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THE COMPARATIVE SOCIO-ECONOMIC DEVELOPMENTAL LEVEL OF ISLAMIC COUNTRIES

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This study investigates the comparative socio-economic developmental level of the Islamic countries in 2000. As a first step, the original data set of 24 variables has been converted into a smaller set of uncorrelated variables made up of 5 principal components. Then, using variance explanation percentages of these components, General Factor has been calculated and countries have been ranked in terms of the values of this factor. In order to compare their development level, countries have been classified in two groups: Developing Islamic Countries and Least-Developed Islamic Countries. As a final step, the relevance of this grouping has been investigated by using discriminant analysis.

1. INTRODUCTION

Development is about improving the quality of people's lives and expanding their ability to shape their own future. Economic growth has been associated positively with poverty reduction. This latter, associated with growth, has varied widely as have social progress and welfare improvements, whether in education, health or participation (The World Bank, The Quality of Growth, 2000).

Economic growth is accompanied by improvements in measures of human and social development.

The countries are unequally endowed with natural capital. The productivity with which countries use their productive resources, physical capital, human capital and natural capital, are widely recognised as the

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main indicator of their level of economic development (The World Bank, Beyond Economic Growth, 2000).

Generally, Gross Domestic Product (GDP) per capita is used to indicate the level of economic development of any particular country. It can also be defined as a good measurement to provide information on the productivity with which different countries use their resources and on their relative material welfare.

In this connection, Islamic countries[1] constitute a heterogeneous group made up of some of the poorest as well as the richest countries of the world. They differ in terms of area, population, human and natural resource endowments, growth and trade potentials, economic structure and performance, and socio-economic development level. The majority of the Islamic countries in the African region are low-income countries, whereas those in the Middle East (oil-exporting countries) enjoy a higher per capita income and constitute a small proportion in the Islamic community.

The aim of this study is to examine the developmental differences between the 46 Islamic countries for which data are available and to rank them according to specific factors having maximum variance properties obtained from selected indicators. For this purpose, an initial data set of 24 variables has been converted into a substantially smaller set of uncorrelated variables made up of 5 components capturing most of the information in the original set. Then, using variance explanation percentages of those, General Factor (GF) has been calculated. Finally, countries under study have been ranked according to the GF and the ranking list has been classified in terms of factor value signs in two groups: 'Developing Islamic Countries' and 'Least-Developed Islamic Countries'. Discriminant analysis has been used to test the relevance of this classification.

The paper is organised as follows: section II describes Factor Analysis (FA) and presents definition of selected socio-economic indicators and empirical results. Section III covers the ranking list of the Islamic countries according to the GF obtained from five components. Section IV describes discriminant analysis and evaluates the success of the ranking list and country group classification. A conclusion is presented in the last section.

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[1] The term "Islamic countries" denotes the member countries of the Organisation of the Islamic Conference (OIC). There are 57 member countries.

2. DATA AND FACTOR ANALYSIS

Factor Analysis (FA) can be a highly useful and powerful multivariate statistical technique for effectively extracting information from large databases and making sense of large bodies of interrelated data. The essential purpose of FA is to describe, if possible, the correlation variance relationships among many variables in terms of a few underlying, but unobservable, random quantities called factors. The factor model assumes that there are m underlying factors, where $m<p$, which we denote by f_1, f_2, …, f_m, and that each observed variable is a linear function of these factors together with a residual variate, so that

$$X_j = \lambda_{j1} f_1 + ... + \lambda_{jm} f_m + e_j \qquad j=1, 2, \ldots, p$$

where the weights $\{\lambda_{jk}\}$ are usually called the factor loading, so that λ_{jk} is the loading of the j^{th} variable of the k^{th} factor. The variate e_j describes the residual variation specific to the j^{th} variable (Chatfield and Collins, 1980).

For the purpose of the analysis, 30 most common socio-economic indicators were selected on the basis of the availability and reliability of the data from both national and international statistical sources[2]. In order to define the indicators that will be included in the analysis, a correlation matrix value based on indicators has been considered since it enables to eliminate those indicators that have a small correlation. An anti-image matrix containing the negative partial correlations has been used to confirm this assumption.

Finally, 24 socio-economic indicators, listed in Table 1, were included in the analysis.

When the correlation coefficients are estimated by using a small sample, they are less reliable. Thus, in order to show whether the size of a sample is adequate, the Kaiser-Meyer-Olkin (KMO) criterion has been

[2] The World Bank, World Development Indicators 2002. UNDP, Human Development Report 2001. IMF, International Monetary Finance Yearbook 2002.

used. In this study, the fact that the value of KMO is 80% indicates that all the variables can be included in the analysis. Bartlett's test of sphericity also presents whether correlation matrix is an identity matrix, which would indicate that variables are unrelated. As it is clear that in our case correlation matrix is not an identity matrix, there are significant relationships among the variables.

Table 1. Socio-Economic Indicators List

Definition of Variables	Code
1) GNP per Capita ($)	PERGNP
2) Share of Government Expenditure in GDP (%)	EXP/GDP
3) Share of Agriculture in GDP (%)	AGRGDP
4) Share of Industry in GDP (%)	INDGDP
5) Share of Military Expenditure in Total Expenditure (%)	MILEXP
6) Current Account Balance (Million $)	CABAL
7) External Debt as Percentage of GNP (%)	EDT/GNP
8) Share of Exports of Goods and Services in GDP (%)	XGDP
9) Share of Labour Force in Agriculture (%)	LABAGR
10) Share of Children Labour Force (%)	LABCHIL
11) Life Expectancy (Years)	LIFE
12) Fertility Rate (Births per Woman)	FERT
13) Share of Urban Population (%)	SURB
14) Dependency Ratio (%)	DEPEN
15) Adult Literacy Rate (%)	LITER
16) Daily per Capita Supply of Calories (Calorie)	CALORIE
17) Children Under 5 Mortality Rate (Per 1000 Children)	UNDER5
18) Passenger Cars (Per 1000 People)	CAR
19) Telephone Mainlines (Per 1000 People)	TELEP
20) Share of Paved Roads (%)	ROAD
21) Electricity Use per Capita (kWh)	PERELEC
22) Access to Safe Water (% of Urban Population)	WATER
23) HIV Incidence among 15-49 Population (%)	HIV
24) Fertilizer Consumption (Hundred of Grams per Hectare of Arable Land)	FERTILIZER

While extracting factors, the Principal Component Analysis method, which is frequently used, was preferred. The next step is to determine the number of eigenvalues which are to be included in the analysis. There are some criteria developed for this purpose. The most common one, that is called Kaiser Test, is to select those for which variance share is greater than one. Table 3 shows the 5 eigenvalues that are to be included in the analysis. As expected, the first principal component has a large variance accounting for 50.126%. In other words, the first component explains a substantial amount of variation in the variables while the remaining four components explain a considerably less amount. The cumulative variance explained by the five components is 75.715%.

Table 2. Bartlett's Test

Kaiser-Meyer-Olkin		0.80 %
Bartlett's Test of Sphericity	Approximate Chi-Square	793.97
	Degrees of Freedom	276
	Significance	0.00

Thus, at the end of this step, the original data set of 24 variables was converted into a substantially smaller set of uncorrelated variables made up of 5 components capturing most of the information in the original data set.

Table 3. Total Variance Explained

Component	Initial Eigenvalues		
	Total	**Share of Variance**	**Cumulative (%)**
1	12.531	50.126	50.126
2	2.212	8.849	58.975
3	1.781	7.125	66.100
4	1.308	5.233	71.332
5	1.096	4.383	75.715

The Component Matrix reports the factor loading for each variable on the unrotated components or factors. Each number represents the correlation between the item and the unrotated factor. The algebraic sign and magnitude of the factor weight indicate the direction and the importance of the contribution of each indicator to all components. These correlations help us interpret the factors. After examination of the component matrix and considering that some of the factors could not be interpreted, the rotated component matrix has been applied as shown in Table 4 below.

Table 4. Rotated Component Matrix

	Component				
	1	**2**	**3**	**4**	**5**
FERT	-0.936	-0.17			
UNDER5	-0.825	-0.207	-0.241	-0.271	-0.246
LITER	0.812	0.175		0.322	-0.123
LABCHIL	-0.811	-0.2	-0.296	-0.259	-0.164
LIFE	0.804	0.256	0.316	0.238	0.254
ROAD	0.784	0.185			0.237
DEPEN	0.772	0.381	-0.196		0.252
LABAGR	-0.71	-0.413	-0.309	-0.345	-0.108
CALORIE	0.654	0.331	0.265	-0.19	0.23
WATER	0.63	0.281	0.389		0.185
HIV	-0.578		-0.248		-0.347
PERGNP	0.156	0.892	0.108	0.219	0.135
PERELEC	0.214	0.854	0.147	0.304	
TELEP	0.504	0.727	0.184	0.146	0.157
SURB	0.418	0.608	0.461	0.201	0.187
CAR	0.202	0.558	0.302	-0.106	0.277
AGRGDP	-0.385	-0.427	-0.377	-0.366	-0.338
MILEXP		0.125	0.794	0.327	0.203
EXP/GDP	0.225	0.314	0.767	-0.105	-0.155
XGDP	0.382	0.339		0.723	-0.197
CABAL			0.113	0.68	0.314
INDGDP	0.268	0.379	0.124	0.538	0.263
EDT/GNP	-0.261	-0.179		-0.112	-0.693
FERTILIZER	0.259	0.319		0.268	0.544

As seen in Table 4, the correlation coefficient between the first component and Fertility Rate is -0.94, while the figure for Fertilizer Consumption is much less correlated with the same component (0.26%). The sign of the factor weight is useful to verify the relation between the indicators and the socio-economic development level. This means that it is expected that a negative correlation exist between the Fertility Rate and development level, while, on the other hand, a positive one is expected to exist between the Literacy Rate and development.

The first factor is strongly correlated with the social development level. It covers FERT, UNDER5, LITER, LABCHIL, LIFE, ROAD, DEPEN, LABAGR, CALORIE, WATER and HIV. Due to the characteristics of these indicators, we decided to call this factor ‘Social Factor’. The second factor component covers PERGNP, PERELEC, TELEP, SURB, CAR and AGRGDP. The third factor component covers only two indicators, MILEXP and EXP/GDP. The fourth factor covers XGDP, CABAL and INDGDP, and finally, the last factor covers two indicators, EDT/GNP and FERTILIZER.

3. RANKING OF THE ISLAMIC COUNTRIES ACCORDING TO THE GENERAL FACTOR

In order to obtain a country ranking on the basis of a unique factor, GF has been calculated by using variance explanation percentages of the five components, as follows (Erçetin, 1994).

$$GF_j = \sum_{i=1}^{5} \lambda_i F_{ij} \quad j = 1,2,\ldots,46$$

By using the above formula, the GF values of individual countries have been ranked according to their magnitude. This ranking is presented in Table 5.

This section of the study compares the development levels of the Islamic countries according to whether they have a positive or negative GF value. For this purpose, the countries are divided into two groups. The first comprises the ‘developing Islamic countries’ (from Kazakhstan to Saudi Arabia), and the second comprises the ‘least-developed Islamic countries’ (from Pakistan to Niger). The countries of the first group are mostly located in the Asian region except for Tunisia, Egypt, Guyana and Suriname. Some of them are ‘oil-exporting countries’ and have nearly $12,000 per capita income on average. The industrial sector constitutes their major economic activity. On the other hand, the countries of the second group are mostly poor West African countries. They have low per capita income, about $300, and agriculture is their main economic activity. They do not have rich oil reserves or raw material resources.

Table 5. Ranking List of Islamic Countries According to the General Factor

	GROUP I		GROUP II
Countries	**GF**	**Countries**	**GF**
Kazakhstan	17.58	**Oman**	0.57
Tunisia	16.41	**Saudi Arabia**	0.45
U.A.E.	15.92	**Pakistan**	-2.72
Lebanon	15.73	**Gabon**	-3.61
Turkey	15.56	**Bangladesh**	-3.73
Azerbaijan	14.80	**Sudan**	-4.91
Kyrgyzstan	14.34	**Gambia**	-6.27
Albania	12.97	**Mauritania**	-8.44
Algeria	11.76	**Senegal**	-8.48
Brunei	11.56	**Nigeria**	-9.91
Jordan	11.44	**Cameroon**	-10.13
Malaysia	11.28	**Togo**	-10.20
Tajikistan	10.42	**Benin**	-12.24
Kuwait	9.88	**Yemen**	-12.48
Indonesia	9.83	**Guinea**	-13.23
Morocco	9.30	**Sierra Leone**	-16.77
Guyana	9.27	**Guinea-Bissau**	-17.03
Egypt	9.06	**Chad**	-17.27
Iran	8.78	**Uganda**	-19.00
Suriname	8.01	**Mali**	-21.00
Bahrain	7.76	**Mozambique**	-22.18
Qatar	7.46	**Burkina Faso**	-22.33
Syria	7.29	**Niger**	-23.59

On the other side, there is a remarkable point that cannot be ignored. In the first group, there exist dramatic differences between the GF value of the transition countries (Kazakhstan, Azerbaijan, Albania, Kyrgyzstan and Tajikistan) and that of the oil-exporting countries (Bahrain, Kuwait, Qatar, Oman and Saudi Arabia). Since the weighted first factor component, 'Social Factor', constituted by all social indicators, has 50% share of total variance explained, it implies that these indicators are more important than the economic development indicators. When the value of social indicators of those countries is compared, it is seen that the transition countries performed better than the oil-exporting countries in terms of social welfare.

4. TESTING CLASSIFICATION RESULT

Discriminant analysis is a multivariate analysis, which is an extension of one way Multivariate Analysis of Variance (MANOVA). It aims to make a decision in which misclassification probability is minimised, i.e. individuals are correctly classified according to the groups they belong to. The classification of the individuals according to their known p characteristics is of great importance in statistical evaluation from the point of view of the descriptive information obtained.

In one way Analysis of Variance (ANOVA) model, the null hypothesis which states that there is no difference between the group means, is tested using the F statistic:

$$F_{n-p}^{p-1} = \frac{SS_b/(p-1)}{SS_w/(n-p)} \qquad (4.1)^3$$

A similar criterion has been developed for the linear component of $X_1,X_2,...,X_p$ variables (cf.4.2) by using Fisher's discriminant analysis;

$$Y=V_1X_1+ V_2X_2+... + V_pX_p= V'X \qquad (4.2)$$

The linear component given in (4.2) is called "Discriminant Function". Fisher's method is based on finding the V_i coefficients (i=1,2,…,p) which maximises the ratio of between-groups variance to within-groups variance.

Fisher's discriminant analysis aims to transform the multivariate X observations to univariate Y observations, in which two populations are separated as much as possible. The easiest way for the calculation of Y's is to take linear components of X's.

By focusing preliminarily on country group classification (Developing Islamic Countries and Least-Developed Islamic Countries), its success has been tested by using discriminant analysis. For this aim, the value of 'Wilks Lambda' has been examined in order to test whether mean values of each group are equal or not. 'Wilks Lambda' is the ratio of the within-groups sum of squares to the total sum of squares. The values that are close to one indicate that there are no group differences. The value of

[3] SS_b= Sum of square between groups.
$SS_{w=}$ Sum of square within groups.

Wilks' Lambda for the 'CABAL' variable is 0,94 and significance is 0,16. Therefore, it has been excluded from the analysis. The rest of the analysis has been realised using 23 indicators. The summary results that contain the proportion of the "true and false" classification are given in Table 6. As can be seen from the table, the achievement of the country classification obtained from the ranking list according to GF is 100%[4].

Table 6. Classification Results

			Predicted Group Membership		
	General Factor		Developing Countries	Least-Developed Countries	Total
Original Membership	Developing Countries	Frequency Percent	15 100	0 0	15 100
	Least-Developed Countries	Frequency Percent	0 0	19 100	19 100

5. CONCLUSION

In this study, the Islamic countries have been ranked according to their socio-economic development level. 46 Islamic countries having different socio-economic conditions have been considered and 24 most common development indicators have been used.

First, the eigenvalues and the proportion of total variance explained by each of the factors were calculated. Accordingly, five factors having a cumulative share of about 76% of the total variation were chosen as the principal components. Then, using variance explanation percentages of five components, General Factor (GF) has been evaluated and the countries have been ranked according to its value. To make the picture clear in terms of socio-economic conditions of the Islamic countries, the ranking list has been classified in two groups. As it was expected, the countries in the first group had high development levels while the others had lower levels, hence, their designation by 'Developing Islamic Country' and 'Least-Developed Islamic Country' groups, respectively.

Finally, discriminant analysis was used to evaluate the relevance of the classification. Both ranking of the countries and country groups obtained using GF turned out to be correct at 100 percent.

[4] 100%-90% perfect, 89.5%-80% excellent, 79%-70% good, 69%-60% medium, 59%-5% weak, less than 50% rejected.

It is worth mentioning that no similar study on this subject has been found at Social Sciences Citation Index (SSCI) and Sciences Citation Index (SCI). For the purpose of this study, it was not possible to obtain full and up-to-date data regarding all the selected indicators for the Islamic countries for recent years. This lack of sufficient data has prevented the use of all specific variables. Certainly it would be possible to further elaborate this study by using more and different development indicators and obtain different results.

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