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DEFINING AND DEVELOPING A RURALITY INDEX FOR TURKEY

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Abstract: Correctly defining the term "rural" and determining the rurality level of provinces/regions are very important for effective regional/rural planning. A well-defined and consistent rurality index will be useful in putting forward the current rurality level of regions and in implementing appropriate rural development policies. In this study, a rurality index was developed, and the rurality level was calculated at provincial level in Turkey. As Multi-Criteria Decision-Making techniques, Entropy and TOPSIS methods were used in the study. Eighteen variables were used under four sections, which are: (1) demographic, (2) economic, (3) agriculture and livestock activities, and (4) urbanisation and infrastructure. Provinces were ranked and divided into five categories according to their rurality level and a rurality map was created for Turkey. It is also expected that the results would be useful for policy makers.

Keywords:

rural development;
rural area;
rurality index;
entropy;
TOPSIS;
Turkey

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Introduction

The term "rural area" needs to be well understood and defined for rural planning and rural development policies. Effective rural development policies need to be based on an accurate and consistent classification of the main characteristics of different regions. Developing a consistent rurality index and defining the territories by their rurality levels is important for the identification of both needs and opportunities of rural areas (Li et al. 2015). Historically, rural development and rural areas have been primarily associated with non-urbanization and agriculture. However, Isserman (2005) gives an example of the Grand Canyon, USA. The Grand Canyon is in metropolitan America, and, at the same time, it has more than a million farmers. Therefore, the separation of territories as town or country, rural or urban does not reflect the complex reality of today (Isserman 2005).

A thorough and accurate understanding of the main characteristics of different rural areas and the classification of rural areas by their rurality levels can provide important information for decision-makers and policymaking. In other words, more knowledge on rurality allows more inclusive policies in regional/rural planning (Temel 2013, Li et al. 2015).

Turkey, as a developing country, has been struggling with regional imbalances for a long time. Since the beginning of the planned development period in 1963, many plans, programs, projects, and policies have been put into practice to decrease the regional disparities. Regional development plans, provincial development plans, the local-regional-sectoral incentive system, and the Priority Regions in Development (PRD) are the first initiatives that come to mind among the tools that have been implemented so far for a balanced regional development in Turkey. In addition, the National Rural Development Strategy (NRDS) 2014-2020 is an important strategy for achieving rural development and reducing rural to urban migration (Turkish Republic Ministry of Agriculture and Forestry 2015). However, as explicitly stated in the NRDS, there is any rurality index showing which areas in Turkey are defined as "rural" (Turkish Republic Ministry of Agriculture and Forestry 2015). In this context, the necessity of the production of a new definition of rural areas is also evaluated within the scope of NRDS: "in addition to the study to define what a rural area is, a general rurality index study will be conducted for rural areas at province and district level if needed" (Turkish Republic Ministry of Agriculture and Forestry 2015: 15).

Defining rural areas in a consistent way is an important issue for Turkey. Because the rural population, the rural employment (agricultural employment) and the size of rural economic activities (agriculture and farming) still have great importance for the economy of Turkey. According to the Turkish Statistical Institute (TUIK), nearly 8% of Turkey's total population (6.4 million people) live in villages (in other words, in rural

areas) and 18% of the total employment (about 5.3 million people) are employed in the agricultural sector by the year 2018 (Table 1). As of 2017, the share of the agricultural sector in GDP is 6%. In addition, according to World Bank Data, the rural population in Turkey is 24% by the year of 2019.

Table 1. Population of province/district centers and towns/villages by years

Year	Total population	Province and district centres	Share (%)	Towns and villages	Share (%)
1927	13 648 270	3 305 879	24.2	10 342 391	75.8
1940	17 820 950	4 346 249	24.4	13 474 701	75.6
1950	20 947 188	5 244 337	25.0	15 702 851	75.0
1960	27 754 820	8 859 731	31.9	18 895 089	68.1
1970	35 605 176	13 691 101	38.5	21 914 075	61.5
1980	44 736 957	19 645 007	43.9	25 091 950	56.1
1990	56 473 035	33 326 351	59.0	23 146 684	41.0
2000	67 803 927	44 006 274	64.9	23 797 653	35.1
2007	70 586 256	49 747 859	70.5	20 838 397	29.5
2008(*)	71 517 100	53 611 723	75.0	17 905 377	25.0
2009	72 561 312	54 807 219	75.5	17 754 093	24.5
2010	73 722 988	56 222 356	76.3	17 500 632	23.7
2011	74 724 269	57 385 706	76.8	17 338 563	23.2
2012	75 627 384	58 448 431	77.3	17 178 953	22.7
2013(**)	76 667 864	70 034 413	91.3	6 633 451	8.7
2014	77 695 904	71 286 182	91.8	6 409 722	8.2
2015	78 741 053	72 523 134	92.1	6 217 919	7.9
2016	79 814 871	73 671 748	92.3	6 143 123	7.7
2017	80 810 525	74 761 132	92.5	6 049 393	7.5
2018	82 003 882	75 666 497	92.3	6 337 385	7.7

(*) Differences in the population of "province and district centres" and "towns and villages" compared to the previous year resulted from the administrative division changes regulated by the Law no. 5747.

(**) Differences in the population of "province and district centres" and "towns and villages" compared to the previous year resulted from the administrative division changes regulated by the Law no. 6360.

Source: Turkish Statistical Institute (TUIK)

This study aims to develop a rurality index at provincial level for Turkey. As we know, to our knowledge, this study is the first attempt to calculate the rurality index at

provincial level in Turkey. By doing so, we aim to present the current rural situation of Turkey at provincial level, to obtain comparable results among the provinces by rurality levels, and to provide useful information to policy makers for rural development policies. The following steps have been implemented in the study to define, to develop and to calculate the rurality of provinces in Turkey:

- Similar studies were examined, and the data set was generated. At this stage, new variables that have not been used before were added to the data set as well as the variables obtained from similar studies.
- The appropriate analysis method was chosen according to the purpose of the study.
- In the first stage of the analysis, the importance of the criteria was calculated. In the second stage, using the importance levels in the decision-making analysis, the rurality levels of the provinces were calculated.
- In the last stage, Turkey's provinces, based on their rurality levels, were grouped and mapped in five different categories.

Defining rural areas and measuring rurality

The concept of "rural development" has gained importance especially in the last 15-20 years. The search for improving the living conditions and the welfare of rural people has gained momentum recently in connection with the strategies developed to create an environment for those people that live in prosperity (Kaypak 2012). In the period after the 1950s, rural areas have undergone significant changes/challenges and their importance in regional development has gradually increased (İnal Çekiç and Ökten 2009). Basically, agricultural development is concerned with improving the living conditions and economic well-being of farmers, herders, and agricultural workers. It mainly focuses on the utilisation of land-intensive natural resources such as agriculture, livestock, forestry, and fisheries. It includes improving agricultural resources (such as land, irrigation, human capital, and rural infrastructure), agricultural services, agricultural incentives, and technologies (International Fund for Agricultural Development 2016).

Rural development, on the other hand, is a broader concept than agricultural development. In general, it is defined as the process of improving the economic well-being, social welfare, and quality of life of individuals living in rural areas (Turkish Republic Ministry of Agriculture and Forestry 2015). According to the International Fund for Agricultural Development (2016), rural development is defined as the process of improving the opportunities and well-being of people in rural areas and it includes human development, social and environmental objectives, in addition to economic objectives. Therefore, rural development covers health, education, and other social

services. It also uses the multi-sectoral approach for the promotion of agriculture, mining, tourism, leisure, and niche manufacturing (Figure 1).

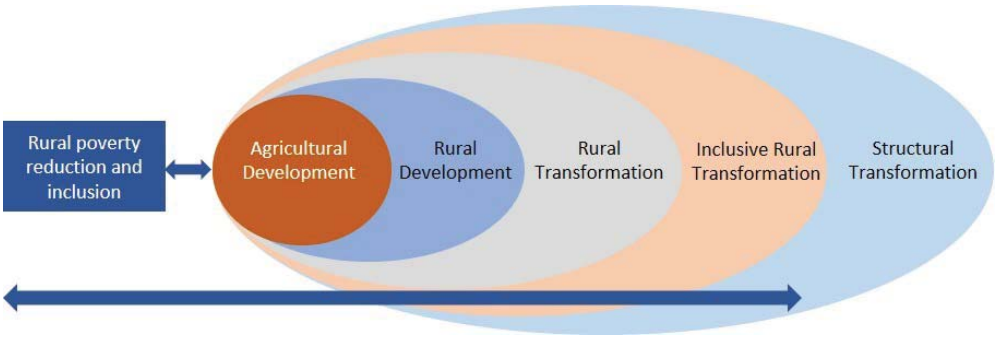

Figure 1. Agricultural development, rural development, and rural transformation. Source: International Fund for Agricultural Development (2016)

There is no single generally accepted definition of rurality. Rurality is a dynamic phenomenon that can be defined according to different perspectives (Woods 2011). This blurriness in the definition of rurality has attracted the attention of many researchers and it has led to the determination of the variables that should be used in defining rurality (Hoggart 1990, Halfacree 1993, Pierce 1996). In fact, since rurality covers a wide area, it can be measured and defined with different variables according to the focused perspective (Ilbery 1998, Bryden 2002, Ballas et al. 2003, Labrianidis 2004, Network of Independent Agricultural Experts in the CEE Candidate Countries 2004). Indeed, the definition of rural life varies according to the perception of each individual who lives in the rural (Halfacree 1995, Hoggart et al. 1995, Ilbery 1998). For this reason, the broad category 'rural' is obfuscatory, whether the aim is its description or theoretical evaluation, since intra-rural differences can be enormous and rural-urban similarities can be sharp (Hoggart 1990). Except for all these uncertainties, the knowledge and understanding of rural settlements' patterns and functions were constructed through the quantitative analysis of population data, measurements of distance between the settlements, and enumerations of service provision, combined with a range of socio-economic data (Woods 2011).

In its traditional definition, the "rural" area is defined as the area where the agricultural sector and agricultural activities are dominant, whereas the "urban" area is defined as the area where there are industrial and service activities. Until the 1970s, the industrialisation and tertiarisation of the economy coincided with the urbanisation process since urban areas have new job and entrepreneurship opportunities in the industrial-service sectors. Rural areas, on the other hand, remained as an ideal space for modern commercial agricultural activities (Saraceno 1994).

The rural area briefly defines the places where rural development activities can be carried out. In Turkey, the settlements with a population of less than 20,000 people (province and district centres, towns, and villages) are considered as "rural areas" in the NRDS (Turkish Republic Ministry of Agriculture and Forestry 2015). Bakırcı (2007) made a more comprehensive definition of rural areas in Turkey. He defined rural areas as the areas where the population density is low, economic activities are predominantly agricultural, natural conditions and traditional values are dominant in the shaping of life and social facilities (such as education-health-communication) are underdeveloped. Also, these areas provide recreation opportunities for the urban population, and they have strong social ties with them (Bakırcı 2007).

Although there is no single definition agreed upon in Turkey, it is observed that different definitions are made in different studies. However, due to the rapid development in the rural areas and the economic and social transformation in the countryside, it is not easy to define a rural area based on the distinction between urban and rural areas. Therefore, rural areas must be redefined. Using the population size alone is not sufficient for the definition of a rural area. Rather than making a single definition, countries also make different definitions including variables such as geography, environment, economic structure, and population (Yıldız 2009).

Various international institutions / organisations (such as OECD and the European Commission) and researchers have made different rural indicators and rural definitions in order to better define rural areas and to develop appropriate policies for rural areas. In literature, the studies by Cloke (1977), OECD (1994, 1996), Weinert and Boik (1995), and Dahly and Adair (2007) are the main ones. Cloke (1977) calculated the rurality index of England and Wales by the year 1961 and 1971 censuses. He performed the Principal Component Analysis using 16 variables and, as a result of the study, he found that the most rural region was Newcastle Emlyn.

Cloke (1977)'s methodology was widely used by various studies, and it proved as a useful tool to calculate the rurality levels of England and Wales. For example, Cloke and Edwards (1986) calculated the same rurality index using data from the 1971 and 1981 censuses, while Harrington and O'Donoghue (1998) created an index of rurality for the 1991 census data. Weinert and Boik (1995) identified rurality within the framework of health. They used only two variables: (1) the population of the county of residence (as reported in the census), and (2) the distance to emergency care as indicated by the self-report of study participants (Weinert and Boik 1995).

Some studies have been carried out in various countries for the continuous assessment of the rurality level. For example, studies on the change of rural areas were conducted by Cloke (1977), Cloke and Edwards (1986), and Harrington and O'Donoghue (1998) for England and Wales; by Ocaña-Riola and Sánchez-Cantalejo (2005), and Prieto-Lara and Ocaña-Riola (2010) for Spain; by Gulumser et. al. (2009) for Turkey; and by Long

et. al. (2009a, 2009b) for China. Within the context of the rural–urban continuum, Ocaña-Riola and Sánchez-Cantalejo (2005) calculated the rurality index of Spanish municipalities based on the Principal Component Analysis using the 1991 population, housing, and household survey data. Prieto-Lara and Ocaña-Riola (2010) replicated and updated the study of Ocaña-Riola and Sánchez-Cantalejo (2005) in order to capture the changes of the rurality level of Spanish municipalities, using the data of the 2001 census of population. They found that only 10% of the Spanish municipalities have changed their rurality status between 1991 and 2001 (Prieto-Lara and Ocaña-Riola 2010). Li et al. (2015) calculated China's rurality index using the data of the year 2000 and 2010 while performing the principal component analysis. As a result of the analysis, in which China was defined with six levels of countryside, it was observed that the Northern regions are less rural, while the rural areas were higher in the Southern and inner parts (Li et al. 2015).

Gülümser et al. (2010) compared the rurality levels of Turkey with 25-member countries of the European Union. In this study, countries were evaluated based on factors of underdevelopment, demography, urbanisation, higher education, and industrialisation. According to the results obtained in the study using the factor analysis, Turkey was identified as the country with the highest rurality index.

The determinants of rurality may vary among countries with different social backgrounds. Therefore, the selection of the variables used to construct the index should be based upon the context and social structure of the areas that are being studied (Harth et al. 2005, Ocaña-Riola and Sánchez-Cantalejo 2005, Nestorová Dická et al. 2019). In the literature, various indicators were used to define rurality (Table 2).

Table 2. The main rurality indicators in the literature

Variables	Studies
Population size	Waldorf (2006), Nestorová Dická et al. (2019)
Population density	Cloke (1977), Harrington and O'Donoghue (1998), Ocaña-Riola and Sánchez-Cantalejo (2005), Prieto-Lara and Ocaña-Riola (2010), Braga et al. (2018), Galluzzo (2018), Nestorová Dická et al. (2019)
Population growth rate	Gülümser et al. (2010)
Mean age	Nestorová Dická et al. (2019)
Percentage of population between 0-14 age, 14-49 age and above 65 age	Cloke (1977), Harrington and O'Donoghue (1998), Ocaña-Riola and Sánchez-Cantalejo (2005), Prieto-Lara and Ocaña-Riola (2010), Galluzzo (2018), Nestorová Dická et al. (2019)
Percentage of employment in agriculture, manufacturing, and service sector in the total employment	Cloke (1977), Ocaña-Riola and Sánchez-Cantalejo (2005), Gülümser et al. (2010), Prieto-Lara and Ocaña-Riola (2010)

Variables	Studies
Agricultural area (percentage in the total area)	Gülümser et al. (2010)
Migration rate	Prieto-Lara and Ocaña-Riola (2010), Galluzzo (2018), Nestorová Dická et al. (2019)
Fertility and mortality rates	Gülümser et al. (2010)
Housing (number of houses, percentage of inhabited housing, household density etc.)	Cloke (1977), Harrington and O'Donoghue (1998), Gülümser et al. (2010), Nestorová Dická et al. (2019)
Schooling rate	Gülümser et al. (2010)
GDP	Gülümser et al. (2010), Galluzzo (2018)
Distance to the nearest urban area (with 50-100-200 thousand population)	Cloke (1977), Harrington and O'Donoghue (1998), Nestorová Dická et al. (2019)

It is seen that different data are used depending on the purpose of the study and the region. Population density, the percentage of the population above 65 age, the percentage of active population (15-49 age), the percentage of employment in agriculture, manufacturing and service sectors in the total employment are widely used variables. Along with these variables, various additional indicators are also used such as the highway length, CO_2 emissions, electricity consumption (Gülümser et al. 2010), and time accessibility to the hospital (Nestorová Dická et al. 2019).

Nestorová Dická et al. (2019) determined the rural level of Slovakia in 2015 by considering various socio-economic factors using 14 different variables. These are: (1) population, (2), population density, (3) mean age, (4) percentage of population between 0-14 age, (5) percentage of population above 65 age, (6) percentage of population between 14-49 age (active population), (7) migration rate, (8) percentage of unemployed population in active population, (9) percentage of migrated active population, (10) percentage of inhabited housing, (11) percentage of family houses in all houses, (12) percentage of new houses built between 2010-2011 in total houses, (13) time accessibility to hospital, and (14) time accessibility to city with 50-100-200 thousand population. In this study, in which the principal components analysis was used in parallel with similar studies in the literature, it was concluded that the western region of Slovakia is less rural than the eastern region (Nestorová Dická et al. 2019).

Zhao et al. (2019) calculated the rurality index for Auckland and Northland regions of New Zealand. Unlike similar studies, rurality was evaluated from a health services perspective. While health criteria were included in the analysis during the calculation of the index, data used extensively in similar studies (such as the percentage of the population living on agriculture, animal husbandry or fishing, and the ratio of natural areas to the total area) were also included in the analysis (Zhao et al. 2019). In the study,

the Multiple Logistic Regression analysis was conducted and it was concluded that the regions were low rural (Zhao et al. 2019).

Methodology

"Rurality" has a structure that cannot be calculated with a single explanatory variable and it should be calculated by considering more than one variable. On the other hand, each variable does not affect the rurality level with the same intensity. Therefore, it is necessary to start calculating the rurality level by calculating the significance level of the variables. In addition, the model must allow comparison and ranking functions and it must be able to analyse with multiple alternatives and variables. Within the scope of these objectives, the Multi Criteria Decision Making (MCDM) method was used in the study. It is thought that the MCDM methods have a working mechanism that can give correct answers to the aims of the study.

The MCDM methods, which do not lose their ability to analyse in various situations (such as different measurement units, decision-maker's value judgments, missing information etc.), refer to multiple analysis methods adopting different approaches to the same objective rather than a single method (Hwang and Yoon 1981, Kuru and Akin 2012). Among MCDM methods, it was decided to use the Entropy method in determining the weights of the criteria, and the TOPSIS method in order to list the alternatives.

According to Shannon's Entropy approach, the degree of significance of the criterion depends on the nature of the data as well as on the subjective judgement of the decision maker (Çınar 2004). According to the entropy method, the most important data group is the group with the greatest irregularity (i.e., the largest entropy). The steps of the entropy method are as follows (Dashore et al. 2013, Tuş Işık and Aytaç Adalı 2017):

1. The decision matrix is normalised to eliminate the contradictions in different units of measurement (P_{ij}):

$$P_{ij} = \frac{a_{ij}}{\sum_{i=1}^{m} a_{ij}}; \forall_j \quad (1)$$

2. The entropy of *j* criterion is calculated:

$$E_j = \left(\frac{-1}{ln\ ln\ (m)}\right) \sum_{i=1}^{m} \left[P_{ij} * lnP_{ij}\right]; \forall_j \quad (2)$$

3. The uncertainty is calculated as the degree of diversity:

$$d_j = 1 - E_j; \forall_j \tag{3}$$

4. Weights (w_j) are calculated as the significance of j criteria:

$$w_j = \frac{d_j}{\sum_{j=1}^{n} \quad d_j}; \forall_j \tag{4}$$

Where i is the alternatives, j is the criteria, m is the number of alternatives, a_{ij} is the performance value of alternatives, P_{ij} is the normalised values, E_j is the output entropy, d_j is the variation coefficient and w_j is the weight of entropy.

Hwang and Yoon (1981) developed the TOPSIS as a MCDM technique (Shyjith et al. 2008, Ustasüleyman 2009), the second method used in this study. The logic of the TOPSIS method is to determine the positive and negative ideal solution, then to rank alternatives based on the relative proximity to the ideal solution. The positive ideal solution is a solution that maximises the benefit criterion and minimises the cost criterion. On the contrary, the negative ideal solution minimises the benefit criterion and maximises the cost criterion. The most appropriate option is the one closest to the ideal solution and the farthest from the negative ideal solution (Wu et al. 2008, Akyüz et al. 2011). The steps of the TOPSIS method are as follows (Alp and Engin 2011, Roszkowska 2011, Yıldırım and Önder 2015):

1. A $m*p$ size initial decision matrix is created in which alternatives and criteria are combined:

$$A = \begin{bmatrix} a_{11}\, a_{12} & a_{21}\, a_{22} & \cdots\cdots & a_{1p}\, a_{2p} & \cdots\cdots & a_{m1}\, a_{m2} & \cdots\cdots\cdots & a_{mp} \end{bmatrix} \tag{5}$$

2. The decision matrix (N) is standardised. It is calculated from the matrix A:

$$N = \begin{bmatrix} n_{11}\, n_{12} & n_{21}\, n_{22} & \cdots\cdots & n_{1p}\, n_{2p} & \cdots\cdots & n_{m1}\, n_{m2} & \cdots\cdots\cdots & n_{mp} \end{bmatrix} \tag{6}$$

One of the most frequently used methods of calculating the normalised value n_{ij} is as follows:

$$n_{ij} = \frac{a_{ij}}{\sqrt{\sum_{k=1}^{m} \quad a_{kj}^2}} \tag{7}$$

3. The weighted standard matrix is created by multiplying w_j by n_{ij}:

$$[w_1n_{11}\ w_2n_{12}\ \ w_1n_{21}\ w_2n_{22}\ \ \cdots\cdots\ w_nn_{1p}\ w_nn_{2p}\ \ \cdots\cdots\ w_mn_{m1}\ w_mn_{m2}\ \ \cdots\cdots\cdots w_mn_{mp}\ ] \qquad (8)$$

4. The positive ideal (A+) and negative ideal (A-) solutions are calculated. In order to form a set of ideal solutions, the biggest (the smallest if the related evaluation factor is minimised) of the weighted evaluation factors (column values) in the (V) matrix is selected:

$$V_j^* = \{maxV_{ij}|j \in J, minV_{ij}|j \in J\} \qquad (9)$$

5. The separation measures are calculated by using the Euclidean distance formula to reach the optimum alternative:

$$S^+ = \sqrt{\sum_{j=1}^{n} \left(V_{ij} - V_j^*\right)^2} \qquad (10)$$

$$S^- = \sqrt{\sum_{j=1}^{n} \left(V_{ij} - V_j^-\right)^2} \qquad (11)$$

6. The closeness to ideal solution is calculated and the share of the negative discrimination criterion within the total discrimination criterion is examined:

$$C_i^* = \frac{S_i^-}{S_i^- + S_i^+} \qquad (12)$$

7. Alternatives according to the proximity to the ideal solution (C_i^*) are ranked.

Where A is possible alternatives, m is the number of alternatives, p is the number of criteria, a^{ij} is the value of i alternative with respect to j criterion, n_{ij} is the normalised values of the j^{th} criterion, w_{ij} is the weighted normalised value of the j^{th} criterion.

Data set

In this study, in accordance with the literature and in addition to the literature, four different sections and 18 variables were used in order to determine the rurality level (Table 3).

Table 3. Variables

Section	Variable	Source	Data Year
(1) Demographic Indicators	Total Population	TUIK	2018
	Population Density	TUIK	2017
	Average Household Size	TUIK	2017
	Average Growth Rate of Population	TUIK	2013-2018
	Average Net Migration Rate	TUIK	2013-2018
	Active Population (rate of population of 15-64 ages in total)	TUIK	2018
	Crude Birth Rate (number of births per 1000 population)	TUIK	2018
	Infant Mortality Rate (number of deaths per 1000 live births)	TUIK	2018
(2) Economic Indicators	Gross Domestic Product per capita	TUIK	2017
	Agricultural GDP per capita	TUIK	2017
	Service GDP per capita	TUIK	2017
	Industrial GDP per capita	TUIK	2017
(3) Agriculture and Livestock	Number of Cattle per capita	TUIK	2018
	Number of Sheep per capita	TUIK	2018
	Total Agricultural Area per capita	TUIK	2018
(4) Urbanisation and Infrastructure	Number of Households	TUIK	2018
	Highway Length per 1000 km^2	TUIK	2018
	Electricity Consumption per capita	TUIK	2018

Source: Turkish Statistical Institute data prepared by the authors

The term rurality does not only mean the regions that are low populated and relatively less industrialised. Therefore, sparsely populated, and non-industrialized regions remain very weak in the definition of the rural. In accordance with the priority "the development of agriculture and animal husbandry in the country" in the development plans in Turkey, we focused more on agriculture and livestock activities in addition to other rurality indicators. For this reason, the number of indicators on agriculture and livestock is much more in our data set compared to other studies. In the previously studies conducted in Turkey aimed to measure the socio-economic development and to generate a "socio-economic development index", more generalised data sets (such as population density, fertility rate, infant mortality rate, schooling rate, GDP) were used (Dincer et al. 2003, Karabulut et al. 2004, Urfalıoğlu and Seyfullahoğulları 2004, Ersungur 2007, Yılancı 2010, Sakarya and İbişoğlu 2015, Kart and Keser 2019, Temurlenk and Abar 2019, Özlü et al. 2020). As we know, there is no study focusing on rurality at provincial level in Turkey. The current study separates from other studies both in accordance with Turkey's development plans and also due to the contribution to these plans.

The data were obtained from the Turkish Statistical Institute, and they were used at provincial (NUTS-3) level. The most up-to-date data were included in the study. However, since some variables (active population, number of cattle and sheep per capita, total agricultural area per capita etc.) are not found in the TUIK with their raw form, they were added to the analysis after proportioning the provincial population of the relevant year.

Results

The total population of Turkey in the year 2018 is 82,003,882 people and the average population per province is slightly higher than 1 million people (Table 4). The highest value for the total population is 15,067,724 (Istanbul) and the lowest value is 82,724 (Bayburt). The population density of Turkey is 105, the lowest population density is 11 and the highest population density is 2,892.

Table 4. Descriptive statistics

Variable	Mean	Min.	Max.
Total Population	1 012 393	82 274	15 067 724
Population Density	105	11	2892
Average Household Size	3	2	6
Average Growth Rate of Population	21.98	1.15	45.01
Average Net Migration Rate	29.88	2.64	51.01
Gross Domestic Product per capita	7 946.44	3 489	17 827
Agricultural GDP per capita	3.44	0.06	10.40
Industrial GDP per capita	7.84	1.53	29.43
Service GDP per capita	13.74	6.49	39.54
Number of Cattle per capita	0.38	0.01	3.10
Number of Sheep per capita	0.95	0.01	5.21
Total Agricultural Area per capita	0.40	0	1.44
Active Population	0.91	0.85	0.97
Highway Length per 1000 km^2	84.81	45.79	168.11
Number of Households	286 682	22 201	4 306 967
Crude Birth Rate	15.58	9.79	32.69
Infant Mortality Rate	9.20	4.62	17.24
Electricity Consumption per capita	2.51	0.67	8.07

First, the importance levels of 18 variables (criteria) were determined by the entropy method. The highest weight belongs to the active population density and the lowest weight belongs to the population density (Table 5).

Table 5. Criteria weights

Rank	Variable	Coefficient
1	Active Population	0.055922
2	Average Household Size	0.055896
3	Highway Length per 1000 km^2	0.055890
4	Infant Mortality Rate	0.055882
5	Average Net Migration Rate	0.055875
6	Crude Birth Rate	0.055867
7	Gross Domestic Product per capita	0.055864
8	Service GDP per capita	0.055861
9	Average Growth Rate of Population	0.055852
10	Agricultural GDP per capita	0.055792
11	Electricity Consumption per capita	0.055773
12	Industrial GDP per capita	0.055707
13	Total Agricultural Area per capita	0.055564
14	Number of Sheep per capita	0.055482
15	Number of Cattle per capita	0.055463
16	Total Population	0.054767
17	Number of Households	0.054710
18	Population Density	0.053831

The most significant variable in the provinces of Turkey is the number of active population. It is observed that while the active population ratio is quite low in some provinces, it is quite high in some other provinces (for example in Istanbul). This large difference can easily be explained by the differences in the education and working opportunities of the provinces. The other most important variables are the average household size, the highway length per 1,000 km2, the infant mortality rate and the average net migration rate. On the other hand, it is seen that the population density has the lowest weight among the variables. From this point of view, it can be stated that the population density of the provinces does not show great differences in general. This criterion, which is frequently used in the studies in the literature, has been replaced by the active population, which has a qualitatively stronger representation ability in the entropy method results.

The results of the TOPSIS evidence five categories to divide the provinces according to their rurality levels (Table 6). While the first level rurality represents the provinces with the highest rurality level, the fifth level includes the provinces with the lowest rurality level.

Table 6. The rurality scores of Turkish provinces

First level rural provinces		Second level rural provinces		Third level rural provinces	
Ardahan	0.838	Amasya	0.774	Çanakkale	0.760
Kars	0.822	Bingöl	0.774	Kırklareli	0.760
Iğdır	0.817	Siirt	0.771	Uşak	0.759
Bayburt	0.808	Bitlis	0.769	Elazığ	0.759
Kırşehir	0.801	Kastamonu	0.769	Kütahya	0.757
Muş	0.800	Tokat	0.765	Kırıkkale	0.757
Ağrı	0.795	Hakkari	0.765	Artvin	0.756
Aksaray	0.792	Çorum	0.765	Bolu	0.756
Tunceli	0.791	Sinop	0.765	Konya	0.755
Burdur	0.790	Gümüşhane	0.764	Mardin	0.755
Erzurum	0.787	Edirne	0.764	Batman	0.754
Karaman	0.787	Nevşehir	0.763	Balıkesir	0.752
Çankırı	0.780	Isparta	0.762	Diyarbakır	0.752
Niğde	0.780	Şırnak	0.762	Adıyaman	0.749
Erzincan	0.779	Van	0.762	Şanlıurfa	0.748
Yozgat	0.778	Kilis	0.761	Eskişehir	0.746
Sivas	0.776				
Afyon	0.775				

Fourth level rural provinces		Fifth level rural provinces	
Malatya	0.746	Trabzon	0.730
Giresun	0.745	Mersin	0.728
Denizli	0.744	Zonguldak	0.726
Aydın	0.744	Sakarya	0.725
Bartın	0.744	Tekirdağ	0.724
Kahramanmaraş	0.744	Adana	0.720
Muğla	0.743	Yalova	0.719
Kayseri	0.740	Hatay	0.718
Karabük	0.739	Antalya	0.715
Bilecik	0.738	Gaziantep	0.713
Rize	0.736	Bursa	0.687
Ordu	0.736	Kocaeli	0.672
Manisa	0.736	İzmir	0.656
Samsun	0.735	Ankara	0.644
Düzce	0.734	İstanbul	0.091
Osmaniye	0.733		

At first sight, the results show that our rurality index works well. It is seen that the most rural provinces of Turkey are Ardahan, Kars, Iğdır, Bayburt and Kırşehir, Muş and Ağrı. First, all of the provinces with the highest rurality level are located in the eastern region of Turkey, except Burdur and Afyon (Figure 2). Ardahan, located at the northeastern part of Turkey, is the third least populous city of Turkey with only 98 thousand persons and a population density with only 20 people per km2. It has a -1.3 percent annual population growth rate and an almost -1.5 percent net migration rate during the period 2013-2018. The share of the agriculture sector in the city's total GDP is 37.4 percent (the highest value among 81 provinces) and the agricultural production per capita is 18,522 TL (the highest value among the 81 provinces).

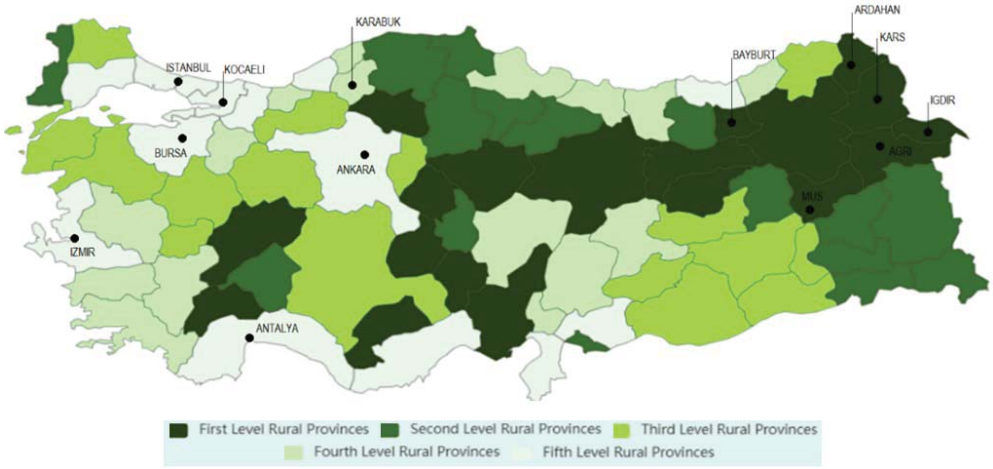

Figure 2. The rurality levels of Turkish provinces

Kars, the second most rural province of Turkey, is located next to Ardahan. It has almost 289 thousand people and the population density is 28.4 persons per km2. The annual population growth rate of Kars is -0.7 percent and the net migration rate during the period 2013-2018 is -2.2 percent. The share of the agriculture sector in the city's total GDP is 31.6 percent. The city exports only 208 thousand dollars, having the lowest export performance among the 81 provinces of Turkey.

Iğdır is located next to the Kars, and it has the third highest rurality level. It produces 36.4 percent of its total GDP from the agriculture sector. Bayburt is the least populated city of Turkey with 82 thousand people, and it has the fourth highest rurality level. Tunceli has the lowest population density in Turkey with only 11 people per km2. Ağrı has the lowest net migration rate with -2.8 percent in the period of 2013-2018.

On the contrary, the provinces with the lowest rurality index are Istanbul, Ankara, Izmır, Kocaeli, Bursa, Gaziantep, and Antalya. Based on the results, it is seen that the rurality level of Istanbul is considerably lower than the other provinces. Istanbul is the

most populous city and the financial capital of Turkey having more than 15 million people and a population density with 2,892 people per km2. The city produces almost 263 million TL in industry and 596 million TL in the service sector. The share of the industry sector in the total GDP is 31 percent and the share of the service sector is 69 percent. The share of the agricultural GDP is only 0.11 percent in the city's total GDP. Nearly one-third of Turkey's universities are located in Istanbul and 27 thousand academics work in these universities. Also, 30 percent of Turkey's enterprises are located in Istanbul. Istanbul produces 50.6 percent of Turkey's total export and at the same time 54 percent of the total import.

The province with the second lowest rurality score is Ankara, the capital of the Republic of Turkey. Ankara is also the second most populous city in the country, and it has a population density with 222 people per km2. The city produces 1.8 percent of its GDP from the agriculture sector, 29.7 percent from the industry sector and 68.4 percent from the service sector. There are 17 universities and 46 R&D centres specialised in fields such as computer, software, and defence industries.

Izmir, the third lowest rural province, is a port city located in the west and Turkey's third most populous city with more than 4.3 million people. It is a highly developed city in terms of R&D, innovation, and human capital. Kocaeli, located at the east of Istanbul, is considered Turkey's "industrial capital". Chemistry, automotive, and iron steel are the biggest industrial sectors. The city has a major role in the automotive industry with Bursa, another industrial city.

The most important result showing that our method works well is that while evaluating the weaknesses of the criteria, such as the population and land area of Karabük, it also takes into consideration its superiority in the industry (as one of the major provinces in iron and steel production in Turkey) and it does not assign a high rurality score to Karabük. This is also a reflection of the findings that the variable selection and the weighting methods are consistently designed as well as the method.

Most of the cities with the highest rurality level are located in the eastern part of Turkey. On the other hand, it can be clearly seen that the provinces with the lowest rurality index are located at the western part of Turkey and concentrated at the maritime. As a result of the analysis, nearly all provinces of the "First Level Rural Provinces" are located on the east. This result is not surprising as Turkey's eastern part is much less developed than the western part and the disparities between them are high (Özlem Önder et al. 2010), which is often called the "East-West Divide". There is a huge difference between the eastern and the western part of Turkey in terms of economic and social indicators such as per capita income, education, employment, unemployment, salaries etc. (Öcal and Yıldırım 2008, Filiztekin 2009, Celebioglu and Dall'erba 2010). In terms of many socio-economic indicators such as population,

income, GDP per capita, industry, employment, and financial indicators, Turkey's eastern part has remained quite backward compared to the West.

Discussion

The results obtained from this study are consistent with other studies that rank the provinces in Turkey. Although there are slight differences in the ranking of some provinces according to the data used by years, Istanbul is ranked first in terms of development in all studies (Karabulut et al. 2004, Urfalıoğlu and Seyfullahoğulları 2004, Ersungur et al. 2007, Yılancı 2010, Acar et al. 2019, Özlü et al. 2020). Istanbul is followed by Ankara, Bursa, Kocaeli and İzmir, in general. For example, in the study conducted by Dincer et al. (2003), the top five most developed provinces are Istanbul, Ankara, Izmir, Kocaeli and Bursa, while the five least developed provinces are Bayburt, Tunceli, Hakkari, Şırnak and Ardahan. According to the results obtained from this study, while the first five provinces are the same, only Ardahan and Bayburt provinces comply with our results as least developed provinces. In addition, Tunceli (73rd rank), Hakkari (57th rank) and Şırnak (50th rank) are included in the underdeveloped provinces group in compliance with our study.

In the ranking of Acar et al. (2019), the most developed provinces ranked as Istanbul, Ankara, Istanbul, Izmir, and Antalya, while the least developed five provinces are Van, Hakkari, Muş, Ağrı and Şırnak. Temurlenk and Abar (2019), on the other hand, found that the most developed provinces were Istanbul, Ankara, İzmir, Kocaeli and Bursa, while the five least developed provinces were Ağrı, Siirt, Muş, Hakkari and Şırnak. While the ranking of the five most developed provinces of the study is the same with our results, Ağrı (75th rank), Siirt (61st rank), Muş (76th rank), Hakkari (57th rank) and Şırnak (50th rank) are at the bottom of the list in compliance with our study. It is also clear that the rurality level of Turkey from the west to the east rises (the socio-economic development level decreases from west to east), as mentioned in many other studies (Dincer et al. 2003, Gulumser et al. 2009, Sakarya and İbişoğlu 2015, Acar et al. 2019).

Considering the analysis results, Eastern Anatolia and Southeastern Anatolia regions are more homogeneous compared to the other 5 regions. In the Mediterranean, Aegean and Black Sea regions, which have a coast to the sea and therefore they are advantageous in terms of trade and tourism opportunities, this homogeneous structure is disrupted, and the rurality index decreases because of these economic activities. Izmir, Antalya, and Trabzon can be given as examples of these provinces.

In addition, in some studies in the literature, it is seen that even the regions that are less rural in terms of socio-economic indicators are included in different groups by showing differences among themselves (Yılancı 2010). Although the socio-economic development level of some provinces is not high, it is concluded that the development

levels are relatively higher than the eastern regions due to the fact that some provinces are port cities, some are industrial cities, and some are tourism cities (Karabulut et al. 2004). While Eastern Anatolia and Southeastern Anatolia provinces are mostly in the same group in terms of rurality level, on the contrary, some important commercial cities in the Black Sea and Aegean regions separate from their regions and they disrupt the homogeneity of their groups (Özlü et al. 2020).

Conclusions

Identifying rural areas is not easy. Because the concept of "rural" does not have a single meaning and objective definition. The rural system is a complex system, and it cannot be defined by just one or two variables. An index consisting of many indicators is needed to define rural areas and to determine the level of rurality (Li et al. 2015). Areas with similar characteristics may have different degrees of rurality if they are located in areas that are quite distant from each other (Romano et al. 2016).

A well-developed and consistent rural index should be able to combine different indicators using objective and statistically verifiable weightings. A coherent index should also be based on a reliable theoretical framework, and the items like analytical reliability, accessibility, and the relationship between the variables and rural areas in the selection of variables should be considered (Romano et al. 2016).

In defining rurality, determining the quality and quantity of investment in the rural areas has become a frequently discussed issue in Turkey since the beginning of the 2000s. In the 2000s, various concrete and decisive steps have been taken towards eliminating regional imbalances and producing solutions to regional differences. As a result of the Government's prioritisation in this area, the studies on rural areas have increased. However, considering the national literature, rural indices are developed to define rural areas.

This study aimed to investigate the level of Turkey's rurality at provincial level by using 18 indicators especially focused on agriculture and livestock activities. In doing so, it is aimed to present the current rurality levels of the provinces and to rank them. This study is a pioneering work in this regard and the consistency of the results is very important for the literature and the future studies to be conducted in Turkey. When we look at the studies which have been conducted on rural areas, it is seen that there is no study in Turkey calculating and comparing the rurality level of the provinces. This study distinguishes it from other studies in three different aspects. These are: (1) the focus of the study (to agriculture and livestock activities to calculate the rurality at provincial level), (2) the criteria and (3) the analysis method. The data set used in the study was composed by the synthesis of similar studies and the addition of new ones. On the other hand, it was found that the Principal Components Analysis (PCA) was

generally used to determine and to compare the rurality index. In this study, the most commonly used MCDM methods (Entropy and TOPSIS) were used. It is thought that the study will enrich the literature from different perspectives.

The rural indices of the study showed consistent results and it is possible to develop the index and to obtain results that are more consistent by adding different variables and by applying different statistical methods.

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