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An Estimation Model for Countries Economic Rank Evaluation

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Economic growth and development of a country, depends on various economic parameters. According to the basic principles of factor analysis, this paper evaluates comprehensive score for countries economic rank. The results of our work are calculated for IMF dataset with 15 economic parameters of 20 countries (Kuwait, Germany, Iceland, Belgium, Denmark, Taiwan, Qatar, Ireland, Sweden, Luxemburg, Austria, Singapore, Norway, Netherland, Hong Kong, Brunei, US, Switzerland, Canada, and Australia). By essentially evaluating and analyzing the results, we find that the rank provided by the world ranking list and our evaluated rank is almost similar which proves that factor analysis can be successfully used for country economy rank evaluation.

Keywords : Comprehensive Score, Country Economy, Economic Parameters, Factor Analysis.

1. INTRODUCTION

With the development of economy, the competition between countries is increasing. We analyze the competitiveness between countries on the levels of economic development for a comprehensive, objective and systematic evaluation. Every parameter reflects certain information of evaluation from different angles and perspectives, but there are some relationships between these various parameters, then the reflected information will generate overlapping, resulting in the distortion of statistical analysis [1][2].

Factor analysis method can effectively overcome these problems and make a significant evaluation of the level of economic development between countries. This paper takes data of 20 countries as an example to introduce the application of factor analysis in comprehensive evaluation of country economic development. We analyze the influential factors of countries competitiveness to provide support and protection for the development of countries.

2. BASIC PRINCIPLES OF FACTOR ANALYSIS METHOD

Factor analysis [3-5] is used to uncover the latent structure (dimensions) of a set of variables. It reduces attribute space from a larger number of variables to a smaller number of factors. Factor analysis has a variety of applications such as an assessment of underlying relationships or dimensions in the data and there placement of original variables with fewer, new variables.

The factor analysis model [6][7] expresses each variable as a linear combination of underlying common factors f_1, f_2,..., f_m, with an accompanying error term to account for that part of the variable that is unique (not in common with the other variables). For y_1, y_2,.., y_p in any observation vector y, the model is as follows:

$y_1 - \mu_1 = \lambda_{11} f_1 + \lambda_{12} f_2 + ...+ \lambda_{1m} f_m + \epsilon_1$
$y_2 - \mu_2 = \lambda_{11} f_1 + \lambda_{12} f_2 + ...+\lambda_{1m} f_m + \epsilon_2$

$y_p - \mu_p = \lambda_{p1} f_1 + \lambda_{p2} f_2 + ...+\lambda_{pm} f_m + \epsilon_p$

Ideally, m should be substantially smaller than

Table 9
Correlation Matrix

	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	V12	V13	V14	V15
V1	1	0.491	0.29	0.57	0.815	0.637	0.536	0.536	0.169	0.597	0.756	0.513	0.356	0.423	0.532
V2	0.491	1	0.337	0.636	0.675	0.621	0.621	0.585	0.254	0.656	0.647	0.971	0.412	0.459	0.526
V3	0.29	0.337	1	0.581	0.456	0.79	0.574	0.52	0.278	0.592	0.537	0.436	0.989	0.429	0.522
V4	0.57	0.636	0.581	1	0.766	0.735	0.99	0.967	0.689	0.991	0.895	0.789	0.691	0.793	0.904
V5	0.815	0.675	0.456	0.766	1	0.856	0.716	0.756	0.35	0.795	0.939	0.704	0.535	0.618	0.765
V6	0.637	0.621	0.79	0.735	0.856	1	0.723	0.702	0.28	0.759	0.794	0.663	0.825	0.549	0.657
V7	0.536	0.621	0.574	0.99	0.716	0.723	1	0.955	0.67	0.979	0.839	0.777	0.684	0.772	0.866
V8	0.536	0.585	0.52	0.967	0.756	0.702	0.955	1	0.656	0.948	0.871	0.732	0.629	0.74	0.858
V9	0.169	0.254	0.278	0.689	0.35	0.28	0.67	0.656	1	0.639	0.533	0.412	0.368	0.871	0.562
V10	0.597	0.656	0.592	0.991	0.795	0.759	0.979	0.948	0.639	1	0.915	0.802	0.703	0.801	0.935
V11	0.756	0.647	0.537	0.895	0.939	0.794	0.839	0.871	0.533	0.915	1	0.743	0.634	0.744	0.908
V12	0.513	0.971	0.436	0.789	0.704	0.663	0.777	0.732	0.412	0.802	0.743	1	0.528	0.593	0.673
V13	0.356	0.412	0.989	0.691	0.535	0.825	0.684	0.629	0.368	0.703	0.634	0.528	1	0.525	0.627
V14	0.423	0.459	0.429	0.793	0.618	0.549	0.772	0.74	0.871	0.801	0.744	0.593	0.525	1	0.732
V15	0.532	0.526	0.522	0.904	0.765	0.657	0.866	0.858	0.562	0.935	0.908	0.673	0.627	0.732	1

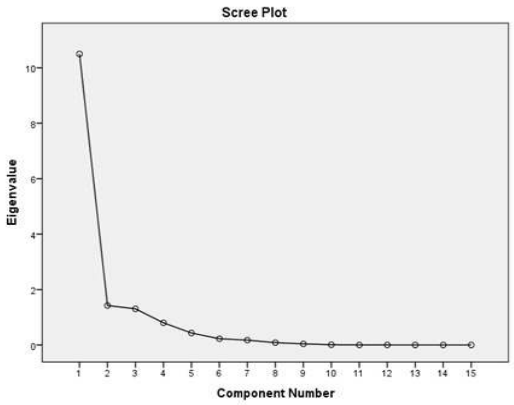

Figure 1. Scree Figure

culated according to Table 7:
F_1=0.331V_1+0.303V_2-0.173V_3+.....-0.107V_{14}-0.019V_{15}
F_2= -0.172V_1-0.118V_2-0.102V_3+.....0.294V_{14} + 0.126V_{15}
F_3=-0.101V_1-0.124V_2+0.524V_3+.....-0.075V_{14}-0.008V_{15}
V_1, V_2, V_3 ... ... V_{14} and V_{15} respectively indicate Gross domestic product per capita, Implied PPP conversion rate, Total investment, ..., General government gross debt and Current account balance in the standardized values of original parameters. In order to evaluate the economy rank of 20 countries, we calculate their comprehensive scores. The outcome of Table 8 is calculated using given formula.
Comprehensive evaluation score:

$$CS = \frac{\sum_{j=1}^{m}\sum_{i=1}^{n} SF_{ij}}{\sum_{i=1}^{n} F_i * 100} \quad (2)$$

Where, m=No of countries, n=No of factors, $SF_{i,j}$=Sum of i^{th} factor for j^{th} country
Table 8 represents the comprehensive scores of top 15 economic developed countries; however we calculated the results for 20 countries.

5. CONCLUSIONS

Factor analysis is an emerging technique to analyze only common variances. It is used to analyze the country's economic growth. Extraction and classification of common factors are an important step in factor analysis. Let us summarize the most relevant outcomes of the analysis we made in this paper.

From our results we observed that our calculated rank (Qatar, Luxemburg , Singapore, Norway, Hong Kong, US, Brunei, UAE, Switzerland, Australia, Canada, Ireland, Netherlands, Austria, Sweden) and the world ranking list (Qatar, Luxemburg, Singapore, Norway, UAE, Hong Kong, Brunei, US, Switzerland, Canada, Austria, Australia, Ireland, Netherlands, Sweden) of top richest countries are almost similar. So, from our evaluation, we conclude that estimated rank of economically rich countries can be successfully evaluated using factor analysis.

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