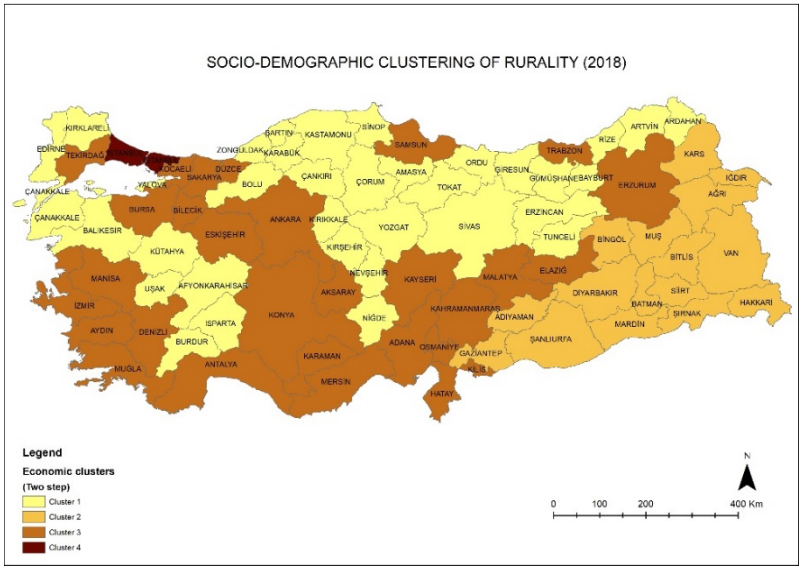
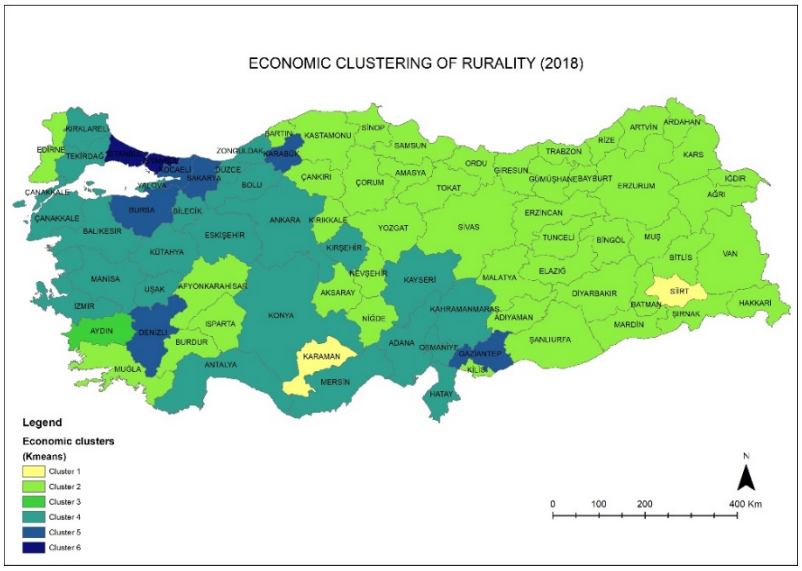
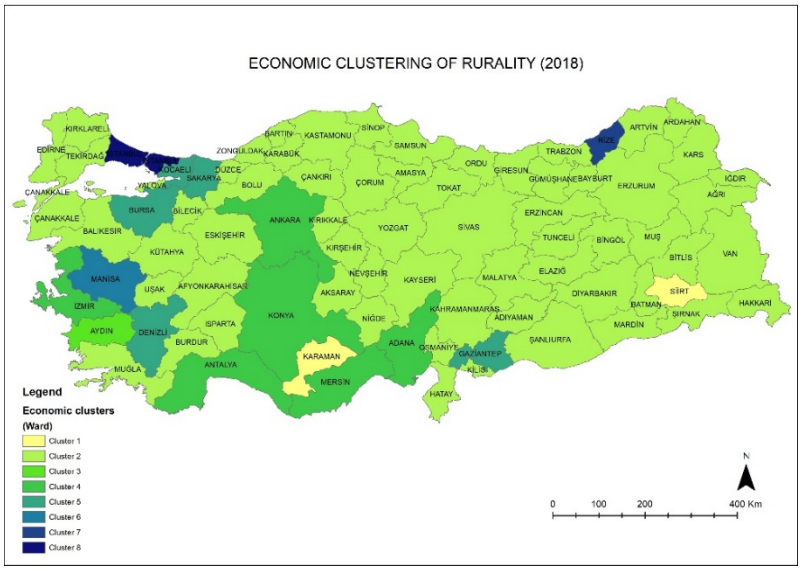


Fig.4 Spatial distribution of socio-demographic clusters

K-Means Cluster Analysis



Ward Cluster Analysis



Two-Step Cluster Analysis

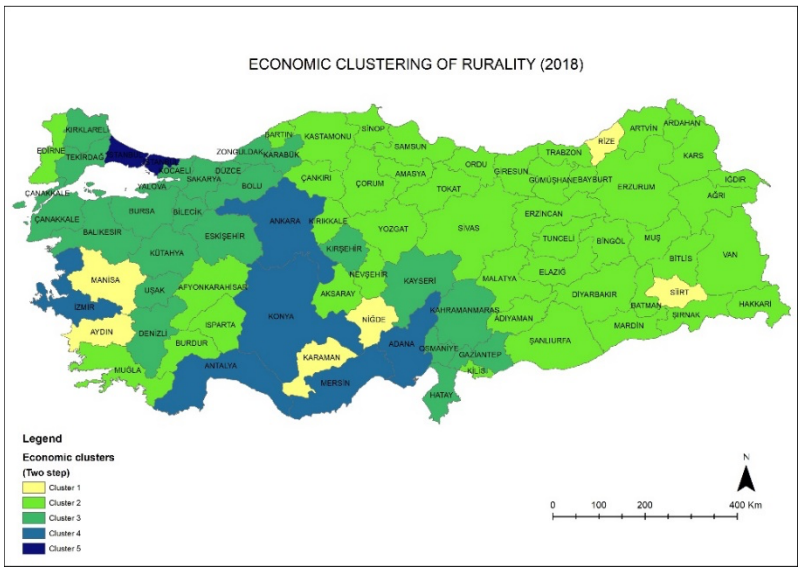


Fig.5 Spatial distribution of economic clusters

4. Conclusion

The levels of rurality in rural areas and settlements exhibited differences in Turkey. Based on the variables used to define rurality in the study, the rurality of the provinces in Turkey was clustered sociodemographic and economic similarities. The analyses conducted with three clustering methods revealed that the spatial distribution of the rurality levels of the provinces were mapped and the variables that led to cluster formation were determined. The present study did not claim to develop a new typology but aimed to compare the current state of the rurality in the country by analyzing the existing data. The conclusions of the present study where rurality was analyzed based on two dimensions.

In all three cluster analyzes conducted with sociodemographic variables, it was observed that the homogeneity and continuity of homogeneity increased as the analysis moved from northeast towards south and especially towards southeast and the latter region was not affected by the changes in cluster count. In the Two-Step cluster analysis and Ward method, the country was economically clustered based on an imaginary diagonal axis and it was observed that the most heterogeneous clusters were formed with the K-Means method. Although the rurality levels varied spatially with both the socio-demographic and economic variables between the clusters, the general similarity of the clusters formed with the three methods was significant.

Although urban-rural interactions are currently considered less important, the reality contradicts with this perception. Furthermore, it is predicted that the relationships and interactions between the settlements will increase even further due to technological advances and the increase in mobility. This requires a good understanding of the problems and potential of urban and rural areas, determination of rurality levels, and a multi-directional approach to settlements. The present study is considered beneficial for the discussion of rural variables, to reveal spatial distribution of rural clusters, and to understand the potential use of the results obtained with alternative methods in future planning.

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Image Sources

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