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SPATIAL ANALYSIS OF REGIONAL INEQUALITIES IN TURKEY

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Spatial Analysis of Regional Inequalities in Turkey[1]

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Abstract

In this paper, we examine regional inequalities in Turkey not only at the inter-provincial level but for three different regional definitions as well. The motivation draws on the findings of Gezici and Hewings (2001) that raised questions about inequalities not only between regions (inter-regional) but inequalities within each region. Hence, one contribution of this paper is to test the effects of aggregation and scale on the identification of regional inequalities using currently accepted spatial analytic methods. The results indicate that overall inequalities are decreasing, however spatial dependence is becoming more dominant. The Theil index indicates that interregional inequalities are increasing while intra-regional inequalities are declining for all spatial partitions from 1980 to 1997. Most developed provinces are enhancing overall inequalities, although there is some evidence of a spread effect on their neighbors.

Key words: interregional inequalities, intra-regional inequalities, spatial dependence, spatial data analysis

1. Introduction

There has been a resurgence of interest in regional disparities and inequalities as new developments in methodology have opened the way to more creative consideration of the problem. Since not all parts of a country have the same characteristics with respect to resource orientation, manpower, economic, social and political history, spatial interactions between regions and geographical location play an important role in explaining the economic

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performance of regions. However, the inequality literature has generally neglected the spatial dimension (Rey, 2001). In Turkey, the persistence of a spatial dualism between east and west from the past until present was revealed in Gezici and Hewings (2001), while the European Union has north and south spatial regimes (Le Gallo and Ertur, 2001; Baumont and *et al*., 2001), Italy still has historical north and south dualism (Mauro and Podrecca, 1994), furthermore Greece has two main regions as Athens and non-Athens (Siriopoulos and Asteriou, 1998). This geographical disparity within several countries is further evidence that space continues to matter, even though the sources of disparities might be different from country to country. Empirical studies to explore and explain these issues are needed and recent advances in spatial data analysis not only facilitate consideration of the spatial issues of inequalities but enhance the reliability of the empirical work as well (Goodchild, 1987). Exploratory Spatial Data Analysis (ESDA) focuses explicitly on spatial effects and consists of techniques to describe spatial distributions, discover patterns of spatial association (spatial clustering), identify atypical locations (spatial outliers) (Anselin and Bao, 1997). Recent empirical works by Rey and Montouri (1999), Rey (2001), Le Gallo and Ertur (2001), Baumont, et al., (2001), Ying (2001) are some examples that focus on regional inequalities and spatial dependence of growth using ESDA.

In the next section, the motivation and expectations are presented, while in the third section the methodology and data are reviewed. In the fourth section, the analysis focuses on the inequalities between and within region of different partitioning in Turkey by using Theil index. In the fifth section, attention is directed to spatial dependence, global and local clustering through Exploratory Spatial Data Analysis. Furthermore, the spatial pattern of GDP regional growth is examined in relation to their initial level of GDP per capita. The paper's conclusion reviews the findings.

2. Motivation and Expectations

Regional inequality in Turkey is major issue in terms of regional policy. The analysis of Gezici and Hewings (2001) revealed that the dispersion of GDP per capita across the provinces and functional regions have similar trends with little evidence of convergence. The growth rate and initial levels are essentially uncorrelated across the provinces and functional regions resulting in the rejection of β convergence for the 1980-97 period (see Barro and Sala-i-Martin, 1995 for a review of the various types of convergence). Further, GDP per capita is not randomly distributed, but highly clustered and spatially dependent at the regional level (functional regions).

In the case of Turkey, one of the main goals has been maximizing national growth and enhancing strong economic factors in order to enable the country to survive in a competitive world. The externally oriented policies and the focus on the European Union have concentrated the privileges in the metropolitan cities, especially Istanbul, generating significant advantages for them in the context of globalization. Policy conflicts can be revealed between those that have, on the one hand, stimulated the concentration of the fastest growing activities in the 1980s in large cities and a few developed regions while others, on the other hand, have addressed development in the poorer regions. These policy conflicts have neutralized many attempts to reduce regional disparities and have sustained core-periphery disparities. The result of the spatial correlation analysis provides evidence that the disparities between east and west regions remain (see Gezici and Hewings, 2001).

In this paper, the level of the spatial analysis of regional inequalities in Turkey is developed not only at the inter-provincial level but for three different regional definitions as well. This need, to explore alternative geographies was generated by the findings of Gezici and Hewings (2001), wherein there appeared to be a need to examine not only inequalities between regions (inter-regional) but inequality within each region (intra-regional) as well. Hence, the paper affords a limited opportunity to test the effects of aggregation and scale on the identification of regional inequalities. Finally, spatial data analysis offers the opportunity to include explicitly the spatial dimension in inequality studies in Turkey and provides the option to explore the relationship between spatial dependence and the dynamics of growth.

3. Methodology and Data

One of the main purposes of this paper is to examine the inequality not only over time, but across regions and within regions as well. Furthermore the spatial dependence of growth and its relationship to regional inequality in terms of GDP per capita is also examined. Essentially, the initial question posed is how the provinces are clustering in space in terms of growth and inequalities.

In literature, several empirical studies on regional inequalities using by the Theil Index have focused on interregional inequalities, but in order to realize the dynamics and the role of regions or smaller spatial units on inequalities, attention should also be directed as well to intra-regional inequalities. The Theil index accounts both for inter-regional and intra-regional inequalities and is presented as:

$$T = T(y:x) = \sum_{i=1}^{n} y_i \log\left(\frac{y_i}{x_i}\right) \qquad (1)$$

where x_i = population of province *i* relative to the national population and y_i =GDP of province *i* relative to the national GDP. By using the Theil index, interregional and intra-regional disparities can be estimated as:

$$T = \sum_{i=1}^{n} y_i \log\left(\frac{y_i}{x_i}\right) + \sum_{g=1}^{n} Y_g T_g(y:x) \qquad (2)$$

where the left side is the Theil index measuring the disparity between regions (inter-regional), and Y_g is the region *g*'s share of total GDP, and $T_g(y:x)$ is the Theil index measuring the disparities among provinces (intra-regional or within) in region *g*.

However, there is no formal administrative regional unit in Turkey; several studies on regional issues have used the geographical regions. Furthermore, the State Planning Organization and State Statistics Institute have used provincial data to define 16 functional regions in 1982, but this division did not become a common aggregation for either the empirical studies or regional policy initiatives.

In this paper, three alternative partitions are explored in order to analyze inequality from different levels and perspectives: geographical regions, functional regions and coastal-interior regions. Therefore, the role of spatial scale and its impact on inequality can be examined in parallel to the way Rey (2001) adopted for his study in the US. In order to test spatial dependence, the well-known Moran-*I* and Moran Scatter-plot (Anselin, 1988; 1995) were used. Moran's *I* provides an indicator for spatial autocorrelation, here interpreted to imply value similarity with locational similarity. A positive autocorrelation occurs when similar values for the random variable are clustered together in space and vice versa (Cliff and Ord,1981; Upton and Fingleton,1985). The spatial dependence (global spatial autocorrelation) measure of Moran's *I* is represented by equation 3:

$$I_i = \frac{n}{s}\frac{\sum_i \sum_j w_{ij} z_i z_j}{\sum z_i^2} \qquad (3)$$

n is the number of regions, z_i and z_j are log of per capita income of each region, w_{ij} are the elements of weight matrix $W(n \text{ x } n)$ and it is equal to 1 if *i* and *j* are neighbors and 0 if they are not; *s* is the sum of all elements of *W*(spatial weights). A binary contiguity matrix was used adopting the familiar rules. There are two constructions of used for the binary spatial weight matrix, namely rook and queen. Rook computes only common boundaries, while queen compute both common boundaries and nodes[2]. In the case of our data, there is no different result by using either rook or queen, because all neighbors have common boundaries rather than nodes.

A value of Moran's *I* statistics around 1 represent strong and positive spatial autocorrelation, while values around –1 show negative spatial autocorrelation. The Moran scatter-plot provides a way of visualizing spatial association (Anselin, 1995,1996). Four quadrants in the scatter-plot represent different spatial association. The upper right and lower left quadrants correspond to positive spatial association by the presence of similar values in neighboring locations. The other two quadrants correspond to negative spatial association. The Moran scatter-plot can also be mapped as Moran scatter-plot map.

The global indicators of spatial association are not capable of identifying local patterns of spatial association, such as local spatial clusters or local outliers in data that are statistically significant. Anselin (1995) suggested a new general class of local indicators of spatial association (LISA) to facilitate the decomposition of global indicators. LISA statistics have two basic functions, first, they assist in the identification of significant local spatial clusters. Secondly, they can be used as a diagnostic of local instability (spatial outliers) in measures of global spatial association (Anselin, 1995). A local Moran statistic for an observation *i* is defined as:

[2] For more information about binary weight matrix, see Anselin (1988)

$$I_i = z_i \sum_{j}^{n} w_{ij} z_j \qquad (4)$$

"The observations z_i, z_j are the deviations from the mean, and the summation over j is such that only neighboring values are included" (Anselin,1995). The local Moran enables to identification of both positive and negative types of spatial interactions. A positive value for I_i indicates spatial clustering of similar values whereas a negative value indicates spatial clustering of dissimilar values between a region and its neighbors. The significance of LISA yields to the so-called Moran significance map, which shows the regions with significant LISA (Anselin,1995). The provincial GDP time series has been constructed from two different sources. For 1979-86, the data were obtained from the Istanbul Chamber of Industry (ISO,1988) and for 1987-97, data are derived from the State Statistics Institute (**www.die.gov.tr**). All nominal data were converted to 1987 constant prices. Population data have been obtained from State Statistics Institute based on 1980-1985-1990 and 1997 official census and interpolated for the years that do not coincide with the census. To avoid the effect caused by the creation of new provinces after 1990, though there are 80 provinces currently, the data set was created based on the former 67 provincial level throughout the 1980-1997 period.

4. Analysis of Regional Inequality in terms of GDP per capita

Although there is no formal administrative unit at the regional level in Turkey, reducing interregional inequalities has been a major goal during the planning period. Thus, inter-regional inequalities have been one of the main foci of regional studies. Atalik (1990) measured regional income disparities in Turkey for the years 1975 and 1985. For the functional regions, the coefficient of regional income variation moved from 0.32 in 1975 to 0.43 in 1985. Multivariate analysis verified a strong relationship of GDP variations by regions as a function of activity, infrastructure, industrial employment and agglomeration rates.

Issues of regional inequality can be addressed with aggregation issues as well. Rey (2001) found out that "the choice of the partition can fundamentally change the inequality decomposition". When he used three different partitions on state level and compared the interregional inequalities, he could explain that "...interregional share is not a simple function of the number of regional groupings used". In addition to this, he emphasize that "interregional inequality is dominant when state data are used, yet intraregional inequality is most important when county level data are used". Furthermore, his findings indicate that there is a strong positive relationship between the inequality measure and autocorrelation index, while they are both declining over 72 years in US.

4.1 The Findings of Inequality Analysis

In this paper, the three partitions are as follows geographical regions (7 regions), functional regions (16 regions) and coastal-interior provinces (2 sets). Tables 1 and 2 provide some descriptive information about the two main regional partitions. It is easy to gain a sense of the distribution and concentration of GDP among regions. At the provincial level, especially after 1986, inequalities have been declining, even though there has been increasing trend in 1992 (figure 1).

Geographical regions: Figure 2 shows the division of geographical regions. Inequality among the seven geographical regions has been increasing steadily. Although there is a decline of total inequality in the mid 1980s, from 1992, it has been increasing again (table 3). In the initial year (1980), inequalities could be categorized as 55% at the between/inter-regional level, while 45% were derived from within/intra-regional level. This proportion increased to 66% for between region inequality (table 3). Even a decreasing trend for "within region" inequality does not imply that there are decreasing trends within inequalities among the seven regions.

Mediterranean, Southeast Anatolia, Black Sea and East Anatolia are more stable and have relatively lower within region disparities. The Marmara region has the highest share of inequality (28%) within region during all analyzed period, while Central Anatolia and Aegean regions indicate respectively higher within inequalities as well (table 3). Black Sea and Southeast Anatolia have relatively lower share of total within inequalities in geographical regions. This result shows that less-developed or poor regions have relatively lower inequalities than richer ones related to the Kuznets hypothesis[3]. On the other hand, although the Marmara

[3] According to Kuznetz "inverted U curve", development will cause to increase interregional inequalities, at a certain time it will reach the highest level and after that it will decrease. Inequality is higher in middle income regions and lower among poorer and richer regions.

and Central Anatolia regions still have the largest "within region" inequality, there is a decreasing trend and it seems that other provinces within these regions are in the process of catching up. In terms of between or inter-regional inequality, developed regions that are located in the west part of the country elevate the inequality across regions.

Functional regions: Figure 2 shows the division of functional regions. The Theil index indicates slightly decreasing inequality within regions, while there is increasing inequality between regions, a result similar to the one found for geographical regions. Analysis reveals that for functional regions inequalities between regions account 60% of total inequalities in 1980 and 73% in 1997. Within region or intra-regional inequalities account 40% of total disparity in 1980 and 27% in 1997 (table 4). Intra-region inequalities for functional regions are lower than geographical regions, while interregional inequalities are higher (figure 3).

When the focus is on the inequalities within functional regions, it is obvious that the highest inequality is within the Istanbul functional region (Istanbul province and 9 provinces as hinterland) with a declining share of 42% in 1980 and 38% in 1997. İzmir and Ankara functional regions are other regions that have relatively higher within region inequalities. These results are related to the effect of metropolitan/big cities in the corresponding region, but it is also related to the number of provinces in the region.

Coastal-Interior provinces: With this partition, the objective was to examine whether there is a relation between geographical position in terms of coastal or interior provinces and inequalities in terms of growth. Although the west and south coasts of Turkey include the most developed provinces, the provinces along the Black Sea coast have basically backward features such as high out-migration, low growth rate, etc. At first, coastal provinces are the wealthiest in the country in terms of initial advantages like location and transportation opportunities[4]. In Turkey, the inclusion of provinces in the Black Sea region as PPDs[5] to the coastal partition, within region inequalities account 72% of total inequalities in 1980 and 66% in 1997. Moreover, between-region inequalities have been increasing from 28% to 34% in 1997 (figure 3 and table 4). Even though within region/intra-region inequality accounts for a large part of total inequalities, there

[4] Fujita and Hu (2001) examine this hypothesis for China. They emphasize that disparity within coastal provinces should be smaller than others.

[5] Backward regions- defined as Priority Provinces in Development by State Planning Organization. For more information Gezici and Hewings (2001)

has been declining inequality. On the contrary, inequality "between" coastal and interior provinces is increasing. The Theil index shows that "within" coastal inequality is declining while "within" interior is increasing slightly.

The hypothesis is that during the period of fast national growth, richer regions receive more benefits than poorer regions and thus it is to be expected that the result would be increasing inequalities. On the other hand, when the national economy slows down, the richer areas could be the first ones to be affected, while the poorer regions experience the negative effects later on. In order to examine this hypothesis, the inequality index was regressed against national GDP growth. However, the findings for Turkey made it difficult to postulate a clear interpretation related for the limited time period that was analyzed[6]. Figure 4 reveals some trends such that when national income growth is increasing, inequality index is declining (in the lower right of the graph).

4.2 Growth rate differences

Turkish provinces were grouped into three regions in terms of growth: very low, less than the national growth rate, more than the national growth rate (table 5). By excluding three provinces that have negative growth rates from 1980 to 1997, two main groups are growing either slower or faster than the national average. Even for both groups, the difference between the maximum and minimum rate is enormous. However, in terms of GDP per capita, they form the same group, while within these groups, there are several disparities. Moreover, one noticeable feature is that the three metropolitan cities and 4 of 5 first developed provinces experienced GDP per capita growth less than national average.

Absolute GDP and growth is still dominant in the provinces of Marmara, Aegean and Mediterranean regions from 1980 to 1997 (figure 5). Examining the distribution of GDP in 1997, that the three metropolitan provinces have a major role in the economy (see figure 5). The main differences in GDP per capita between east and west still exist; from 1980 to 1997, the provinces in Aegean are becoming richer, while the provinces in East Anatolia are becoming poorer. Distribution of GDP per capita in 1997 highlights the "spatial peripherality" as an effective factor associated with being economically peripheral as well (figure 6). Sanlıurfa, a

[6] The findings of Azzoni (2001) for Brazil indicate that "the association between national growth and regional inequality can not be rejected,"

province of the Southeast Anatolia project, is a notable case, having a low GDP per capita in 1980, but experiencing a high growth rate[7]. In terms of GDP per capita growth rate, the neighbor provinces of three metropolitan cities (Istanbul, Ankara and İzmir) are growing relatively faster. Moreover, most of the provinces in the east have a low GDP per capita growth rate positioning parallel to their rank in terms of GDP per capita, while there are few provinces that are growing relatively faster[8].

5 Spatial Dependence of Growth- Spatial Autocorrelation

Rey (2001) examined the relationship between regional inequality and spatial dependence in the US. Using the Theil index and Moran's I, his findings indicated "*a strong positive relationship between the inequality measure and the autocorrelation index.*" He used several spatial partitions[9] and each of the interregional inequality shares had a strong positive correlation with the measure of spatial dependence. Ying (2001), emphasized Friedmann's assumption[10] in terms of polarization and spread-spillover effects. He used local Moran statistics in order to identify both positive and negative types of spatial interactions. His findings prove the presence of the expected spillover effects in the Chinese space economy especially for coastal provinces.

In order to examine the dynamism of EU regions, Le Gallo and Ertur (2001) used the log of per capita GDP and mean growth rates from 1980 to 1995. They found more instability when they compared the scatter-plots for GDP per capita in 1980 and 1995. Only 59.42% of the European regions show association of similar values, while 40.58% of the regions are negatively associated. LISA statistics shows that the patterns of spatial association remain dominated by clustering of Low-Low and High-High types. Furthermore, the comparison between log of GDP per capita in 1980 and mean growth rate indicates that the regions are located in the opposite quadrant from the each other. While these regions indicate dynamism, some poor regions still have strong signs of delay of development. The question is if this delay is due to the dynamism of their neighbors or not.

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[7] For more information Gezici and Hewings(2001)

[8] In the east, Malatya and Sanliurfa are growing faster.

[9] Census regions, Census division, BEA regions (Bureau of Economic Analysis) in US

[10] Friedmann's (1972) hypothesis on spatial interaction that spread process is a successful diffusion of the core's existing institutions into the periphery.

In this section, the dynamics of provinces by using spatial autocorrelation of GDP per capita and mean growth rate during 1980-1997 in Turkey were examined. [11]

5.1. Spatial Autocorrelation

It is important to look at the spatial patterns of mean growth rates in order to examine spillover effects. If the growth rates of poor regions are higher than the growth rates of rich regions, this spatial inequality may probably decrease in future and convergence is expected. If comparison is made of the spatial clustering of both growth rates and initial and actual GDP per capita, then the dynamism of the poor regions and rich regions can be related to their neighbors' dynamism. At this point, if a neighbor relation has a positive effect, spillover effects and complementarities can be assumed. ESDA highlights the importance of spatial interactions and geographical locations in regional growth issues. In order to test the spatial dependence of convergence in Turkey, the log of GDP per capita in 1980 (initial year) and the mean of GDP per capita growth were used. The initial(1980) and final year(1997) variances were also examined. In addition, both the spatial dependence of GDP per capita growth and absolute GDP growth were analyzed.

Using the Wald test for data normality, highly significant results for Log of GDP per capita in 1980 and 1997 were obtained. While the hypothesis of normality for two variables cannot be rejected, normality for GDP growth rate and GDP per capita growth can be rejected for the period between 1980 and 1997 (table 6).

Moran's *I* of the log of GDP per capita is increasing from 0.5372 in 1980 to 0.6398 in 1997;[12] (a randomization assumption is rejected for both variables (highly significant) and it means that the distribution of GDP per capita by province is strongly influenced by neighbors (table 7). This highly spatial clustering can be seen in the Moran scatter plot map for two years as well (figure 7 and 8). In 1980, 76.12% of the provinces show association of similar values with their neighbors, while this ratio increased slightly to 77.61% in 1997. The distribution revealed 38.88% in quadrant I as HH and 37.31% in quadrant III as LL in 1980, while 41.79% were in quadrant I as HH and 35.82% in quadrant III as LL in 1997. The spatial dependence is increasing among richer provinces rather than the poorer ones.

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[11] Results of this section were obtained through SpaceStat™ extension for ArcView™ (Anselin, 1999)

[12] Moran's I for GDP per capita in 1980=0.4538, in 1997=0.5447 (without taking log)

In both years (1980 and 1997), provinces that are clustering as high-high are located in the west and mainly west and south coast. In 1997, the HH cluster is more concentrated in the coast than was the case in 1980, indicating that spillover effects are more visible in the west and especially the coastal provinces. While some provinces that are interior neighbors of coastal provinces, are catching up the coastal provinces, many of them are remaining behind. There is almost no difference in the east provinces categorized as Low-Low over the 17 years.

Computation of Moran's I on the mean of absolute GDP growth between 1980 and 1997 reveals positive correlation for most of the provinces (Moran's I=0.351567). 73.13% of the provinces indicate positive spatial association (32.83% as HH and 40.30% as LL), while 26.87% of them have negative spatial association. On the other hand, there is little evidence for high spatial autocorrelation for GDP per capita growth (Moran's I=0.134526). 56.72% of the provinces indicate association of similar values (19 of them are HH and 19 of them LL types), while 43.28% of them indicate randomness. HH types are clustering in four geographical locations as following as shown in figure 9.

As a result of our findings, it may be claimed that even though there is a strong spatial autocorrelation on GDP per capita for initial and final years, GDP per capita growth during the period analyzed does not include strong spatial autocorrelation. The level of growth among provinces is dependent on their neighbors, while the growth rates seem to be more independent of the growth of neighbors.

5.2 Regional inequality and spatial dependence

Figure 10 indicates the relationship between regional inequality and spatial autocorrelation among provinces in Turkey. Inequality is measured by using the Theil index, while spatial autocorrelation is measured by using Moran's *I*. Rey and Montouri (1999) used the coefficient of variation the log of GDP per capita and Moran's *I* in order to present this relationship. According to their findings, in any given year, state income distribution exhibits a high degree of spatial dependence. They offered two explanations: first, an increase in spatial dependence could indicate that each cluster is becoming more similar in terms of convergence. Secondly, "an increase in spatial dependence could also be due to newly formed clusters emerging during a period of increased income dispersion." Next, Rey (2001) used the Theil index and Moran's *I* and found strong positive relationship between the inequality and autocorrelation index in US.

His analyzed period (1929-2000) allowed him to interpret the time differences. His findings indicate that there is a decline in both the global inequality measure and level of spatial dependence.

In Turkey, the Theil index is decreasing especially in mid 1980's, while Moran's *I* is slightly increasing over entire period. Moran's *I* coefficients are highly significant[13] for all years providing support for the hypothesis of spatial dependence, while rejecting a hypothesis of a random distribution of income. Although overall inequalities are decreasing, spatial dependence is becoming more dominant. This finding may be interpreted to imply that interconnections among provinces have been increasing over time, by increasing concentration of clusters as either HH or LL. Furthermore, a comparison between Moran's *I* and both interregional and intra-regional inequalities, reinforces the role of neighbor effects on growth and inequality (figure 11). Between regional inequalities are increasing in parallel fashion to the spatial dependence, while within regional inequalities are diminishing. Hence, increasing spatial dependence has a positive effect on within regional inequalities. As noted earlier, spatial dependence mostly includes spatial clusters as HH in the west and LL in the east of the country. Furthermore, this result strengthens the findings of Gezici and Hewings (2001) that there is no strong evidence on convergence and east and west dualism (spatial regime) still remains in Turkey.

5.3. Patterns of mean growth rates

When GDP per capita in 1980 and mean growth of GDP per capita between 1980 and 1997 are compared, it is difficult to find evidence that LL clustering provinces as poor ones in initial year, are growing faster than rich ones. In the Moran scatter plot of the mean growth, 13 of 25 LL provinces of GDP per capita in 1980 indicate negative spatial autocorrelation, while 8 of them are clustering as LL positive autocorrelation. Only three provinces classified as LL type indicate HH type growth. Thus, they do not have high dependence of their neighbors in terms of growth. There are some provinces growing faster than their neighbors in the east of Turkey. In terms of spatial dependence, spillover effects of growth have appeared in the west of Black sea and Central Anatolia regions (see figure 9).

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[13] z-values are highly significant (less than 1%) for all years.

The global indicators of spatial association are not capable of identifying local patterns of spatial association such as local spatial clusters or local outliers. In order to examine the local clusters, the Local Moran was used to capture LISA outliers. GDP per capita in 1980, indicates 23 provinces as significant and clusters as follows (table 8):

1. HH- 11 provinces- 2 geographical clusters: 8 of them in the Marmara region and most developed provinces and 3 of them in Aegean and Mediterranean as tourism areas.
2. LL- 10 provinces- All of them in East and Southeast Anatolia
3. HL- 1 province in East Anatolia (Elazig),
4. LH- 1 province in Central Anatolia (Nigde)

For GDP per capita in 1997, 24 provinces are significant and 2 clusters with positive spatial association can be identified as follows (see table 8):

1. HH- 13 provinces- 2 geographical clusters: 8 of them in the Marmara region, 4 of them in Aegean region and 1 of them in the west of Black Sea region.
2. LL- 11 provinces- All of them in East and Southeast Anatolia, 5 of them are geographically periphery as boundary provinces.

There is a noticeable difference that the provinces are becoming more clustered as HH in the west and as LL in the east from 1980 to 1997.

The mean growth of GDP per capita between 1980 and 1997 yields 11 provinces as significant and 4 clusters result: (see table 8):

1. HH- 3 provinces- Edirne, Tekirdag, Nevsehir
2. LL- 4 provinces- Bitlis, Van, Siirt, Hakkari (all of them in the south east)
3. LH- 1 province- Yozgat
4. HL- 3 provinces- Malatya, Sanliurfa and Mus

In terms of growth, the weak spatial dependency is seen in local analysis as well as global one.

From 1980 to 1997, there is evidence that local spatial clusters are concentrating and enhancing east and west dualism. All significant provinces with HH values are located in the west, while all provinces that have LL values are located in the east. Thus, west provinces are becoming richer with their neighbors while east and especially geographically peripheral provinces are becoming poorer with their neighbors.

6 Conclusion

Regional analysts have known for a long time that regional divisions of space are often arbitrary but, overall, there has been very little testing of model results across different regional divisions. The Theil index indicates that interregional inequalities in Turkey are increasing while intra-regional inequalities are declining for all partitions from 1980 to 1997, results that parallel other cases in the world except US case. According to the findings of Rey (2001) and also Sonis and Hewings (2000), interregional dependence is becoming more important across states and the structures of regional economies in US are becoming more similar over time. Intra-regional inequalities for functional regions are lower than geographical regions, while interregional inequalities are higher.

In terms of intra-regional inequalities, less-developed or poor regions have relatively lower inequalities than richer ones. Developed regions that are located in the western part of the country enhance the inequality both across regions and within regions. The Marmara region as the dominant region in the national economy has the highest share of within region inequality (28%) over the whole time period. In terms of the coastal-interior partition, “within” coastal inequality is declining, while “within” interior is increasing slightly.

Given the existence of spatial interactions between regions, geographical location plays an important role for explaining the economic performance of regions. Interconnections among provinces have been increasing over time, through the increasing concentration of clusters as HH or LL. According to the results of the spatial autocorrelation analysis, spatial dependence is increasing among richer provinces rather than poorer ones. In both years (1980 and 1997-GDP per capita), provinces that are clustering as High-High are located in western regions and the west and south coasts. Furthermore, there is almost no difference among the east provinces categorized as Low-Low for 17 years. Although overall inequalities are decreasing, spatial dependence is becoming more dominant.

However, there is an indication of strong spatial autocorrelation for levels of GDP per capita for both the initial and final years, while GDP per capita growth during the period does not indicate strong spatial autocorrelation. The level of growth among provinces is dependent on their neighbors, while growth rates are more likely to be independent of those of neighbors.

In terms of GDP per capita for 1980 and 1997, the local spatial association indicates two main clusters as HH in the Marmara and Aegean/Mediterranean regions. These provinces are mostly surrounding areas of Istanbul or main tourism areas along the coast of Aegean and Mediterranean Sea. On the other hand, most of the provinces that are clustering as LL, are located in the east and especially geographically periphery. These findings provide an opportunity to view the inequalities and interdependence among regions in more detail. The effects of most developed provinces have to be considered.

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Table 1- Share of GDP among Geographical Regions

Geographical Regions	**1980**	**1985**	**1990**	**1995**	**1997**
Marmara	31,76	34,85	35,86	36,74	38,14
Aegean	16,08	16,53	16,48	17,15	16,75
Mediterranean	11,92	10,95	11,29	11,25	11,19
Central Anatolia	18,67	17,81	16,95	16,75	16,06
Black Sea	10,69	9,37	8,97	8,42	8,32
Southeast Anatolia	5,26	5,28	5,46	5,29	5,38
East Anatolia	5,63	5,20	5,00	4,39	4,15

Table 2-Share of GDP among Functional Regions

Functional Regions	**1980**	**1985**	**1990**	**1995**	**1997**
ADANA	8,87	8,03	8,13	7,83	7,70
ANKARA	***10,39***	***10,09***	***9,75***	***9,69***	***9,15***
BURSA	3,18	3,61	3,98	4,05	3,89
DİYARBAKIR	3,22	3,05	2,86	2,76	2,72
ELAZIĞ	1,12	1,00	0,97	0,77	0,72
ERZURUM	1,87	1,67	1,55	1,30	1,23
ESKİŞEHİR	2,92	2,85	2,44	2,59	2,45
GAZİANTEP	3,98	3,87	4,23	3,97	4,06
İSTANBUL	***29,83***	***32,11***	***32,54***	***33,22***	***35,23***
İZMİR	***19,92***	***20,08***	***20,57***	***21,36***	***20,92***
KAYSERİ	2,29	2,35	2,06	2,08	2,00
KONYA	3,77	3,37	3,29	3,15	3,18
MALATYA	0,69	0,88	0,85	0,88	0,81
SAMSUN	4,61	4,02	4,14	3,83	3,68
SİVAS	0,82	0,73	0,67	0,66	0,61
TRABZON	2,52	2,29	1,98	1,84	1,66
Total	100,00	100,00	100,00	100,00	100,00

Table 3- Proportion of between and within region inequalities-geographical regions

	total		between	within	Marmara	Aegean	Mediter.	Central Anatolia	Black Sea	S.East Anatolia	East Anatolia
1980	0,1162	100%	55%	45%	29%	17%	7%	24%	7%	4%	11%
1981	0,1207	100%	53%	47%	36%	13%	9%	23%	5%	4%	9%
1982	0,1243	100%	57%	43%	30%	18%	10%	23%	7%	3%	10%
1983	0,1283	100%	57%	43%	41%	18%	4%	19%	6%	4%	9%
1984	0,1277	100%	60%	40%	36%	17%	3%	20%	8%	5%	11%
1985	0,1282	100%	61%	39%	36%	17%	2%	24%	6%	4%	11%
1986	0,1288	100%	61%	39%	36%	16%	3%	24%	6%	4%	11%
1987	0,123	100%	61%	39%	34%	17%	3%	25%	6%	5%	11%
1988	0,1139	100%	62%	38%	29%	18%	3%	26%	6%	6%	11%
1989	0,1146	100%	64%	36%	26%	19%	4%	26%	7%	6%	12%
1990	0,1131	100%	61%	39%	26%	16%	3%	26%	7%	10%	11%
1991	0,107	100%	62%	38%	28%	16%	4%	26%	8%	8%	11%
1992	0,1045	100%	63%	37%	27%	19%	4%	26%	7%	7%	12%
1993	0,1136	100%	62%	38%	30%	19%	4%	25%	6%	7%	9%
1994	0,1016	100%	61%	39%	26%	20%	4%	26%	8%	5%	11%
1995	0,1076	100%	64%	36%	25%	20%	3%	26%	7%	7%	12%
1996	0,1057	100%	66%	34%	23%	20%	3%	25%	10%	9%	11%
1997	0,1088	100%	66%	34%	29%	20%	2%	24%	9%	7%	10%

Table 4- Proportion of between and within region inequalities for different partitions

	Theil index	**Geographical regions**		**Functional regions**		**Coastal-interior**	
	Total	Within	Between	Within	Between	Within	Between
1980	0,1162	0,4527	0,5473	0,3992	0,6008	0,7158	0,2842
1981	0,1207	0,4707	0,5293	0,4275	0,5725	0,7347	0,2653
1982	0,1243	0,4330	0,5670	0,4004	0,5996	0,7245	0,2755
1983	0,1283	0,4320	0,5680	0,4078	0,5922	0,6965	0,3035
1984	0,1277	0,3966	0,6034	0,3652	0,6348	0,6950	0,3050
1985	0,1282	0,3928	0,6072	0,3774	0,6226	0,7127	0,2873
1986	0,1288	0,3929	0,6071	0,3749	0,6251	0,7135	0,2865
1987	0,1230	0,3860	0,6140	0,3700	0,6300	0,7097	0,2903
1988	0,1139	0,3769	0,6231	0,3700	0,6300	0,7043	0,2957
1989	0,1146	0,3638	0,6362	0,3409	0,6591	0,6515	0,3485
1990	0,1131	0,3917	0,6083	0,3517	0,6483	0,6936	0,3064
1991	0,1070	0,3777	0,6223	0,3518	0,6482	0,7104	0,2896
1992	0,1045	0,3674	0,6326	0,3310	0,6690	0,6850	0,3150
1993	0,1136	0,3775	0,6225	0,3405	0,6595	0,6977	0,3023
1994	0,1016	0,3866	0,6134	0,3333	0,6667	0,6941	0,3059
1995	0,1076	0,3632	0,6368	0,3152	0,6848	0,6822	0,3178
1996	0,1057	0,3413	0,6587	0,2809	0,7191	0,6617	0,3383
1997	0,1088	0,3388	0,6612	0,2707	0,7293	0,6605	0,3395

Table 5-Growth in Real Per Capita Income, 1980-97

Group	**Number**	**Mean**	**Std.Dev.**	**Min.**	**Max.**
Dismal (very low)	3	-0.0076	0.0093	-0.0016	-0.0180
< national mean	30	0.0183	0.0080	0.0006	0.0286
>national mean	34	0.0497	0.0153	0.0335	0.1141

Table 6- Wald test for normality

Variable	Test	Probability
LNGDPCapita-1980	0.9351011	0.62653504
LNGDPCapita-1997	1.988163	0.37006321
GDP per capita growth (1980-1997)	23.74364	0.00000698
GDP growth (1980-97)	37.0167	0.00000001

Table 7-Moran's I Test for Spatial Autocorrelation (Randomization assumption)

Variable	Moran's I	Mean	Std.Deviation	Z-value	Probab.
LNGDPC80	0.5372149	-0.015	0.077434	7.133391	0.000000
LNGDPC97	0.6397748	-0.015	0.077656	8.433687	0.000000
GDPCGR8097	0.134526	-0.015	0.077653	1.927519	0.053915
GDPG8097	0.3515673	-0.015	0.075825	4.836400	0.000001

Table 8- Significance of LISA

Variables	p=0,001	P=0,01	p=0,05
LNGDPC80	Erzurum, Agri, Bursa	Istanbul,Kocaeli, Sakarya,Mus,Erzincan, Bingol,Bitlis,Van, Diyarbakir, Mardin	Elazig,Kirklareli,Bolu,Balikesir, Bilecik, Manisa, Aydin, Siirt, Nigde, Antalya
LNGDPC97	Bursa,Agri,Van, Siirt,Bitlis, Mus	Istanbul,Tekirdag,Edirne, Sakarya,Balikesir,Aydin, Bingol,Erzurum,Mardin, Diyarbakir	Kirklareli,Kocaeli,Bolu,Manisa, Kutahya,Mugla, Hakkari,Erzincan
GDPCG8097	Siirt	Edirne, Van, Hakkari	Tekirdag,Yozgat,Nevsehir,Mus Malatya,Sanliurfa,Bitlis

Bursa; The provinces are significant in initial and terminal year.

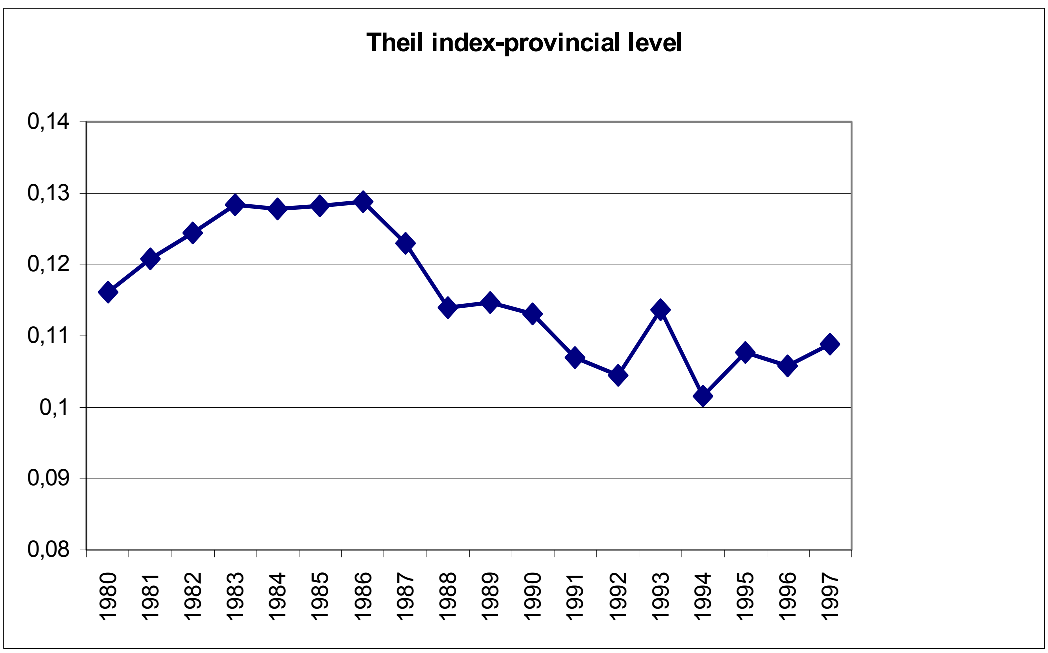

Figure 1- Inequalities among provinces

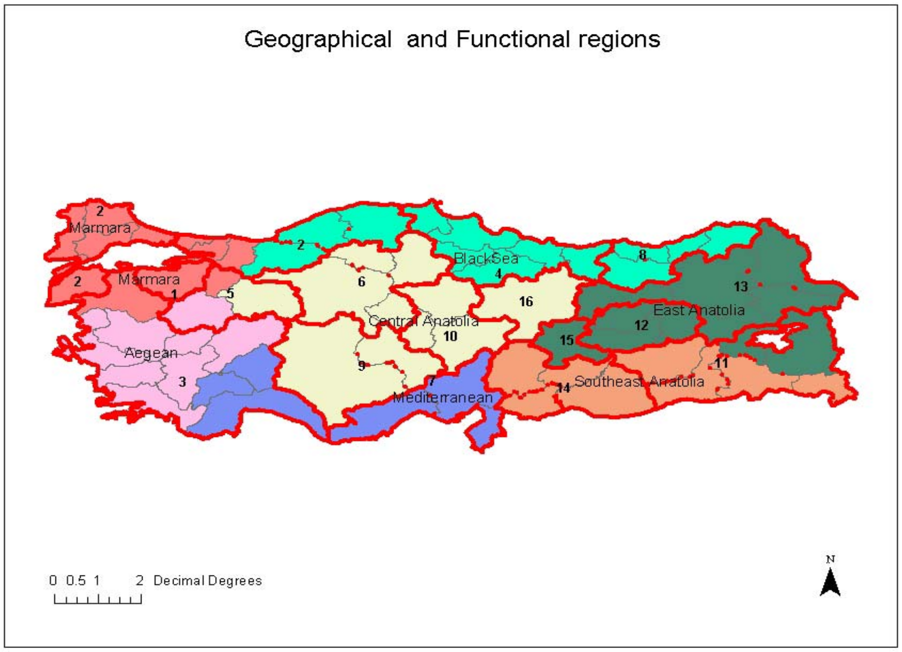

Figure 2- Geographical and Functional regions of Turkey

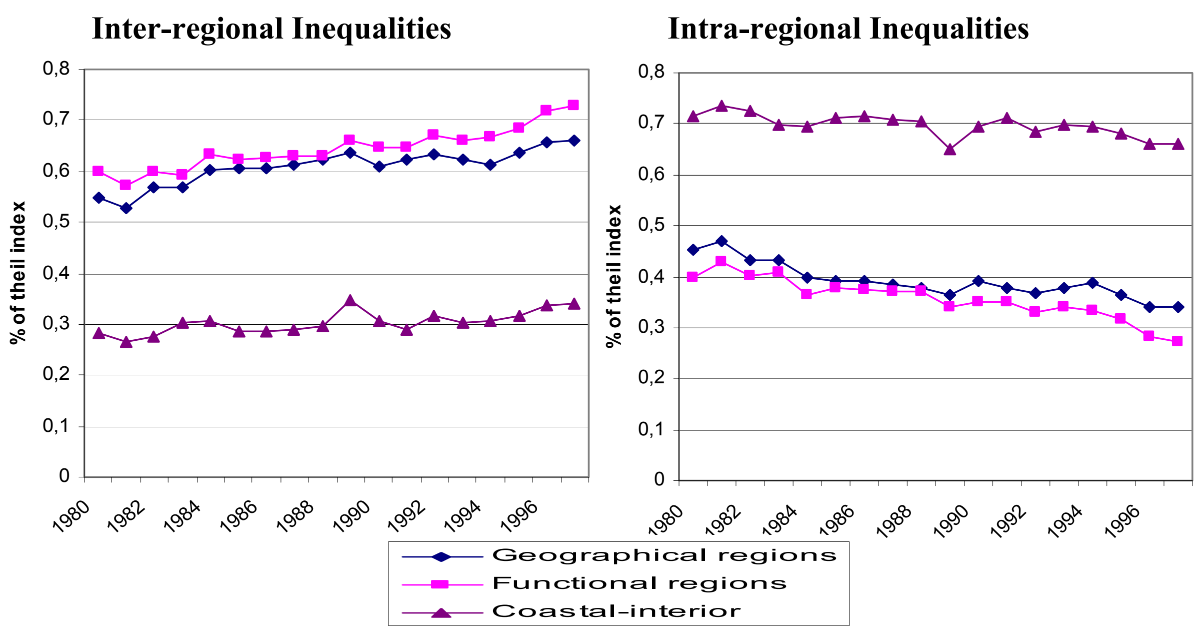

Figure 3- Inter-regional and intra-regional inequalities in terms of different partitions

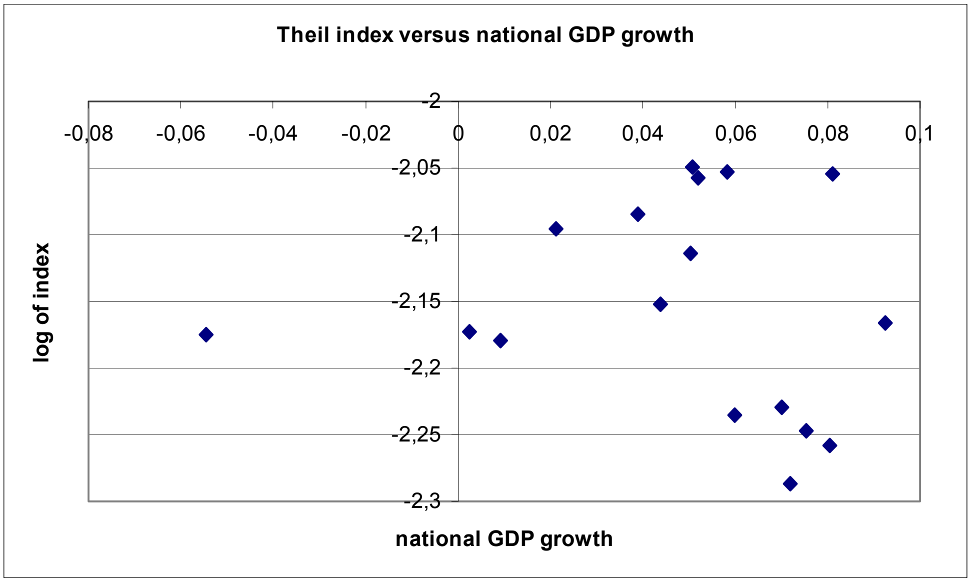

Figure 4- Relation between inequality and national GDP growth

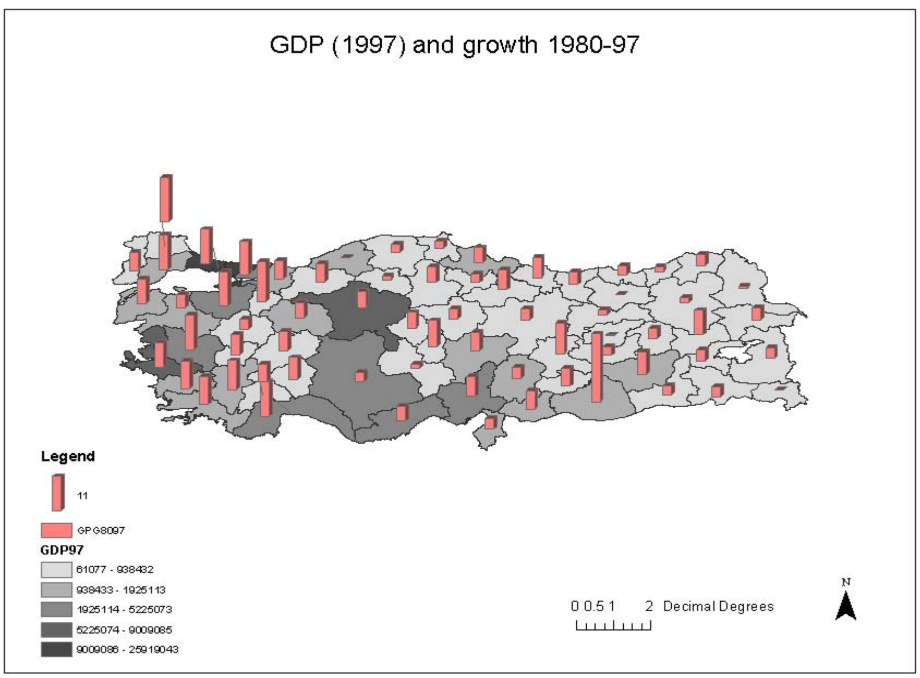

Figure 5- Distribution of GDP and GDP growth (1980-97) across provinces

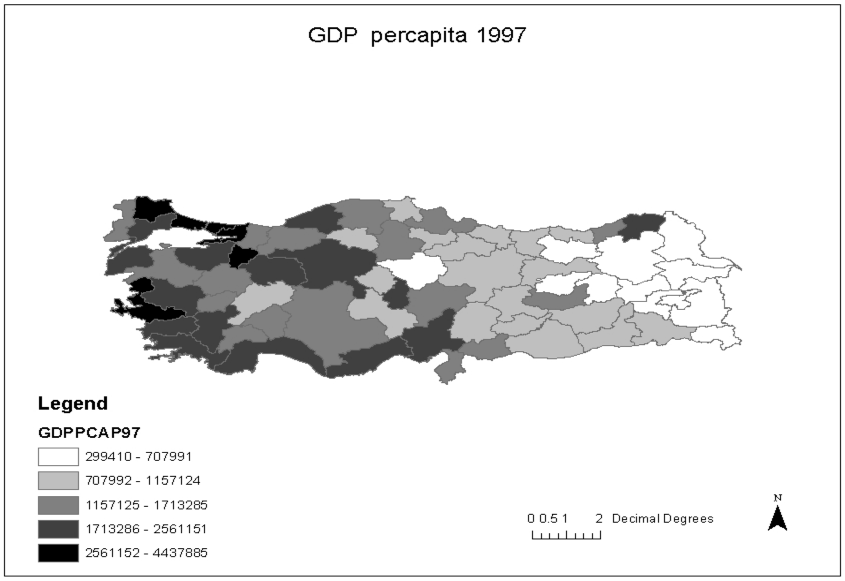

Figure 6-Distribution of GDP per capita across provinces in 1997

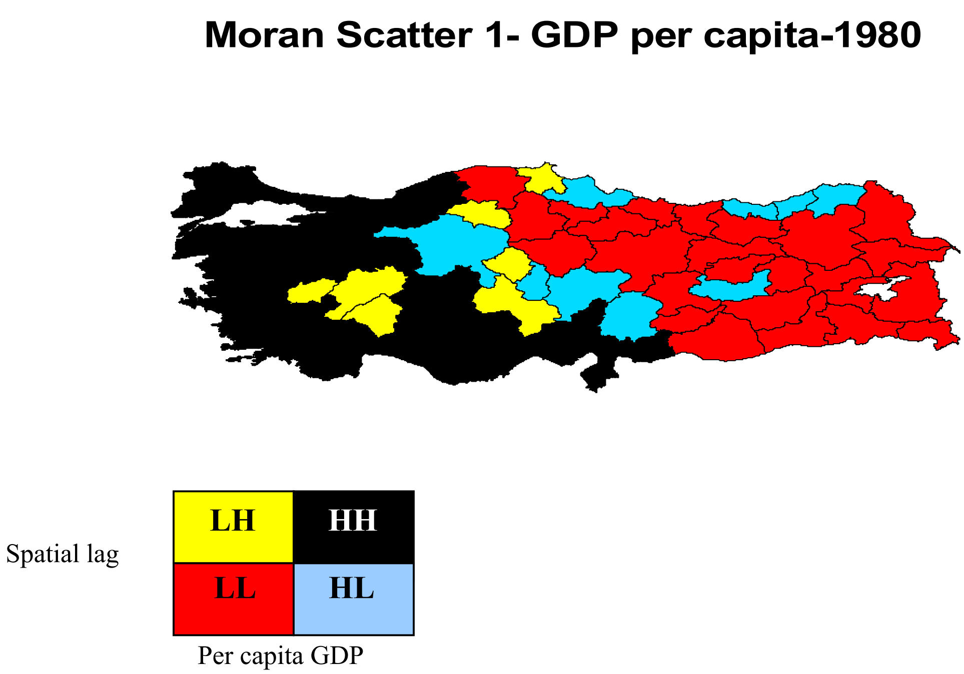

Figure 7- Moran Scatter-plot map for Log of GDP per capita-1980

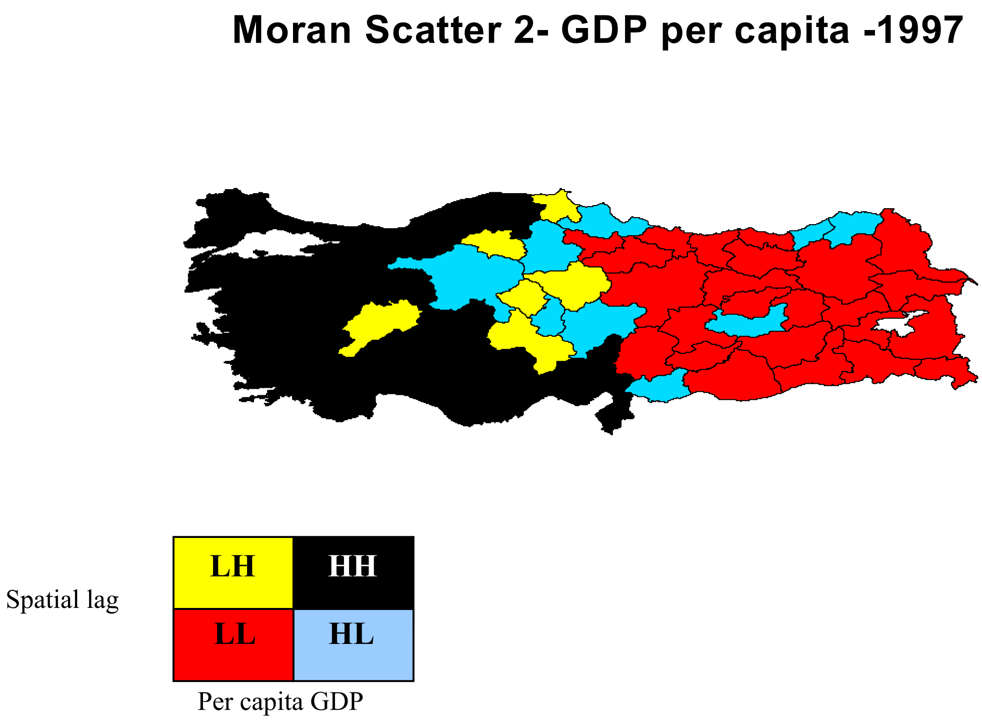

Figure 8- Moran Scatter-plot map for Log of GDP per capita-1997

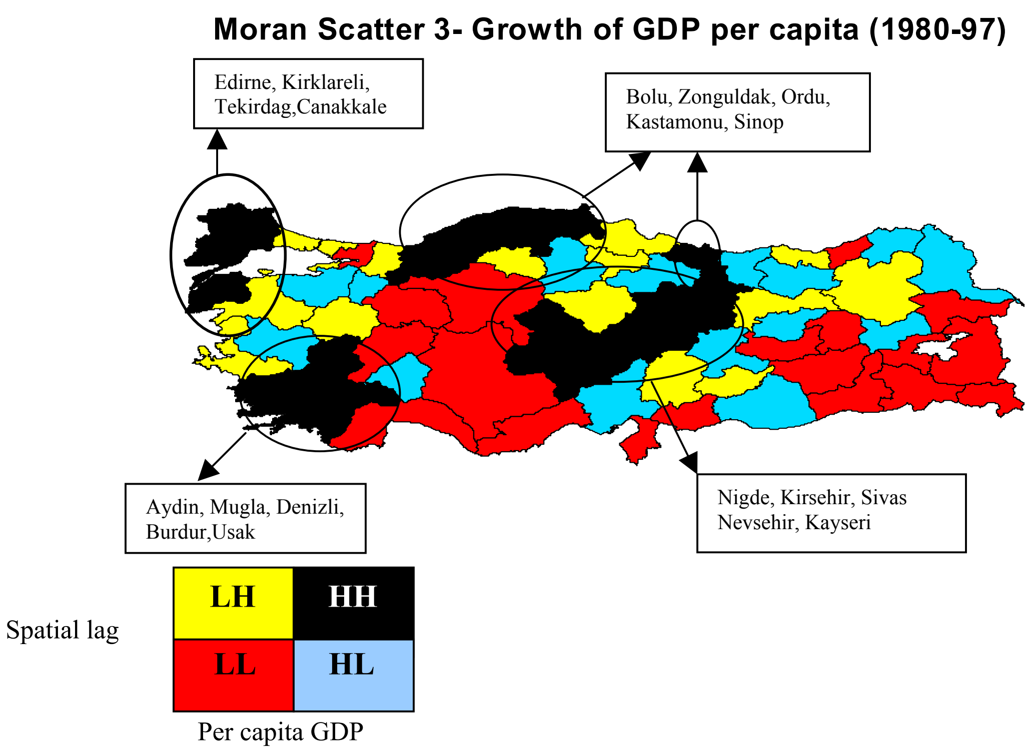

Figure 9- Moran Scatter-plot map for mean growth of GDP per capita (1980-97)

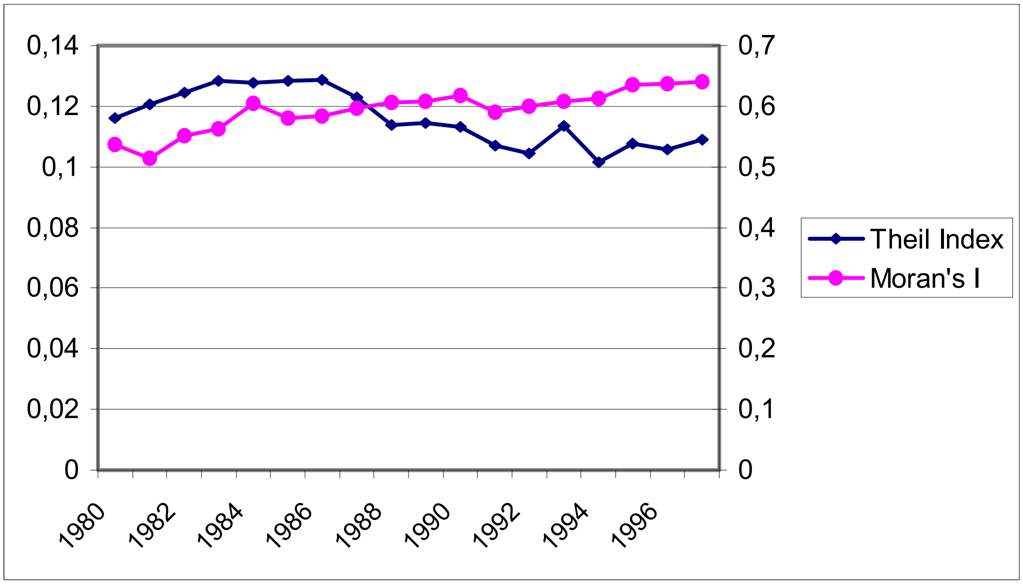

Figure 10- Regional inequality and spatial dependence (Theil Index and Moran's I)

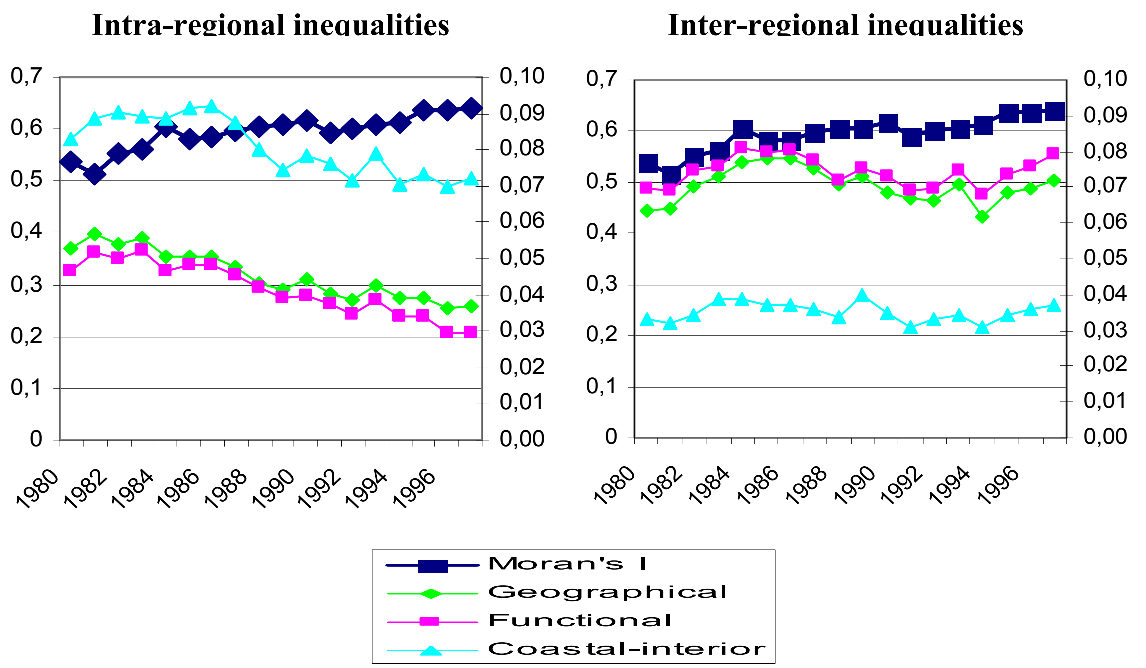

Figure 11- Inter-regional and intra-regional inequalities compare to the spatial dependence