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Spatial Patterns of Poverty in Iran

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ABSTRACT

Poverty can have spatial dimensions. While general figures might show the spatial pattern of poverty, there is a need for more detailed examination of this pattern. Relying on simple figures of spatial patterns and ranking regions based on them might be misleading. This paper tries to apply spatial analysis methodsm, namely spatial autoregressive models to find out the impacts of space on the human poverty index (HPI).

The results suggest that there is a significant spatial relationship between the HPI in the Iranian provinces. This means that the location of the provinces has some contributions to the differences of HPI in the country. However, the results show that space can partially explain the variations in poverty.

1. Introduction

Despite the existence of many studies on poverty, the spatial analysis of poverty appears to have been neglected. This partly reflects the lack of interest in spatial analysis, and also the absence of spatial analysis research. Whereas it would appear that there has been considerable research activity in the spatial analysis domain during recent years,in practice there has been very little more than the efforts of a small number of individual enthusiasts (Openshow, 1998; Lesage, 1995; 1989; 1990; McMillen et al., 1997). The

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consequences of this failure to reject methods of spatial analysis and views of spatial data that are inappropriate can be severs. For example, most of the current official reports on poverty simply try to rank areas based on poverty indexes. Although, these simple presentations are attractive to the end-users, because the results are easy to understand, but they can be wrong or misleading. In such cases, usually fundamental spatial knowledge and principles are being ignored. If regions are ranked on the basis of HPI, how are the effects of spatial autocorrelation being handled? More clearly, if one region with another are compared, what makes us think that these arial entities are comparable?

Moreover, most anti-poverty policies tend to treat the poor as a homogeneous group and fail to differentiate between different regions or interregional differences in the nature of poverty (Cushing and Zheng, 1999). Effective anti-poverty programs must vary across types and regions in order to meet the unique needs of each region's low-income poulation. Anti-poverty policies that are uniform across area types and targeted at the overall poverty population, rather than at specific population subgroups, will more likely yield disappointing results.

It seems that the importance and value of spatial statistics has not been fully addressed. Basically, identifying local rather than only globally recurrent spatial patterns are very fundamental. In some cases non-spatial results might be misleading (Anselin, 1994). Therefore, finding spatial patterns and corrolations are often of greatest interest and also the hardest to find. It is particularly important in poverty studies that researchers can look within the study region for any spatial patterns and impacts. It is absolutely fundamental that we can develop tools able to detect, by any feasible means, patterns and localized associations that exist between poverty variables. During the recent years, some very interesting developments in local measures of spatial association has been occurred (Anselin et al., 1988; Anselin et al., 1993; Anselin, 1994; Getis and Ord, 1992; Nass and Garfinkle, 1992; Casetti, 1992; Kelejian and Robinson, 1995).

There are many ways in which one can spatially analyze the poverty. However, in this study, the main focus is to simply find out if there is any spatial autocorrolation between poverty measures such as HPI. Based on current data and simple interpretation of that, it is said that there exists a spatial pattern or correlation in poverty in the country. But, can it be statistically proved? The aim of this study, therefore, is to find out the existence of any spatial autocorrolation of poverty and its main indicators in Iran.

The rest of this paper is organized as follows. In section two there will be a general view on the human poverty index in Iran and its spatial view. Section three describes the first order spatial autoregressive model used in this study. In section four the nature of data will be briefly explained. The results of the analysis will be given in section five. Finally, section six concludes the paper.

2. The Human Poverty Index in Iran

Human poverty index measures poverty based on lifetime period, education and income. The first Iranian report of HPI was issued by the Iranian planning and budget organization in 1999 based on the year 1996 statistics. Table 1 presents the national results of HPI calculated for 1988 to 1997. According to these figures, the HPI has significantly improved during this period. Sharp decrease in some indicators such as adult's illiteracy rate, and people without access to adequate toilet has contributed to this improvement.

Table 1: Human Development Index for Iran (1988-1997)

HPI and its Components	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Human Poverty Index (HPI)	31.1	29.0	27.0	24.9	23.9	22.8	21.6	20.5	19.2	18.1
People with Life Expectancy less than 40 (%)	17.1	15.6	14.0	13.4	12.7	12.2	11.4	10.7	8.2	7.9
Adults' Illiteracy Rate (%)	42.9	40.3	37.6	34.8	33.4	31.9	30.3	28.7	27.1	25.5
Population Without Access to Clean Water (%)	14.3	12.4	10.4	8.5	7.4	7.3	6.7	6.4	6.0	5.5
People Without Access to WC (%)	72.0	72.0	67.5	63.0	58.5	54.9	49.5	45.0	40.5	35.7
Gross Per Capita Expenditure for 20% Poorest (000 rial)	810	802	881	937	1088	1201	1271	1197	1190	1246
Gross Per Capita Expenditure for 20% Wealthiest (000 rial)	9043	9093	9894	1146 9	1219 8	1257 7	1270 7	1277 4	1256 1	1236 0
Population Below Poverty Line(%)	18.4	17.8	18.8	21.6	20.9	19.0	19.9	19.8	19.7	18.6
Population Below Daily Expenditure of One Dollar (%)	1.5	2.1	3.5	3.8	3.3	3.3	2.7	3.0	3.4	3.3

Source: Planning abnd Budget Organization, 1999, "First National Report on Human Development Index", Budget and Planning Organization, Tehran, Iran, P.225.

Adults's illiteracy, population without adequate access to clean water and toilet and inadequate income distribution has significantly contributed to this gap.

According to the HPI report, there seems to be a significant gap between poverty measures in different regions of the country. While HPI has been

Table 2: Human Poverty Index for Iranian Provinces

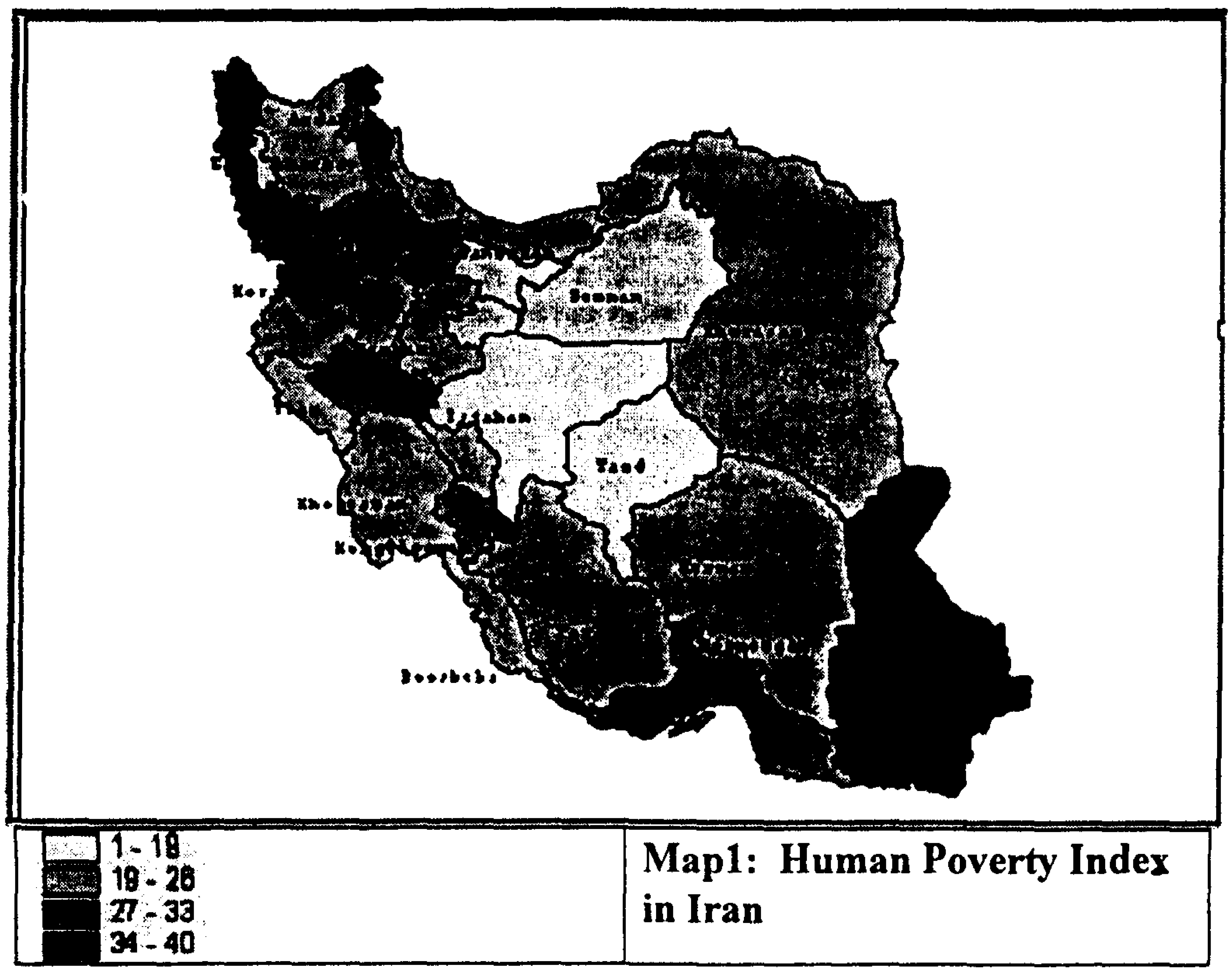
Province	Population (1996) (Million)	HPI	People with Life Expectancy less than 40 (%)	Adults' Illiteracy Rate (%)	People within Access clean water (%)	People within Access to WC (%)	Gross Per Capita Expenditure for 20% Poorest (000 rial)	Gross Per Capita Expenditure for 20% Wealthiest (000 rial)	Population Below Poverty Line (%)	Percent of Population Below Daily Expenditure of One Dollar
Tehran	11176.2	11.3	6.9	15.3	0.2	14.7	832	7011	19.4	0.4
Semnan	501.4	15	9.3	20.5	0.6	17.9	300	3398	20.8	3.8
Isfahan	3923.2	15.4	7.2	20.5	2.2	22.8	385	4239	15.6	2.4
Yazd	750.8	16.1	8.9	22.1	0.9	18.8	316	4241	17.1	2.7
Qom	853	17.6	9.9	24.6	0.5	16.2	832	7011	20.8	2.6
fars	3817	20.8	10.1	25.3	6.4	36.2	546	4212	14.7	1.4
Gilan	2241.9	20.9	7.1	27.4	14.2	22.7	428	4002	17.4	1.9
Markazi	1228.3	21.1	11	28.3	1.4	31	428	3956	11.6	1.4
Booshehr	743.7	21.7	11.1	27.5	3.5	37.5	441	3189	17.6	3.6
Mazandaran	4028.3	22.1	10.2	28	7	35.4	371	3730	16.6	4.2
Kerman	2004.3	22.9	12.5	29.5	10	30.8	384	4114	21.1	7.4
Khorasan	6047.7	23.1	13.8	26.1	5.8	45.3	277	3721	19.6	6.3
Khoozestan	3746.8	23.5	10.8	30.8	9	31.4	658	3753	11.7	0.7
Ilam	487.9	23.7	14.2	33	4.1	16.2	435	2865	19.1	1.8
Charmahal	761.2	24.6	11.9	32.8	1.3	38.2	391	3355	15.7	3.5
Kermanshah	1778.6	24.8	12.9	31.9	5.1	39.6	618	3941	13.2	1.3
East Azarbaejan	3325.5	25.2	11.2	32.5	7.8	38	461	3680	17.2	1.4
Hamedan	1677.9	26.2	12.3	31.9	7.3	46.6	252	2879	18.8	9
Lorestan	1584.4	27.6	13.5	35	4.8	47.3	495	3094	17.2	2.4
Hormozgan	1062.2	27.7	11.9	35.7	13.6	37.7	403	35.5	14.6	2.5
Zanjan	1036.9	28.5	12	34.8	9.5	49.6	310	2900	20.8	10
Ardebill	1168	29.8	12.1	36.8	10.1	50.3	378	3759	16.9	4.2
West Azarbaejan	2496.3	30.4	12.4	38.9	8.5	48.6	393	3233	16.9	6
Kordestan	1346.4	31.7	17.2	43.1	4.2	39.3	485	2827	10.9	2.7
Kohgelooyeh	544.3	33.2	15	38.1	11.9	62.1	222	2840	21.3	17.7

Source: Budget and Planning Organization, 1999, "First National Report on Human Development Index", Budget and Planning Organization, Tehran, Iran, P.238.

estimated 11.7 per out cent in the Tehran province, this figure has been around 39.5 percent in the Sistan and Baloochestan province in the south east part of Iran (Table 2). This report explains the differences by HPI components and concludes that decrease in adults' illitracy rate, access to clean water and adequate WC and better distribution of income can be the most important steps towards poverty reduction in the country. Again, a ranking method has been used to show the differences in poverty between the regions in which Tehran is 1 and Sistan and Baloochestan is at rank 26.

But the question is that, is there any spatial dependence in poverty measures? Can for example one say that the closer to the capital, the less poverty index? Without any analysis many would answer yes to this question, but do the statistics support this idea?

Map 1 shows a simple classification of HPI in the country. One can observe a spatial pattern here. It is almost clear that most of the central provinces such as Tehran, Semnan, Isfahan, Qom and Yazd have a relatively better HPI, while some of the provinces specially in the border lines such as Sistan, East Azarbayjan and Kordestan have relatively higher HPI. However, there are some other provinces, which are in the edges, but still have better HPI. So, there is a need for better measures to find out if there is any significant spatial difference between the regions.



Map1: Human Poverty Index in Iran

3. Model

Spatial dependence in a collection of sample data observations refers to the fact that one observation associated with a location i depends on other observations at locations j. In this paper, the first-order spatial autoregressive model (FAR) will be used to test for spatial patterns of HPI in Iran. FAR is a special case of general spatial autoregressive models. FAR takes the form:

$$y = \rho Wy + \varepsilon$$
$$\varepsilon \sim N(0, \sigma^2 I_n)$$

Where y contains an n*1 vector of cross sectional dependent variables. W is spatial weight matrix, usually containing first-order contiguity relations or functions of distance. This matrix has zeros on the main diagonal, ε is the stochastic disturbance similar to any other regression model. Also ρ represents a regression parameter to be estimated. This parameter reflects the spatial dependence inherent in data. In fact ρ measures the average influence of neighboring or contiguous observations on the vector y.

Since least-squares estimate of ρ will be biased, the maximum likelihood estimator is usually used for estimation. Estimation of this model requires that we find eigenvalues for the large n by n matrix W, and the determinant of the related n by n matrix $(I_n - \rho W)$. LeSage (1999) has developed a matlab function that can produce estimates for the first order spatial autoregressive model.

Finally, it should be noted that one can use the Baysian autoregressive model in this case. However, because the final results of this model do not make much difference with the FAR model, the Bayesian model is not applied here.

4. Data

As discussed earlier, HPI data provided in the first national HDI report of Iran has been used in this study (Table 2). The HPI has been developed for the Iranian provinces using 8 different indicators. The HPI and its components provide the necessary data for dependent variables in this study. These data cover 26 provinces of Iran. This is the number of provinces at the time of data used for HPI calculation. Since then some changes have been made to the provincial division of the country and this has increased the number to 28. Mazandaran and Zanjan provinces have been divided into two different provinces.

Associating locations in space with observations is essential to the modeling relationship that exhibits spatial heterogeneity. Therefore, the first task to be undertaken before any question about spatial dependence and heterogeneity is quantification of the locational aspects of our sample data. In this study a first-order rook's contiguity relations for the 26 provinces has been used. This creates a 26*26 matrix. Later, it has been transformed to prepare the standardized first-order contiguity matrix, which has row-sums of unity.

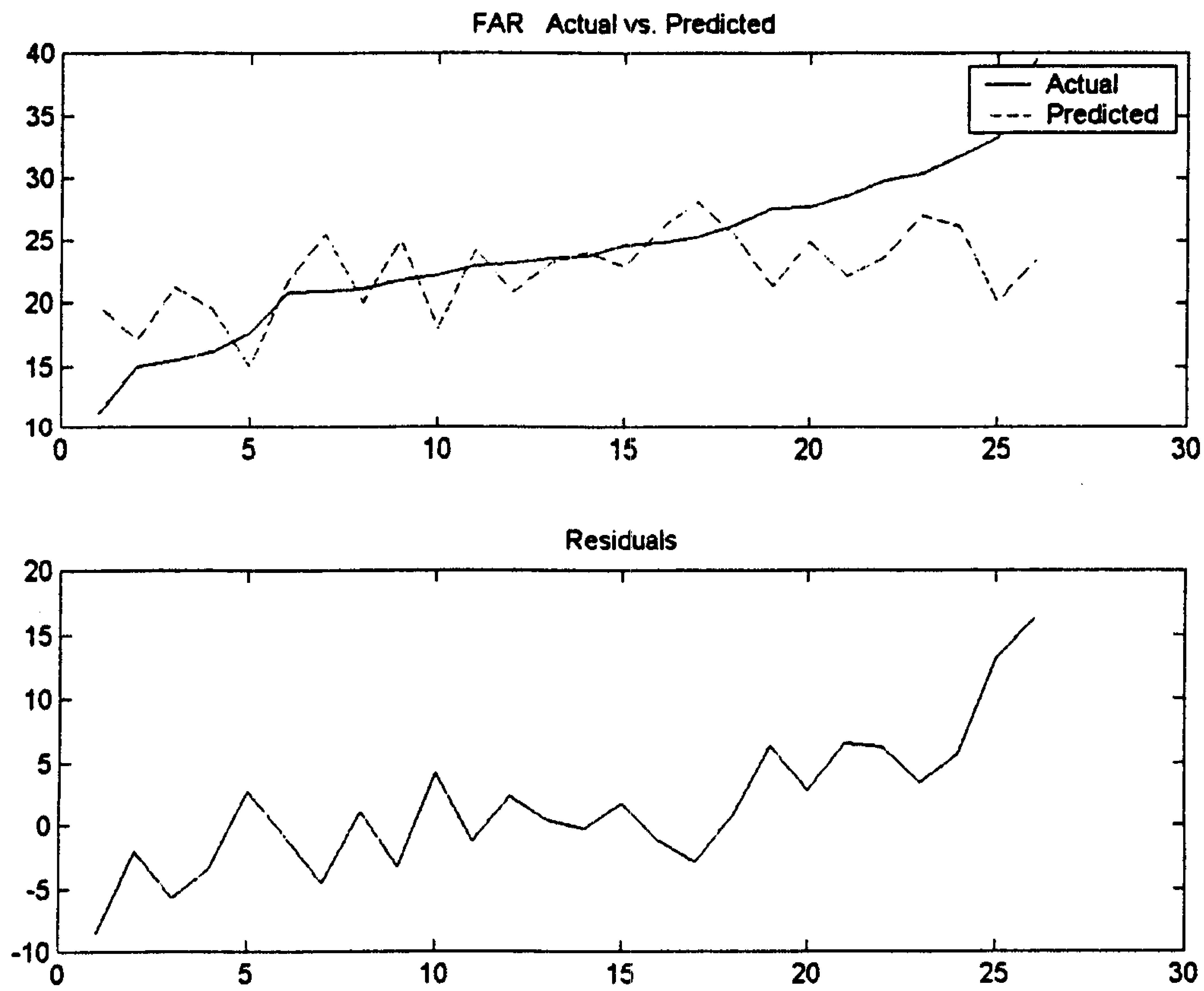
5. Results

Table 2 presents the results of FAR model of spatial autocorrolation of HPI and its components for the 26 Iranian provinces. From the output, we would infer that significant spatial dependence among the HPI and its components observations for the sample of 26 provinces exist. We also see that this model explains nearly 17 percent of the variations in HPI. As these results reveal, all indicators are spatially dependence, but only few of them have reasonable R^2. Fig.1 shows the graph of actual versus estimated results of HPI only.

Table 3: Results of First-Order Spatial Autoregressive Model

	R^2	log - likelihood	P	Asymptot t-stat	z - Probability
HPI	0.1714	-152.14593	0.948030	19.088249	0.000000
People with Life Expectancy less than 40	0.0598	-111.48087	0.959731	24.717686	0.000000
Adults' Illiteracy Rate	0.2039	-161.65346	0.965931	29.297486	0.000000
Population Without Access to Clean Water	0.1801	-128.08827	0.836831	6.113096	0.000000
People Without Access to WC	-0.0517	-195.82075	0.906331	10.580353	0.000000
Gross Per Capita Expenditure for 20% Poorest	-0.2330	-328.50552	0.890631	9.075407	0.000000
Gross Per Capita Expenditure for 20% Wealthiest	0.0982	-421.11521	0.938431	16.089719	0.000000
Population Below Poverty Line	-0.4272	-136.95377	0.537431	2.234183	0.025471
Percent of Population Below Daily Expenditure of One Dollar	0.0866	0.0866	-0.392369	-0.935449	0.349557

Fig. 1: Actual versus predicted results of FAR Model for HPI in Iran



Based on these findings it is now possible to make better judgements about the spatial patterns of the poverty index and its components. If one can conclude that the spatial differences in HPI in Iran are due to spatial differences in the adults' illitracy rates, and population without access to clean water, and somewhat distribution of income, therefore, better distribution of these facilities over space can improve the gap between the poorest and the wealtiest provinces.

6. Conclusion

Experience shows that most anti-poverty policies are uniform across space in most countries that used such policies, often with urban bias. Due to different variables such as economic, social, cultural, spacial or other factors, some regions have a higher rates of poverty. This study tried to open another dimension in the analysis of poverty using spatial econometrics methods and data on the human poverty index. Although the model that was used in this study is relatively a simple spatial analysis technique, it can answer some of the existing questions about the spatial patterns of poverty. Nevertheless, a deep understanding of the impacts of spatial factor on poverty will need more sophisticated models and more appropriate data.

The results of this paper support the idea that there is a spatial correlation in human poverty in Iran. However, the differences in HPI can not be fully explained by a spatial factor. There are possibly other important variables that can measure such differences. Only 20 percent of the variations might be related to space. These results still show that regions and area types had a complex pattern of effects. Given our analysis, providing an opportunity to design different policies to fit different regions and locations is much preferred to a system of highly centralized uniform anti-poverty policies applied equally to all locations. Further investigations are needed in this regard. In doing so, other spatial econometrics methods such as the mixed FAR model can be applied. Where data is available, it would be helpful if one can use smaller spatial units such as counties. This increases the number of observations and reduces the current imbalances that exist at the providential level.

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