A Spatial Analysis of Poverty in Muslim Countries

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Abstract

A key issue for many countries and even for international organizations including "The World Bank" and "The United Nations" is how to attack poverty. In many countries of the world, millions of people are hungry, lacking shelter and clothing, sick and uncared for, illiterate and not schooled. These, all cause to reduce efficiency and productivity of labor, and hence decrease income. Also, being in a geographical region in which there are poor countries is itself a factor of poverty. In fact, there is a poverty trap in such regions. That is, being poor and being in a poor region are factors which lead to longer and deeper poverty.

Many Muslim and Arab countries are classified as low income countries and they are also contiguous to other low income ones. Studying poverty in these countries is necessary and can be helpful for deciding about both domestic and common regional polices for them. Therefore, this study focuses on poverty in Arab and Muslim nations, and analyzes this subject through spatial econometric techniques, because spatial econometrics is a suitable method for considering spatial and geographical effects. Countries under study are clustered in accordance of both income poverty indices.

Keywords: Poverty, Arab and Muslim Countries, Spatial Econometrics

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1- Introduction

It is introduced into microeconomics the poverty threshold or poverty line concept. As is probably known, beginning in 1992, the Panel on Poverty and Family Assistance of National Academy of Sciences/National Research Council recommended a new poverty measure based on the concept of satisfying the family's needs for the basic necessities: food, clothing and shelter (including utilities).[1] This is the right concept about poverty. It is named "necessity minimum". The existence and relevance of this concept is evident. But it usually will not be found in a textbook of microeconomics[2]. Poverty doesn't exist in conventional microeconomics theory.

It is important to stress the difference between "necessity minimum" and "subsistence minimum". Below subsistence minimum**,** people would soon die; between subsistence minimum and necessity minimum, people can stay alive but remain poor. This difference is important because biological subsistence minimum could be extremely low and may virtually disappear due to public assistance and charitable aid in developed countries, while necessity minimum may be quite high and increasing with development.

An interesting question is what happens to a person who cannot get necessity minimum income in the labour market. The answer is that this person is out of the market. She doesn't count. She has no quality income and no quality time. She is poor.

A large amount of cross-country evidence suggests that growth and poverty reduction are strongly positively correlated. This result is consistent with the "trickle down" theory that some benefits of growth will always trickle down to the poor. Thus the incidence of poverty can diminish with growth even if the poor receive only a small fraction of total benefits.

A recent World Bank study by Dollar and Kraay (2000) has come out with a much stronger result that the income of the poor rises one-for-one with overall growth. It means that the proportional benefits of growth enjoyed by

1- *Focus*, vol. 20:2, spring 1999.

2- See for example VARIAN H. R. (1992) *Análisis microeconómico. Tercera edición.* Barcelona. Antoni Bosch Ed. Org.: *Microeconomic Analysis, 3rd edition.* Norton & Company Inc.

the poor are the same as those enjoyed by the remainder of the population. An important implication of this research is that growth is good for the poor irrespective of the nature of growth. Thus, the government need not follow pro-poor policies with a focus on poverty reduction. To achieve a rapid reduction in poverty, they should focus on maximizing economic growth while maintaining macroeconomic stability.

The World Bank study, although highly influential, is based on cross-country regressions, which can indicate only average trends. Individual country experiences can be quite different. We can not have the same policy prescription for all countries. For some countries, the growth maximizing policies may be adte but for other countries, there may be a need to have pro-poor growth policies with a focus on reducing inlity.[1]

The objective of this study is analyzing poverty in Muslim countries from a spatial perspective. Following the introduction, we will first provide some issues on poverty and then overview some poverty indicators in Muslim countries. Section 4 presents a brief on spatial econometric techniques, since they are used for analyzing poverty in the case study in the next section. Therefore, the results are discussed in section 5. Section 6 summarizes and brings together the main conclusions.

2- Some Issues on Poverty

2-1- Essential Factors of Poverty

The degree of poverty depends on two factors: average income and income inlity. The increase in average income reduces poverty and the increase in inlity increases it. Thus, the changes in poverty can be composed into two components: one is the growth component relating to change in mean income, and the other is the inlity component relating to change in inlity. The magnitudes of two components provide the relative sensitivity of poverty reduction to growth and inlity. It is obvious that if the growth component dominates over the inlity component, then growth-maximizing policies may be adte in achieving a rapid reduction in poverty. If the inlity

1- For a detailed discussion of pro-poor growth see Kakwani and pemia (2000).

component dominates, then the policies that are pro-poor and thus reduce inlity should be adopted.[1]

Also it must be considered that as countries become richer, on average the incidence of income poverty falls. Other indicators of well-being, such as average levels of education and health, tend to improve as well. For these reasons, economic growth is a powerful force for poverty reduction. This observation is not the end of the story, for it raises the questions of what causes economic growth and why countries with similar rates of economic growth can have very different rates of poverty reduction.

2-2- Economic Growth and Poverty Reduction

Today close to a fifth of the people in the world survive on less than $1 a day. The incidence of this deprivation varies greatly across countries. Not surprising, the richer the country, the higher the average consumption of the poorest fifth of its population and the smaller on average the fraction living on less than $1 a day. There are also significant variations around this relationship. Countries with the same average consumption have quite different proportions of the population living on less than $1 a day, reflecting substantial difference in inlity across-countries.

Education and health indicators are also better on average for richer countries. In rich countries less than 1 child in 100 does not reach its fifth birthday, while in the poorest countries as many a fifth of the children do not. Similarly, in the poorest countries as many as a half of the children fewer than five are malnourished, whereas in rich countries the figure is fewer than 5 percent. Again, however, there can be striking deviations from the average. For example, the United States is vastly richer than China and India, but the life expectancy of Americans is about the same as that in China and in some states in India.[2]

1- Kakwani Nanak, (2001), "A Not on Growth and Poverty Reduction", Asian Development Bank, Manila, 5-9 February 2001.

2- World Development Report (2000/2001), "Growth, Inlity and poverty", P. 45.

3- A Brief about Poverty in Islamic Countries

Islamic countries have heterogeneous socio-economic conditions, but most of them are classified as poor nations and included in the classification of LCDs. They generally face low incomes and high population growth. In accordance with the World Bank Report in 2000, among all 57 Islamic countries, 29 countries are low-income (with less than $760 per capita income); 16 countries are low-medium-income nations (between $760 and $3030); 8 countries are high-medium-income (between $3030 and $9360); and only 4 countries are high-income (more than $9360) (the World Development Report, 2000).

Islamic countries contain 23 percent of the world area. The major activities are agriculture and services, and industrial activities have little share in those economies. Real per capita income of such Muslim nations as Sierra Leone, Comoros and Guinea-Bissau, has decreased over time and the growth rate of their real GDP has been negative.

In many Islamic countries a relatively high proportion of people are below the poverty line, so that the percentage of people living on less than $1 a day in some countries has been as follow:

Uganda 82.2 percent (1996), Mali 72.8 (1994), Nigeria 70.2 (1997), Niger 61.4 (1995), Burkina Faso 61.2 (1994), Gambia 59.3 (1998), Sierra Leone 57.0 (1989), and Bangladesh 36.0 (2000) (the World Bank Report, 2003). Figure (1) shows the percentage of people living on less than $1 a day

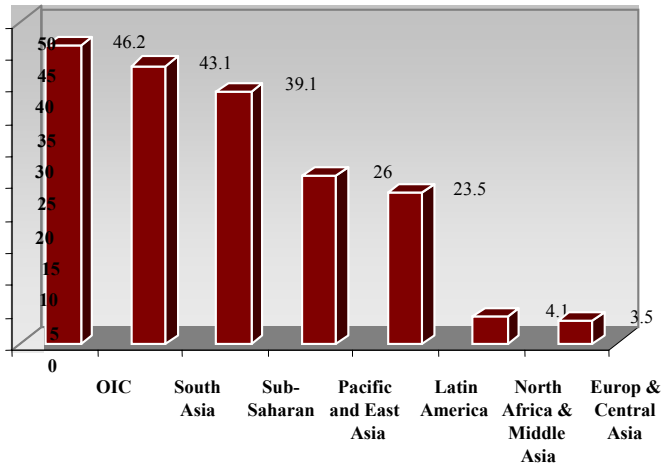


Fig 1: People Living on Less than $1 a Day

in Muslim countries in comparison with different regions of the world, by using the World Bank data. The figure indicates that the ratio of poor people in Muslim nations is even more than Sub-Saharan Africa.

In addition to low income levels in these countries, the income distribution is unl. Ginni coefficient of most Islamic countries is high, and in some countries, it is more than 50 percent. While the income shares of 10 percent of poorest are less than 2 percent, the income shares of 10 percent of richest are more than 30 or even 40 percent (HDR, 2002)

Absolute and relative poverty of Muslim nations results in lack of income for providing needs. In fact, most of them do not access to the resources needed for a decent standard living. The life expectancy at birth in many Muslim countries is relatively low. For example, in 2000 life expectancy at birth for some selected Islamic countries have been 38.9 for Sierra Leone, 39.9 for Mozambique, 43.1 for Djibouti, and 44 for Uganda while the life expectancy of that year has been 76.8 for OECD countries and 66.9 for the world as a whole. In the world, in 2002, a bout 56 percent of people used adte sanitation facilities, while this percent has been 20 for Niger, 21 for Gabon, 23 for Benin, 28 for Sierra Leone, 29 for Chad and so on. In the same year, population using improved water sources in mentioned countries has been 59,70,63,28 and 27 percent, respectively. This ration has been 81 for the world. Also, the percentage of population with access to essential drugs has been 0-49 for Sierra Leone, Guinea-Bissau, Chad, Nigeria, Sudan, Gabon, Tajikistan, and Guyana (HDR, 2002). Of course, such Islamic countries as United Arab Emirates, Libya, Saudi Arabia, and so on have better health conditions, but most Muslim nations suffer inadte conditions.

In addition to health, the situation of education in Muslim nations is unsuitable in comparison with other nations. The adult literacy rate is very low in some Islamic countries. In 2000, while more than 99 percent of OECD countries' adults have been literate, the literacy rate of Niger has only been 15.9; In fact low literacy rate in such countries could play an important role for becoming poorer and poorer.

4- Spatial Analysis through Spatial Econometric Techniques

We are going to analyze poverty in Muslim countries. Each country is a location-a point in space. When we deal with data which are collected with reference to locations, we must pay attention to spatial interaction of those locations, because spatial relations affect collected data of them. In other words, the location aspect of data must be considered in analysis because of spatial dependence. In economics, it is done through spatial econometrics techniques.[1]

Spatial dependence in a collection of a sample data implies that one observation associated with a location in space which labeled i depends on other observations at locations $i \neq j$. formally;

$$Yi = F(Yj), \qquad i = 1, 2, \ldots, n \qquad i \neq j. \tag{1}$$

In other words,

$$Cov(Yi,Yj) = E(Yi,Yj)-E(Yi).E(Yj) \neq 0 \qquad \text{for} \quad i \neq j \tag{2}$$

in which Y can be any variable with n observations (Lesage, 1999, pp.3-4).

It is clear that observations that are near each other would reflect a greater degree of spatial dependence than those which have more distant from each other. That is, the strength of spatial dependence between observations would decline with the distance. Briefly, when we analyze a variable in different locations -for example poverty of different countries- we must take into account spatial aspects of considered data. For this purpose, according to the locational information, spatial weights matrix W can be generated based upon contiguity or distance and it is used in analysis. In this paper, we use a simple contiguity matrix, so that its element takes values of 0 or 1, in accordance to the absence or presence of a contiguity relationship.[2]

1- Spatial econometrics is a sub-field of econometrics that deals with the treatment of spatial interaction (spatial auto correlation) and spatial structure (spatial heterogeneity) in regression models (Anselin, 1999).

2- The contiguity relationship can be defined as linear, rook, bishop, double linear, double rook, or queen contiguity like movements in chess. For further discussion, see Lesage, 1999.

$$W = \begin{bmatrix} 0 & w_{12} & w_{13} & . & w_{1n} \\ w_{21} & 0 & w_{23} & . & w_{2n} \\ w_{31} & w_{32} & 0 & . & w_{3n} \\ . & . & . & . & . \\ w_{n1} & w_{n2} & w_{n3} & . & 0 \end{bmatrix} \quad (3)$$

W is a contiguity matrix. wij -the element of row i and column j in matrix "W"- is l to 1, if regions of i and j are contiguous, other wise wij=0 .Spatial matrix is a n×n one for n observations. The elements of the spatial weights are row standardized, so that for each i, $\sum wij = 1$. Pre-multiplying the spatial matrix by the vector elements of the interested variable, the spatial lag operator of that variable is obtained. Observations of this variable indicate weighted average of the neighbors.

$$Sy = W.y = \begin{bmatrix} 0 & w_{12} & w_{13} & . & w_{1n} \\ w_{21} & 0 & w_{23} & . & w_{2n} \\ w_{31} & w_{32} & 0 & . & w_{3n} \\ . & . & . & . & . \\ w_{n1} & w_{n2} & w_{n3} & . & 0 \end{bmatrix} \begin{bmatrix} y_1 \\ y_2 \\ y_3 \\ . \\ y_n \end{bmatrix} \quad (4)$$

Then, we can examine spatial dependence through regressing the main variable on its spatial lag.

If the estimated coefficient is statistically significant, we say there is spatial dependence among contiguous observations. Also, we can test spatial dependence by Moran's I and Geary's C statistics:

$$I=n / S_0 \sum_i \sum_j wij\ (yi-\mu) / \sum_i (yi-\mu)^2 \quad (5)$$

$$C= (n-1) / 2S_0\ [\sum_i \sum_j Wij.\ (yi-yj)^2] / \sum_i (yi-\mu)^2 \quad (6)$$

where I and C are Moran's I and Geary's C statistics, respectively. yi is an interested variable and μ is its average, n is number of observations and S_0 is sum of all elements of spatial weight matrix. The expected value of I is l

to-1/n-1. The computed Moran's I and Geary's C statistics are compared with critical Z values. If computed I in considered observations is greater than its expected value, there is positive spatial auto correlation. That is, the value of variable in an observation increases when value of the same variable in its neighbors increase. Also the expected value of C ls 1.There is positive spatial auto correlation, if computed C is less than 1 (Anselin, 1992).

In addition to Moran's I and Geary's C statistics for testing spatial auto correlation, we can show spatial relations through Moran scatter plot, suggested by Anselin 1993, which plots the standardized variable against its spatial lag (also standardized).

5- Spatial Dependence of Poverty in Muslim Countries

There are different indicators measuring poverty of nations, such as, the percentage of the population living on less than 1$ a day, real per capita income, and so on. Because of the lack of other poverty indicator data for many of the considered countries, we use real per capita income data for 1975-2002 in this paper.[1] As mentioned before there are 57 Islamic countries in the world .We omit 14 countries -Afghanistan, Albania, Azerbaijan, Brunei, Kazakhstan, and Kyrgyz, Libya, Maldives, Palestine, Qatar, Tajikistan, Turkmenistan and Uzbekistan-since their 1975 income data are not available.[2] Therefore, we analyze spatial dependence of their real income per capita and then cluster them in terms of the situation of poverty in each country and its nation through Moran scatter plot.

1- The 1975 data are collected from the World Bank -Global Development Finance & World Development Indicators and the data of 2002 are per capita income (ppp) and from CIA, the world Fact book, 2004. Meanwhile the list of considered countries is stated in the Appendix.

2- The considered countries are: Algeria, Bahrain, Bangladesh, Benin, Burkina Faso, Cameroon, Chad, Comoros, Cote d'Ivoire, Djibouti, Egypt, Arab Rep, Gabon, Gambia, Guinea, Guinea-Bissau, Guyana, Indonesia, Iran, Islamic Rep, Iraq, Jordan, Kuwait, Malaysia, Mali, Mauritania, Morocco, Mozambique, Niger, Nigeria, Oman, Pakistan, Saudi Arabia, Senegal, Sierra Leone, Somali, Sudan, Suriname, Syrian Arab Republic, Togo, Tunisia, Turkey, Uganda, United Arab Emirates, Yemen.

Table (1) indicates values of Moran's I and Geary's C statistics of income per capita for years 1975 and 2002, respectively. Moran's I statistics are greater than their mean (0.024) for both considered years. Thus, as stated in the previous section, the positive autocorrelation hypothesis of income per capita in Islamic countries is confirmed. As the two last columns of the table show, the result of Geary's C test confirm this hypothesis too. Hence, income of each Islamic nation is affected by its neighbors, so that its income would

Table 1: Moran's I and Geary's C Tests for Spatial auto Correlation of Income per Capita of Islamic Countries

Test Type	Var.*	Value of Statistic	STD	Mean	z-Value	Prob.
Moran I	**Y75**	0.51	0.13	0.024	4.21	0.00
	Y02	0.61	0.13	0.024	4.83	0.00
Geary C	**Y75**	0.41	0.14	1	-4.18	0.00
	Y02	0.37	0.14	1	-4.50	0.00

* Y75 is the per capita income in 1975 and y02 is the per capita income in 2002.

increase with growth in its neighbors, and vice versa. In other words, poverty of Islamic countries has negative effect on their neighbors, and being in a poor region would help to remain poor. This is observable in real data, and many Islamic countries have had negative growth over time.

According to the results of spatial autocorrelation tests, the spatial lag of per capita income variable should be considered as an explanatory variable in models in which the per capita income is dependent variable.

For examining spatial effects, we also regress the spatial lag of per capita income variable on per capita income variable for 43 considered Islamic countries in years 1975 and 2002. The general form of these regressions is as follow:

$$yi = \alpha + \rho.Syi + \varepsilon_i \qquad (7)$$

Where yi is the vector of income per capita variable, Syi is its spatial lag operator, and ε_i is the vector of error terms. If ρ is statistically significant, there is spatial dependence. Table (2) shows the estimation results. As the

table indicates, both estimated coefficients are statistically significant. Therefore income of each country is influenced positively by its neighbor incomes. In other words, if a country surrounded by poor countries, there is a negative regional effect on its income, and vice versa.

Table 2: Estimation Results of Spatial Auto-Regression Model (SAR) for per Capita Income of Islamic Countries.

Var.	ρ	STD	t-Value	Prob.	$\overline{R}_2$
Y75	1.21	0.15	8.12	0.00	0.61
Y02	1.04	0.13	8.07	0.00	0.61

As we said before, the Moran scatter plot is another way for showing spatial auto correlation. For considered variable in this study- income per capita -Moran scatter plot plots the standardized income of a country against its spatial lag (also standardized). A country's spatial lag is a weighted average of incomes of its neighboring countries, with the weights being obtained from the simple contiguity matrix. The four different quadrants of the scatter plot identify four types of local spatial association between a country and its neighbors: (HH) a high income country with high income neighbors (quadrant I); (LH) a low income country surrounded by high income neighbors (quadrant II); (LL) a low income country surrounded by low income neighbors (quadrant III); and (HL) a high income country with low income neighbors (quadrant IV).

Quadrants I and III pertain to positive forms of spatial dependence while the remaining two represent negative spatial dependence (Rey and Montoury, 1999). Also, it is clear that countries in quadrant I indicate a rich region in the sample and on the contrary, countries in quadrant III show a poor region.

Figures (2) and (3) show the Moran scatter plot for years 1979 and 2002, respectively. As figure (2) shows, in 1975, seven countries are classified as HH cluster. An interesting point is that most of these countries- Bahrain, Iran, Kuwait, Oman, United Arab Emirates- are Persian Gulf

Fig 2: Moran Scatter Plot of Real Income per Capita of Muslim Countries, 1975

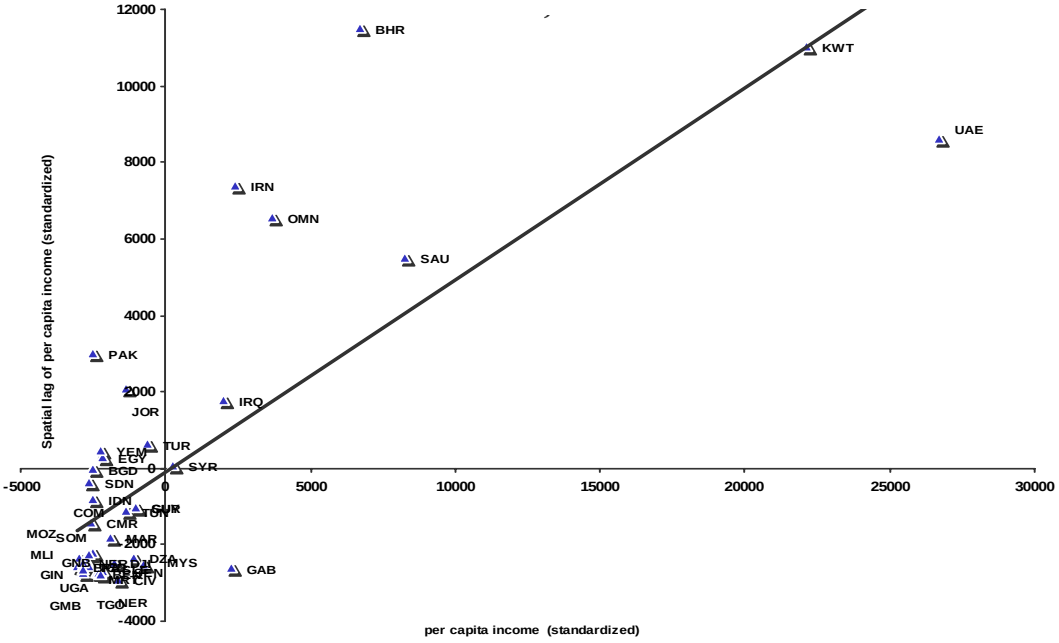
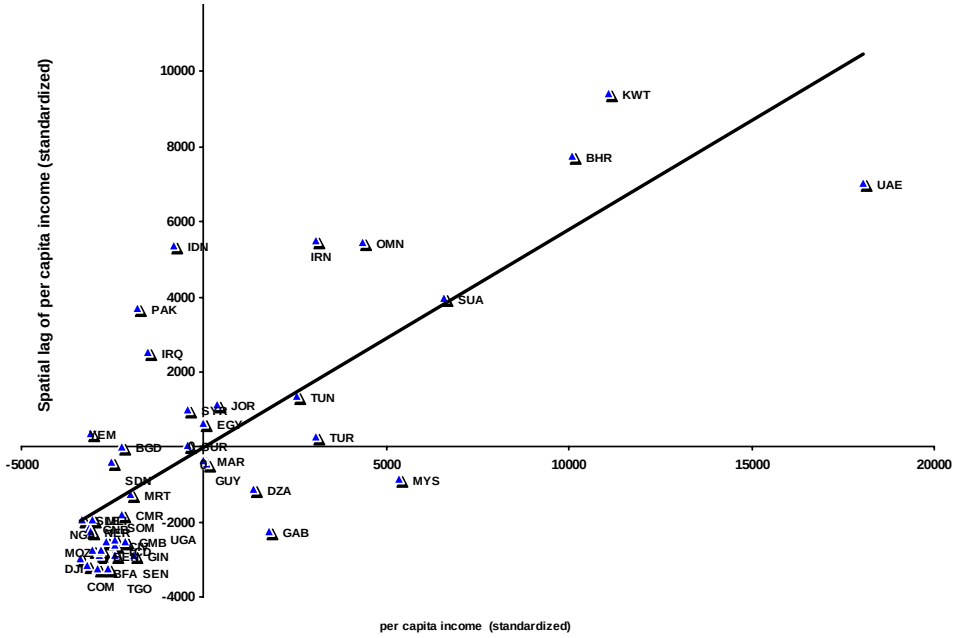


Fig 3: Moran Scatter Plot of per Capita Income (ppp) of Muslim Countries, 2002



countries. The United Arab Emirates is the last one on the right side of quadrant I; therefore it has been the richest Islamic country in 1975. Most African Islamic countries have placed in quadrant III. Only Gabon is in HL cluster which has been the richest African Islamic nation bordering poorer countries.

In 2002, Persian Gulf countries, as well as Tunisia and Turkey, classify as HH cluster. Again, United Arab Emirates has the highest income. Indonesia and Malaysia are neighbors and by raising the income of Malaysia in 2002, it has moved to quadrant II and its neighbor -Indonesia- has moved to quadrant II.

Mean while, Iraq has become poorer with respect to 1975 and has moved to quadrant II. In 2002, like 1975, most African Islamic countries cluster as poor ones.

Figure (4) is similar to figure (3), with a difference that in this figure per capita income standardizes with respect to the world mean in 2002 -$7900. In this way, this figure shows the relative poverty of Islamic countries in the world. As the plot shows, only United Arab Emirates, Kuwait, Bahrain, Saudi Arabia, Oman and Malaysia had income more than the world mean and other considered countries have income less than the world mean. Again countries in quadrant I are contiguous. In figure (4), compared to figures (2) and (3), the countries in quadrant III have moved down and the distances of them relative to the origin have increased. This indicates the more relative poverty of them in the world.

Fig 4: Moran Scatter Plot of per Capita Income (ppp) of Muslim Countries Relative to the World Mean, 2002

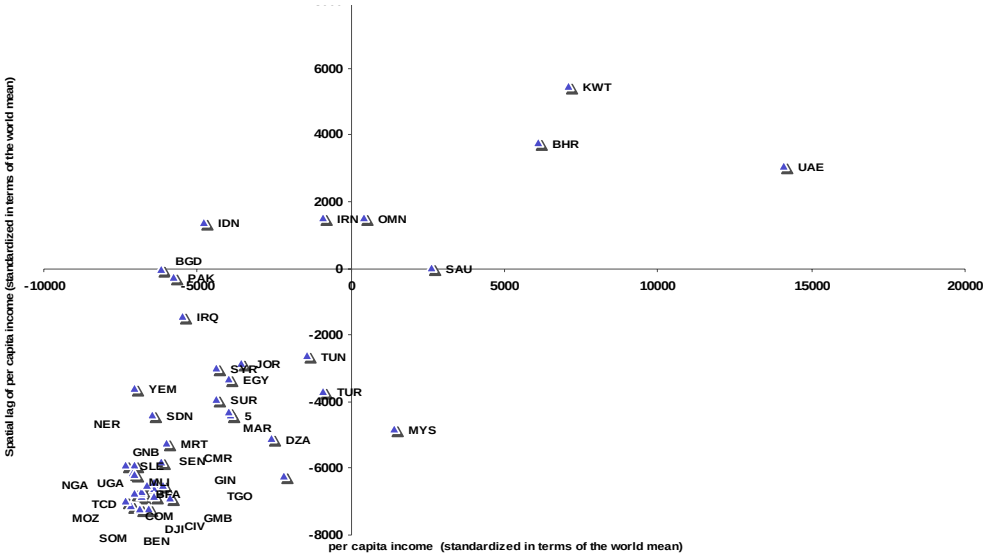


Figure (5) shows the dispersion of per capita income in Islamic countries geographically.

As mentioned before, poverty is affected by different social economic factors. In this section, we considered two representative factors -per capita health expenditure and public education expenditure as the percentage of GDP. Figure (6) and (7) demonstrate the dispersion of them respectively, which are comparable with figure (5).

Since we considered real per capita income as an index of poverty in Muslim nations if we compare figure (6) and (7) with figure (5), it is clear that in most poor Islamic countries, expenditures on health and education are both low. Being poor causes lower allocation of incomes to health education, which lead to health unsuitable conditions and low education perpetuating poverty. In other words, there is a spiral between poverty and low expenditure on health and education.

Fig 5: Dispersion of Real per Capita Income in Islamic Countries, 1998.

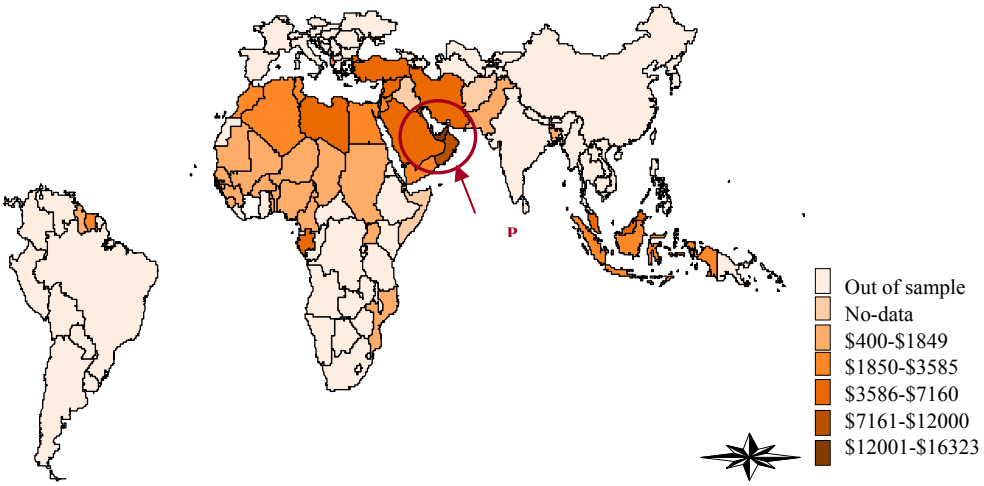


Fig (6): Dispersion of per Capita Health Expenditure in Islamic Countries, 1998

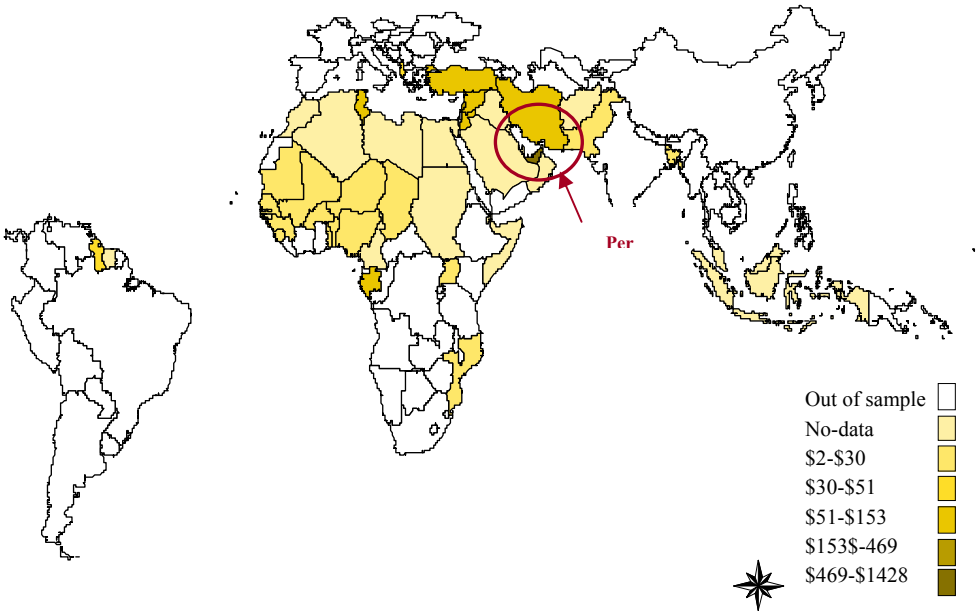
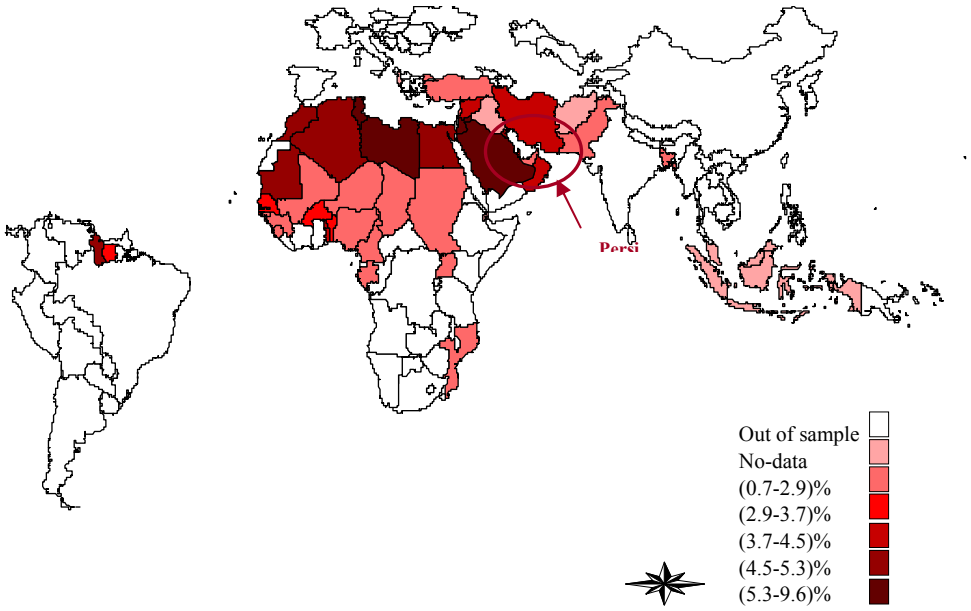


Fig (7): Dispersion of Education Expenditure in Islamic Countries, 1998



6- Conclusion

Poverty is one of the important problems of mankind, and millions of people around the world are suffering a high rate of poverty. As mentioned in the paper, most Islamic countries are considered poor countries group. Different poverty indicators show the strength of poverty in such countries. The results of spatial analysis of poverty in 43 Islamic countries indicate that there is a positive spatial dependence among poverty of considered countries. In other words, the poverty of a country's neighbors influences its poverty. If a country is surrounded by low income ones, there is a negative effect on its income through neighbors, and vice versa. Therefore, being located in a poor region encourages to the perpetuation of poverty, and as the Moran scatter plots show, this is the case of most Muslim nations. Many African Islamic countries are contiguous with other poor countries. Meanwhile, the figures present low expenditures on health and education in most considered countries. In fact, being poor causes low allocation of incomes to health and education, and unsuitable conditions of health and low education levels lead

to remaining poor. In other words, there is a spiral between poverty and low expenditures on health and education. Of course, availability of more data for these countries will allow more complete analysis.

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Appendix

List of considered Muslim countries in figs (2)-(4):

Country Name	Code
Algeria	DZA
Bahrain	BHR
Bangladesh	BGD
Benin	BEN
Burkina Faso	BFA
Cameroon	CMR
Chad	TCD
Comoros	COM
Cote d'Ivoire	CIV
Djibouti	DJI
Egypt, Arab Rep.	EGY
Gabon	GAB
Gambia, The	GMB
Guinea	GIN
Guinea-Bissau	GNB
Guyana	GUY
Indonesia	IDN
Iran, Islamic Rep.	IRN
Iraq	IRQ
Jordan	JOR
Kuwait	KWT
Malaysia	MYS
Mali	MLI
Mauritania	MRT
Morocco	MAR
Mozambique	MOZ
Niger	NER
Nigeria	NGR
Oman	OMN
Pakistan	PAK
Saudi Arabia	SAU
Senegal	SEN
Sierra Leone	SLE
Somali	SOM
Sudan	SDN
Suriname	SUR
Syrian Arab Republic	SYR
Togo	TGO
Tunisia	TUN
Turkey	TUR
Uganda	UGA
United Arab Emirates	UAE
Yemen	YEM