

# Investigating Spatial Distribution of Regional Quality of Life (RQoL) in Iran Between 1996 and 2011

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**Abstract** The issue of quality of life has found a growing place in the field of urban and regional studies in recent decades. Although many studies have tried to investigate the subjective and objective aspects of quality of life especially in the urban and rural contexts, a few studies focused on regional levels. Therefore there is a necessity for these kinds of researches to assess the quality of life conditions in the specific territory. The main objective of this article is to investigate spatial patterns of the regional quality of life (RQoL) in Iran using objective indicators, over the period of 15 years. In this way, the changing process of objective quality of life will be investigated. Using descriptive—analytics and comparative method of research, five factors including economic-cultural, political-institutional, socio-geographic, health and infrastructure were extracted and analyzed using principle component analysis and composite index. The temporal analysis shows that from 1996 to 2011, RQoL in Iran has significantly increased in all regions; and economic factor considered as a main reason for this positive change; the results show that Tehran has the high quality of life conditions amongst the regions. Isfahan and Khuzestan are in a very good state. Also, the QoL in the western regions increased significantly faster than eastern regions. Sixty-five percent of regions have improved in quality of life with a moderate fluctuation rate. Although, the level of regional homogeneity has gradually increased over the course of 15 years, but RQoL does not show a specific central or scattered pattern, demonstrating a random scattering in Iran territory.

**Keywords** Regional quality of life (RQoL) · Objective indicator · Spatial distribution · Principle component analysis (PCA) · Composite index · Iran

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## 1 Introduction

Since the second half of the twentieth century, the quality of life (QoL) is considered as an important concept, used, by scholars, social scientists and policy makers (Mokhtari and Nazari 2010). Three periods in the historical background of QoL can be identified. The first period which lasts to 1960s, mainly focused on economic growth and materialistic ideas. Due to the negative results of economic growth and emerging of sustainability theories, in the 1970s and 1980s, the QoL mostly concerned social and environmental issues (Ghaffari and Omid 2009); it was a multi-dimensional concept which included many indices in this field of study (Wish 1986; Cabello and Eras et al. 2014). In the third period (1990s), the mentioned subjects changed the nature and the approach of QoL studies in different scales. They were mainly focused on social structure, social capital, social right, and other related concepts (Ghaffari and Omid 2009). In general, QoL is a complex concept related to different aspects of social, spatial, economic, psychological and physical health, with various measuring units in different disciplines (Kokabi 2005; Gulersou-Zeren et al. 2009; Li and Weng 2007); these disciplines with different approaches try to measure, evaluate and explain this particular concept based on their knowledge.

Nowadays, the concept of QoL is considered as a universally accepted theoretical framework in evaluating various communities; it focuses on both individual and collective aspects as well as macro and micro levels (Haq and Zia 2013; Hagerty 1999; Sirgy et al. 2005). Researches with objective dimension, for example considering socio-economic indices at local, regional, or national level, can be used to assess the level of living quality (Hagerty et al. 2001). Thus, according to Lambiri et al. 2007, the importance of QoL lies in the sake of the analytical ability of this concept as a policy tool by governmental institutes in order to make important decisions. Considering this fact, most of the problems considering QoL in different levels, relate to geographical aspect (Frazier 1982) which alters in different places and in various scales (Andráško 2008). This paper studies a geographical aspect of QoL by using secondary data as objective indicator. The theories and empirical studies of QoL mainly stem from western countries (Teshfaghzi et al. 2009). Such studies are seldom in developing countries, particularly in Iran. In Iran, the main factors affecting people's QoL have not been clearly identified (Rezvani et al. 2013) in this level. Many studies tried to investigate the subjective and objective aspects QoL on micro level mainly in the urban and rural contexts such as Zebardast (2009) in Tehran metropolitan fringe, Malekhosseini and Joodaki (2011) and Rezvani et al. (2013) on Noorabad city; Houshyar and Valizadeh (2013) on rural area of Shahindezh; Rahnama et al. (2013) on Saqqez city., but a few studies concerned with regional levels. Given that the spatial level of analysis is most relevant for policy purposes aimed for improving QoL (González et al. 2010); assessing the QoL conditions in the specific territory seems necessary for these kinds of researches. The main objective of this article is to investigate spatial distribution of the regional quality of life (RQoL) in Iran using objective indicators, over the 15 years period. Therefore, the changing process of objective QoL will be investigated. In addition to the importance of macro level study of QoL, this paper intends to investigate a spatial pattern from the geographical point of view to analyze the level of homogeneity across Iran.

The paper includes three sections. In first section, the concepts, theories and views on the QoL will be presented. In the second section, the methods of research and RQoL related data will be discussed. And finally in the last section, the results of findings and

discussion on RQoL across Iran using spatial patterns and analytical tools will be illustrated along with the concluding remarks.

## 2 Concepts, Theories and Views on the Quality of Life

The term of QoL involves multiple definitions which is the result of three different factors. First, multi-dimensional structure of the term; second, the application of the concept in different areas of study such as medicine, psychology, human geography, development studies, economic and sociology; the last but not the least factor is the level of analysis that can be concerned with processes, structures, opportunities, and actors (Ghaffari and Omidi 2009). Ghaffari and Omidi (2009) define QoL in four different terms: 1—Satisfaction of “having”, which refers to an accessibility to opportunities and amenities; 2—Satisfaction of “relation”, which refers to a social relationship; 3—Satisfaction of “being”, which refers to a personal opinion about him/herself and self-definition, it also refers to meaningfulness and control on his/her life against Alienation; 4—Satisfaction of “action”, which relates to a leisure time. Liu (1976) employs three approaches to define QoL: 1—based on its elements (such as happiness, satisfaction, wealth, life style, etc.); 2—by applying social subjective and objective indicators such as GDP, health, welfare and education; 3—based on affecting variables and changing situations and contexts. According to Baldwin (1994), QoL is an ambiguous term which is considered as a result of the way individuals think about their situation; he refers to cultural and environmental conditions in which member of certain society live in. In general, QoL refers to satisfaction of life in individual and collective manner (Diener and Suh 1997). In more practical sense, QoL is considered as a general term which includes all the tangible and intangible dimensions of life. It also refers to the degree of satisfaction which relates to objective and subjective aspects of human life (Szalai 1980) such as financial satisfaction, basic needs, personal development, ecosystem health and self-awareness. Based on the above issues, two levels of QoL can be identified: micro (individual-subjective) and macro level (collective-objective). Micro level mainly focuses on individual experiences such as income, employment, housing quality, education, health and other environmental concerns (Pacione 2003), in other words, the subjective matters which can be obtained through primary data collection. Subjective approach is generally applicable on local level (rural and urban areas), and requires a thorough survey dealt with people’s (both individual and collective) perception about amenities and the level of accessibility to basic needs. In fact, it focuses on personal values and opinions (Lora and Powell 2011). It should be noted that, collective data are also useful in obtaining the subjective QoL; for instance, the collective perception of safe and secure neighborhood by its citizens (Foster et al. 2010). In fact, some data which relates to subjective matters can be gathered through collective approach. On the other hand, macro QoL is generally concerned with objective approach, for which the data can be achieved through analyzing secondary data. Secondary data refers to official census reports which are collected in certain periods of time (Sajeva et al. 2012). Yet, some objective data can be achieved through field survey and based on individual approaches. For example, the monthly expenses can be obtained through census survey which is also considered as an individual data. However, objective indicators are mostly concerned with tangible issues and measurable aspects of life such as socio-economic status in different geographical contexts (such as local, regional and etc.) (Lora and Powell 2011). The main purpose of the objective method is to measure the tangible societal condition in different

**Table 1** Previous studies on RQoL

Title	Authors	Journal	Aspect	Geographical level	Methodology	Indicators	Results
Integration of landsat thematic mapper and census data for quality of life assessment,	Lo and Faber	Remote sensing of environment (1997)	Objective-subjective	County	Principal components analysis and geographical-information-system overlay of ranked data layers	Population density, per capita income, median home value, and percentage of college graduates	Strong negative correlation with “per cent of urban use” and “surface temperatures”, is in turn strongly correlated with per capita income, population density, and median home value
Pattern of regional disparities in socio-economic development in India: district level analysis	Ramphul Ohlan	Soc Indic Res (2013)	Objective	Regional	Wroclow taxonomic technique	Regional socio-economic disparities in India (agriculture, industrial and infrastructural)	India’s Southern region is far more and symmetrically developed in comparison of Central and Northern regions Wide disparities in the level of socio-economic development exist among different districts within and between different regions of India
Quality of life in the regions: an exploratory spatial data analysis for West German labor markets	Karsten Rusche	Jahrb Reg Wiss (2010)	Objective	Regional	An exploratory spatial data analysis, regression	Economic (price of land household income labor market)	Spatial inequality with a QoL respect between northern, central and southern regions of Germany The regions with the highest quality of life are found solely in southern Germany
Spatial inequality and development—is there an inverted-U relationship? Period: 1980–2009	Christian Lessmann	Elsevier B. V. (2013)	Objective	56 countries	Parametric and semi parametric regressions	Economic (regional GDP, urbanization, ethnic)	Strong support for the existence of an inverted-U Spatial inequalities increase again at very high levels of economic development

**Table 1** continued

Title	Authors	Journal	Aspect	Geographical level	Methodology	Indicators	Results
Multidimensional wellbeing: an index of quality of life in a developing economy 2006–2007	Rashida haq and uzma zia	Soc Indic Res (2013)	Objective and subjective	National level (Pakistan)	Principle component analysis	Education-health-life condition-economic condition	Substantial variation in human wellbeing among districts of Pakistan Disparity in objective condition and in subjective perceptions are adequately depicting wellbeing differences
Quality of life and spatial inequality in London	Paul Higgins et al.	European urban and regional studies (2014)	Objective and subjective	London (outer and inner part of London)	K-means clustering analysis	73 indicators, 10 distinct RQoL themes: community safety, health/social well-being, environment, economic well-being, community cohesion, housing, education/life-long learning, culture and leisure, transport, and people and place	Other parts of England are doing much better than 'Global' London in sustainable QoL terms Spatial inequality is mostly around the pertinent themes of health, education and community safety
Parallels between objective indicators and subjective perceptions of quality of life: a study of metropolitan and county areas in Taiwan	Pei-shan Liao	Soc Indic Res (2009)	Objective and subjective	Metropolitan and county level	Factor analysis (PCA)	Medical services, domestic finances, work, education, leisure, public safety, and environmental quality	There is no significant correlation between objective indicators and subjective perceptions, except in education and environmental quality

Source Lo and Faber (1997), Ohlan (2013), Rusche (2010), Lessmann (2013), Haq and Zia (2013), Higgins et al. (2014), Liao (2009)

fields of study related to demographical subjects (Basekha et al. 2010). Four characteristics of human activities which can be calculated with objective indicators are economic, prosperity and welfare, social structure and environmental quality (CEMI 1997). As it was mentioned, QoL can be studied using different approaches and for different purpose. Since the main objective of this study is to identify the geographical and spatial patterns of QoL in relation to the process through which these patterns are obtained, this section focuses on geographical dimension.

The first practical application of QoL concept began with a focus on environmental and psychological approach in the 1960s (Sirgy et al. 2005; Das 2007; Li and Weng 2007). Since 1970s, this field of study mainly employed the geographical and spatial approach. This approach mostly concerned the poverty, health, hunger, crime rate and environmental pollution and their effects on human lives (Smith 1994). Since the emergence of QoL discussion in the geographical context, the beginning of spatial studies on its subjective and objective aspects, individual and collective welfare study which has a context based origins, the geographical dimension of QoL came forth. The first scholars, who applied the concept of QoL were Smith (1973) and Knox (1975). Their studies had quality-based approach and included human life indicators such as income, employment, housing and living environment, physical and mental health, education, social and geographical status. They tried to answer this question that “who is going to achieve what?” by evaluating above indicators in macro and micro levels, also by analyzing geographical differences in human life style (Smith 1979). Other practical and theoretical studies that were conducted in the geographical context can be identified in different disciplines and scholarly studies. Some examples on national and international scopes can be found in practical researches of Lessmann (2013), Henderson et al. (2000), on regional and sub-regional level, Ohlan (2013), Rusche (2010), Lo and Faber (1997), Boyer and Savageau (1981) studies can also be recognized. On micro level (urban–rural level) Pacione (1986), Schneider (1975), Andráško (2008), Weber and Hirsch (1992), Li and Weng (2007), Higgins et al. (2014) had significant works. The Table 1 represents the number of main researches that have been conducted on a macro level in a spatial context since 1997.

### 3 Measuring Objective Quality of Life in a Spatial Context

The first step for evaluating RQoL is to adopt proper indicators based on certain spatial contexts. These indicators can be obtained through theoretical as well as practical studies. The extracted indicators should be both case- and context-oriented; they should also be limited to the statistical data and attainable information. There are different objective oriented indicators that can be employed in these kinds of researches; the most important and effective one is an economic factor which often refers to GDP rate of regions, employment rate and other similar issues. The second most important aspect is social factor which can be identified through community life, gender equality and educational system. Geographical and health related factors form other impactful aspects that change the QoL status in different regions. Other factors such as cultural, environmental and political due to availability of data can be included in QoL studies. QoL researches should concern these dimensions, choosing the right indicators, the crucial step that is taken in this section.

In addition to the indicators introduced and explained in previous section in Table 1, several other practical studies which extracted and used QoL indicators in evaluating regional contexts are recognizable. For instance, in 2005 the economics intelligence unit

index (EIU) introduced six indicators applicable in macro level studies. They included political stability and security, material wellbeing (GDP per person, at PPP in \$), health (life expectancy at birth, years), job security (unemployment rate, %), community life (political freedom, gender equality) and climate (to distinguish between warmer and colder climates). International living website published a version of its research on international QoL in 2010, which employed the following indicators: cost of living (income tax rate), economy (interest rate, GDP, GDP growth rate, GDP per capita, the inflation rate, and GNP per capita), health (the number of hospital beds per 1000 people, the percentage of the population with access to safe water, the infant mortality rate, life expectancy), safety and risk (unhealthy or dangerous living conditions), culture and leisure (literacy rate, primary and secondary school enrollment ratios, number of people per museum), freedom (citizen's political rights and civil liberties), climate (average annual rainfall and average temperature), environment (population density per square kilometer, population growth rate, greenhouse emissions per capita, and the percentage of total land that is protected), infrastructure (length of railways, paved highways, and navigable waterways, the number of airports, motor vehicles, telephones, internet service providers, and cell phones per capita) ([www.internationalliving.com](http://www.internationalliving.com) 2010). There are several other studies which evaluate QoL based on similar indicators. Beside limited accessibility to proper data set, especially regarding 15 years period, the main reason for choosing such collection of data are listed below:

### 3.1 Economic

GDP is considered as a crucial economic indicator in QoL studies (see Lessmann 2013; EIU 2005; [www.oecdbetterlifeindex.org](http://www.oecdbetterlifeindex.org)). It represents the level of economic activities in each region although it is not the only economic indicator in this particular field. In additions, degree of accessibility to public amenities (safe water, gas and electricity) and employment rate are also considered as important indicators which evaluate individual approach of objective QoL. Also, rate of urbanization shows an access to better services and life condition in comparison with rural areas especially regarding economic dimension.

### 3.2 Health

Life expectancy along with number of health institutions and number of divorces per marriages illustrate the living condition of each region regarding health issues (both collective and individual health).

### 3.3 Geographical

Climate is considered as an important indicator to evaluate environmental comfort which indicates a favorable place to live. Annual rainfall and average temperature are two useful indicators which depict degree of comfort and livability of one region, and distinguish warmer and colder climates (Baskha et al. 2010).

### 3.4 Social

Education explains socio-cultural condition of a region and number of educated people affects QoL. Increase in the rate of population density causes more demands in all the

areas, therefore, it has social consequences. In fact, this is a multi-faceted dimension which affects several areas of RQoL. Based on several studies, political participation represents the level of satisfaction of citizens of one region about governmental acts and policies. Also it can be interpreted as level of freedom in one country (Estes 2004; Higgins et al. 2014; [www.oecdbetterlifeindex.org](http://www.oecdbetterlifeindex.org)). Although, indicators such as political participation and gender equality can be assessed by many other variables, but lack of essential data, limits these kinds of studies. Furthermore, education, number of security problems is a determinant indicator in assessing RQoL.

### 3.5 Cultural–Recreational

In this field, number of active cultural facilities, indicates cultural interest of a region and citizen demands for desirable and happy environment.

Obviously, many other indicators may better evaluate QoL. However, due to the lack of data, they could not be used in this study. Also, there is a fine line between each dimension; for example, some indicators such as insurance rate or urbanization can be put in other group of dimensions. Since selecting appropriate indicators is the first and most important part of this study, five factors and 18 indicators were extracted and presented in Table 2; indicators were selected based on objective approach in regards to regional level.

**Table 2** Dimensions and indicators of RQoL employed in this study

Dimensions	Sub-dimensions	Indicators
Economic	Welfare	Gross domestic product (GDP)
		Electricity (amenity 1)
		Gas (amenity 2)
		Water (amenity 3)
	Job security	Employment rate of persons aged 10–65 years old
	Urbanization	Percent of population who lives in urban areas
Health	Family health	Life expectancy at birth
		Number of health institutions per 1000 persons
	Family life	Divorce rate
Geographical	Climate	Annual rain fall (mm)
		Average temperature (°C)
Social	Education	Literacy rate of persons aged 6 years old and older
	Demographic	Population density
		Insurance rate
	Political participation	People (eligible individuals) that vote in presidential elections
	Gender equality	Rate of accepted women in universities
	Security	Number of security problems: homicides, burglaries, poisonings, brawls, assaults and street fights, over the course of a year
Cultural-recreational	Cinemas	Number of active cinemas, libraries and cultural centers per 1000 people
	Libraries	
	Cultural centers	

Source authors based on previous studies



In order to more explanations, for instance, Gross domestic product was calculated per each region. Amenities were calculated based on the number of households who have access to safe water, electricity and gas resources in each region (both rural and urban areas). Job security was calculated using following formula; (employment rate of persons aged 10–65 years old)  $\times$  100. Also, divorce rate was obtained using the total number of divorces to the total number of marriages over the course of a year  $\times$  100. Education indicator was calculated based on the number of literate persons aged 6 years old and older to the total number of persons aged 6 years old and older  $\times$  100. Insurance rate explains the number of health-insured individuals/population of each region  $\times$  100. Political participation rate was calculated applying the number of people who vote in presidential elections to the total number of eligible people who can vote  $\times$  100. Gender equality was calculated based on the total number of accepted women in universities to the total number of accepted men  $\times$  100.

## 4 Methods of Research

### 4.1 Research Design

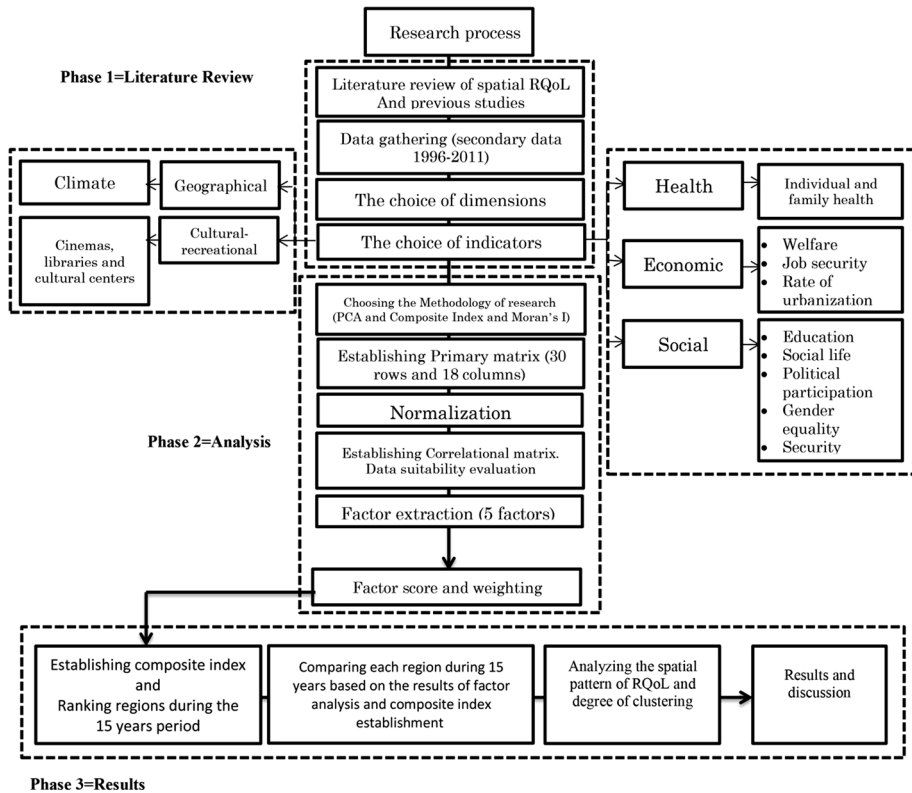
In order to achieve the main objective of this research, descriptive—analytic and comparative method were adopted and applied in this paper. Secondary data from Iran's annual census report (1996–2011) in 30 regions was used. Because of the lack of information on the newest region—“Alborz” since 1996—Alborz were eliminated from evaluation process; and the statistical data of Alborz were presented and analyzed in combination with Tehran. Five factors and 18 indicators were analyzed and were extracted using principle component analysis method (PCA). SPSS 21 software was used for the analysis. The RQoL of Iran was evaluated using composite index; and the overall image of spatial RQoL distribution were captured and illustrated by ArcMap 10.2. Also, using autocorrelation analysis (Moran's I and Anselin Local Moran's Index) degree of clustering were depicted. The total process is presented and elaborated thoroughly in the following section. As it illustrated in Fig. 1, this paper includes three phases: literature review, analysis and results section, each of which including certain subcategories. In this section, data gathering, methodology, analysis phases and adopted software are introduced in a hierarchical order.

### 4.2 Data Collection

After choosing the main indicators based on previous studies, secondary data were obtained from general censuses report (1996–2011) and statistical year Book of Statistic Center of Iran. 18 indicators were created based on selected data from demographical report of each region during 1996–2011. The significance of choosing the 15 years period is the availability of statistical data as well as the feasibility of illustrating the spatial changes in regional context.

### 4.3 Study Area

The scope of this paper is Iran's regions divided based on political- administrative boundaries. According to the latest division of the country, Iran is divided into thirty-one regions (*ostāns*). Each region is governed by an appointed governor. Mazandaran, Gilan, Kermanshah, Kerman, Fars, Khuzestan and Isfahan are the oldest regions in the area and



**Fig. 1** Research processes

the date of their establishment goes back to 1937. According to the recent division of the country, Alborz is considered as the newest regions since it was established in 2010. In the case of area, Sistan Baloochestan has the highest area (with the area of 181,785 km<sup>2</sup>) and Alborz is the lowest (with the area of 5122 km<sup>2</sup>) amongst all. The total area of Tehran has reduced during 15 years since the establishment of Alborz in 2010. Another great change that has happened during this period is the separation of three regions of Southern, Northern and Razavi Khorasan from the original Khorasan region in 2004. Also, during 1996 and 1997, Qazvin and Golestan formed separating from Zanjan and Mazandaran. Tehran, with a population of 1,218,339, is the capital and the largest region in Iran; it is the cultural, commercial, and industrial center of the nation. The least populated region is Ilam with the number of 557,599 people (Iran's Statistic Yearbook 1996–2011) over the 15 years period; all the regions experienced population growth, with highest rate of 2.6 in Hormozgan. The total area of 13 regions has increased during the 15 years especially the area of yazd which changed from 7346 to 129,285 km<sup>2</sup>. This is due to transference of Tabas County (area: 55,344 km<sup>2</sup>) from Khorasan region to Yazd in 2002, which caused the change in the total area of Yazd in a short period of time (Iran's Statistic Yearbook 1996–2011). Statistical reports show an increase in number of small and intermediate regions, indicating the balanced distribution of total population in the country. But they do not necessarily represent positive changes in RQoL status of Iran. In the following section, the quality of 30 regions in Iran is evaluated based on annual statistical report.

#### 4.4 Choice of Method

Several methods were adopted in previous studies for measuring QoL on a regional scale such as PCA method, regression, etc. However, most of them used factor analysis and PCA methods which caused applicable and desirable results. Part of this research is also conducted on PCA method. PCA is a statistical tool that uses an orthogonal transformation to convert a set of observations of possibly correlated variables into a set of values of linearly uncorrelated variables called principal components (Ohlan 2013). The primary purpose of PCA analysis is to reduce the original number of explanatory variables to a smaller number of independent factors in terms of which the whole set of variables can be understood (Haq and Zia 2013). Although, this is a very useful method for the evaluation of QoL index, it does not depict the whole picture of QoL by itself. In other words, other tools should be used to fully demonstrate the QoL of each region. So, composite index were chosen as a complementary tool in this study. Composite index is considered as a single index for evaluating the overall QoL, especially in a case of different time period. It is known as an optimum tool which is also applicable in regional ranking based on summation of all factors weight (Booyesen 2002). According to Salzman (2003) and Mazziotta and Pareto (2013), phenomenon such as QoL requires combination of different dimensions which can be obtained by applying methodologies such as composite indices. This index is used to rank different areas based on their features, in this case RQoL. Composite index can be obtained through different techniques and it depends on some fundamental steps. Choosing suitable indicators, normalization (make indicators comparable and bring them all to the same standard) and aggregation and weighting of indicators (it combines all the indicators and includes different techniques) are the most important steps in constructing a composite index (Mazziotta and Pareto 2013). Therefore, in this study, indicators were selected according to their relevance to RQoL phenomenon, also based on their accessibility. In order to evaluate the data suitability the KMO and Bartlett's test were used. After normalizing the indicators using z-score (standardization) technique, in order to reduce the number of indicators also to aggregate and weight them, PCA method was applied. In order to construct the composite index, the factors obtained should be transformed though normalizing them. A min–max normalization was applied using the formula:

$$\frac{Fs_i - Fs_{\min}}{Fs_{\max} - Fs_{\min}} \times 100 = TFS_i$$

$TFS_i$  = transformed factor score which is considered ad linear scale,  $Fs_i$  = factor score,  $Fs_{\min}$  = minimum factor score,  $Fs_{\max}$  = maximum factor score.

In the next step, weight of each factor was calculated using  $WLTF_i$  formula.

$$\frac{TF_i}{\sum_1^5 TF_i} \times 100 = WLTF_i$$

$WLTF$  = weighted linear transform factor,  $TF_i$  = each transformed factor score,  $\sum_1^5 TF_i$  = sum of all the factor scores.

This step helped to create composite index which led us to regional ranks. It was obtained through multiplying each TFs in  $WLTF$  and summing up all these results together using following formula.

$$\text{Composite index} = (TF_1s_i \times WLTF_1) + (TF_2s_i \times WLTF_2) + \dots + (TF_5s_i \times WLTF_5)$$

In this stage, by comparing the results of composite index, ranks of each regions regarding RQoL were calculated. This process was applied to each four periods (from 1996 to 2011) in order to compare all the regions of Iran (see Table 7). All the above analysis was conducted using SPSS 21 software. It should be noted that, composite index rate with higher value was ranked as the most qualified region and vice versa.

Afterwards, using Arc Map 10.2 the spatial distribution of RQoL across Iran was captured, classified and illustrated based on six qualitative groups. The natural break method was used for clustering six classes of RQoL (high, very good, good, average, very poor, poor). Regions with composite index rate below 40 units were valued as very poor in quality. Those with 40–70 units were valued as poor quality, and those with 70–100 were valued as average quality; 100–150 indicated good quality, 150–210 indicated very good and 210–420 represented high QoL. These categories were estimated using composite index calculation process. In order to conduct the accurate spatial distribution analysis, also to show the level of disparity in regions of Iran regarding RQoL Moran's I were used. Theoretically, the global Moran estimates the level of clustering. The Moran coefficient is defined as:

$$Moran = \frac{N \sum_{i=1}^N \sum_{j=1}^N W_{ij}(X_i - X)(X_j - X)}{\left(\sum_{i=1}^N \sum_{j=1}^N W_{ij}\right)(X_i - X)^2}$$

$N$  = number of the regions in Iran;  $X_i$  = RQoL in region  $i$ ;  $X_j$  = RQoL in region  $j$ ;  $X$  = is the mean of RQoL; and  $W_{ij}$  = denotes the weighting between  $i$  and  $j$ .

The Moran coefficient ranges from  $-1$  to  $+1$ , where positive values indicate that regions with similar values of RQoL are closely clustered; a value close to zero means random scattering, and a value of  $-1$  means a chessboard pattern of RQoL (Tsai 2005).

In order to identify the local spatial pattern, also capturing regional clusters and outlier in Iran, using composite index of each regions, Anselin Local Moran's I were calculated. Using the cluster and outlier analysis tool in ArcMap, analysis was conducted. This technique was applied in order to identify concentration of high/low values and spatial outliers. In order to interpret the results of this analysis, both local index and  $p$  value is required. A positive value for  $I$  indicates that region has neighboring a region with similarly high or low attribute values; which is also a part of a cluster. A negative one shows dissimilar values which surround a region; this region is considered as an outlier. Considering  $p$  value results [which should be small enough for the cluster or outlier to be statistically significant (below 0.05)], four types of output can be identified: cluster of high values (HH), cluster of low values (LL), outlier in which a high value is surrounded by low values (HL), and outlier in which a low value is surrounded by high values (LH). The following formula is used to calculate the local Moran's I (Baumont et al. 2004)

$$I_i = xi - \mu/m_0 \sum_j W_{ij}(xi - \mu) \quad \text{with} \quad m_0 = \sum_i (xi - \mu)^2/n$$

where  $X_i$  is an attribute for region  $i$ ,  $\mu$  is the mean of the corresponding attribute,  $W_{ij}$  is the spatial weight between regions  $i$  and  $j$ ,  $n$  as number of regions.

#### 4.5 Extraction of Factors and Ranking an Objective RQoL

Based on the available data of Statistical Centre of Iran from 1996 till 2011 and annual census report, 18 indicators were normalized and weighted. Weights and ranks of each indicator were evaluated through PCA method using SPSS 21 software. Based on the

results of KMO and Bartlett test, the set of chosen data were proper for this study (Table 3). Regarding the results of PCA, five factors were extracted. These factors contain 18 indicators (see Table 4), all of which included in the analysis, even the health insurance (the insurance rate) with the value of 0.475, mostly for its importance in evaluating RQoL. Accumulative variances were 75.84 which indicate the satisfactory range of obtained factors. The first principal component which includes economic and cultural explains 32.67 % variations. Factors number two, three, and four capture all socio-geographic and political factors; they explain 35.32 % variation. Fifth factor is correlated with infrastructure indicators that explained 7.85 % variation. Regarding the fact that each variable and data was considered as a positive variable, the ranking of each region increased with rise in value of factor's weights (Table 4). According to the following calculation, five standardized factors, were weighted and employed for ranking regions. The composite index is employed to rank each region. Table 7 shows the composite index of each region along with their ranks, over the period of 15 years (1996–2001 to 2006–2011).

## 5 Results

The aim of this analysis is to understand the differences between each region during the period of 15 years. In this section of the study, the changing trend of objective RQoL in the context of Iran will be described; having evaluated 18 indicators, five factors in a total manner followed by the overall status of the country will be explained. Then, based on factorial weight and total scores of each region between 1996 and 2011, each region and their changing trend will be compared. Finally, using ArcMap, spatial distribution of objective RQoL will be illustrated.

### 5.1 RQoL Analysis Regarding 18 Indicators (1996–2011)

The temporal analysis shows that from 1996 to 2011, RQoL in Iran has significantly increased in all regions; and economic factor considered as a main reason for this positive change. The main reason for this occurrence may be the improving rate of urban–rural amenities per households (increasing number of households who have access to water supplies (average growth in the accessibility to water resources = 200,000 households per 5 years), access to electricity (average growth in the accessibility to electricity = 250,000 households per 5 years) and access to gas resources (average growth in the accessibility to gas resources = 500,000 households per 5 years) as well as the increasing rate of GDP per regions (the average growth = 1E + 13 Rials per 5 years). In addition, other significant reason for this level of improvement relates to cultural–recreational indicator, which is caused by an average rise of 70 % in cultural and recreational amenities per region. The other positive indicators which caused noticeable improvement in this domain are: 40 % rise in the insurance rate, 61 % rise in the urbanization rate and 35 % rise in the gender

**Table 3** KMO and Bartlett's test

Kaiser–Meyer–Olkin measure of sampling adequacy	0.651
Bartlett's test of sphericity	
Approx. Chi-square	459.67
<i>df</i>	153
Sig	0

**Table 4** Factors and indicators, factor loading, % of variance, factor scores and weights

Domain (factor titles)	Indicators	Rotated factor matrix					Factor scores	Factors weight
		% of variance						
		32.67	12.76	11.65	10.91	7.85		
		Factors and factor loading						
		1	2	3	4	5		
Economic-cultural	Electricity (amenity 1)	0.965					28.67	50
	Gas (amenity 2)	0.951						
	Cultural-recreational	0.950						
	Water (amenity 3)	0.945						
	GDP (gross domestic product)	0.875						
	Education	0.582						
Institutional-political	Job security		0.746				8.73	15
	Political participation		0.730					
	Life expectancy at birth		-0.579					
Socio-geographic	Population density			0.739			7.3	12
	Annual rain fall (mm)			-0.702				
	Security			-0.593				
	Insurance rate			0.475				
Health	Average temperature (°C)				0.824		7.5	13
	Number of health institutions				-0.552			
Infrastructure	Gender equality					0.652	4.75	8
	Urbanization					-0.613		
	Divorce rate					0.554		

Extraction method: principle component analysis

Rotation method: varimax with Kaiser normalization

Rotation converged in eight iterations

equality rate. Given the fact that economic (with 32.67 % of variance and factorial weight with the value of 50) and socio-geographic indicators (with 11.65 % of variance and factorial weight with the value of 12) are rated higher than other ones; they have greater impact on RQoL. The increasing rate in security (an average 21 % reduction in security problems) and the rise in the life expectancy, (15 % reduction in infant deaths) also 75 % rise in number of urban-rural health institutions are the second reasons to cause improvement in QoL. All the diagrams indicate 10 % drop in family life (increasing divorce rate), considering the fact that this particular factor has a 2 point weight, it caused

a slightly negative impact on RQoL. Decreasing level of annual rainfall (85 mm) caused negative effect. Education rate, population density, and economic participation show steady process and have no particular effect on RQoL over the period of 15 years.

## 5.2 RQoL Analysis Considering Five Factors (1996–2011)

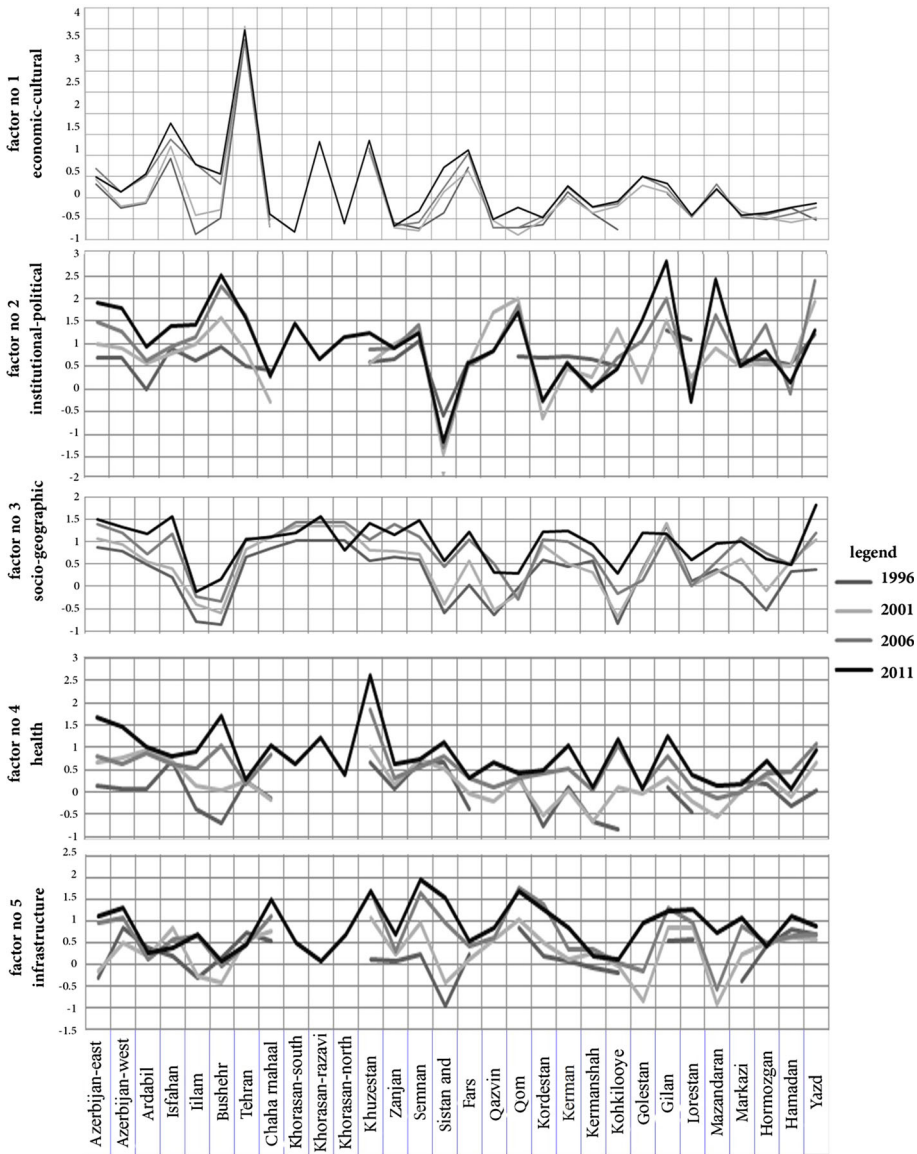
This section explains the condition of each region, based on the maximum and minimum scores and factor loading value from 1996 to 2011. Table 6 shows each factor scores considering each region in 1996–2011.

### 5.2.1 Factor No. 1

The factors which were extracted and weighted using factor analysis method (PCA) can be categorized in five groups: economic-cultural, political-institutional, social-geographical, health factors and infrastructure. The most effective one in comparison to other factors is the economic-cultural factor with 32.67 % of variation. This factor includes six indicators such as urban–rural amenities (water, electricity and gas), GDP per region, cultural–recreational and educational ones. Educational indicator has the lowest factorial weight and rural–urban amenities along with cultural indicators have the highest factorial weight; therefore the most affective indicators in ranking regions are those with the highest factorial weight and percent of variation. The table indicates that the region of Tehran achieved the highest score in economic-cultural factor, which explains the importance of this region from the RQoL point of view. Because of the fact that economic-cultural factor has the highest factorial weight and loading, it has the greatest impact on RQoL of each region in comparison to others. In addition to Tehran, Khorasan Razavi, Khuzestan and Isfahan regions achieved the high score in the context of RQoL. Ilam, Southern Khorasan and Kohgiluyeh and Booyer Ahmad achieved the lowest score in economic-cultural factor. The Fig. 2 shows the steady changes considering this factor during 1996–2011. According to the figure, there is no noticeable change in the trend of RQoL. Also insignificant differences between regions are recognizable (Fig. 2).

### 5.2.2 Factor No. 2

The second factor which is quite different with the first one, considering factorial weight, is political-institutional factor. The main reason for such naming can be related to the nature of this group in which three indicators (such as job security, political participation and life expectancy at birth) are included. The variance percentage of this factor is 12.76, which makes it to be the second most important factor in this research. Job security and political participation are the most impactful indicators in comparison to the others. In fact, this factor represents the community participation in social and political events of Iran. The level of fluctuation in political-institutional factor, is much noticeable than the first factor; similarly, the improving level of RQoL over the period of 15 years is recognizable. The region of Gilan, Mazandaran and Bushehr achieved the highest score which is related to the increasing level of political participation and life expectancy rate in these areas. Regions of Tehran and Isfahan have the steady status in economic participation (employment rate) and life expectancy. Sistan and Baluchistan with  $-1.66$  score, achieved the lowest score in the factor analysis from economic point of view. This is caused by low level of economic participation or low level of job security (Fig. 2).



**Fig. 2** Factor analysis of objective quality of life (1996–2011)

### 5.2.3 Factor No. 3

The third factor which explains 11.65 variations is called socio-geographical factor. There is an insignificant difference between the second factor and this one. This factor includes population, annual rainfall, security and insurance rate as positive ones. The most effective indicators in this category are population density and annual rainfall which have the highest factorial weight among the others. Because of the similar factorial weight and



variance percentage, social- geographical factor has as much impact on QoL as political-institutional factor. The fluctuation of the factor no. 3 which relates to socio-geographic indicators is much greater than the second and first factors. Khorasan Razavi and Isfahan achieved the highest point considering this factor, while regions like Ilam, Bushehr, Kohgiluyeh and Booyerahmed achieved the lowest rank in comparison to the others. The level of changes in Isfahan and Khorasan Razavi was steady and during the period of 15 years it has gradually improved. The main reason of the significant improvement in these areas is the increasing number of health insured individuals. The level of changes was very noticeable in regions like Ilam. In addition, the changes in average annual rainfall rate caused more improvement in some regions in comparison to the other ones; Gilan is one of the best examples in this domain. There were two indicators that cause some improvements in Isfahan, Khorasan Razavi and Yazd, which are related to the increasing number of health insured individuals and noticeable reduction in security problems (Fig. 2).

#### 5.2.4 Factor No. 4

The forth factor which explains 10.91 variance percentage is health factor. It includes average temperature and the number of active health institutions per 1000 people. The average temperature of each region is weighted more than socio-geographical indicators. Therefore it has a higher impact on QoL than the third factor. Considering the factor no. 4, Khuzestan has the highest quality which is related to the health issues, while Bushehr and Kohgiluyeh and Booyer Ahmad got the lowest rank. The main reason for this incident is the number of active health institutions in these areas (Fig. 2).

#### 5.2.5 Factor No. 5

The last factor is named as infrastructural factor which has 7.85 % of variance in comparison to all the factors; it is the least affective one and includes gender equality, urbanization and divorce rate. Gender equality explains rate of accepted women in universities. Almost, all the indicators in this category had equal weight and affected the QoL in similar way. The average score of all 30 regions have significantly increased, considering factor no. 5, which is due to the increasing trend in gender equality rate, level of urbanization and family life over the period of 15 years. Figure 2 shows the lowest score of Sistan Baluchistan, Mazandaran and Golestan regions, which is mainly caused by the lower level of urbanization and low level of gender equality in comparison to other ones. Fortunately, the level of infrastructure quality has improved considerably in these areas during the period of 15 years and has affected QoL in those regions. Semnan, Qom and Khuzestan, got the highest score which is caused by increasing level of urbanization and gender equality in 2011 (Fig. 2).

Over the period of 15 years, the level of changes in regards to factor no. 1 shows a steady trend in comparison to other factors which experienced more fluctuation in their process. The level of fluctuation in factor no. 4 is too high and in 80 % of situations, instability and inequality are recognizable. This has caused regions to experience sudden rise and fall in RQoL. For instance, Ilam, Bushehr and Kermanshah endured these significant yet unsteady changes over the period of 15 years. In additions, the level of changes in accordance with each five factors can be identified and explained on the diagram. The fluctuation rate of factor no. 3 in comparison to other factors is too high regarding all 30

regions, this caused a significant difference in the country also between each regions. In other words, this particular factor caused lots of ups and downs in an objective RQoL level.

### 5.3 Spatial Distribution of the Composite Index of RQoL

As it was mentioned in the second section of the paper, six qualitative groups [high (210–450), very good (150–210), good (100–150), average (70–100), poor (40–70) and very poor (below 40)] were extracted using ArcMap natural break method. These categories were estimated based on composite index scores. According to the classification, in 2011, the overall RQoL has increased in all 30 regions, which indicates the positive impact of development programs on the RQoL rate in the country. The overall status of Tehran has improved and rated highest in the quality and its composite index rate remained in the same range (210–450) over the period of 15 years. In addition to Tehran, Isfahan, Khorasan Razavi, Khuzestan, Fars and Eastern Azerbaijan are rated as very good and good. QoL in the region of Isfahan has moved from very good quality in 1996 to high in 2011. The maximum rate of changes that occurred during 1996–2011 belong to the regions of Golestan (average rate of 93 unit), Khorasan Razavi (with 95 unit) Qazvin (83.8), Southern Khorasan (81), Northern Khorasan (74) and Tehran (74) according to composite index level. Both southern and northern Khorasans have got improved in RQoL rate (from poor to good RQoL) over the period of 5 years (2006–2011). The rate of changes has occurred faster in Southern Khorasan than the Northern Khorasan. It seems that one of the reasons of this occurrence in Golestan, Southern and Northern Khorasan and Qazvin were their establishment by division of other regions as well as allocation of various opportunities to each region, which caused the regions experience significant changes, mostly positive ones in RQoL (Fig. 3).

Because of the important role of Tehran, Isfahan and Khorasan Razavi in development plans of Iran, they all have experienced noticeable (mostly improved in quality) changes over the period of 15 years. On the contrary, Chaharmahal o Bakhtiari, Zanjan and Markazi with average changes (6 units) in composite index level have got the lowest changing trend in comparison to other regions. In 1996, Fars and Mazandaran were rated good, but during 2001 and 2006 this level of quality reduced. Again in 2011 the level of composite index rate in Fars has increased by 10 units in quality while Mazandaran remained in the same position. The region of Eastern Azerbaijan has experienced a steady trend in its composite index rate. Average changes of this region in each four sections of time equaled with the value of 7. Khuzestan and Gilan with 10 units' difference in amount of composite index and Khorasan Razavi are the other examples with similar results. The region of Yazd, Southern and Northern Khorasan have experienced more significant changes in the level of composite index rate between 1996 and 2011, which is caused by increasing value of GDP level and the level of accessibility to urban–rural amenities (Fig. 3).

Based on the RQoL spatial distribution illustrated on the map, it seems that western regions of Iran have improved in RQoL from poor state to good. The eastern regions of the country especially Sistan and Baluchistan have improved from very poor level to poor. Considering spatial distribution via composite index, the homogeneity in RQoL level is recognizable. In 1996, the level of differences across the country was significantly high. Nine regions were rated very poor in 1996. This is due to unequal distribution of rural–urban amenities and GDP rate differences across the country. In this case, Tehran and Isfahan have got the highest scores. In 2001, the RQoL rate has gradually improved and the number of very poor regions reduced to five regions; therefore, Iran faced more

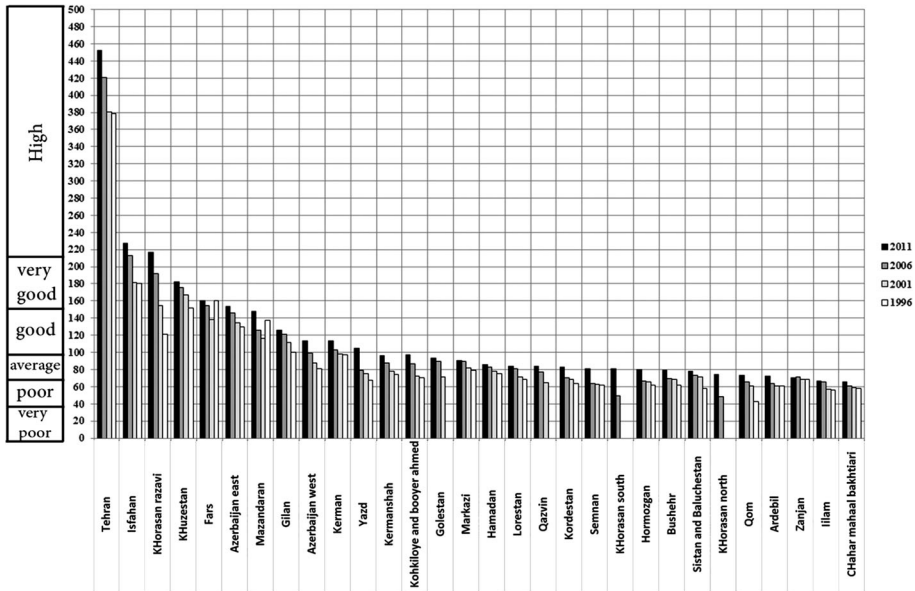
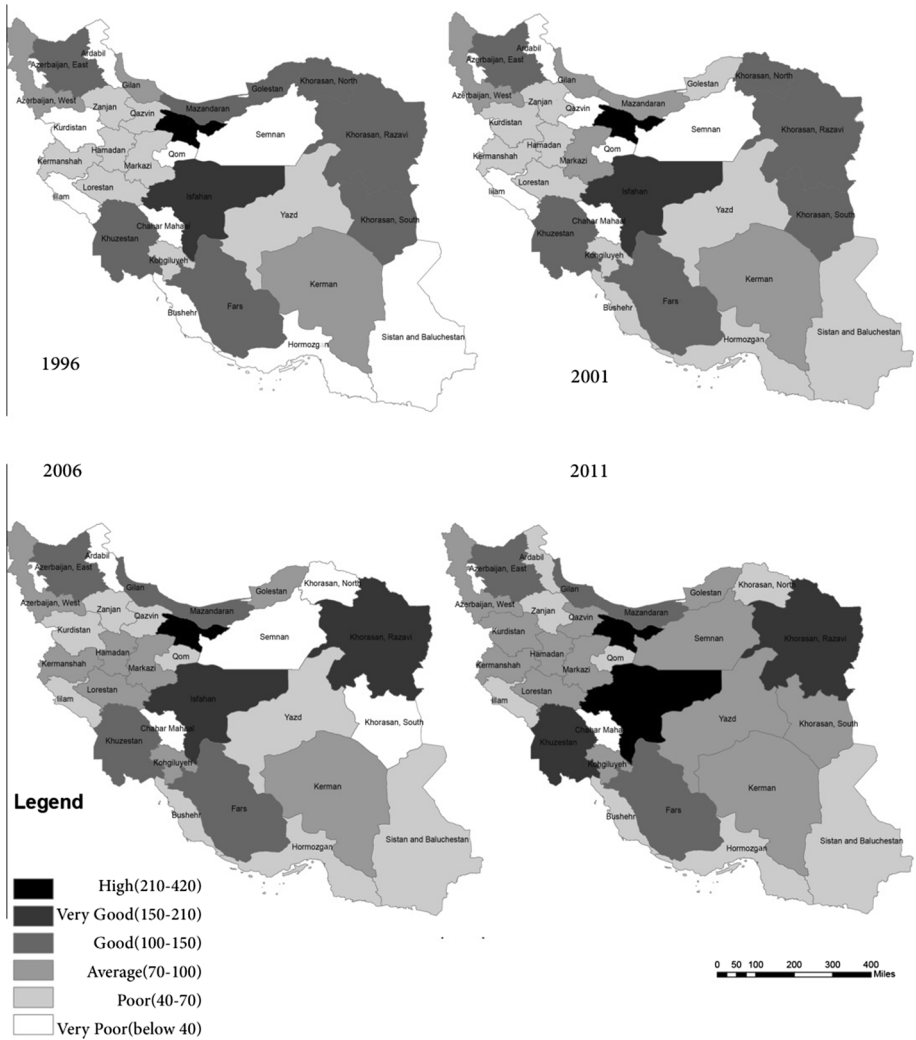


Fig. 3 Composite index of RQoL (1996–2011)

homogeneity in RQoL. In 2006, Because of the increase in the number of regions, overall amount of very poor regions were remained the same as 2001. The western regions of Iran have improved to average and good in the RQoL rate. In 2011, the degree of homogeneity significantly improved and 14 regions of Iran rated as having average quality and 7 of them gained a condition from good to high. On the same year, the number of regions with very poor quality reduced to only one region, which in comparison to the 1996 till 2006 was an important incident; the level of composite index in Chaharmahaal o Bakhtiari calculated as 65 points which was the lowest rank in the RQoL. The above results show considerable increase in the RQoL over the period of 15 years (Fig. 4) and confirm regional development plans and policies to improve the QoL and to achieve spatial equity in the country. In addition to Fig. 4 results, by applying Moran coefficient technique, the degree of clustering of RQoL in Iran during 15 years period were evaluated. Based on its results, Moran’s index shows a random scattering in all periods (Table 5). It means that, RQoL does not follow a specific pattern. In addition, the following results do not show major changes in Moran index value over the course of 15 years. Though, slight changes towards clustered shape can be recognized. Another step is required to recognize the cluster or outlier pattern of Iran’s regions. Therefore, Anselin Local Moran’s I analysis was also applied (see Table 8).

Based on the results of Local Moran’s, three significant regions can be recognized (see Table 8). Tehran, Qom and Mazandaran’s *p* values are below 0.05 which make them statistically significant. However, values appertained to Qom and Mazandaran were only significant in 1996. The only region with considerable changes over the course of 15 years is Tehran. According to the *z*-score values, Tehran with highest negative value in 1996 and the following years is considered as an outlier region which is surrounded by regions with lower RQoL. Qom is the second region with high negative *z*-score which is also an outlier region and surrounded by higher valued regions. Unlike Qom and Tehran, Mazandaran



**Fig. 4** Spatial distribution of RQoL between 1996 and 2011

with the highest  $z$ -score value is identified as a cluster which is surrounded by high valued regions. Therefore, there is only one cluster recognizable in Iran which has a similar RQoL in shared-bordered regions. But as it was mentioned, this pattern was only occurred in 1996.

In general, it seems that, regions which were used to be capitals of Iran are rated higher in value compared to other regions. Also, based on the map, border regions are rated lower in RQoL in comparison with central regions. In addition, it seems that, regions with high quality have an insignificant impact on neighbors. So, there is only one cluster shaped during 15 years period which had occurred in 1996. In other words, regions with shared borders with high QoL have less homogeneity than regions without ones.

**Table 5** Global Moran's index results regarding RQoL

Periods	1996	2001	2006	2011
Moran's index	-0.073	-0.084	-0.079	-0.064
<i>p</i> value	0.561	0.460	0.503	0.649
<i>z</i> -score	-0.581	-0.737	-0.669	-0.454

## 6 Conclusions and Discussion

As it noted in the first section, the main objective of this research was to investigate the degree of spatial distribution of RQoL over the 15-year period. In order to achieve the purpose, objective indicators were employed to evaluate the QoL across Iran. The importance of employing both subjective and objective approaches in QoL research were asserted and proved by many scholars; and most of the previous studies on QoL measured and evaluated both objective and subjective indicators. They argued that objective and subjective indicators are needed to understand human quality in a whole manner (Haq and Zia 2013; Szalai 1980; Bradshaw and Fraser 1989; Kao and Liu 1984; Shin and Snyder 1983; Hagerty 1999; also see Gerson 1976). Because of unavailability of primary data, this paper does not evaluate individual's cognitive perception or satisfaction on a regional level. According to needs theory, subjective appreciation of life directly depends on objective living condition (Diener and Lucas 2000), also according to comparison theory, objective conditions affect subjective perceptions indirectly (Hagerty 1999, 2000; Veenhoven 1995). Therefore, by evaluating an objective QoL in Iran regions, the overall image of living condition and people level of satisfaction can be predicted. Recognizing the differences between each region and over the period of 15 years, principle component analysis along with composite index was employed for ranking each region. The essential data were adopted from annual census reports from 1996 to 2011 of official governmental reports and the classification and spatial distribution of regions were conducted by GIS technique. Then the results were illustrated on Iran map. Based on the above explanations, the following results were concluded.

QoL in all 30 regions of Iran have significantly increased over the period of 15 years, especially between 2006 and 2011. In other words, the quality rate of Iran has changed from very poor to average range in quality. When it comes to the relation between the range of proximity to the center of Iran (Tehran as a capital region) and the level of RQoL, specific pattern can be identified. There is a noticeable level of improvement in south eastern and western regions of country. In fact, the regions which are near the capital haven't improved in QoL as much as western, southern and eastern parts of Iran. The economic factor (with 32.67 % variance) and political-institutional factors (with 12.76 % of variance) are the most effective factors that cause positive changes in the given period of time. In the case of regional pattern of socio-economic development, Tehran has the highest rank in Iran. Also, considering RQoL, Tehran is ranked as "high" with the composite value of 406.75. The Steady range of excellency also can be identified in Tehran over the period of 15 years. Other regions, such as Isfahan, Khorasan Razavi, Khuzestan and Fars are the most developed regions—from the socio-economic perspective—across the country. These regions have experienced moderate increase in RQoL rate and are placed in the range of very good and good in quality. This clearly points the inequitable distribution of primary amenities amongst regions and the urgent need to change the

current planning process in governmental policy making system. The least developed region in Iran is Chaharmahal o Bakhtiari which hasn't improved over the 15 years despite of its socio-economic potentials; it endures a lack of primary amenities and opportunities. The other disadvantaged regions suffer in the same way. In 2011, the level of homogeneity has improved in the evident equality which is recognizable on the spatial map; in the same year, Iran faces average quality across its territory. Although, the Moran index shows a random RQoL scattering, the degree of homogeneity improved nationally based on the composite index rate and all the diagrams show more equal distribution of RQoL indicators across the country. It seems that, this is the result of governmental development plans and policies that has changed and got more concerned with social equality and social right in the period of 15 years. By the way, the RQoL level of disadvantaged areas can be improved through applying cultural and social programs.

Majority of previous studies in developing countries resulted in identifying the level of regional homogeneity in the case of QoL across counties, regions and countries (Ohlan 2013; Haq and Zia 2013). They indicated that, in the case of objective QoL, there is a great disparity between different parts of country. According to them, nation can be divided into four to five development categories. For instance as Ohlan (2013) says, India can be categorized into three regions based on QoL parameters. Based on Ohlan (2013) research, there are wide disparities in the level of socio-economic development; and the economic factors are the most affective dimension which causes difference across the nation (also see Rusche 2010 in Germany); similarly, the most impactful domain in this paper is an economic factor. Haq and Zia (2013) in Pakistan, Liao (2009) in Taiwan and Higgins et al. (2014) in London, consider the objective indicators of education as the most important variables in ranking of districts; accordingly, in the case of RQoL in Iran, education as cultural factor with the high variances is an effective factor in development of regions like Tehran and Isfahan. Job security and family health are also considered as important indicators in the case of RQoL.

Concentrating on RQoL in 15 years period is one of the remarkable advantages of this study. In majority of the previous studies, level of QoL was examined in one section of time (Haq and Zia 2013; Basekha et al. 2010) or only in one region (Higgins et al. 2014); they focused on changing trend of QoL during the certain period of time. This study has none of those shortcomings. For this reason, the results of this research seem to be more reliable than previous studies.

It seems that, by improving the socio-geographical factors across the county, especially in the poor quality regions, the eastern regions along with southern regions will be improved. This can be achieved through introducing new approaches such as environmental and cultural programs in national and regional development plan, which can be a helpful tool in both geographical and social aspects. By defining new cultural plans and allocating more cultural and recreational amenities to poor regions, the RQoL will be significantly improved. Welfare indicators (the number of the households with an access to electricity, water and gas power) are the other powerful aspects which noticeably impacts the RQoL rate. So, allocating socio-economic infrastructures in accordance with each region potential will improve the overall homogeneity. Through defining new socio-cultural approaches, the total rate of divorce and insecurity, as the main negative parameters affecting the RQoL, will be reduced gradually. Focusing on environmental issues, the negative side effects of the polluting activities will be reduced and the climate factors will improve. In the case of social involvement, which is achieved in safe and secure yet free social environment, and by allocating power to the local and regional level authorities, new approaches should be defined or older policies should be refined and rewritten. Continuing

the privatizing policy and providing necessary socio-political as well as economic infrastructure in national development plans, the economic and social aspects of country will face improvement. In addition, in order to get more complete picture of RQoL in Iran, one of the crucial steps is to do a comprehensive survey on people perception (subjective aspect) of their QoL. In this way the overall picture of QoL, also more accurate result, would be captured. This paper provides a practical tool in regional development which can be employed as a useful guidance in decision-making process.

**Acknowledgments** The authors would like to thank from very valuable comments received from an anonymous referee and give special thanks to Miss Tayyebeh Shokrnia for her helps in some phases of the research.

## Appendix

See Tables 6, 7 and 8.

**Table 6** Factor scores considering RQoL in 1996–2011

Region	Fact.1.1996	Fact.1.2001	Fact.1.2006	Fact.1.2011	Fact.2.1996	Fact.2.2001	Fact.2.2006	Fact.2.2011	Fact.3.1996	Fact.3.2001
Azar-East	0.32	0.44	0.69	0.49	0.19	0.48	0.99	1.42	0.88	1.08
Azar-West	-0.25	-0.20	0.14	0.14	0.20	0.40	0.77	1.29	0.78	0.93
Ardabil	-0.14	-0.10	0.50	0.57	-0.51	0.07	0.14	0.44	0.48	0.54
Isfahan	0.93	1.21	1.38	1.76	0.39	0.29	0.44	0.89	0.20	0.39
Ilam	-0.87	-0.42	0.81	0.79	0.12	0.48	0.65	0.92	-0.79	-0.41
Bushehr	-0.48	-0.29	0.33	0.57	0.42	1.06	1.77	2.01	-0.86	-0.61
Tehran	3.75	4.06	3.70	3.98	0.01	0.35	1.14	1.09	0.66	0.83
Chaharmahal	-0.69	-0.67	-0.53	-0.38	-0.06	-0.78	-0.24	-0.21	0.86	1.11
Khorasan-South				-0.81				0.97	1.02	1.36
Khorasan-Razavi	1.47	1.39	1.32	1.32	0.14	-0.38	-0.34	0.16	1.02	1.36
Khorasan-North				-0.62				0.65	1.02	1.36
Khuzestan	1.10	1.10	1.17	1.35	0.09	0.07	0.38	0.73	0.56	0.81
Zanjan	-0.59	-0.71	-0.67	-0.68	0.16	0.49	0.42	0.40	0.65	0.79
Semnan	-0.73	-0.79	-0.59	-0.31	0.57	0.82	0.92	0.75	0.60	0.72
Sistan	-0.37	0.14	0.23	0.71	-1.07	-1.93	-1.78	-1.66	-0.61	-0.39
Fars	0.72	0.63	1.04	1.13	0.09	0.03	0.02	0.08	0.02	0.58
Qazvin	-0.54	-0.71	-0.71	-0.51	0.09	1.18	0.35	0.35	-0.65	-0.54
Qom	-0.71	-0.89	-0.71	-0.23	0.23	1.51	1.34	1.21	-0.03	-0.16
Kordestan	-0.65	-0.53	-0.45	-0.47	0.21	-1.14	-0.79	-0.76	0.59	0.92
Kerman	0.14	0.03	0.26	0.28	0.21	-0.04	0.12	0.07	0.44	0.50
Kermanshah	-0.37	-0.36	-0.24	-0.21	0.16	-0.23	-0.53	-0.47	0.56	0.32
Kohgiluyeh	-0.75	-0.21	-0.14	-0.09	0.01	0.82	0.19	-0.04	-0.84	-0.69
Golestan		0.30	0.50	0.51		-0.36	0.55	1.00	0.38	0.33
Gilan	0.10	0.13	0.22	0.34	0.79	1.01	1.50	2.31	1.38	1.41
Lorestan	-0.44	-0.46	-0.46	-0.41	0.58	-0.23	-0.49	-0.78	0.13	0.00
Mazandaran		0.18	0.32	0.20		0.40	1.14	1.93	0.38	0.31



Table 6 continued

Region	Fact.1.1996	Fact.1.2001	Fact.1.2006	Fact.1.2011	Fact.2.1996	Fact.2.2001	Fact.2.2006	Fact.2.2011	Fact.3.1996	Fact.3.2001
Markazi	-0.41	-0.33	-0.46	-0.42	0.13	0.01	0.05	0.02	0.08	0.61
Hormozgan	-0.40	-0.48	-0.52	-0.35	0.17	0.07	0.91	0.33	-0.53	-0.10
Hamadan	-0.25	-0.59	-0.38	-0.23	0.04	0.02	-0.59	-0.35	0.32	0.58
Yazd	-0.53	-0.47	-0.23	-0.13	0.72	1.44	1.90	0.79	0.37	1.06
Region	Fact.3.2006	Fact.3.2011	Fact.4.1996	Fact.4.2001	Fact.4.2006	Fact.4.2011	Fact.5.1996	Fact.5.2001	Fact.5.2006	Fact.5.2011
Azar-East	1.39	1.49	0.13	0.67	0.81	1.67	-0.28	-0.13	0.99	1.12
Azar-West	1.19	1.33	0.08	0.78	0.61	1.46	0.85	0.52	1.11	1.33
Ardabil	0.71	1.18	0.07	0.95	0.86	1.00	0.41	0.20	0.15	0.30
Isfahan	1.18	1.57	0.69	0.68	0.62	0.80	0.21	0.88	0.58	0.39
Ilam	-0.23	-0.13	-0.38	0.15	0.52	0.92	-0.30	-0.26	0.68	0.70
Bushehr	-0.33	0.16	-0.70	0.05	1.04	1.69	0.16	-0.39	-0.02	0.09
Tehran	1.06	1.04	0.23	0.26	0.19	0.30	0.74	0.60	0.49	0.47
Chaharmahal	1.08	1.12	-0.15	-0.18	0.86	1.04	0.57	0.79	1.14	1.51
Khorasan-South	1.44	1.20				0.62			0.07	0.52
Khorasan-Razavi	1.44	1.58	0.05	0.87	0.89	1.23	0.30	0.03	0.07	0.09
Khorasan-North	1.44	0.82				0.37				0.70
Khuzestan	1.04	1.41	0.68	1.00	1.83	2.62	0.12	1.10	1.70	1.72
Zanjan	1.40	1.15	0.07	0.18	0.31	0.63	0.10	0.24	0.34	0.70
Semnan	1.11	1.49	0.65	0.74	0.54	0.73	0.25	0.98	1.68	1.96
Sistan	0.44	0.58	0.67	0.54	0.79	1.12	-0.95	-0.42	0.96	1.56
Fars	1.04	1.21	-0.38	-0.03	0.30	0.30	0.23	0.15	0.45	0.53
Qazvin	0.50	0.31		-0.21	0.11	0.68		0.58	0.61	0.86
Qom	-0.29	0.28	0.36	0.27	0.31	0.42	0.86	1.06	1.79	1.69
Kordestan	1.04	1.23	-0.75	-0.51	0.43	0.49	0.22	0.53	1.39	1.30
Kerman	1.00	1.25	0.10	0.04	0.53	1.03	0.09	0.14	0.34	0.85

Table 6 continued

Region	Fact.3.2006	Fact.3.2011	Fact.4.1996	Fact.4.2001	Fact.4.2006	Fact.4.2011	Fact.5.1996	Fact.5.2001	Fact.5.2006	Fact.5.2011
Kermanshah	0.68	0.93	-0.66	-0.65	0.04	0.09	-0.06	0.29	0.34	0.22
Kohgiluyeh	-0.16	0.29	-0.85	0.11	1.04	1.19	-0.17	-0.04	0.05	0.13
Golestan	0.15	1.19		-0.04	0.09	0.07		-0.83	-0.14	0.99
Gilan	1.13	1.19	0.10	0.32	0.80	1.27	0.56	0.87	1.34	1.24
Lorestan	0.01	0.60	-0.46	-0.20	0.09	0.39	0.58	0.86	0.97	1.30
Mazandaran	0.55	0.97		-0.56	-0.12	0.13		-0.92	-0.55	0.75
Markazi	1.09	1.01	0.25	0.04	0.01	0.16	-0.35	0.25	0.89	1.11
Hormozgan	0.74	0.61	0.18	0.35	0.42	0.69	0.44	0.51	0.50	0.46
Hamadan	0.49	0.48	-0.31	-0.09	0.46	0.06	0.82	0.62	0.68	1.14
Yazd	1.20	1.82	0.04	0.67	1.09	0.95	0.69	0.59	0.70	0.90

**Table 7** Composite index of RQoL in regions

Regions	2011		2006		2001		1996	
	Rank	Composite index	Rank	Composite index	Rank	Composite index	Rank	Composite index
Tehran	1	452.02	1	420.35	1	380.24	1	378.43
Isfahan	2	227.62	2	212.61	2	181.48	2	180.01
Khorasan, Razavi	3	216.72	3	191.78	4	154.36	7	121.56
Khuzestan	4	182.70	4	175.25	3	166.83	4	152.14
Fars	5	160.08	5	155.05	5	138.83	3	159.94
Azerbaijan, East	6	153.46	6	146.06	6	134.50	6	129.62
Mazandaran	7	147.80	7	126.37	7	116.72	5	137.54
Gilan	8	126.23	8	120.90	8	111.45	8	100.40
Azerbaijan, West	9	113.67	10	99.31	10	87.17	10	80.88
Kerman	10	113.52	9	102.66	9	98.44	9	97.25
Yazd	11	105.20	16	79.39	13	74.81	16	67.98
Kermanshah	12	96.10	13	87.31	12	78.20	13	74.32
Kohgiluyeh and Boyer-Ahmad	13	96.80	17	86.86	14	72.74	14	70.81
Golestan	14	92.98	11	89.95	16	71.12	–	–
Markazi	15	90.10	12	89.71	11	81.63	11	78.90
Hamadan	16	85.77	14	82.55	13	77.64	12	75.64
Lorestan	17	84.04	15	80.95	15	71.59	15	68.94
Qazvin	18	83.75	18	76.80	22	64.83	–	–
Kurdistan	19	82.60	21	70.05	19	68.81	17	64.14
Semnan	20	81.26	26	63.98	22	62.82	20	61.37
Khorasan, South	21	81.03	29	49.01	–	–	–	–
Hormozgān	22	79.68	23	67.03	21	66.02	18	61.67
Bushehr	23	78.81	22	69.39	18	68.88	19	61.50
Sistan and Baluchestan	24	78.35	19	73.14	17	70.96	22	58.24
Khorasan, North	25	74.02	30	48.30	–	–	–	–
Qom	26	73.50	24	66.01	23	61.21	25	43.01
Ardabil	27	72.28	27	63.54	24	61.02	21	60.52
Zanjan	28	70.38	20	71.11	20	68.52	16	68.39
Ilam	29	66.78	25	65.32	26	56.81	24	56.17
Chahar Mahaal and Bakhtiari	30	65.85	28	60.42	25	58.44	23	57.50

**Table 8** Results for Anselin Local Morans I

Region's name	Year															
	1996				2001				2006				2011			
	LM	CL	PV	ZS	LM	CL	PV	ZS	LM	CL	PV	ZS	LM	CL	PV	ZS
Qom	<b>-3.09</b>	<b>LH</b>	<b>0.02</b>	<b>-2.23</b>	-2.07		0.15	-1.44	-2.05		0.15	-1.43	-2.03		0.15	-1.42
Azerbaijan, West	0.12		0.79	0.26	0.10		0.82	0.23	0.02		0.90	0.13	0.02		0.90	0.12
Azerbaijan, East	-0.67		0.57	-0.57	-0.70		0.55	-0.59	-0.61		0.62	-0.50	-0.56		0.65	-0.45
Ardabil	0.33		0.63	0.48	0.32		0.64	0.46	0.11		0.81	0.24	0.22		0.72	0.36
Kurdistan	0.98		0.30	1.02	0.95		0.32	0.99	0.59		0.50	0.68	0.70		0.44	0.77
Kermanshah	0.65		0.46	0.73	0.64		0.48	0.71	0.30		0.68	0.41	0.40		0.61	0.50
Ilam	0.66		0.42	0.80	0.65		0.43	0.79	0.34		0.64	0.47	0.54		0.49	0.68
Lorestan	0.40		0.61	0.51	0.38		0.62	0.48	0.08		0.82	0.23	0.24		0.71	0.37
Hamadan	0.36		0.65	0.45	0.35		0.66	0.44	0.07		0.82	0.22	0.25		0.71	0.36
Zanjan	0.36		0.65	0.45	0.35		0.66	0.44	0.00		0.87	0.17	0.17		0.76	0.29
Gilan	-0.00		0.890	0.14	-0.00		0.89	0.13	0.08		0.84	0.20	0.02		0.87	0.16
Qazvin	-0.42		0.86	-0.17	-0.51		0.81	-0.24	-0.54		0.79	-0.26	-0.46		0.84	-0.20
Markazi	-0.12		0.93	0.08	-0.13		0.94	0.07	-0.25		0.98	-0.02	-0.31		0.95	-0.06
Tehran	<b>-4.98</b>	<b>HL</b>	<b>0.00</b>	<b>-3.79</b>	<b>-5.65</b>	<b>HL</b>	<b>0.00</b>	<b>-4.29</b>	<b>-3.15</b>	<b>HL</b>	<b>0.02</b>	<b>-2.34</b>	<b>-3.76</b>	<b>HL</b>	<b>0.00</b>	<b>-2.84</b>
Mazandaran	<b>1.96</b>	<b>HH</b>	<b>0.03</b>	2.13	0.61		0.46	0.74	0.95		0.27	1.09	1.33		0.13	1.50
Golestan	0.03		0.90	0.12	-0.06		0.98	-0.02	0.13		0.77	0.30	0.12		0.77	0.28
Khorasan, North	0.07		0.83	0.20	-0.13		0.86	-0.17	-0.10		0.91	-0.12	-0.09		0.92	-0.09
Khorasan, Razavi	0.07		0.79	0.26	0.42		0.24	1.18	-0.64		0.10	-1.64	-0.46		0.23	-1.20
Semnan	-1.22		0.11	-1.59	-0.93		0.24	-1.18	-0.75		0.35	-0.93	-0.68		0.40	-0.84
Isfahan	0.49		0.44	0.76	0.44		0.49	0.68	0.93		0.19	1.32	1.02		0.15	1.44
Khuzestan	-1.31		0.15	-1.42	-1.62		0.08	-1.77	-1.19		0.20	-1.28	-1.22		0.18	-1.33
Chahar Mahaal	-0.60		0.64	-0.47	-0.74		0.55	-0.60	-0.95		0.42	-0.81	-0.89		0.44	-0.76
Kohgiluyeh	-0.05		0.96	0.05	-0.03		0.94	0.08	-0.09		0.98	0.02	-0.03		0.94	0.07

**Table 8** continued

Region's name	Year															
	1996				2001				2006				2011			
	LM	CL	PV	ZS	LM	CL	PV	ZS	LM	CL	PV	ZS	LM	CL	PV	ZS
Fars	-0.45	0.39	0.93	-0.86	-0.24	0.66	-0.45	-0.24	-0.24	0.66	-0.43	-0.20	-0.20	0.72	-0.35	
Sistan and Baluchestan	0.01	0.93	0.09	0.09	0.01	0.92	0.10	0.01	0.01	0.94	0.07	0.07	0.93	0.08		
Kerman	0.02	0.89	0.14	0.02	0.02	0.89	0.13	0.03	0.03	0.87	0.16	0.03	0.88	0.15		
Yazd	-0.138	0.83	-0.20	-0.16	-0.16	0.79	-0.26	-0.02	-0.02	0.96	0.05	-0.02	0.97	0.03		
Khorasan, South	-0.01	0.97	0.04	0.08	0.08	0.77	0.29	-0.21	-0.21	0.65	-0.45	-0.17	0.71	-0.36		
Bushehr	-0.17	0.85	-0.19	-0.06	-0.06	0.99	-0.01	-0.15	-0.15	0.88	-0.15	-0.09	0.94	-0.06		
Hormozgan	0.01	0.93	0.08	0.08	0.02	0.91	0.11	0.01	0.01	0.94	0.08	0.01	0.93	0.08		

According to the results, the only region which remained in high quality range with low valued regions in surroundings is Tehran while Mazandaran and Qom were only significant in one period (1996)

LM, Local Moran's I; CL, cluster; PV, pseudo-p-value; Z, z-score; H, high; L, low; HH, cluster of high values; HL, feature with high value and is surrounded by features with low values; LH, feature with a low value and is surrounded by features with high values; LL, cluster of low values

Source: Statistic Center of Iran (1996-2011)

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