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Spatial Analysis of Presidential Election in Iran, the Case of the 2017 Elections*

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Abstract

Electoral geography is often considered a major branch of behavioral geography, which takes into account certain political functionalities. This analysis is particularly important in the case of Iran, where political behaviors and social, behavioral, and geographical complexities take on a unique form. This in turn certainly impacts the combination and function of different political institutions in Iran, especially in the case of presidential elections, at various local, regional, and national scales. In this light, the present study proceeds with an exploratory analysis of spatial data on different electoral sectors to find a balanced spatial division (zoning) of Iran based on principles of electoral geography, which also provides certain indications into existing spatial inequalities. The analysis is based on the assumption that concepts of electoral geography-consisting of a diverse range of spatial-political aspects of election-integrated with exploratory analyses, may prove helpful in establishing fair elections in Iran. The results of this study reveal that the distribution of election votes shows a significantly positive general spatial autocorrelation, which is indicative of the spatial clustering of votes in Iran. Regarding the relationship between the distribution of votes and social and economic variables, votes tallied for Rouhani had positive and significant correlations with factors of relative population aged 25 to 64, relative student population studying at higher education, the ratio of university educated population, unemployment rates, rental rates, housing quality, and the rate of urbanization in all cities. However, for Raeesi, the analysis of the votes indicates a positive and significant correlation between relative population aged 0 to 24, population above 64, employment rates, ratio of households with disabled members, house ownership and ruralization.

Keywords: Behavioral Geography, Electoral Geography, Iran Presidential Elections, Political Geography, Political Structure

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1. Introduction

Presidential elections in Iran are considered the most important political event that takes place every four years. The first elections in Iran for the post of president took place after the political changes following the Islamic Revolution in 1979. In addition, due to this necessity, the first presidential election laws were enacted in Iran in 1985. Since then, several elections have been held in Iran. However, from the seventh election onwards, competitiveness escalated and became more intense, to the point where presidential candidates in one period would also later accrue maximum votes in the next round of elections (second-term presidents). In certain aspects, the presidential elections in Iran comprise an overriding mode of political engagement of the public in certain managing national affairs, in the sense that election results can induce significant political-spatial impacts in various aspects and scales, from local to regional and national (Zarghani & Razavinejad, (1395 [2016 A. D.]); Luger, 2022).

In a more general perspective, however, there are certain factors in any election that are as important as the candidate who receives the majority vote. These are factors that can be analyzed for hints and signs of spatial differences and their impact on political behavior, and can provide new insights into matters of vote inquantity and quality. In other terms, elections are reflective of a society's attitudes, perceptions, bottlenecks and problems. Thus, a distribution map of vote results based on geographical locations (places) can be used to analyze differences in behaviors for different locations. With this background, electoral geography can help conceptualize social sciences in matters of electoral behavior from a spatial sense (Vandermotten & Lockhart,2002; Licht, 2021). This allows for an analysis of the role of space, as a major factor in electoral geography and as a measure for understanding different behaviors of voters as well as the various social, cultural, and economic features of any specific region.

2. Theoretical Foundation

The topic of electoral geography and spatial visualization of different political parties and tendencies has been the concern of many theorists. As Patty and Johnston mention, electoral geography is the interaction between space/location and election processes. Taylor and Johnson (1998) further categorize three major geographical domains in electoral studies; the first, focuses on elections geography based on statistical analysis for demonstrating certain patterns in electoral cycles. The second area deals with the effects of geographical factors on the process of election and voting, and the third domain addresses candidate geography, which pertains to the importance of electoral districts and boundaries (Hataminezhad et al., 1392 [2014 A. D.]).

In another respect, the objective ontology provided in electoral geography about voting as a phenomenon, as well as it account of the spatial distribution of votes and voters, has linked this approach with the idea of space and spatial methods. As such, geographers find themselves interested in not only the issue of the "identity" of people involved in an election process, but also the matter of "where" these individuals live and reside. Other faculties of electoral geography include analyses of spatial interactions, place, and election processes (Patti, 2006, p. 2), as well as investigations into the effects of spatial differences on political behavior (Estes, 2006). Place is defined in this context as a combination of different elements, including nationality, social-economic strata, and geographical location, which can influence the results of an election (Agnew, 1996, p. 52). In other words, place is a reflection of institutional constructs and the constructs of relationships, and further includes in itself various cultural patterns or norms and modes of interactions and social relations (Lopez & Scott, 2006). One relative institutional prerequisite, which occurs in the case of competition of parties during elections, is decentralization (Baumann et al., 2020). It should, however, be taken into account that candidates (political actors) come from different geographical regions and therefore different levels of authority , as a result of which they engage in gaining experience from competitor party candidates in matters of organizational features and policies (Bohmelt et al., 2017; Gilardi & Wasserfallen, 2019). During the past few decades, scholars of electoral geography have accorded significant priority to investigating the topic of competition among parties, with great emphasis on motives of political actors, resulting from interactions among different political strata towards establishing a centralized government (Debus & Gross, 2016). This, in turn, is considered a geopolitical process, which falls into the jurisdiction of political geography. Among other matters of great debate in electoral geography is the issue of public engagement (Dielerman, 2001). Therefore, to the degree that self-interest is concerned in voting, it is expected that the number of voters will in all likelihood be higher than non-voters (Dowding et al., 2012). Even if individuals do not care for the fate of elections and its impact on their lives, they do exert some degree of importance for the local community and must minister to their locale even after departing it. From this angle, it can be understood how an individual may see some purpose to voting for the candidate or party that will provide the society with the best services. This may venture so far that even intentions of leaving a society will not affect the decision to partake in voting (Dowding et al., 2012).

The theoretical foundation mentioned was primarily constructed on electoral geography as a branch of political geography, which studies the different geographical aspects of election results and the organizational and pragmatic structures put into place. The following will jump into more contextual areas of electoral geography with an analysis of election results, voter engagement, and mobilization of parties, which are key subjects in electoral geography, with a case study of Iran. The following models and patterns were used to analyze presidential elections in Iran.

Considered a sub-field of political geography, electoral geography proposes that voters are reluctant to state their preferences in a vacuum, and that political decisions are influenced by various levels of contexts (national, regional, and local), thereby emphasizing the importance of geography in elections. In this direction, the significance of spatial and contextual aspects have become bolder in electoral engagement, voting, and performance of election systems (Mirheydar & Mirahmadi, 1397 [2018 A. D.], p. 26, in Gregory et al., 2009, p. 12). This attention to geography is primarily owed to the emergence of the (spatial-)quantitative revolution in political geography in the 1970s. Alternatively put, from the 1960s to the 1970s, electoral geography found the highest support among political geographers (Muir, 1997). In 1975, Busteed, expressed his ideas on electoral geography in a research titled *Geography and Voting Behavior* (1975) (Dikshit, 1982); his studies were centered on two primary aspects: 1- emphasizing space and 2- electoral division. Along this thread, the first published research on electoral geography was put forth and published by Andref Siefried (1913), also known as the “father of electoral geography" (Dikshit, 1982), who procured the first electoral division maps used to compare and contrast the level of support from different parties in sectors of Ardeche, France with components of physical, social, and economic geography of the region. Despite its simplicity, the works of Siefried pertained to ideas of environmental determinism, alluding to the fact that electoral patterns are spatially diverse and significantly correlated with the spatial distribution of social and economic structures (Jones et al., 2007). The first foundational research on electoral geography was later introduced in 1959 by Prescott, in which he claimed that geography can be used to infer electoral patterns. He also found electoral maps as an indicator of the territorial diversity and the distribution of the people's opinion about specific subjects (Dogan, 1967, p. 49). Other important factors of electoral geography consist of the physical environment and contiguity (proximity). Electoral geography, on the other hand was only extensively studied by American and English scholars, followed by other political geographers after the quantitative revolution (Glassner & Blij, 1989). Robert Crisler also proposed certain studies in the field of electoral patterns in 1948, and Dean (1949) conducted research on the geographical characteristics of referendums (Kasperson & Minghi, 1969).

The presentation of different criteria for regional divisions alone can be a starting point for researches in political geography. Prescott explicitly presumed electoral geography as a regional paradigm, and as a result, focused on the use of cartographical methods for indicating electoral divisions. According to Mirheydar & Mirahmadi (2018, p. 23), the two primary approaches to electoral geography can ultimately be categorized as: 1) Traditional (place) approach, which focuses on spatial patterns and the analysis of the relations between humans and environment, 2) Behavioral (space) approach, which promotes a behavioral-spatial perspective on geographical studies.

The traditional approach converges more towards the relationship between the social and natural environment of a place and, on the other hand the subject of election patterns. The method is itself composed of two main sub-branches, including studies on mapping spatial patterns of voting and efforts made to compare election maps with natural, economic, and social indices maps. The first sub-branch came to be identified as "place and structure" and the second as "place-ecology". Electoral maps are similar to a topographic surface with a fixed relative morphology but variable elevation. This indicates the governance of the social and social-economic gap in electoral policies. In other words, electoral geography, in the traditional sense, is nothing more than an image of a country's economic geography.Place-structure approach, which, briefly stated, includes the study of spatial patterns and the structure of elections. Place-ecology approach refers to the study of spatial patterns of election results with respect to the general environment. The basic assumption here is that people vote based on what they perceive to be to their benefit. Spatial differences among different economic, social, religious, nationality, and racial strata are among the most primary factors considered in studies of this field. Taylor and Johnston (1998) labeled the place-ecology approach as the "geography of elections".

Spatial patterns of elections represent the inter-social gap among people, which can be analyzed from different perspectives. Elections are therefore a suitable measure for the amount of social change, since they directly reflect public opinion, as opposed to other surveys. They also reveal the underlying social constructs and a clear representation of the changing tendencies at different regional scales. The proposed techniques used in exploratory spatial data analysis (ESDA) are designed with the idea of visualizing spatial distributions in mind, while accounting for certain outliers and agglomerations. These methods should also be able to detect and highlight spatial autocorrelations and heterogeneities (Anselin, 1988; Le Gallo & Ertur, 2003).

The commonly employed measure for similarity in spatial observations made across a whole system is the global Moran’s I, which is an indicator of spatial correlation among data collected from certain coordinates in space (Anselin, 1995). However, in the event of an unbalanced spatial clustering, the Local Indicators of Spatial Association are used, which rate individual spatial unit shares in the global Moran’s I index (Anselin, 1995). Accordingly, in this study, Moran's scatter diagrams were used to visualize the spatial distribution of different criteria.

3. Methodology

The data used in this study included presidential election results for 2017, as well as public census and housing data for 2016. The spatial unit of analysis were set at county level and Excel, SPSS, ArcGIS, and GeoDA were used for information processing and analysis. Analysis was carried out in the form of exploratory spatial data analysis approach (ESDA).

3. 1. Exploratory Spatial Data Analysis (ESDA)

Adhering to the element of space is inevitable in any analysis of spatial inequalities. By introducing the element of space, one can surpass the limitations encountered by analyses neglecting the correlations among social and economic factors and geographical location. ESDA methods account for the specific geographical features of one region, as opposed to another, and consist of a set of techniques for describing and representing spatial distributions, recognizing spatial irregularities, identifying spatial patterns and correlations, and spatial clustering and regimes or other heterogeneities (Anselin, 1998, p. 258). The methods also measure spatial autocorrelation on both local and general scales, as well as spatial heterogeneity, with special attention to the former as grounds for stating that regions in close proximity (contiguous regions) are more similar than those located far away.

3. 1. 1. General Indicators of Spatial Autocorrelation

Among the most frequently used indices for general spatial autocorrelation is the Moran's I index, which represents the linear relationship between observed values and spatially weighted mean values of adjacent places. In other words, the Moran's I index shows whether clustering has occurred amongst data sets or not. The equations for these indice follow Eq(1):

$$I = \frac{n\sum_{i=1}^{n}\sum_{j=1}^{n} w_{ij}(x_i-\bar{x})(x_j-\bar{x})}{(\sum_{i=1}^{n}\sum_{j=1}^{n} w_{ij})\sum_{i=1}^{n}(x_i-\bar{x})^2} \quad (1)$$

where n is the number of regions, x_i and x_j are the target variable in regions i and j, respectively, $\overline{x}$ is the mean for the target variable in all regions, and w_{ij} is the corresponding weight used to compare regions i and j. Values of this index greater than the expected value $E(I) = -1/(n-1)$ represent negative spatial autocorrelation. The Moran's I index ranges from +1 (absolute positive autocorrelation) to -1 (absolute negative autocorrelation).

3. 1. 2. Local Indicators of Spatial Autocorrelation

The Moran’s I index is a general statistic instrument and does not allow for an assessment of the regional structure of spatial autocorrelation or the identification of local and regional clusters contributing to the general autocorrelation. Moran scatter plots (Anselin, 1996), local indicators of spatial autocorrelation or LISA (Anselin, 1995), and the Getis-Ord index (Ord & Getis, 1995) are commonly used in the case of evaluating local spatial autocorrelation. These techniques can be used to reveal the structure of spatial autocorrelation within regions by identifying local clusters with very high or very low values in areas with higher contribution to the general spatial autocorrelation. The methods can also be utilized to locate certain areas or groups of areas that have deviated from their general spatial autocorrelation pattern.

3. 1. 3. Moran’s Scatter Plots

Moran scatter plots depict the spatial range of a the variable (vertical axis) against the variables value in each region (horizontal axis), and therefore help represent local spatial anomalies. The spatial range refers to the average weighted values of adjacent values of a specific location. The Moran’s I index can then be identified as a regression coefficient, visually realized as the slope (derivative) of the scatter plot for a standardized weighted matrix. Moran’s scatter plots are an efficient tool for visual exploration of spatial autocorrelation, but show no significant signs of spatial clustering. The four quantiles of the Moran scatter plot convinced with four types of local spatial relations between a region and its surrounding areas are depicted in Ttable 1:

Table 1. Interpretation of Moran's Scatter Plot Results.

Strata	Quantile	Autocorrelation	Interpretation
Upper-Upper	Upper-right	Positive	Regional cluster with high value, surrounded by high value regions
Upper-Lower	Lower-right	Negative	Regional irregularity with high value, surrounded by low value regions
Lower-Lower	Lower-left	Positive	Regional cluster with low value, surrounded by low value regions
Lower-Upper	Up-right	Negative	Regional irregularity with low value, surrounded by high value regions

Source: Authors

3. 1. 4. LISA

The Moran's I index only indicates the general spatial autocorrelation. Using LISA, one can determine which specific locations contribute to the general spatial autocorrelation; i.e., cluster centres can be identified accordingly. LISA can be formulated as Eq (2,3):

$$(2) \qquad I_i = \frac{(x_i - \overline{x})}{m_0} \sum_j w_{ij}(x_j - \overline{x})$$

$$(3) \qquad m_0 = \sum_i (x_j - \overline{x})^2 / n$$

where x_i is an observation in region i, and $\bar{x}$is the average value of observations in all regions. Positive values of I_i indicate spatial clusters of similar values (high or low), while negative values of the parameter represent non-similar spatial clusters (e.g., high value areas surrounded by low value regions).

4. Findings

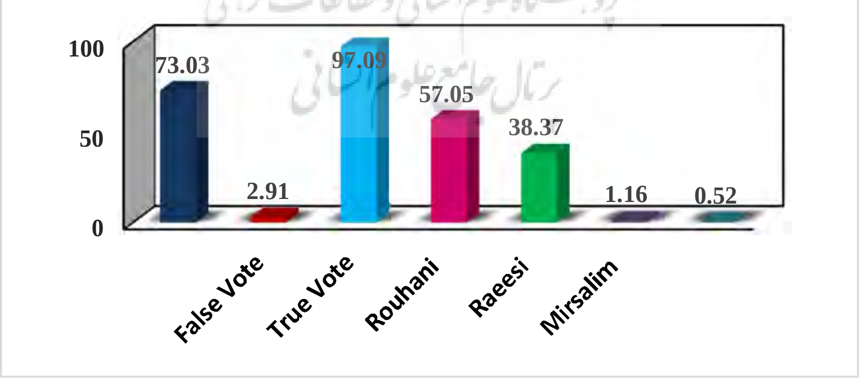
4. 1. National and Provincial Scale of Election Results

The 12th presidential elections in Iran were held on May 19, 2017.

Based on reports from the Statistical Centre of Iran, the overall population of the country by May of 2017 was estimated at 80.5 million, of which 56.41 million were eligible for voting for the president of the Islamic Republic of Iran. In other words, the participation rate for the elections was 73.03 percent, with the highest contributions made in Bushehr, Yazd, and Mazandaran, with respective participation rates of 96.18, 93.4, and 91 percent. The lowest participation rates, on the other hand, were observed for Lorestan, Kurdistan, Khuzestan, and Eastern Azerbaijan provinces, with respective values of 50, 59, 65, and 65 percent.

The presidential election results showed Rouhani as the leading candidate with 23.501 million votes, contributing to nearly 57.05 percent of all true votes. Raeesi followed in second place as the representative of the fundamentalists' party of Iran with 15.805 million votes, totaling to 38.37 percent of total true votes. Tallied votes for Mirsalim (conservative background) came to 477,247 (1.16%), while Hashemitaba gained a total of 213905 votes (0.52%) (Figure 1).

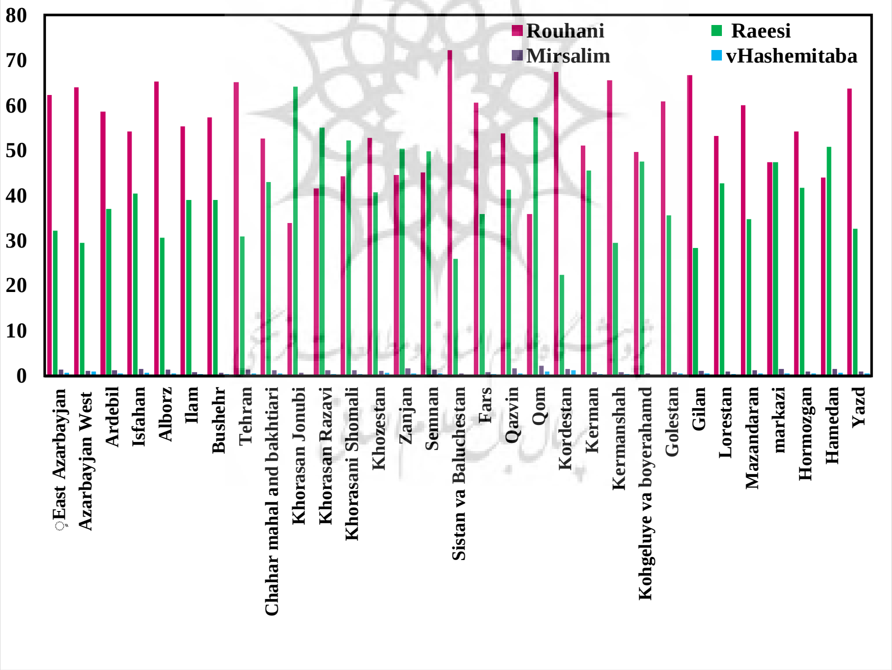
Figure 1. Overview of Presidential Election Results by Candidates



Source: 2017 Iranian Presidential Election, n.d.

As evident, the reformist party gained the highest votes from the following provinces: Sistan-o Baluchestan (72.2%), Kurdistan (67.4%), and Guilan (66.7%), while the lowest number of votes for reformists were counted in Southern Khorasan (33.9%), Qom (35.9%), and Razavi Khorasan (41.6%). The tallied votes for the conservative parties from different provinces show the highest rates in Southern Khorasan (64.2%), Qom (57.3%), and Razavi Khorasan (55.1%), and the lowest in Kurdistan (22.3%), Sistan-o Baluchestan (25.9%), and Guilan (28.3%).

Figure 2. Tallied Votes for 2017 Presidential Elections in Iran by Province



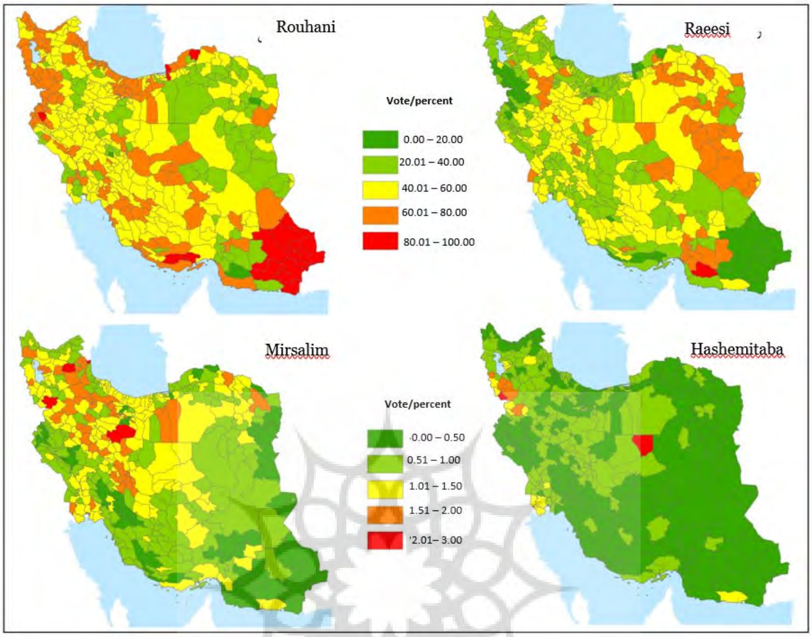
Source: 2017 Iranian Presidential Election, n.d.

4. 2. County-Scale Analysis of Election Results

As the findings suggest, the highest number of votes for the reformist party came from cities of Sib and Sooran (94.2%), Mehrestan (93.2%), and Khash (90.9%), all located in the province of Sistan-o Baluchestan. The lowest number of votes for the reformist party were observed in Boshagard (12.8%) of Hormozgan Province, Bon (17.7%) of Chahar Mahal-e Bakhtiari, and Zaveh (18.5%) in Khorasan. The average number of votes for the reformist party was estimated at 53.15% of total votes and a standard deviation of 15.2% among all 429 cities. As figure 2 shows, the highest number of votes for the reformist party came from the south eastern, southern, northern, north western, and western sectors of the country.

As for the conservative party, the highest votes were from Boshagard (68.1%) in Hormozgan, Zaveh (79.6%) in Razavi Khorasan, and Rashtkhar (77.1%) in Razavi Khorasan. The fewest number of votes for the conservative party appear to come from Sib and Sooran (4.4%) in Sistan-o Baluchestan, Bastak (5.5%) in Hormozgan, and Mehrestan (5.9%) in Sistan-o Baluchestan. The average number of votes for the conservative party among 429 cities contributed to 42.23% of total votes and a standard deviation of 15.66%. The spatial distribution of votes for the conservative party are primary centralized in the eastern and north eastern areas of the country.

Figure 3. Spatial Distribution of Presidential Election Results across Cities of Iran



Source: Authors

4. 3. Spatial Analysis of Presidential Election Results

4. 3. 1. Spatial Weights Matrix

The first step to ESDA consists of establishing a spatial weight matrix, which can be defined in various ways and is incorporated to account for the factor of contiguity (neighborhood) of data. For an N-sized set, the spatial weight matrix W is defined as an $N \times N$hollow matrix (diagonal entries are all zero). Each element of the matrix (W_{ij}) shows the degree to which region i impacts region j. The weighted matrix represents the structure and intensity of spatial impacts and can be a contiguity or distance-based matrix. The Queen Contiguity matrix (consisting of 0s and 1s) was employed in this study with the condition that if region i shares a common border with region j, even at a single point, they are considered neighbors (contiguous) and therefore $W_{ij} = 1$; otherwise, if no common boundaries exist between the regions, $W_{ij} = 0$ and they are not considered contiguous (Hataminezhad et al., 1392 [2014 A.D.]).

4. 3. 2. General Spatial Autocorrelation

Table 2 shows the results for the Moran's I index based on percentages of candidate votes per county. As illustrated, the null hypothesis indicating random spatial distribution of candidate votes is rejected. By method of permutation, with a total of 999 random permutations, the obtained results are at a significance level of 0.001; therefore, the distribution of election votes shows a significantly positive general spatial autocorrelation, which is indicative of the spatial clustering of votes in Iran. This means that cities with a high number of votes given to one candidate were also in proximity to cities with a high number of votes for the same candidate and vice versa; i.e., regions with a low number of votes for a specific candidate tend to be closer to each other.

Table 2. Moran's I Index for Urban and Rural Unemployment among Cities of Iran

Variable	W Binary weight matrix		
	Moran's I	Z-value	P-value
Rouhani	0.4385	14.189	0.001
Raeesi	0.4655	15.194	0.001
Mirsalim	0.5314	17.837	0.001
Hashemitaba	0.5190	17.096	0.001

Source: Data taken from Molaei Qelichi, 2017

These results suggest the importance of geography and location, which come into play when comparing election results on a general scale, when the number of votes for a candidate from a specific county are compared to the average number of votes from all cities. However, under such circumstances, one cannot make claims as to spatial randomness or decorrelation, since Moran's I cannot distinguish between high value and low value spatial clusters. This highlights the importance of local indicators of spatial autocorrelation, which help identify a specific spatial cluster for a given cluster pattern denoted by its own Moran's I value.

4. 3. 3. Local Spatial Autocorrelation

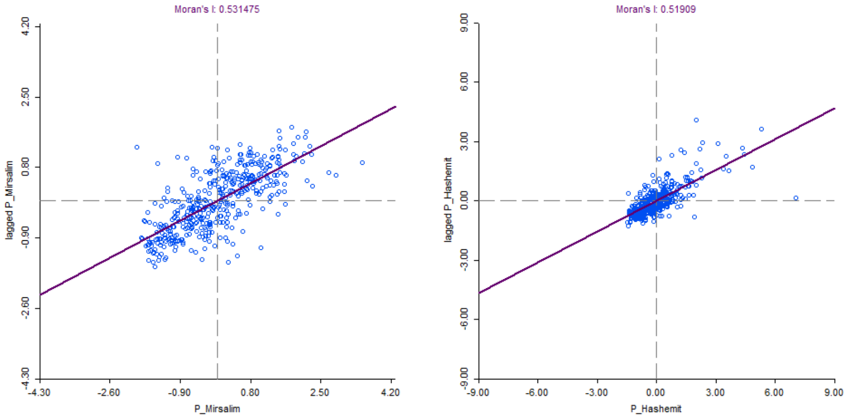
4. 3. 3. 1. Moran's Scatter Plot

Anselin (1998) defines Moran's scatter plot as: a state which allows for the analysis of the link between general spatial autocorrelation (line tangent/slope) and local spatial autocorrelation (local patterns in scatter plots), provided that variables are defined in standard forms (zero-average and one standard deviation of the mean). The analysis of local spatial autocorrelation is done using the quantiles of the scatter plot, as follows: positive correlation among high values is found in the upper right quantile (HH); for low values in the lower left quantile (LL), negative correlations among high value surrounded by low values are positioned in the lower right quantile (HL)' and finally negative correlations among low values surrounded by high values can be observed in the upper left quantile (LH).

In the case of similar values, Moran's scatter plot indicates the general trends, which also coincide with positive spatial autocorrelation. The plot can also be used to identify spatial irregularities, which consist of regions with outlier values, which is considered a characteristic of their neighboring values; i.e., regions that have deviated from their general pattern of positive spatial autocorrelation. Figure 4 illustrates Moran's scatter plot obtained for the presidential elections in Iran using Queen's weighted contiguity matrix.

Results from the Moran scatter plot for Rouhani's votes reveal that 38.93% of cities were within the HH quartile, 32.4% in LL, 15.62% in LH, and 13.05% distributed in the HL quartile. For Raeesi, the corresponding values were 34.26% of cities in HH, 39.86% in LL, 12.82% in LH, and 13.05%in HL. For Mirsalim, 40.09% of cities were within the HH quartile, 41.72% in the LL, 9.32% in LH and 8.86% in HL. Finally, for Hashemitaba, quartiles HH, LL, LH, and HL consisted of 28.9, 44.75, 12.6, and 13.75 percent of cities, respectively (figure 2).

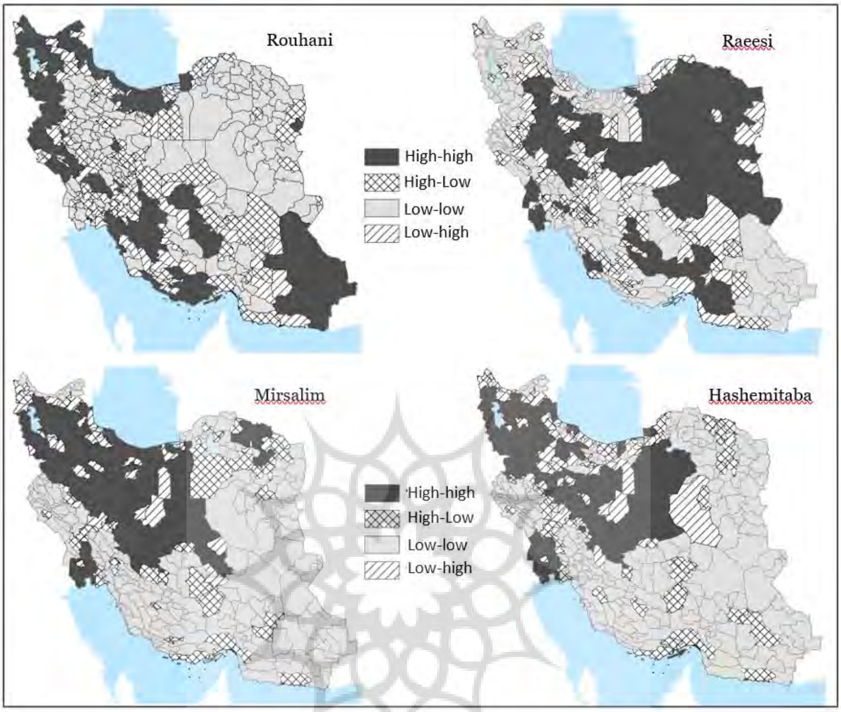
Figure 4. Moran's Scatter Plots of Presidential Election Results



Source: Authors

Mapping Moran's scatter plots can help make it more understandable (figure 4). The symbology used for this purpose categorizes regions located within the HH quartile as HH regions, and accordingly so for the rest of the quartiles. As the final map shows, HH regions for Rouhani are primarily located in the northern, north western, western, southern, and south eastern sectors of the country, while Rouhani's LL regions are distributed in the central, eastern, and north eastern sectors of Iran. HH region for Raeesi are found to the central, south-central, and north eastern sectors of the country, and LL regions in the North West, north, south, and south east.

Figure 5. Moran's Scatter Plot Maps for Percentages of Votes for Presidential Candidates



Source: Authors

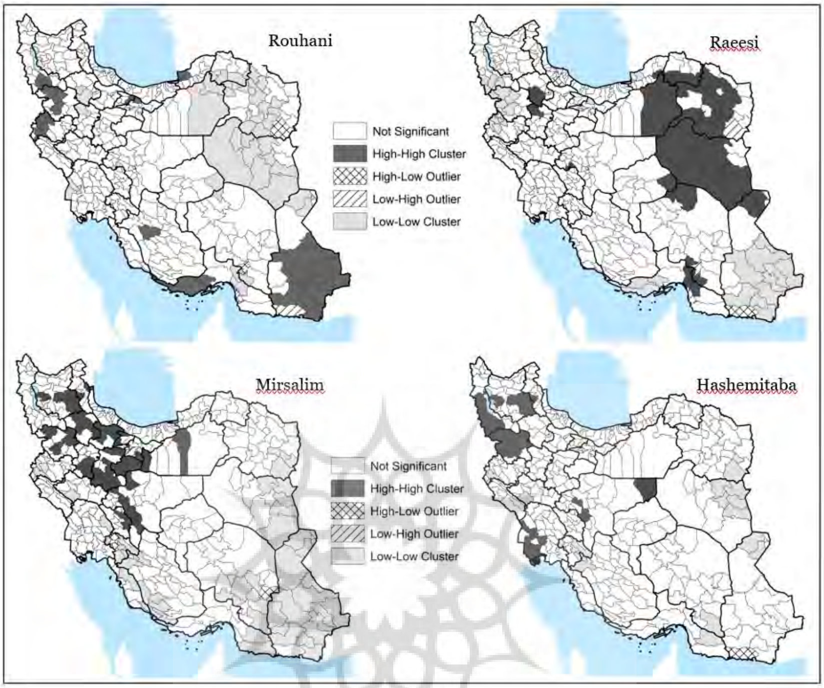
The obtained map from Moran's scatter plot, however, cannot assess the significance of regions located in quartiles HH, LL, HL, or LH; and therefore, only acts to provide a perspective for planning executives, and in no way gives a comprehensive understanding of the mechanisms at play. Since Moran's scatter plots provide no significant results, LISA statistics must be used to evaluate new patterns.

4. 3. 3. 2. LISA

Previous results showed that the spatial distribution of election results across the various cities of Iran had positive spatial autocorrelation, with some cases of spatial heterogeneities. Using LISA indices, one can determine which specific patterns contribute to the general spatial autocorrelation; i.e., cluster centers. The LISA statistic for each observation gives a measure of significant spatial clustering of regions with similar value regions in the surroundings; alternatively stated, LISA measures the degree to which a specific distribution of surrounding regions (values) of a given location deviate from the standard mean (Anselin, 1995, p. 94).

Base LISA patterns for election results were obtained by way of permutation and with respect to a significance level of 0.05 (figure 4). Results from the Queens weighted matrix indicate that certain regions have deviated from the standard mean, proving the feasibility of LISA analysis in revealing HL and LH regions (with spatial exceptions) (Boix & Stokes, 2009). LISA analysis of Rouhani's results indicates three main HH clusters scattered across cities located in the south eastern, southern, and western sectors of the country, with a single LL cluster to the north east. One HH and two LL clusters were found for the case of Raeesi, in the north east and the south eastern and western sectors of the country, respectively.

Figure 6. LISA Cluster Maps for Presidential Elections



Source: Authors

4. 3. 4. Distribution of Election Results and Social-Economic Factors

Correlation analysis was carried out to assess the relationship between the distribution of votes and social and economic variables. The results revealed that votes tallied for Rouhani had positive and significant correlations with factors of relative population aged 25 to 64, relative student population studying at higher education, ratio of university educated population, unemployment rates, rental rates, housing quality, and rate of urbanization in all cities. The percentage of votes given to Rouhani in each county showed a negative significant correlation with variables of relative population aged 0 to 24, percentage of population above 64, public employment rates, ratio of households with disabled members, house ownership, and ruralization rates (table 3). Correlation results for Raeesi also show a positive and significant correlation between percentage of votes for Raeesi from each county and the following parameters: relative population aged 0 to 24, population above 64, employment rates, ratio of households with disabled members, house ownership and ruralization rates; a significantly negative correlation was also found between Raeesi's votes from each county and relative population aged 25 to 64, ratio of higher educated population, percentage of university educated population, unemployment rates, rental rates, housing quality, and rate of urbanization (Barker & Carman, 2009).

Table 3. Correlation Analysis of Election Results with Respect to Social-Economic Variables

Variable	**Corr. Coefficient**	**Sig. level**	**Corr. Coefficient**	**Sig. level**	**Number of samples**
	Rouhani's votes		Raeesi's votes		
Relative population aged 0-24	0.163-	0.001	0.181	0.00	397
Relative population aged 25-64	0.224	0.00	0.201-	0.00	
Relative population above 64 years old	0,158-	0.002	0.151	0.003	
Literacy	0.029-	0.569	0.016	0.754	
Higher educated student population	0.202	0.00	0.216-	0.00	
University educated population	0.159	0.02	0.164-	0.01	
Employment rates for populations aged 10 years above	0.229-	0.00	0.221	0.00	
Unemployment rates for populations aged 10 years above	0.251	0.00	0.241-	0.00	
Households with disabled members	0.142-	0.005	0.150	0.003	
House owners	0.120-	0.017	0.122	0.015	
Tenant households	0.175	0.00	0.190-	0.00	
Housing quality (water, electricity, gas, kitchen, bathroom, toilet)	0.203	0.00	0.210-	0.00	
Urbanization	0.138	0.006	0.158-	0.002	
Ruralization	0.139-	0.006	0.159	0.001	

Source: Rennwald & Pontusson, 2021, p. 42

5. Conclusion

The various dimensions of electoral geography were investigated in this study using effective spatial data. The study data, proceeded with an assessment of different election patterns and the geographical factors therein to obtain an understanding of the relationship between the distribution of election results and social-economic factors through correlation analysis. The study was implemented using spatial geography models in Arc GIS software to map differences in spatial distribution of voting results extracted for each candidate. The results , consistent with Crouplet maps, indicate the significance of regional contiguity, especially in the case of votes tallied for Raeesi and Rouhani. Moreover, voting patterns also found to be influenced by ideological, ethnic, and religious variables. Study results, to show that the political decision of voters and the geographical distribution of votes in different regions can be studied from the perspective of existing spatial patterns. Because, these geographical and spatial patterns of votes reflect the differences and tendencies of various social-economic or ethnic, and racial groups. The findings further suggest the more diverse tendencies among people in a specific region led to less contiguous election results for that region. The present study also found a negative correlation between percentage of votes obtained for Hasan Rouhani in the eleventh and twelfth presidential elections in Iran and the following parameters: relative population aged 0 to 24, percentage of population above 64, public employment rates, ratio of households with disabled members, house ownership rates and rate of ruralization. To put more accurately, the hierarchy of needs included votes from ecologic minorities and factors of political economy and patterns of voting. Ultimately, it can be concluded that the obtained findings have been influenced primarily by the type of political action and behavior of the three pillars of elections; namely executive and supervisory governmental institutions, patterns of competition among political parties, and electoral behavior patterns of the public and social groups in Iran.

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