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Spatial Analysis of Regional Inequalities in Turkey

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ABSTRACT *In this paper, we examine regional inequalities in Turkey not only at the interprovincial level but for three different regional definitions as well. It has raised questions about inequalities not only between regions (interregional) 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 intraregional 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 neighbours.*

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 performance of regions. However, the inequality literature has generally neglected the spatial dimension (Rey, 2001, 2004). Moreover, since reducing regional inequalities has been an essential part of the integration and cohesion process of the European Union (EU), there has been increasing number of studies that have focused on spatial inequalities within member states and regions of the EU in order to establish policy recommendations. Therefore, it has been a significant issue for Turkey as a candidate member. In Turkey, the persistence of a spatial dualism between east and west from the past until the present was revealed in Gezici and Hewings (2004). In contrast, the EU as a whole has north and south spatial regimes (Le Gallo & Ertur, 2003; Baumont *et al.*, 2003; Fingleton, 2003), while Italy still has historical north and south dualism

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(Mauro & Podrecca, 1994; Terrasi, 1999), and Greece has two main regions as Athens and non-Athens (Siriopoulos & 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 & Bao, 1997). Some empirical works by Rey and Montouri (1999), Rey (2001, 2004), Le Gallo and Ertur (2003), Baumont *et al.* (2003), Ying (2000), Dall'erba (2005) are examples that focus on regional inequalities and spatial dependence of growth using ESDA.

The presence of interregional inequalities has long been an issue in regional development policy in Turkey. Though there have been earlier studies on this issue, emphasis on the spatial dimension has generally been neglected. Therefore, spatial data analysis stimulates a new insight for the regional development agenda in Turkey. Gezici and Hewings (2004) summarize the inequalities literature in Turkey, and explore some of the convergence issues. In the present paper, interregional and intraregional inequalities are analysed based on three different partitions using the Theil Index; further, the paper focuses on the spatial affects of growth as a major contribution to the regional development. Analysing different partitions enables us to discover more about the regional dimension in Turkey's economic development. Since, earlier studies (Senesen, 2002; Özmucur & Silber, 2002; Berber *et al.*, 2000) mostly focused on geographical regions, and few studies are considering on functional regions, e.g. Atalik (1990, 2002), the analysis of three different regional definitions and comparison among them will be a significant contribution to the regional development literature and formulation of regional policies in Turkey.

In the next section, the theory and the hypotheses are presented along with expectations, while in the third section the methodology and data are reviewed. In the fourth section, the analysis focuses on the inequalities between and within regions of different partitioning in Turkey by using the Theil Index. In the fifth section, attention is directed to spatial dependence, global and local clustering through ESDA. Furthermore, the spatial pattern of gross domestic product (GDP) regional growth is examined in relation to their initial level of GDP per capita. The paper's conclusion reviews the findings and presents policy recommendation and an agenda for future research.

An Overview of Theory on Regional Inequalities

There are several factors that contribute to the explanation of interregional growth disparities within a nation. They would include: the growth of labour force, capital stock, technological progress; growth of a region's exports; cumulative process of regional specialization or knowledge spillovers; external economies and agglomeration economies. The growth of GDP has always been used as a basic measure for analysis of regional growth and regional inequalities.

Regional growth displays different viewpoints with respect to inequalities. The endogenous growth literature has suggested a cumulative process wherein regional specialization or knowledge spillovers among industries are the main sources of

growth, and developed regions will always have the benefits of growth more than less-developed regions (Hansen, 1995). Hence, interregional disparities are inevitable and if not regulated, will increase between core and peripheral regions (Hirschman, 1965; Myrdal, 1972; Friedmann, 1972; Hansen, 1995). The spatial concentration of economic activities is a result of increasing returns to scale and economic polarization will lead to geographical polarization with the flow of resources to and the concentration of economic activities at a limited number of centres within a region (Glasson, 1974; Krugman, 1998). The vertical disintegration of industrial activities may have favoured the diffusion of activities from the core to the periphery, but as long as high technology industries and producer services were mainly located in the core, the aggregate productivity of core regions would grow faster than those in the periphery (Lopez-Bazo *et al.*, 1999).

From another point of view, there is a tendency towards reduction of interregional disparities. According to the one of the key predictions of neo-classical growth theory, spatial disparities in per capita income should converge over the long run. The mechanism behind diminishing inequalities rests on decreasing returns to scale to capital; regions with low capital stocks and per capita income should have a higher return to capital (Solow, 1956; Martin, 1998). There is a relationship between the core and its hinterland and the development in a certain area also influences surrounding areas through spread effects (Richardson, 1973). Some of the empirical studies on spatial inequalities put forward that low cost advantages due to production, labour and development in transport and communication seem to have helped lagging regions (Suarez Villa & Cuadrado Roura, 1993; Camagni, 1995; Ying, 2000).

There are empirical studies (Fujita & Hu, 2001; Azzoni, 2001; Lee, 2000; Qingshu & Stough, 2000; Terrasi, 1999) on regional inequalities that have focused on both interregional and intraregional inequalities by using the Theil Index. They used different decompositions such as interprovincial and intraprovincial, coastal and interior. In the present paper, three different regional definitions have been examined in terms of level of inequalities in order to realize the dynamics of different regions. In addition to the well-known geographical regions, functional regions and coastal-interior regions are examined. One of the hypotheses proposed is that the cumulative process of regional growth in Turkey retains a significant influence due to the dominant effects of western developed regions. Secondly, coastal provinces are the wealthiest in the country in terms of initial advantages derived from location and transportation facilities.

However, many economic growth and development theories have focused on economic structure and formation but have ignored the spatial formation. Quah (1997) concludes that the spatial factors are more important than the national ones due to complex nature of regional dynamics. Fingleton (2003), Le Gallo and Ertur (2003), Baumont *et al.* (2003), Rey and Montouri (1999), Rey (2004), Ying (2000), Aroca *et al.* (2004) and Dall'erba (2005) have focused explicitly on the nature of spatial inequalities, considering such phenomena as spatial autocorrelation, spatial regimes, convergence and polarization patterns through the use of ESDA; they concluded that space or geography plays a significant role in conditioning economic growth. In order to examine the dynamism of EU regions, Le Gallo and Ertur (2003) used the log of per capita GDP and mean growth rates from 1980 to 1995. They found more instability when they compared the scatterplots for GDP per capita in 1980 and 1995. Furthermore, the comparison between the log of GDP per capita in 1980 and mean growth rate indicates the convergence. Rey (2001, 2004) 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[1] and each of the interregional inequality shares had a strong positive correlation with the measure of spatial dependence.

ESDA enables us to examine the spatial dependence of regional growth in Turkey. First, the analysis explores how provinces are clustering in terms of GDP per capita and if they are growing together with their neighbours following the hypothesis of a cumulative process of inequalities. Secondly, the process of convergence considers spatial aspects. Finally, the relationships between regional inequalities and spatial dependence are examined. The level of spatial dependence will be helpful in explaining the dynamics of between and within region inequalities as well.

In this paper, the analysis of regional inequalities in Turkey is developed not only at the interprovincial level but for three different regional definitions: geographical, functional and coastal-interior. This need to explore alternative geographies was generated by the findings of Gezici and Hewings (2004), wherein there appeared to be a need to examine not only inequalities between regions (interregional) but inequality within each region (intraregional) 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.

Methodology and Data

The paper focuses on two main aspects and the methodology helps to enhance these aspects. Firstly, inequalities are examined across regions and within regions based on three different regional partitions in order to realize different regional dynamics. Secondly, 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/regions are clustering in space in terms of growth and inequalities.

There are empirical studies (Fujita & Hu, 2001; Azzoni, 2001, Lee, 2000; Qingshu & Stough, 2000; Terrasi, 1999) on regional inequalities that have focused on both interregional and intraregional inequalities by using the Theil Index. The index of interregional inequalities is presented as:

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

where x_i = population of province i relative to the national population, while y_i = GDP of province i relative to the national GDP, and n denotes the number of the regions. By using the Theil Index, the sum of interregional and intraregional disparities can be estimated as:

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

where the left side is the Theil Index measuring the disparity between regions (interregional), 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 (intraregional or within) in region g.

As noted earlier, three different regional definitions are used to explore the role of spatial scale and its impact on inequality in parallel to the way Rey (2001, 2004) adopted it for his study in the US. "Functional regions" were defined resulting from an investigation of "The Hierarchy of Urban Settlements in Turkey" by the State Planning Organization in 1982. However, this division did not become a common aggregation for either the empirical studies or regional policy initiatives. The definition and analysis of coastal-interior regions is based on testing the hypothesis that the coastal provinces are relatively rich ones and growing faster than interior provinces. Moreover, for the purpose of harmonizing with the regional statistical system of EU, establishing the statistical database, and decision-making for regional policies, a classification of new regional statistical units (NUTS) of Turkey has been completed in 2002. The findings of NUTS regions analysis are presented in Gezici (2004). Within region inequalities are mostly stable compared to "between region inequalities" because the NUTS 2 regions have mostly similar features, especially related to economic and political factors within their provinces. However, these regions have not completed their organizational restructuring as administrative regional units.

For the second part of the methodology, global and local spatial association of GDP per capita and growth are analysed. As a first step, 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 & Ord, 1981; Upton & Fingleton, 1985). The spatial dependence (global spatial autocorrelation) measure of Moran's *I* is represented by equation (3):

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

where n is the number of regions, z_i and z_j are the deviation of log of per capita income from the mean of each region, w_{ij} are the elements of weight matrix $W(n \times n)$ and it is equal to 1 if i and j are neighbours 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 predominantly 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, the results are not affected by using either rook or queen, because all neighbours 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 associations. The upper right and lower left quadrants correspond to positive spatial association by the presence of similar values in neighbouring 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). As a second step in the spatial analysis, the local Moran statistic for an observation i is defined as:

$$I_i = z_i \sum_j^n w_{ij} z_j \tag{4}$$

"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 the identification of both positive and negative types of spatial interactions. A positive value for $I_i = (x_i/m_o) \sum_{j=1}^{n} w_{ij} x_j$ indicates spatial clustering of similar values whereas a negative value indicates spatial clustering of dissimilar values between a region and its neighbours. The significance of LISA yields to the so-called Moran significance map, which shows the regions with significant LISA (Anselin, 1995).

The analysed period covers 1980–1997. One of the reasons is related to the data availability, but furthermore, the most intensive effects of liberalization and globalization have been seen in Turkey at the beginning of the early 1980s. Thus, this paper explores the impacts of national policies on regional development during this period. The provincial GDP time series has been constructed from two different sources. For 1979–1986, the data were obtained from the Istanbul Chamber of Industry (ISO, 1988) and for 1987–1997, 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.

Analysis of Regional Inequality in terms of GDP per capita

Since, the reduction of interregional inequalities has been a major goal during the planning period in Turkey, interregional inequalities have still been one of the main foci of regional studies (Atalik, 1990; Berber *et al.*, 2000; Senesen, 2002; Özmucur & Silber, 2002; Gezici & Hewings, 2004; Gezici, 2004). 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".

The Findings of Inequality Analysis

In this paper, the three partitions are as follows: geographical regions (seven regions), functional regions (16 regions) and coastal-interior provinces (two sets). Tables 1 and 2 provide some descriptive information about the two main regional partitions. Figure 1 shows the division of geographical and functional regions. It is easy to gain a sense of

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
South-east Anatolia	5.26	5.28	5.46	5.29	5.38
East Anatolia	5.63	5.20	5.00	4.39	4.15

the distribution and concentration of GDP among regions. At the provincial level, especially after 1986, inequalities have been declining, even though there has been an increasing trend in 1992 (Figure 2).

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/interregional level, while 45% were derived from within/intraregional 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.

Table 3 presents the proportions of each region in terms of intraregional (within region) inequalities as well. Mediterranean, south-east 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 (between 23% and 41%) within region during the whole analysed period, while central Anatolia and Aegean regions indicate respectively higher within inequalities as well (Table 3). Black Sea and south-east Anatolia have relatively

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
Diyarbakir	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
Eskişehir	2.92	2.85	2.44	2.59	2.45
Gaziantep	3.98	3.87	4.23	3.97	4.06
Istanbul	*29.83*	*32.11*	*32.54*	*33.22*	*35.23*
Izmir	*19.92*	*20.08*	*20.57*	*21.36*	*20.92*
Kayseri	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
Sivas	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

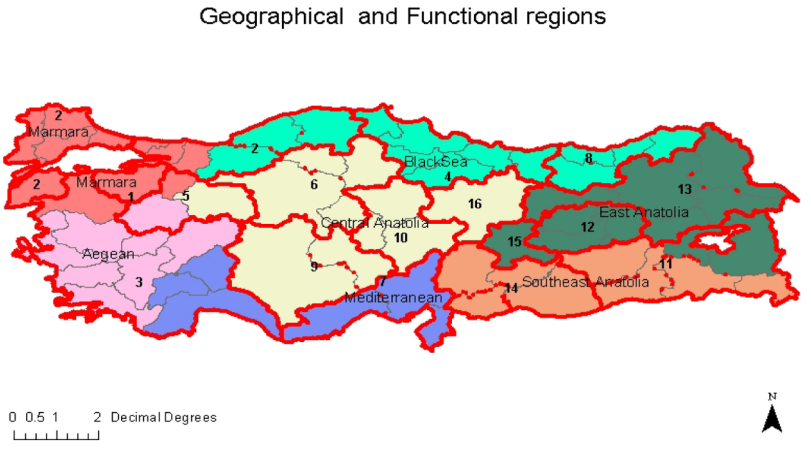

Figure 1. Geographical and functional regions of Turkey

lower share of total within inequalities among geographical regions. This result shows that less-developed or poor regions have relatively lower intraregional inequalities than richer ones. However, although the Marmara 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 interregional inequality, developed regions that are located in the west part of the country elevated the inequality across regions.

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 for 60% of total inequalities in 1980 and 73% in 1997. Within region or intraregional inequalities account 40% of total disparity in 1980 and 27% in 1997 (Table 4). Intraregion inequalities for functional regions are lower than geographical regions, while interregional inequalities are higher (Figure 3).

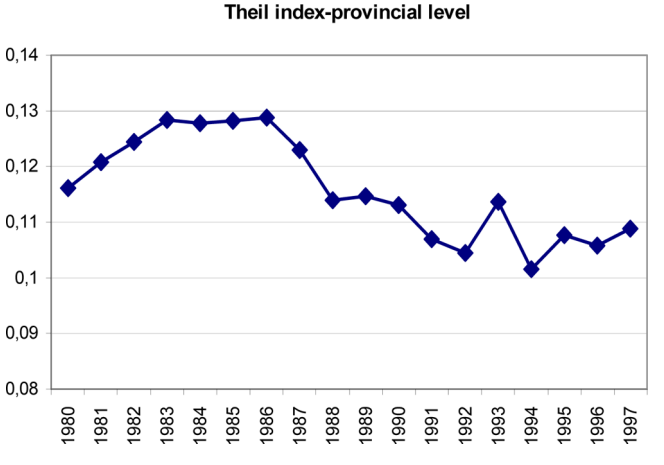

Figure 2. Inequalities among provinces

Table 3. Proportion of between and within region inequalities—geographical regions

	Total	(%)	Between (%)	Within (%)	Marmara (%)	Aegean (%)	Mediterranean (%)	Central Anatolia (%)	Black Sea (%)	South-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 total	Geographical regions		Functional regions		Coastal-interior	
		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

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 nine provinces as hinterland) with a declining share of 42% in 1980 and 38% in 1997 (Figure 4). İzmir and Ankara functional regions are other regions that have relatively higher within region inequalities. These results are related to the effect of metropolitan/large cities in the corresponding region, but it is also related to the number of provinces in the region.

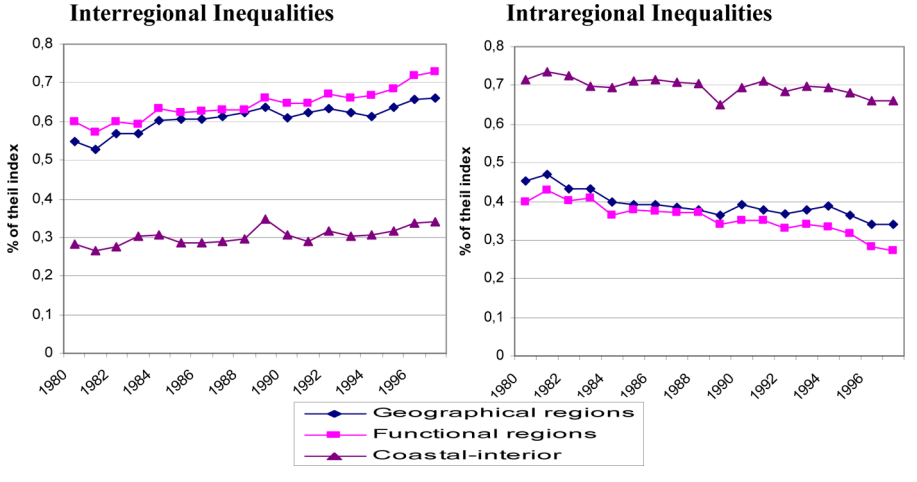

Figure 3. Interregional and intraregional inequalities in terms of different partitions

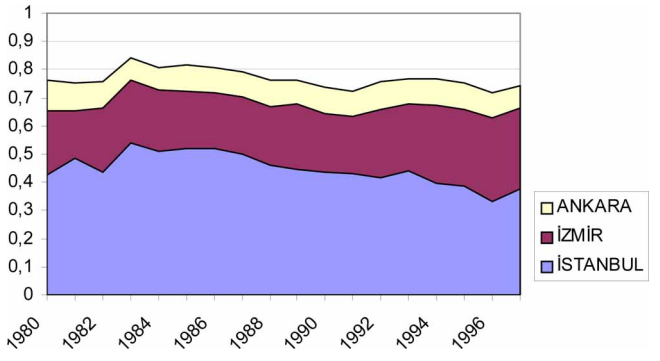

Figure 4. The contribution of first three functional regions to the intraregional inequalities

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 less-developed characteristics such as high out-migration, low growth rate, etc. At first, the coastal provinces are the wealthiest in the country given their initial advantages such as location and transportation opportunities. In Turkey, the inclusion of the provinces in the Black Sea region as priority provinces in development (PPDs)[3] 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/intraregion inequality accounts for a large part of total inequalities, there 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.

Growth Rate Differences

The provinces of Turkey 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, the 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

Table 5. Growth in real per capita income, 1980–1997

Group	Number	Mean	Standard deviation	Minimum	Maximum
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

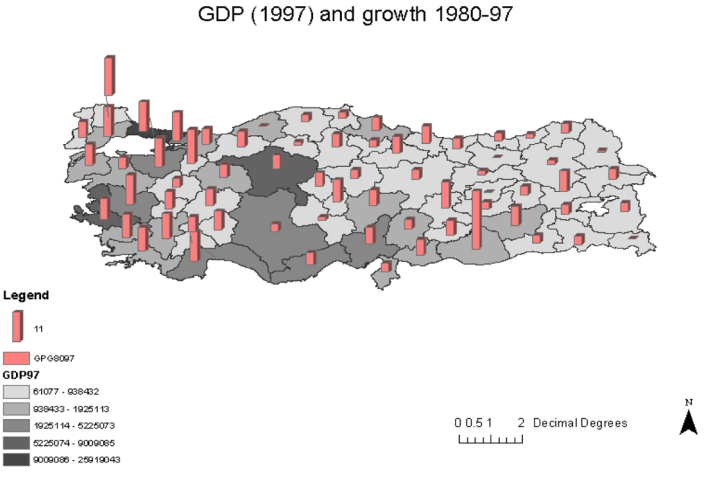

Figure 5. Distribution of GDP and GDP growth (1980–1997) across provinces

four of the five first developed provinces experienced GDP per capita growth less than the 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, note 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). Sanliurfa, a province of the south-east Anatolia project, is a notable case, having a low GDP per capita in 1980, but experiencing a high growth rate.[4] In terms of GDP per capita growth rate, the neighbour 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

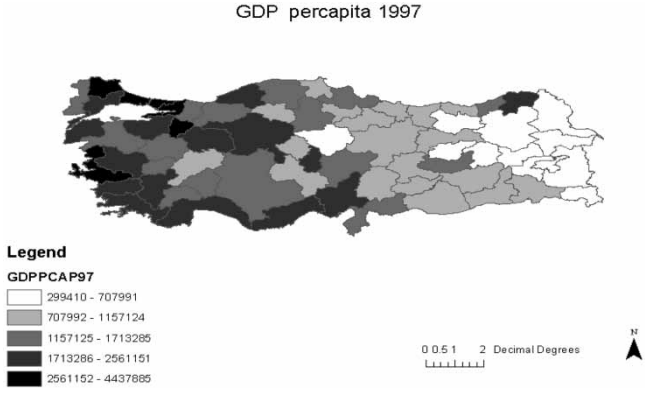

Figure 6. Distribution of GDP per capita across provinces in 1997

their rank in terms of GDP per capita, while there are few provinces that are growing relatively faster.[5]

Spatial Dependence of Growth—Spatial Autocorrelation

In this section, the dynamics of provinces by using spatial autocorrelation of GDP per capita and mean growth rate and the relationship between regional inequalities and spatial dependence during 1980–1997 in Turkey were examined.[6]

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, spatial inequality may probably decrease in future and convergence could be 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 neighbours' dynamism. At this point, if a neighbour 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 or divergence 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 analysed.

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;[7] 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 neighbours (Table 7). This high spatial clustering can be seen in the Moran scatter-plot map for 2 years as well (Figures 7 and 8). In 1980, 76.12% of the provinces show association of similar values with their neighbours, while this ratio increased slightly to 77.61% in 1997. The distribution revealed 38.88% in quadrant I as high-high (HH) and 37.31% in quadrant III as low-low (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.

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 (1980–1997)	37.0167	0.00000001

Table 7. Moran's *I* test for spatial autocorrelation (randomization assumption)

Variable	Moran's *I*	Mean	Standard deviation	*Z*-value	Probability
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

In both years (1980 and 1997), provinces that are clustering as HH 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 in the coastal provinces. This result also enhances the findings of the Theil Index that intraregional inequalities of coastal provinces were decreasing. While some provinces that are interior neighbours of coastal provinces are catching up with the coastal provinces, many of them are remaining behind. There is almost no difference in the east provinces categorized as LL 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 $I = 0.351567$). Thus, 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. However, there is little evidence for high spatial autocorrelation for GDP per capita growth (Moran's $I = 0.134526$). Thus, 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 clustered in four geographical locations as follows; western neighbour provinces of Istanbul, southern neighbour provinces of Izmir, western Black Sea coast and central Anatolian zone (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

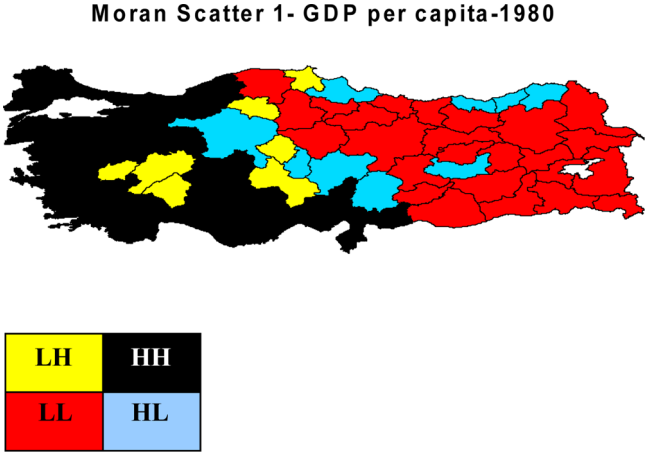

Figure 7. Moran scatter-plot map for log of GDP per capita, 1980

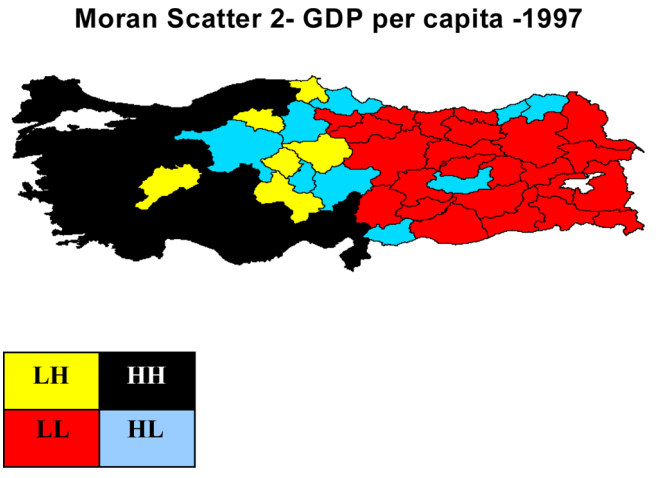

Figure 8. Moran scatter-plot map for log of GDP per capita, 1997

the period analysed does not indicate strong spatial autocorrelation. The level of growth among provinces is dependent on their neighbours, while the growth rates seem to be more independent of the growth of neighbours. However, the results of spatial autocorrelation indicate the spillover effects of developed provinces especially located in the coastal regions and the dynamics of some interior new development nodes.

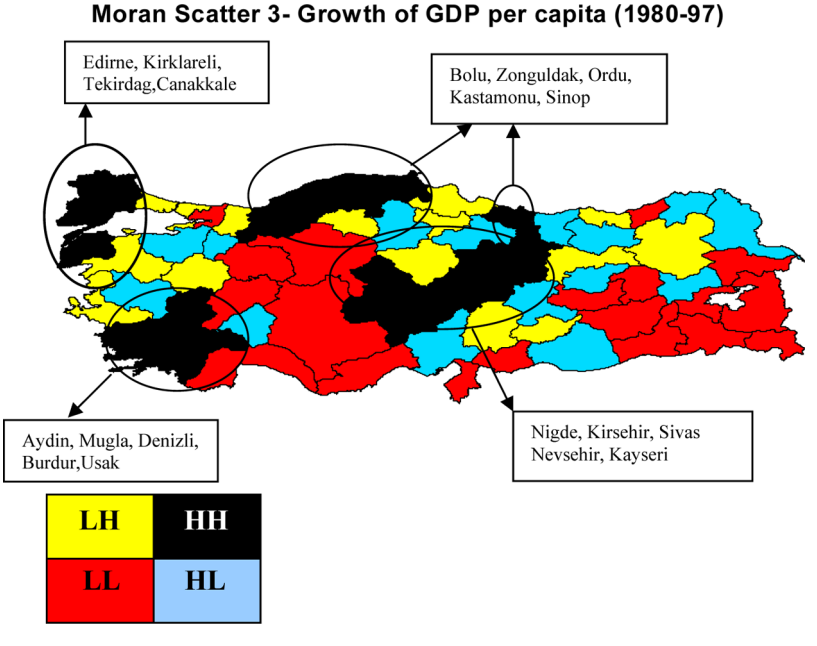

Figure 9. Moran scatter-plot map for mean growth of GDP per capita (1980–1997)

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* following the test of Rey and Montouri (1999). In Turkey, the Theil Index is decreasing especially for the mid-1980s, while Moran's *I* is slightly increasing over the entire period. Moran's *I* coefficients are highly significant[8] 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 intraregional inequalities, reinforces the role of neighbour 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 (2004) that there is no strong evidence on convergence and east and west dualism (spatial regime) still remains in Turkey.

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 eight 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 neighbours in terms of growth. There are some provinces growing faster than their neighbours in the east of Turkey. In terms of spatial dependence, spillover effects of growth have appeared in the west of the Black sea and Central Anatolia regions (see Figure 9).

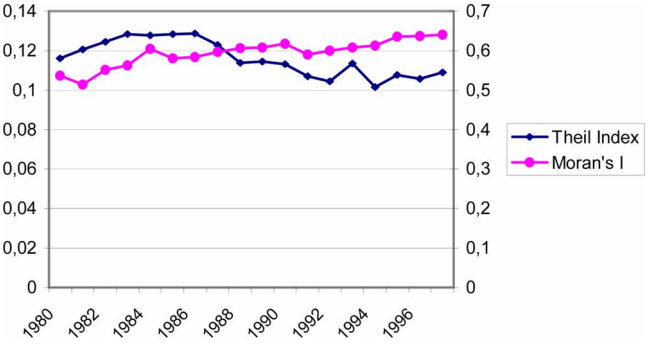

Figure 10. Regional inequality and spatial dependence (Theil Index and Moran's *I*)

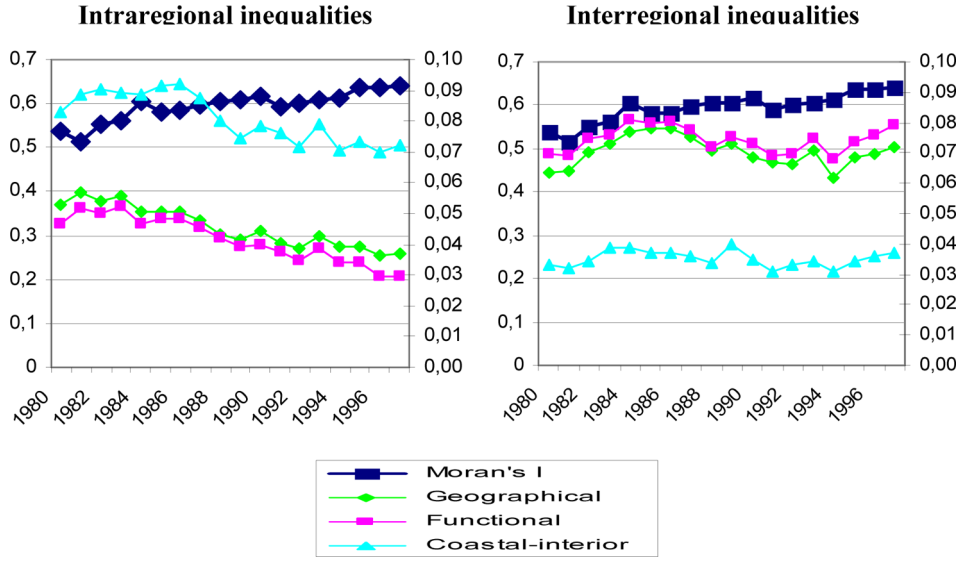

Figure 11. Interregional and intraregional inequalities compared to the spatial dependence

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):

- HH—11 provinces—two geographical clusters: eight of them in the Marmara region and most developed provinces and three of them in Aegean and Mediterranean as tourism areas.
- LL—10 provinces—all of them in east and south-east Anatolia.
- HL (high-low)—one province in east Anatolia (Elazig).
- LH (low-high)—one province in central Anatolia (Nigde).

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.

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

- HH—13 provinces—two geographical clusters: eight of them in the Marmara region, four of them in Aegean region and one of them in the west of the Black Sea region.
- LL—11 provinces—all of them in east and south-east Anatolia, five of them are geographically periphery as border 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 four clusters result (see Table 8):

- HH—three provinces—Edirne, Tekirdag, Nevsehir (Marmara and central Anatolia).
- LL—four provinces—Bitlis, Van, Siirt, Hakkari (all of them in the south-east and eastern Anatolia).
- LH—one province—Yozgat (central Anatolia).
- HL—three provinces—Malatya, Sanliurfa and Mus (eastern and south-east Anatolia).

In terms of growth, the weak spatial dependency is seen in local analysis as well as in the 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, the west provinces are becoming richer along with their neighbours while the eastern and especially the geographically peripheral provinces are becoming poorer in common with their neighbours.

Conclusion

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 EU 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.

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. This paper has analysed the impact of analysis with different regional definitions in Turkey. The Theil Index indicates that interregional inequalities in Turkey are increasing while intraregional inequalities are declining for all partitions from 1980 to 1997, results that parallel other cases in the world (such as Fujita & Hu, 2001; Azzoni, 2001).

In terms of intraregional 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 over the whole time period. In terms of the coastal-interior partition, "within" coastal inequality is declining, while "within" interior is increasing slightly. The findings of this analysis highlight the effects of cumulative development processes and locational advantages.

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 more rapidly rather than poorer ones. In both years of analysis (1980 and 1997—GDP per capita), provinces that are clustering as HH are located in western regions and the west and south coasts. Furthermore, there is almost no difference among the east provinces categorized as LL 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 neighbours, while growth rates are more likely to be independent of those of neighbours. 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. However, most of the provinces that are clustering as LL, are located in the east and especially the geographical periphery.

These findings provide an opportunity to view the inequalities and interdependence among regions in terms of spatial aspects. The impacts of developed provinces/regions have to be considered in relation to their spillover effects on their nearest neighbours and the contribution they make to the overall inequalities. It seems that the dynamics of coastal and western regions have led the regional development of the country. However, the regions that display negative spatial autocorrelation, should be also considered for the policy to change their neighbour relations. Regional policies need to be sensitive to the impacts of different regional definitions on their outcomes. Different types of regional policies may have different impacts on intraregional and interregional inequalities. The inequality analysis, by considering spatial aspects, adds some new perspectives to the empirical studies on interregional inequalities in Turkey, especially in view of its request to be considered for membership in the EU. As data are reorganized into the new NUTS regions for Turkey, it will be important to review the findings of this paper and thus to place regional development issues into a context that more closely aligns to the analyses conducted for other member countries of the EU.

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Notes

1. Census regions, Census division, BEA regions (Bureau of Economic Analysis) in the US.
2. For more information about binary weight matrix, see Anselin (1988).
3. Backward regions—defined as Priority Provinces in Development by State Planning Organization. For more information see Gezici and Hewings (2004).
4. For more information see Gezici and Hewings (2004).
5. In the east, Malatya and Sanliurfa are growing faster.
6. Results of this section were obtained through SpaceStat™ extension for ArcView™ (Anselin, 1999).
7. Moran's I for GDP per capita in 1980 $I = 0.4538$, in 1997 $I = 0.5447$ (without taking log).
8. The z-values are highly significant (less than 1%) for all years.

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