MODIFICATION TO THE HUMAN DEVELOPMENT INDEX

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(108807U)

Degree of Master of Science
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Department of Mathematics

University of Moratuwa

Sri Lanka

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S. Gamlath

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Dissertation submitted in partial fulfillment of the requirements for the degree of Master of Science in Business Statistics

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Declaration of the Candidate

I declare this is my own work and this dissertation does not incorporate without any acknowledgement any material previously submitted for a degree or diploma in any university or other institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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Signature: Date:

S. Gamlath

Declaration of the Supervisor

I have supervised and accepted the thesis titled "Modification to the Human Development Index" for the submission of the degree

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For my father who inspired me to reach great heights.

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S. GAMLATH

ABSTRACT

The Human Development Index (HDI) constructed by the United Nations Development Programme (UNDP) is the most popular measure of human development. The HDI has undergone a substantial number of revisions over time, but in its current form, it is a measure made up of four variables: gross national income in constant purchasing parity dollars, life expectancy at birth, mean years of schooling and expected years of schooling. The first indicator measures the income facet of human development, the second indicator measures the health dimension and the third and fourth indicators measure the education dimension. Each variable is scaled to take a value between 0 and 1. The geometric mean of the scaled values of the two education indicators is defined as the education index. The geometric mean of the education index and the two other variables is taken as the HDI value for a given country. In 2011, based on the values of the above HDI, 187 countries were ranked and grouped into four categories.

In spite of its simplicity, popularity and wide acceptability, a number of authors have noted some major shortcomings of the UNDP's HDI such as: the narrowness of scope, the arbitary nature in which weights are attached to different dimensions, the unreliability of data used in computations and the inability to compare HDI values over time due to frequent revisions to the composition and construction methodology. Upon looking these shortcomings the present study identified 17 new variables in addition to the four variables currently used to develop an alternative HDI to broaden the dimensions of human development measured.

Upon carrying out Principal Components Analysis (PCA), these 21 variables were reduced to 13 variables which were deemed to be adequate for the purpose of measuring human development effectively. Thereafter, two alternative indices were constructed by applying PCA and Factor Analysis (FA) to this system of 13 variables.

Under PCA, two PCs, the first accounting for 71% and the second accounting for 12% of the variance of the 13 variables were identified. Since the first PC constituted of all the variables with similar weights and the same sign, it was considered as an appropriate index for

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measuring human development. The validity of PCA was confirmed using jack-knife validation. Countries expriencing notable changes in rank were identified and possible explanations for these changes were sought. Another ranking was obtained using FA. The system of 13 variables could be represented by two latent factors accounting for 83% of the total variance. The structure of the factor solution was confirmed under differen extraction and rotation methods. Since the first factor loaded mainly on the governance indicators while the second factor loaded on the health, education, income and female empowerment dimensions, a country score with a weight of 0.2 on the first factor and a weight of 0.8 onto the second factor was computed to reflect the number of dimensions each factor captured. These changes were investigated for each group and possible reasons for these changes were outlined and these changes were also analyzed in the light of additional background information about the countries in question. The rankings under factor analysis displayed a higher correlation of 0.973 with HDI ranks when compared to the correlation of 0.953 that the ranks obtained under the principal components analysis displayed with the HDI. These country scores too led to considerable changes in the ranks of many countries when compared to HDI ranks in every group, and an analysis similar to that carried out for changes in rank under PCA, and a comparison of the ranks obtained under the PCA and FA was carried out.

The rankings obtained under FA were regarded as better than the rankings obtained under principal components analysis, since the loadings obtained were higher and the weights in the country scores under FA reflected the importance of each dimension more effectively than the scores obtained under PCA. Upon recognizing the various shortcomings the study suffers from such as unreliability and inaccuracies in the data, the use of certain subjective indicators for developing the alternative indices and the non-use of oblique rotations when conducting FA, the study recommended the potential for broadening the scope of the HDI to include at least some of the variables identified in the study.

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Keywords: Human Development Index, Principal Components Analysis, Factor Analysis, governance indicator.

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