The Core-Periphery Analysis as to Socioeconomic Characteristics: The Case of Ankara

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Abstract In recent decades, socioeconomic inequalities have become increasingly noticeable at international, national and regional scales. Strikingly, a significant number of countries have been characterized by a division between dynamic and growing metropolitan areas and shrinking and declining rural regions. Relatedly, the Territorial Agenda 2020 of the EU states explicitly that "the core-periphery division is still present". Increasing socioeconomic inequalities are more apparent within the prosperous metropolises and there has been an increasing socioeconomic differentiation between core and periphery regarding income, employment, and socioeconomic characteristics. Metropolitan areas have been experiencing population growth within the urban core, driven primarily by younger, better-educated and higher income people, in contrast to the peripheral areas witnessing an ageing, poorly-educated and low-income population. This differentiation occurring between core and periphery of metropolitan areas and their distribution across space may bring challenging issues for the governments to deal with. The aim of the study is to figure out how much core and periphery differentiate from each other in terms of their socioeconomic characteristics. As a case study, Ankara metropolitan area is analyzed considering the variables of age groups, sex, level of education, household structure, employment, and political views in district level. Ankara metropolitan area have totally 25 districts. The core is defined as the inner metropolitan area, including eight central districts, and the periphery as the outer area, including 17 districts mainly defined by their rural characteristics. In the empirical part of the study, the socioeconomic characteristics of the core and the periphery are compared by using the Turkish Statistical Institute's data set. The statistical analysis of socioeconomic variation is realized via recently available economic and social data for the 25 districts and cluster analysis is used for the classification of the districts. By analyzing the districts using the economic

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and social variables, a district pattern of socioeconomic differentiation of Ankara metropolitan area is revealed.

1 Introduction

As a result of globalization and economic restructuring, there has been an increasing socioeconomic polarization among settlements in international, national, regional and local scales. In this process, settlements/regions have been observed as differentiated and divided into different sections containing different activities and people with different characteristics. For instance, it is widely witnessed that while metropolitan areas, carrying the potentials of agglomeration economies, represent a dynamic and growing characteristic, rural areas represent a shrinking and declining characteristic in contrast. The Territorial Agenda 2020 of the EU explicitly states this situation as the maintaining core-periphery division. The 'core-periphery' approach has been appropriated by various fields of research attempting to provide a systematic interpretation of the existence of significant developmental gaps between individuals, regions or countries. It tries to explain uneven development and socioeconomic inequality within a framework that the core is defined as an area of relatively high socioeconomic development, and the periphery is described as a region with low levels of economic activity and associated poor quality of life indicators (O'Hare and Barrett 1996; Taylor 1989).

Heterogeneous divisions within metropolitan areas can be defined as core and periphery regarding income, employment, and other socioeconomic characteristics. Within the core, metropolitan areas have been experiencing population growth, driven primarily by younger, better-educated and higher income people, in contrast to the periphery witnessing an ageing, poorly-educated and low-income population (Siedentop et al. 2018). This differentiation occurring between core and periphery of metropolitan areas and their distribution across space are often seen as a dichotomy and in opposition, with unequal power and resources. This dichotomous division has been increasingly questioned and it may bring challenging issues for the governments to deal with. Mapping of different social, economic, and demographic variables leading to core-periphery approach by which the uneven distribution of people according to their characteristics forms the basis of spatial outcomes of the socioeconomic differentiation.

In the face of these considerations, the main aim of this study is to emphasize the core-periphery discussions regarding the socioeconomic characteristics and to figure out how much core and periphery differentiate from each other in terms of their socioeconomic characteristics. As a case study, Ankara metropolitan area is analyzed regarding the variables of age groups, sex, level of education, employment, and household structure both in the core and in the periphery. For this purpose, after

the introduction the second part of the study contains a short overview of main theories and models of the core-periphery approach and the existing relationships between the core and the periphery. The third part provides an analysis of Ankara case in order to find out the core-periphery pattern by using descriptive statistics and cluster analysis underlining the core-periphery differentiations. For Ankara metropolitan area; the core is defined as the inner metropolitan area including central districts, and the periphery as the outer area including districts mainly defined by their rural characteristics. There are totally 25 districts of Ankara, where eight of them are defined as core districts and 17 of them are defined as peripheral districts. The methods employed in the empirical part of the study are to compare the socioeconomic characteristics of the population living in the core or the peripheral districts by using the Turkish Statistical Institute's data set. Finally, discussions of the results and concluding remarks aiming to help the decision makers to develop alternative policy objectives are given in the fourth part.

2 Theoretical Discussions on Core-Periphery Approach

Core-periphery approach offers a set of processes and outcomes to examine geographical patterns of inequality (Reitsma and Kleinpenning 1985) whether regional, national or international (Hirschman 1958; Friedmann 1973; Healey and Ilbery 1990). There are different definitions for 'core' and 'periphery', which are geographical as well as economic. Mathematical term periphery was adopted in geography to represent "radius" or "fringe". Peripheries were defined as outskirts and determined by their distance to a center/core. The greater the distance from the core, the more peripheral the location is. Here, it is important to recognize that core and the periphery are not regarded as mutually exclusive spatial units. The periphery is therefore compared to a center and the main idea of the core-periphery approach is that core use political and economic dominance to exploit the periphery in favor of its own interests. The relations developed among them covers an asymmetric dependence (Pascariu and Tiganasu 2017).

The core-periphery descriptions entered the scholarly debate after the World War II era and became a novel agenda for social thought. Previously, in 1929 Prebisch used the terminology of 'core' and 'periphery' such another variant of the 'rich and poor' dichotomy in social sciences. In the 1950s, core-periphery approach used as an explanation of dependence as the way in which the formation and the functioning of the peripheral economies match the needs of central economies (Prebisch 1950). In economic geography in the 1950s, regarding the core-periphery approach, polarization theories emerged as a critical response to the neoclassical theories in which it is discussed that regions would converge towards a common equilibrium of productivity and wealth (Myrdal 1957; Hirschman 1958). In contrast to these ideas, polarization theories identified an increase in inequalities between regions depending on the cumulative processes of growth and shrinkage between regions. Growth processes of the centers are linked to shrinking processes of the peripheries

via the interregional mobility of people, goods and capital (Kühn 2015). In the theorization of "polarized development" of Friedmann (1973) "core regions" differentiate from "peripheral regions". Core regions are the centers of technological, economic and social innovation where peripheral regions are all other areas. Besides, cores and peripheries constitute a spatial system to contribute to the divergence of development patterns.

In the late 1950s, the concepts of "growth poles" and "growth centers" which are related to the spatial scale of cities and their surroundings have been added to polarization theories (Hirschman 1958; Perroux 1950). A growth pole results from the advantages that the cities have as agglomerations, their density of services and activities. An agglomeration provides a context favorable to various activities, which in turn attracts more activities and reinforces the agglomeration (Myrdal, 1957, Lasuen, 1973). In this way, cities further extend their advantages over rural regions, which become peripheral in time. The concept of peripherality finds its roots in the definition of lagging behind the core. The main indicators used to explain the degree of peripherality of a country/region are the use of socioeconomic indicators like the GDP, population and rate of employment, correlated with spatiality indicators (density of various transportation modes, distance from one area to another, daily accessibility etc.) (Pascariu and Tiganasu 2017). A peripheral situation is often characterized by a higher concentration of employment in agriculture (Erkut and Ozgen 2003). Conversely, it is argued that the consideration of innovative capacities and knowledge endowment become important to describe the reasons for income disparities in the core than the peripheral location. Place-based inequality is also argued instead of a pure peripheral focus and peripheralization refers to the social 'making' of peripheral cities or regions in this argument (Werner et al. 2017).

During the 1990s, new economic geography has contributed to polarization theories by integrating transport costs and historical development paths in the discussions of core-periphery relationships (Krugman 1991). It is claimed that peripheries are disadvantaged in terms of higher transport and distance costs and weak agglomeration advantages. However, the dichotomy between core and periphery was questioned and criticized as these factors have become less important because of economic and technological improvements such as information and communication technologies and the emergence of polycentric developments (Copus 2001).

Currently, we observe a "revival" of polarization trends with the emergence of the knowledge economy. The current metropolitanization of the knowledge economy creates new peripheries, which have been labelled negatively as "non-metropolitan regions" (Herrschel 2012; Lang 2012). The growth of knowledge economy is driven by highly qualified business services (e.g. banking, consulting, marketing and legal services) which are highly concentrated in metropolitan regions (Crone 2012). The centralization through attracting people, economic productivity and infrastructures determine the processes of centralization and peripheralization. Metropolitan regions nowadays show intense signs of core-periphery differentiation which leads to the idea that the diversity of regions/districts and their dynamics have to be considered. The demographic change of inner metropolitan areas, so the rejuvenation (youthening) of population stands in contrast to the trends of ageing in periphery. On the other

side, the economic restructuring of the core by specialized intensive capital and medium/high tech industries against the periphery by intensive and low/medium tech industries even by carrying rural characteristic clearly reflects the situation. Besides, distinguishing rate of employment, population, GDP/per capita, level of education, accessibility, socioeconomic structure are the other indices of core-periphery differentiation.

Related to the core-periphery differentiation, there is a common emphasis that most approaches are developed to serve for policy recommendations and development of political solutions for lagging regions (Laffan et al., 2016). This means it is important to check the specific assets of an area or region if peripheral regions are always lagging. The underlying reasons for the current status as well as the development potentials of these regions must be considered in order to ensure that the proposed approach can be used for practical applications.

3   Core-Periphery Analysis of Socioeconomic Differentiation in Ankara Case

In this study, it is aimed to analyze socio-demographic, economic and political differentiation among the districts of Ankara metropolitan area. There are totally 25 districts of Ankara metropolitan area where the core is defined as inner metropolitan area including eight central districts, and the periphery as the outer area including 17 districts mainly defined by their rural characteristics (Fig. 1).

3.1   Methodology

The methodology of the study consists of three steps; the selection of the variables, conducting descriptive statistics and cluster analysis.

The first step—Selection of variables for the analyses: For a multidimensional evaluation of core-periphery differentiation, it is important to include different variables. Thus, the validity of core-periphery distinction in Ankara is analyzed by examining the districtwide distribution of three groups of variables: socio-demographic, economic and political structure. Related to socio-demographic characteristics; age groups (0–15, 15–65 and over 65), gender, level of education (illiterate, primary, high school, university, postgraduate) and household size are selected; related to economic structure; employment in manufacturing and service sector variables are selected, and related to political view; voting for political parties that are conservatives, nationalists or social democrats are selected for the analyses. The data on socio-demographic and economic structure are obtained from Turkish Statistical Institute. The political view data, are collected from the 2019 Turkish local election results (Table 1). In terms of displaying the economic structure, although the income data is critical for
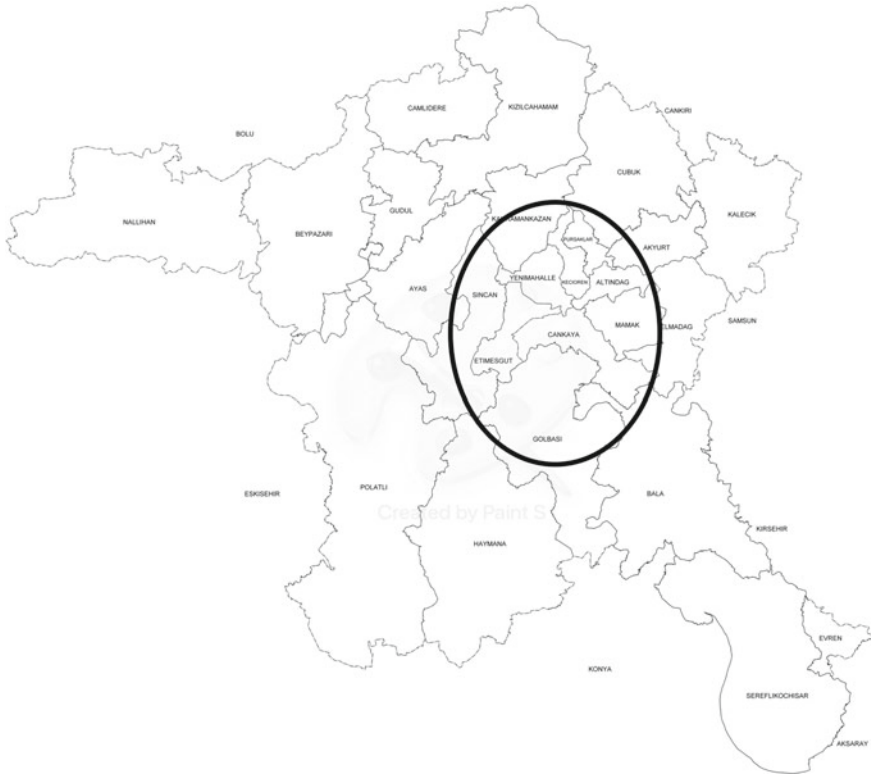
Fig. 1 Core and Periphery Districts of Ankara Metropolitan Area

understanding the distinction between core and periphery, it could not be used in this study because of the scarcity of statistics at district level in Turkey.

The second step—Descriptive analyses: Main descriptive statistics are derived by using SPSS for the selected variables to compare the core and periphery.

The third step—Hierarchical cluster analyses: Hierarchical cluster analysis is used for the classification of districts according to their socio-demographic, economic and political structures. As known, cluster analysis goals to reduce the number of cases or observations by classifying them into homogeneous groups without previously knowing group membership or the number of possible groups (Yim and Ramdeen 2015: 8). In this study, hierarchical cluster analysis, which combines cases into homogeneous clusters by merging them together one at a time in a series of sequential steps (Blei and Lafferty 2009) is preferred, since the authors have no decision about the final number of the clusters. The dendrogram, which is very useful in visualizing the method by partitioning the sample and calculating the relative distance between each potential cluster is used.

The results of the descriptive analyses and hierarchical cluster analyses are mapped by using ARCGIS program to visualize the differentiation of the districts.

Table 1 Description and sources of selected variables

Variables	Descriptions	Sources, Year
Socio-demographic characteristics		
Population	Population size of districts (#)	TurkStat, 2018
Household	Average number of households in districts (#)	TurkStat, 2018
Education	Percentage of illiterate, primary, high school, university, postgraduate in districts (%)	TurkStat, 2018
Gender	Percentage of female and male population in districts (%)	TurkStat, 2018
Age	Percentage of distribution of 0–15, 15–65, 65+ age groups in districts (%)	TurkStat, 2018
Economic structure		
Employment	Employment in manufacturing and service sectors in districts (%)	TurkStat, 2018
Political structure		
Political View	Vote rates for social democratic, conservative and nationalist parties in districts	Results of 2019 Turkish local election

This visualization allows for the inclusion of the spatial component in the core-periphery characterization, thus helps to display spatial aspects like the position of a district at the center or the core. It also allows for the simple evaluation of spatial accumulation of different distribution patterns of all types over a metropolitan area (Werner et al. 2017: 194).

3.2 Descriptive Analyses

Socio-demographic characteristics: To clarify the differentiation of socio-demographic characteristics between the core and the periphery of Ankara, main descriptive statistics are derived from the data set. As can be seen from Table 2, standard deviation of population variable is enormous, which means that there is a discernible distinction in terms of population distribution among districts. While core districts have higher population, peripheries in contrast have lower. The area close to the center has a higher population density than the area further away from the center can be explained by higher employment and consumption patterns in the core areas (Thomas 2013).

According to the household size variable, which also gives clues on socio-demographic characteristics of the districts, the core-periphery description is not

Table 2 Main descriptive statistics of selected variables

|		Minimum	Maximum	Mean	Std. Dev
Socio-demographic characteristics					
Population (#)		2.847	922.536	230.442,72	295.354,4
Household (#)		2.38	3.62	3.07	0.36
Education	Illiterate (%)	1.03	14.29	3.99	3.1
	Primary (%)	7.74	42.53	24.54	9.1
	High school (%)	10.05	41.04	19.22	6.57
	University (%)	3.44	30.42	11.17	6.88
	Postgraduate (%)	0.03	7.57	1.11	1.62
Gender	Male (%)	48.41	52.1	50.19	0.89
	Female (%)	47.9	51.59	49.81	0.89
Age	0–15 (%)	8.6	17.92	13.49	2.93
	15–65 (%)	61.4	79.88	74.21	4.94
	65+ (%)	4.12	29.93	12.3	7.4

apparent among districts (Fig. 2). Minimum household size is 2.38 at Gudul district and maximum household size 3.62 at Pursaklar district that are both peripheral districts.

Education levels of districts are examined in terms of the percentage of illiterates, and graduates from primary, high school, university and postgraduate levels in total population (Fig. 3). The core-periphery separation is clearly apparent for this variable, like the empirical studies of different countries (Hospers 2013; Thomas 2013; Kebza 2018; Kühn 2015; Siedentop et al. 2018). Except the core districts, all peripheral districts have lower education levels. There are three sub-regions due to the results of the analysis; core has the highest values that means the percentage of people graduated from university and had post-graduate education is very high, north and west peripheries have mean values, and southern east peripheries have the lowest values that means lower education level is high in these districts.

According to several researches, the demographic change of inner metropolitan areas, thus the youthening population stands in contrast to the trends of ageing in the periphery. Spatial distribution of percentage of 0–15, 15–65 and 65+ age groups in total population for Ankara is given in Fig. 4. Although, the core- periphery differentiation is apparent, extreme cases emerge. The largest peripheral district in the southwest (Polatli) has higher values in both 0–15 and 15–65 age groups like the core districts that can be the explained by the employment opportunities that the district carries.

Economic Structure: The core and periphery distinction can easily be observed also in the economic structure of Ankara. A high percentage of the employment in service sector (92%) and in manufacturing sector (80%) is in core districts (Fig. 5 and Table 3). One of the core districts Cankaya, where the CBD is located, takes nearly 50% of the service sector employment. On the other hand, 80% of the employment
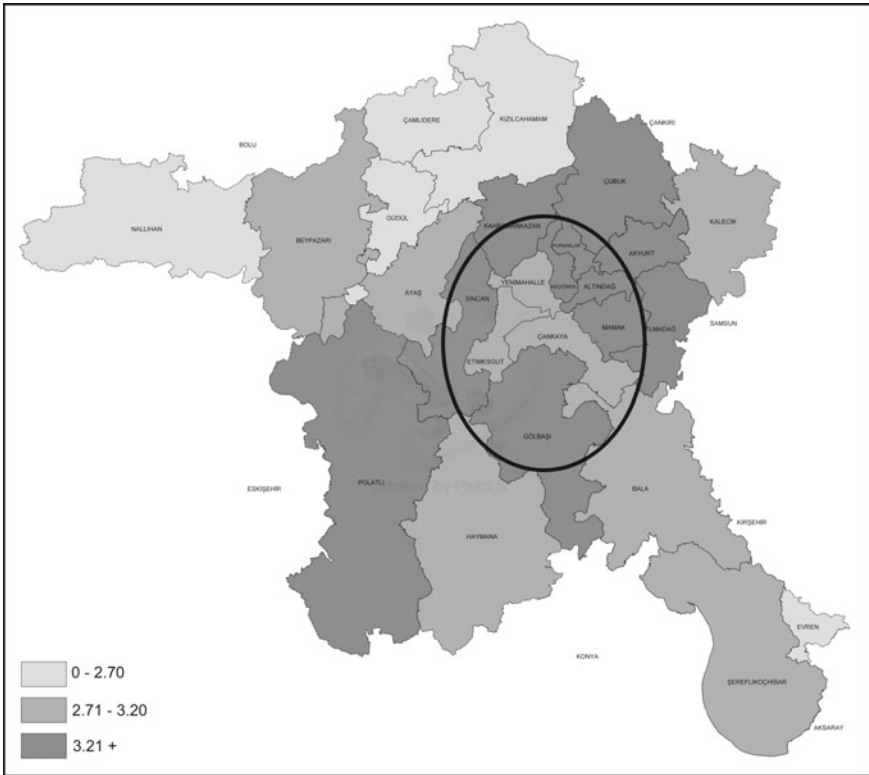
Fig. 2 Spatial distribution of household size by Districts in 2018

Primary School Graduates   University Graduates   Post-graduates
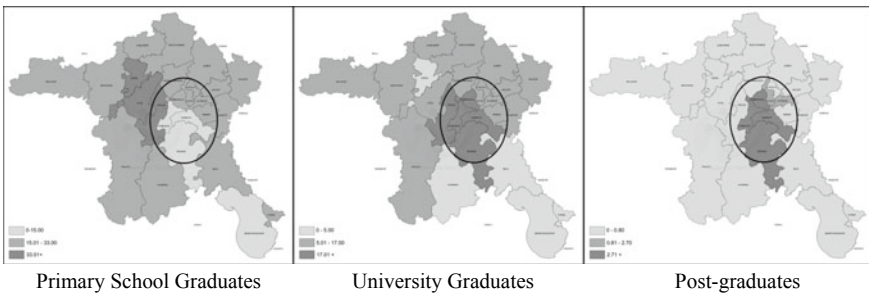
Fig. 3 Spatial distribution of education levels by Districts in 2018 (%)

in manufacturing sector locates again in core, except three districts in the periphery (Kazan, Polatli and Akyurt) where important machinery and defense industry investments exist. These results emphasize that except some of the districts, peripheral districts of Ankara metropolitan area are mostly engaged in agricultural activities, while core districts in service and manufacturing sectors.
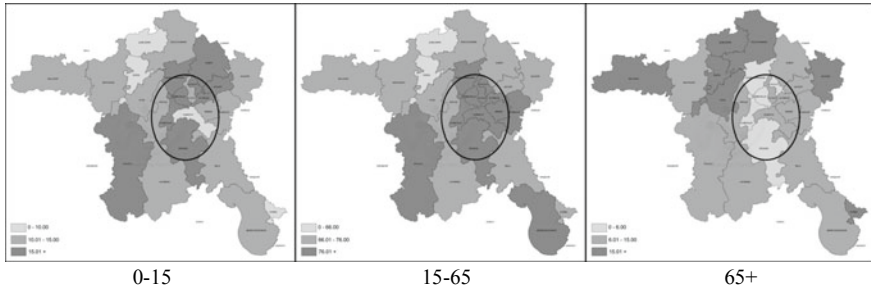
Fig. 4 Spatial Distribution of 0–15, 15–65 and 65+ Age Groups in Total Population by Districts in 2018 (%)
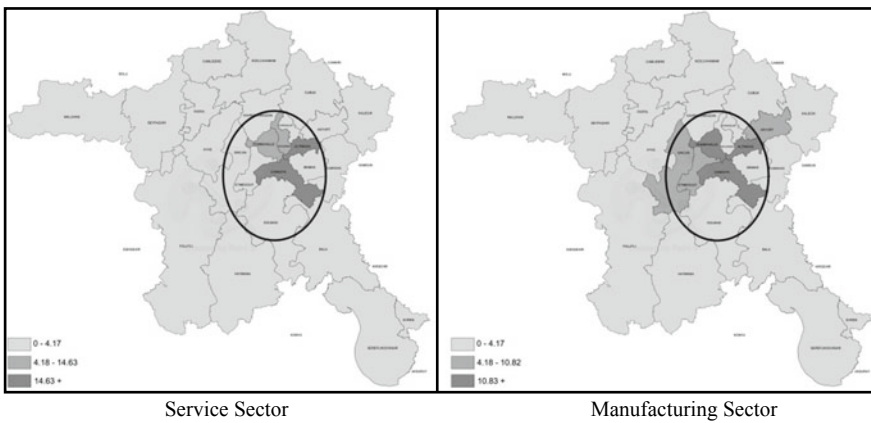
Fig. 5 Spatial distribution of employment in service and manufacturing sector by Districts in 2018 (%)

Political view: Most of the researchses on core-periphery distinction are focused on socioeconomic characteristics. Nevertheless, this study brings a new dimension to the researches by analyzing the political views of the residents in the districts. For the analysis, the results of 2019 local election is examined in district level (Fig. 6). There are three main political views; conservatives (Justice and Development Party-AKP); social democrats (Republican People's Party-CHP) and nationalists (Nationalist Movement Party-MHP) in Turkey. From the results of the local election, it is observed that while the mayors of Ankara Greater Metropolitan Area and the three core districts are from social democrats, the majors of peripheries are from conservative and nationalist ones that obviously show the core-periphery separation in the political views.

Table 3 Employment in manufacturing and service sectors by Districts in 2018 (%)

Districts	Manufacturing		Service		Districts	Manufacturing		Service	
	No	%	No	%		No	%	No	%
Altindag *	23.033	18.96	70.917	15.91	Camlidere	35	0.03	292	0.07
Cankaya *	24.323	20.02	222.89	49.99	Cubuk	891	0.73	3830	0.86
Etimesgut *	6157	5.07	10.312	2.31	Elmadag	3129	2.58	2238	0.5
Golbasi *	1236	1.02	6331	1.42	Evren	3	0	106	0.02
Kecioren *	2184	1.8	24.116	5.41	Gudul	38	0.03	343	0.08
Mamak *	2925	2.41	13.703	3.07	Haymana	124	0.1	1456	0.33
Sincan *	11.298	9.3	11.668	2.62	Kalecik	90	0.07	534	0.12
Yenimahalle*	25.951	21.36	48.851	10.96	Kazan	4713	3.88	2227	0.5
Akyurt	9649	7.94	3511	0.79	Kizilcahamam	197	0.16	2193	0.49
Ayas	52	0.04	1642	0.37	Nallihan	218	0.18	2842	0.64
Bala	138	0.11	653	0.15	Polatli	3745	3.08	9901	2.22
Beypazari	603	0.5	2832	0.64	S.Kochisar	747	0.61	2472	0.55
					Total	121.48	100	445.86	100

Source TurkStat, 2018.
* Core districts
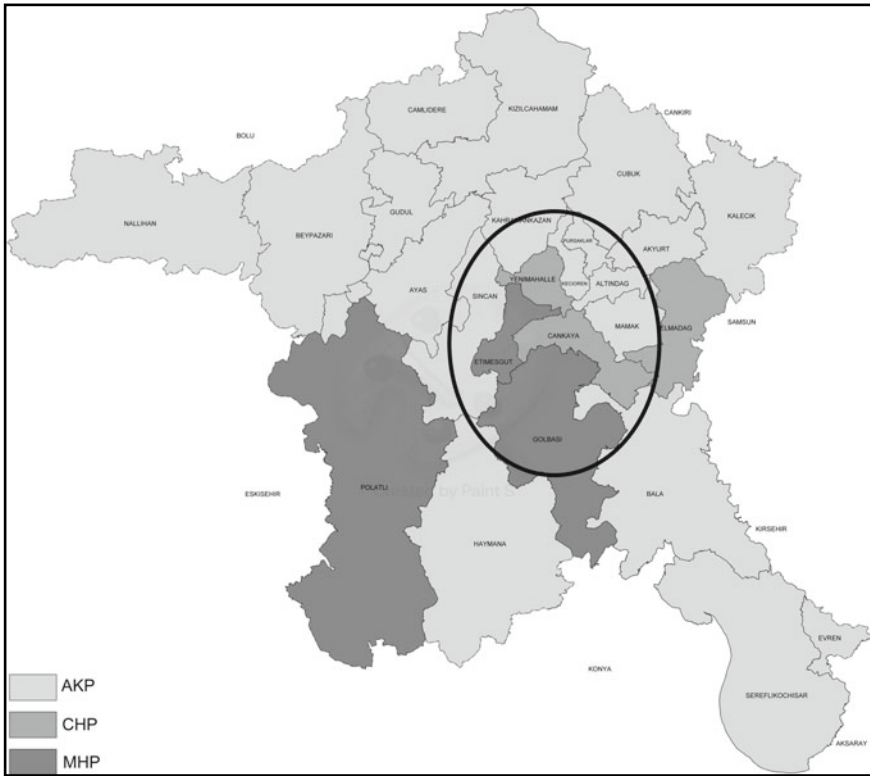
AKP (Justice and Development Party) - conservatives
CHP (Republican People's Party) - social democrats
MHP (Nationalist Movement Party) - nationalists

Fig. 6 Spatial distribution of the major political parties in 2019 Local Election

3.3 Hierarchical Cluster Analyses

After the main descriptive analyses, hierarchical cluster analysis is applied to identify homogenous groups for the districts. In this analysis, districts of Ankara are clustered according to their socio-demographic, economic and political characteristics. The results of the analysis give important evidences about the differentiation of the core and periphery districts.

A hierarchical cluster analysis is best illustrated using a dendrogram (Yim and Ramdeen 2015: 15), thus using average linkage between groups, a dendrogram has been prepared for Ankara (Fig. 7). The vertical lines in the dendrogram represent the grouping of clusters and indicate the distance between clusters. The horizontal lines, on the other hand, represent the differences of these distances. The longest horizontal lines represent the largest differences.
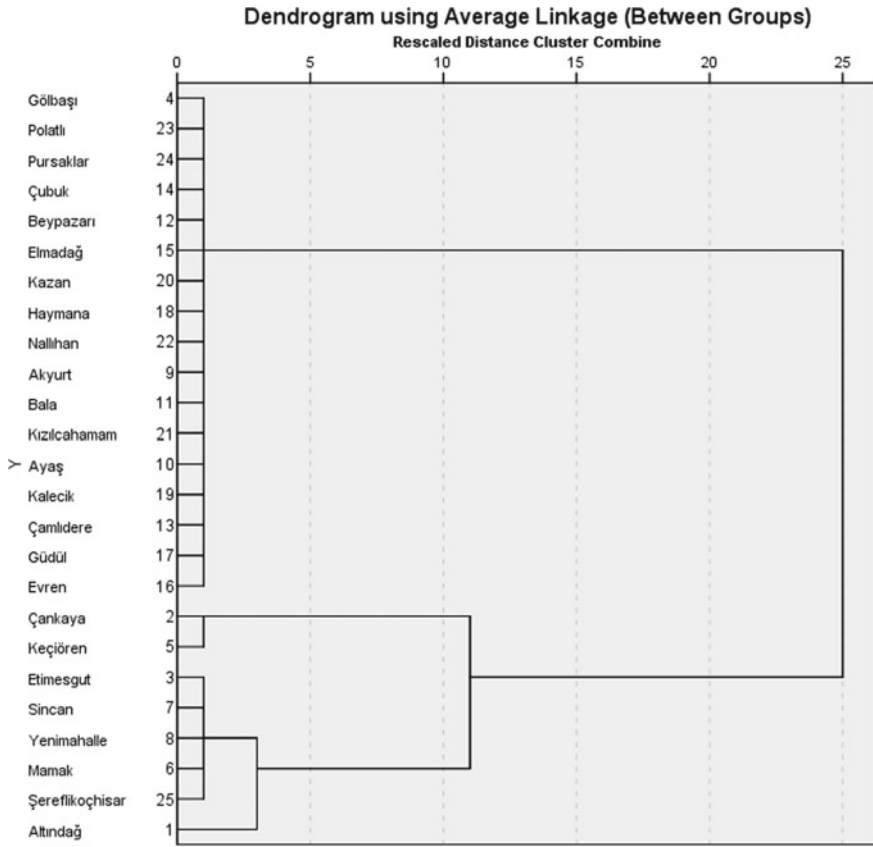
Fig. 7 Dendrogram of cluster analysis representing the linkages among Districts

As illustrated in Fig. 7, except two of the peripheral districts (Golbasi and S.Kochisar), the districts determined as core are clustered in the same group, and the districts determined as periphery are clustered in the same group as well. Golbasi which is determined as a core district is taken place in the periphery according to the results of the cluster analyses and S. Kochisar is vice versa.

Figure 8 shows the results of cluster analyses by different numbers of clustering. Analysis shows that even if the number of clusters changes, the districts in the clusters representing the core and the periphery do not change. As the number of clusters increases, only subgroups appear within the core group.

| Two Clusters | Three Clusters | Four Clusters |
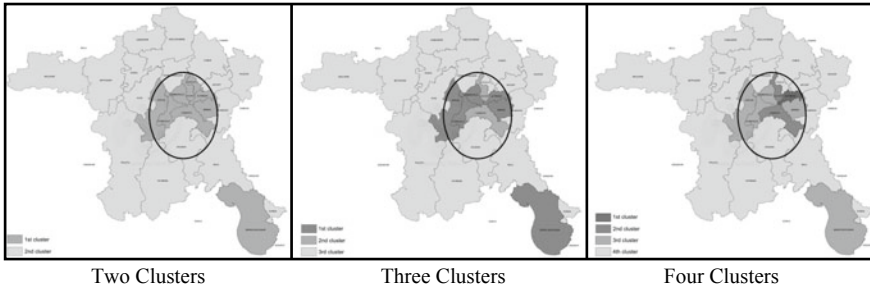
Fig. 8 Results of cluster analyses by different cluster numbers

4   Concluding Remarks

There has been an increasing socioeconomic differentiation between core and periphery of metropolitan areas regarding income, employment and socioeconomic characteristics. Most of the regions defined as core are economically stronger than the regions further away from core and there is a clear movement of production and capital towards the core. However, relatively few studies have explored the spatial socioeconomic inequalities of a metropolitan area in district level. The present study, which aims to emphasize the core-periphery discussions regarding the socioeconomic characteristics, is realized at district level in Ankara metropolitan area. In this study, by using multi-dimensional variables, a complex district pattern of development in Ankara metropolitan area is revealed. Analyses of the study show that spatial socioe- conomic contrasts at the districts of Ankara metropolitan area are distinguishable and core-periphery framework adequately reflects the existing spatial arrangement of socioeconomic inequalities. Parallel to the results of empirical studies from different countries, the analyses display that the core of Ankara is younger, more educated (especially graduate and post-graduate degree), white-collar and has social democrat political view when compared to its periphery.

   Several studies outline the relevant contribution of public interventions through the core-periphery approach aimed to reduce development gaps differentiated by time and types of regions. Especially, interventions on social and technical infrastructure and transportation networks all play a vital role for the economic power of regions. The findings of the present study point to the need to reconsider urban and regional development approaches by placing the main emphasis on a differentiated regional development policy, rather than a homogeneous or a uniform regional development policy due to the differentiation of the districts/regions. The socioeconomic differ- entiation pattern in Ankara can highlight the importance of equity issues and social welfare programs in the country by core inducing tendencies including economic effi- ciency through economic restructuring. Recognizing the socioeconomic differentia- tion pattern between the core and the periphery, governments can develop programs for softening the gap between them, thus helping those regions to converge. Many of the districts within the metropolitan area can also have their own local policies and

programs regarding the intervention within their own spatial boundaries. Concerning the problem of low innovative capacities and knowledge endowments of peripheral districts, the use of smart specialization approach that has realized in the EU in framework of strategy Europe 2020 can also be practiced to overcome the socioeconomic inequalities.

Clearly, the compulsorily limited number of considered variables confines the study, so that more accurate conclusions could be reached by extending the number of variables. Thus, further researches can include more variables, like GDP, density of various transportation modes, distance from one area to another, daily accessibility etc. to explain the degree of peripherality, thus core and periphery differentiation.

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