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Original Research Article

Health Adjusted Human Development Index: A Modified Measure of Human Development

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ABSTRACT

Introduction: Presently we are living in a world where out of every seven persons one person is disabled (WHO Disability Report). Though most of the developed countries have already achieved high level of life expectancies, incorporation of life expectancy as a major component in the construction of Human Development Index (HDI) together with the other two components (Education and Income) may not capture the actual developmental status of a country as people may continue to live longer, but whether higher value of life expectancy ensures a full healthy life in different segments of a population is of serious concern. The quality of healthcare facilities and its accessibility should therefore be the integral part of development and HDI should be adjusted accordingly. It is also necessary to validate the existing 4-group classification (Very High, High, Medium and Low HDI groups) on the basis of which 181 countries are classified. Through this paper we would like to acknowledge the need of using Healthy Life Expectancy at Birth (HALE) together with a newer 5-group classification that could minimize the misclassification errors to an acceptable level.
Objectives: 1) To find the modified HDI that is adjusted for morbidity.
2) To Rank 181 countries on the basis of new modified HDI and to compare the rankings by these two methods.
3) To introduce a newer 5-group classification and to validate that classification against the existing 4-group classification for 181 countries in 2015-2016.
Data Sources: Human Development Report 2016 and Global Health Observatory (GHO) data.
Methodology: Formula for modifying HDI is derived with proper choice of weights. The New 5-group classification is validated against the existing 4-group classification through Discriminant Analysis. Ranks of countries according to the newly constructed Health adjusted HDI are compared with that of the original set of HDI ranks. Differences in the value and rank of both adjusted and unadjusted HDIs are calculated and interpreted accordingly.
Results: Our modification and the new 5-group classification are found to yield lesser misclassification errors than the existing HDI with 4-group classification. The new modification is named as Health Adjusted Human Development Index (HAHDI)
Conclusion: The inclusion of HALE in HDI together with the suggested classification would produce a substantially improved result over the existing HDI with 4-group classification in terms of capturing the true developmental status of these 181 countries in 2015-2016.

Keywords: Human Development Index, Healthy Life Expectancy, Human Development Report (2016), Discriminant Analysis, Health Adjusted Human Development Index.

INTRODUCTION

Background:

Human development is a multidimensional concept that was first addressed by UNDP in the year 1990 and is conceptualized as a process of enlarging people's choice by "creating an environment in which people can develop their full potential and lead productive and creative lives in accordance with their needs and

interests". Until 1970 the terms development and economic growth were being used interchangeably and since the conceptualization of development as a holistic approach which encompasses many other aspects of human livelihood together with economic prosperity, it has been refined and modified several times. In order to reflect on the progress of people in the path of development, a composite measure named Human Development Index (HDI) has been defined and it is designed or structured so as to measure the average achievement of a country in three basic dimension of life- namely: leading long and healthy life (measured by Life expectancy at birth), having access to knowledge (measured by Education Index which is actually derived by combining Mean years of schooling and Expected years of schooling) and maintaining a decent standard of living (measured by the log of the PPP-adjusted Gross National Income per capita). With passage of time the concept of development has been broadened to incorporate not only the expansion of "capabilities and people's choices to live healthy, productive and safe lives- but also ensuring that these choices do not compromise or restrict those available to the future generations" (Human Development Report 2014). Much emphasis was made upon "reducing vulnerabilities and building resilience" so that human progress can be sustained.

In its 25-year history, in spite of gaining popularity as one of the most widely used indicators for comparing welfare across countries, the current method of constructing HDI, being based on only three aspects of well-being has been criticized widely for its inability to capture all the dimensions of development together with the variations and distributions in achievements in those dimensions of life. Moreover, the indices which have already been considered in the construction of HDI are not completely reflecting on all aspects of that respective dimension. For example, in order to encapsulate the degree and direction of development in people's capability to lead long and healthy life, Life Expectancy at Birth (LEB) is being relied upon whereas living a long life in terms of higher LEB doesn't necessarily ensure living a fully healthy life especially when we are living in a world where out of every seven persons one person is disabled (WHO Disability Report) and older population are forced to live with degenerative diseases like cancer, diabetes, impairment or mental illness. The real irony lies in the fact that that though most of the developed countries have already achieved high level of life expectancies, incorporation of life expectancy as a major component in the construction of HDI may not capture the actual developmental status of a country as people may continue to live longer, but whether higher value of life expectancy ensures a full healthy life in different segments of a population is of serious concern. The quality of healthcare facilities and its accessibility should be the integral part of development and HDI should be adjusted accordingly.

Since 1970, the concept of "basic needs" started to gain attention of the policymakers and the attempt of associating or incorporating this concept into human development became a core concern for them (Hicks and Streeten, 1979; Streeten et. al., 1981). The most prominant attempt in this respect is the annual publication of the Human Development Index by the UNDP since 1990. HDI is such a composite index that it comprises of four indicators reflecting on three major dimensions of human development: longevity, knowledge and standard of living. HDI combines the essential choices of people "…to lead a long and healthy life, to acquire knowledge and to have access to resources needed for a decent standard of living" (UNDP, 1990, p. 10). Despite being quite simple and easy to conceptualize and compute, HDI is criticized for overlooking the contribution of several other dimensions of human well-being, such as for example, human rights, social security, political-economic-social

and community participation etc. (Anand & Sen, 1992; Ranis, Stewart & Samman, 2005; Harttgen et. al., 2008).

Till today there have been a good number of attempts to modify HDI by means of modifying either the Education Index (Farhad Noorbakhsh, 1997) or the Income Index (Herrero et.al., 2012). Many of them showed subsistent effort to incorporate some relevant variables and suggested minor changes to the aggregate indices. However, the majority of the related literature and research works on modification of existing HDI have tried to address the inconsistencies in capturing the relevant dimensions of development that were left out and proposed mathematical formulae by utilizing household survey data so that the variables explaining those specific dimensions could be aggregated into a single indicator (G.M. Antony et. al., 2007; Kenneth Harttgen et. al., 2012). Through this paper, we would like to address the inconsistency within the Health and Longevity dimension and would suggest some modifications that would respond to these well-known shortcomings of the traditional design of this index and entail substantial improvements

Rationale Behind the Study:

Though Life Expectancy at Birth (LEB) is considered as a standardized and universally comparable measure to capture the mortality scenario around the world, it is quite incomplete in the sense that it fails to capture the morbidity situation that is getting prevalent and quite prominent over years. As LEB is considered in the calculation of component index LEI, the morbidity situation is ignored in HDI.

In this paper, we are particularly interested in Health-adjusted life expectancy (HALE) which is a measurement developed by the World Health Organization that attempts to capture a more complete estimate of health than standard life expectancy rates. HALE estimates the number of healthy years an individual is expected to live at birth by subtracting the years of ill health – weighted according to severity – from overall life expectancy HALE is also calculated at age 65 to provide a measurement of the quality of life of seniors. By moving beyond mortality data, HALE is meant to measure not just how long people live, but the quality of their health through their lives.

Besides that, there is substantial inconsistency and uncertainty regarding the existing classification on how good it can portray the real picture of human development across the globe or can actually be improved with respect to HDI, i.e. for a classification to be valid, we need to check whether the intra group variations are less but the inter group variations are large. Based on such motives, a detailed analysis is carried out and some changes are proposed in order to avoid the above inconsistencies that the present format involves.

Objectives:

Looking at the current scenario, the main purpose of this paper is to address the burden of degenerative diseases and vulnerability through a newly proposed Human Development Index that will incorporate Healthy Life Expectancy at Birth in the construction of Health Index and thus will encapsulate the morbidity situation together with mortality in the HDI.

a) In this paper, our first objective is to substitute HALE at birth in order to derive a more plausible Health Index for the year 2015 (181 countries).

b) Our next immediate motive is to examine the performance of our proposed method of refining HDI through the newer Health Index. For that, we have to derive the rankings by our modified method and compare it with the actual HDI rankings for the given set of countries in 2015.

c) Next, we will demonstrate the variability within and between 4 different development groups (Very high, High, Medium and Low Human Development Index groups according to the classification of UN) and will assess the effectiveness of a newer 5-

group classification against the existing classification by constructing discriminant functions for both the methods of calculating HDI with the help of discriminant analysis.

DATA AND METHODS

Sources of Data:

For the purpose of the desired modification and to assess the validity of such modification against the existing HDI formula, we have extracted data on LEB (Life Expectancy at Birth), MYS (Mean Years of Schooling), EYS (Expected Years of Schooling), GNI per capita at purchasing power parity (PPP US$) along with the HDI values and complete ranking according to four HDI groups (Very high human development, High human development, Medium human development, Low human development) for 2015-2016 (181 countries) from Human Development Reports (2016) published for the United Nations Development Programme (UNDP). We have used those values to recalculate the HDI values for 181 countries with the help of the existing formula (as updated on 10th June, 2011). For the purpose of calculating our newly proposed HAHDI (Health Adjusted Human Development Index) using HALE instead of LEB, we have extracted the data on HALE (Healthy Life Expectancy at Birth) for the same set 181 countries in 2015 from the Global Health Observatory Data Repository (GHO database) which is a gateway of WHO to health-related statistics for more than 1000 indicators for its 194-member countries.

Methods and Analysis:

As published on 4 November 2010 (and updated on 10 June 2011), the 2010 Human Development Index (HDI) combines the following three dimensions of human life and captures the average achievement in those three dimensions-

- A long and healthy life: Life expectancy at birth
- Education index: Mean years of schooling and Expected years of schooling
- A decent standard of living: GNI per capita (PPP US$)

In its 2010 Human Development Report, the UNDP began using a new method of calculating the HDI. The following three indices are used:

$$Life\ Expectancy\ Index\ (LEI) = \frac{LEB - 20}{85 - 20}$$

$$Education\ Index\ (EI) = \frac{MYSI + EYSI}{2}$$

$$Mean\ Years\ of\ Schooling\ Index\ (MYSI) = \frac{MYS}{15}$$

$$Expected\ Years\ of\ Schooling\ Index\ (EYSI) = \frac{EYS}{18}$$

$$Income\ Index\ (II) = \frac{ln(GNIpc) - ln(100)}{ln(75000) - ln(100)}$$

Finally, the HDI is derived as the geometric mean of the previous three normalized indices.

$$\boldsymbol{HDI = \sqrt[3]{LEI * EI * II}}$$

LE: Life expectancy at birth

MYS: Mean years of schooling (i.e. years that a person aged 25 or older has spent in formal education)

EYS: Expected years of schooling (i.e. total expected years of schooling for children under 18 years of age)

GNIpc: Gross national income at purchasing power parity per capita.

Modification: In this modification, we've substituted Healthy Life Expectancy (HALE) at Birth for Life Expectancy at Birth (LEB) in the existing expression for the Health Index. We have taken 75 years as the maximum and 20 years as the minimum to work out the corresponding normalized index as-

$$\boldsymbol{Healthy\ Life\ Expectancy\ Index\ (HALI) = \frac{HALE(0) - 20}{75 - 20}}$$

We have retained the other 2 indices and calculated the final HDI (***HAHDI***) by taking the Geometric Mean of the 3 indices. We have prepared a ranking and introduced a 5-group classification to categorize 181 countries. We will discuss about the newer classification in the next section.

INTRODUCING A NEW CLASSIFICATION FOR THE MODIFIED HDI: As suggested by UN, there are originally 4 HDI groups- Very High (HDI≥0.8), High (<0.8 but ≥0.7), Medium (<0.7 but ≥0.55) and Low (<0.55) into which these 181 countries are categorized according to their respective HDI values.

In this paper, we are introducing a newer classification, which we have followed to classify these 181 countries according to the values of modified HDI-HAHDI.

In this newer classification, there are 5 groups- Very High (HDI≥0.8), High (<0.8 but ≥0.7), Medium (<0.7 but ≥0.6), Low (<.6 but ≥0.5) and Very Low (<0.5) HDI Groups into which these 181 countries are categorized according to their respective HAHDI values.

DISCRIMINANT ANALYSIS FOR THE ORIGINAL HDI AND THE MODIFIED HDI: We have assessed 3 things- the significance of HALI in determining which group a country should fall, the contribution of HALI to the respective HAHDI and most importantly, the validity of our new classification compared to the original classification by means of Discriminant Analysis in SPSS.

While considering the original 4-group classification according to the original HDI values, we have taken LEI, EI and II as the predictor variables and for the modified HDIs with 5-group setup, we have taken the respective HALI and EI, II as the predictors.

Hence, we have 2 equations-

$\mathbf{D_1 = v_{11}*LEI + v_{12}*EI + v_{13}*II + a_1}$ (for ***HDI***)

$\mathbf{D_2 = v_{21}*HALI + v_{22}*EI + v_{23}*II + a_2}$ (for **HAHDI**)

Where D_i's are discriminant functions, v_{ij}'s are the discriminant coefficients or weights for the j^{th} variable and i^{th} HDI but unstandardized (analogous to the regression coefficients in the regression equation). a_i's are constants. Here j= 3.

The main purpose of these v_{ij}'s is to maximize the distance between the means corresponding to the different categories of the categorical response variable. In our case the aim is to maximize the distance between the HDI Groups on the basis of the predictor variables.

RESULTS AND INTERPRETATION

Interpretation of Rankings by HAHDI and the Relative Deviations with respect to the Ranking according to the Original HDI:

For each of the 181 countries, we have computed the HDI and HAHDI values and obtained the corresponding ranking. The component values and the detailed rankings according to these 2 methods are shown in Table: 6.1. In this section, we will discuss what significant changes in the values of the final Development Index and the rankings could be seen from the said Table: 6.1.

As seen from the ranking according to the HAHDI values as compared to the ranking according to the original HDI values, there are 49 countries for which at least either of the rankings exactly matches with the corresponding HDI ranking. The most significant fact is, the top 10 countries according to the ranking given by HDI values are able to stay within top 10 except for the fact that they have different permutations. Though all the top 3 countries (Norway, Switzerland and Australia) have retained their positions in the modified version of HDI, though their respective scores according to HAHDI (0.9481, 0.9373 and 0.9326 respectively) have dropped significantly from their respective HDI scores (0.9494,0.9391,0.9387 respectively). For the bottom 10 countries again, the only difference is their permutation. The highest rise in the ranking can be seen in case of

Swaziland (+10) on the other hand, the biggest fall in the ranking due to the incorporation of in Health Index can be observed for Lebanon (-12). Now let's observe the relative positions of these 181 countries with respect to the 5-group classification that has been introduced by us. It is observed that, the deviations are more prevalent in High and Medium HDI groups as compared to the other 3 groups modifications.

Table 6.1: The Ranking and Relative Changes in Ranking of 181 countries according to the existing and new formulae of HDI

							Ranking		Relative Change
COUNTRY	**LEI**	**HALI**	**EI**	**II**	**HDI**	**HAHDI**	**HDI**	**HAHDI**	
Norway	0.9494	0.9455	0.9158	0.9843	0.9494	0.9481	1	1	0
Switzerland	0.9713	0.9655	0.8912	0.9568	0.9391	0.9373	2	2	0
Australia	0.9621	0.9436	0.9392	0.9153	0.9387	0.9326	3	3	0
Germany	0.9399	0.9327	0.9145	0.9228	0.9257	0.9233	4	7	-3
Singapore	0.9724	0.98	0.8135	1	0.9249	0.9273	5	4	1
Denmark	0.9294	0.9309	0.9233	0.9212	0.9246	0.9251	6	5	1
Netherlands	0.9493	0.9491	0.8971	0.9272	0.9243	0.9242	7	6	1
Ireland	0.9393	0.9364	0.9105	0.9187	0.9227	0.9218	8	8	0
Iceland	0.965	0.9582	0.9064	0.8935	0.9211	0.9189	9	9	0
Canada	0.9573	0.9509	0.8903	0.9145	0.9203	0.9182	10	10	0
United States	0.9111	0.8927	0.9	0.9483	0.9196	0.9133	11	11	0
New Zealand	0.9542	0.9382	0.9168	0.8754	0.9149	0.9097	12	12	0
Sweden	0.9592	0.9455	0.8551	0.927	0.9127	0.9083	13	15	-2
United Kingdom	0.9361	0.9345	0.8959	0.897	0.9095	0.909	14	14	0
Japan	0.9798	0.9982	0.8416	0.8944	0.9035	0.9091	15	13	2
Korea (Republic of)	0.9558	0.9673	0.8667	0.8829	0.901	0.9046	16	16	0
Israel	0.9625	0.96	0.8698	0.8676	0.8989	0.8981	17	17	0
Luxembourg	0.952	0.9418	0.7835	0.9724	0.8985	0.8952	18	19	-1
France	0.9594	0.9564	0.8393	0.8976	0.8974	0.8965	19	18	1
Belgium	0.9382	0.9291	0.8415	0.9097	0.8955	0.8926	20	21	-1
Finland	0.9386	0.9273	0.8467	0.9007	0.8945	0.8909	21	22	-1
Austria	0.9474	0.9455	0.8198	0.9181	0.8934	0.8928	22	20	2
Slovenia	0.9319	0.9291	0.886	0.8547	0.8903	0.8894	23	23	0
Italy	0.9744	0.96	0.8139	0.8786	0.8866	0.8822	24	24	0
Spain	0.9656	0.9527	0.818	0.875	0.8842	0.8802	25	25	0
Czech Republic	0.9042	0.8982	0.8781	0.8519	0.8778	0.8759	26	26	0
Greece	0.9396	0.9436	0.8296	0.8329	0.8659	0.8671	27	28	-1
Estonia	0.8771	0.8909	0.8767	0.8421	0.8651	0.8696	28	27	1
Brunei Darussalam	0.908	0.9145	0.7158	0.9956	0.8649	0.867	29	29	0
Malta	0.9342	0.94	0.7811	0.859	0.8559	0.8576	30	30	0
Cyprus	0.9282	0.9327	0.7858	0.8588	0.8556	0.857	31	31	0
Qatar	0.8973	0.8691	0.6979	1	0.8555	0.8465	32	35	-3
Poland	0.8865	0.8855	0.8516	0.8286	0.8552	0.8549	33	32	1
Lithuania	0.823	0.8382	0.8824	0.84	0.8481	0.8533	34	33	1
Chile	0.9532	0.9182	0.7837	0.8124	0.8466	0.8361	35	41	-6
Saudi Arabia	0.8376	0.8073	0.7685	0.9427	0.8466	0.8363	36	40	-4
Slovakia	0.8678	0.8745	0.8233	0.8443	0.8449	0.8471	37	34	3
Portugal	0.9413	0.9345	0.7562	0.8406	0.8427	0.8406	38	36	2
United Arab Emirates	0.8788	0.8782	0.6869	0.9812	0.8398	0.8396	39	38	1
Hungary	0.851	0.8618	0.8339	0.824	0.8362	0.8398	40	37	3
Latvia	0.836	0.8564	0.8349	0.8187	0.8299	0.8365	41	39	2
Croatia	0.8845	0.8982	0.7979	0.8025	0.8274	0.8316	42	42	0
Argentina	0.8686	0.8655	0.8078	0.8073	0.8274	0.8264	43	43	0
Bahrain	0.8725	0.8545	0.7167	0.8942	0.8239	0.8182	44	44	0
Montenegro	0.8677	0.8709	0.7966	0.761	0.8072	0.8082	45	46	-1
Russian Federation	0.7733	0.7891	0.816	0.8233	0.8039	0.8093	46	45	1
Romania	0.8436	0.8509	0.7693	0.796	0.8024	0.8047	47	48	-1
Kuwait	0.8392	0.8309	0.6105	1	0.8002	0.7975	48	50	-2
Belarus	0.7918	0.8218	0.8342	0.7631	0.7958	0.8058	49	47	2
Oman	0.8765	0.8473	0.6517	0.8823	0.7958	0.7868	50	56	-6
Uruguay	0.8823	0.8709	0.7169	0.7938	0.7948	0.7913	51	53	-2
Barbados	0.858	0.8509	0.7734	0.7564	0.7947	0.7925	52	52	0
Kazakhstan	0.7629	0.7873	0.8051	0.8154	0.7941	0.8025	53	49	4
Bulgaria	0.8357	0.8436	0.7777	0.7691	0.7936	0.7961	54	51	3
Bahamas	0.8547	0.8473	0.715	0.8117	0.7916	0.7893	55	55	0
Malaysia	0.8446	0.8455	0.7004	0.8317	0.7894	0.7897	56	54	2
Panama	0.8885	0.8745	0.6907	0.7963	0.7877	0.7835	57	59	-2
Antigua and Barbuda	0.8652	0.8582	0.6944	0.807	0.7856	0.7835	58	60	-2

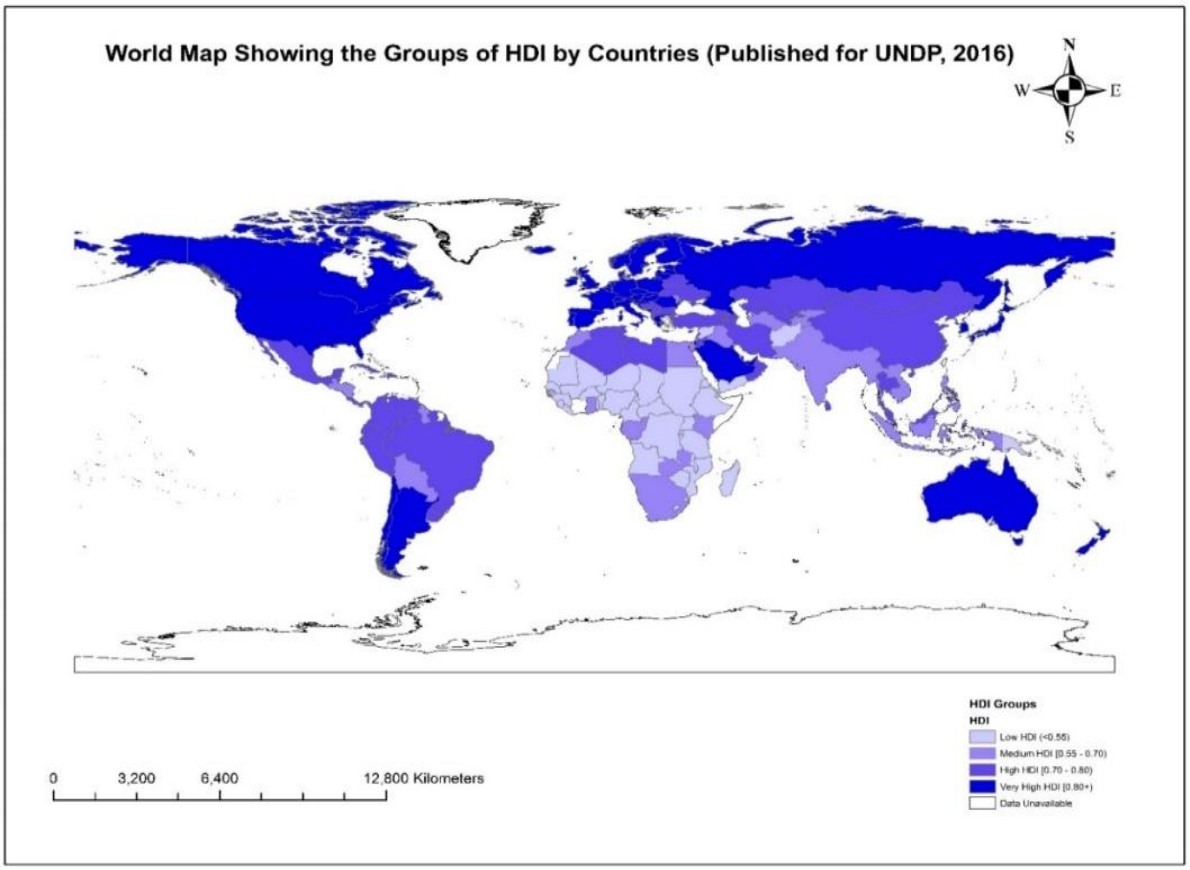
Table to be continued…									
Seychelles	0.82	0.8273	0.7061	0.8272	0.7824	0.7847	59	58	1
Mauritius	0.8399	0.8509	0.7245	0.784	0.7814	0.7848	60	57	3
Trinidad and Tobago	0.7772	0.7873	0.7169	0.8514	0.7799	0.7833	61	61	0
Costa Rica	0.9171	0.9055	0.6837	0.7465	0.7765	0.7731	62	63	-1
Serbia	0.8469	0.8673	0.7595	0.7257	0.7757	0.7819	63	62	1
Cuba	0.9165	0.8945	0.7788	0.6513	0.7747	0.7684	64	67	-3
Iran (Islamic Republic of)	0.8551	0.8455	0.7041	0.7703	0.7741	0.7711	65	64	1
Georgia	0.8465	0.8436	0.7945	0.6773	0.7694	0.7685	66	66	0
Turkey	0.8543	0.84	0.6684	0.7902	0.767	0.7627	67	70	-3
Venezuela (Bolivarian Republic of)	0.8367	0.8218	0.7105	0.7582	0.7667	0.7621	68	71	-3
Sri Lanka	0.8469	0.8545	0.7518	0.7071	0.7664	0.7687	69	65	4
Albania	0.8918	0.8873	0.7154	0.6994	0.7642	0.7629	70	69	1
Lebanon	0.916	0.8309	0.656	0.7388	0.7628	0.7385	71	83	-12
Mexico	0.8765	0.8618	0.6546	0.7702	0.7617	0.7574	72	72	0
Azerbaijan	0.783	0.8127	0.7234	0.7705	0.7585	0.768	73	68	5
Brazil	0.8423	0.8273	0.6808	0.748	0.7541	0.7496	74	76	-2
Grenada	0.824	0.8182	0.7245	0.7168	0.7536	0.7518	75	74	1
Bosnia and Herzegovina	0.8713	0.8836	0.6942	0.697	0.7498	0.7534	76	73	3
The former Yugoslav Republic of Macedonia	0.8543	0.8636	0.673	0.7282	0.7481	0.7508	77	75	2
Algeria	0.8466	0.8418	0.6583	0.7413	0.7448	0.7434	78	80	-2
Ukraine	0.7866	0.8018	0.8032	0.6494	0.743	0.7478	79	77	2
Armenia	0.8444	0.8527	0.7295	0.6655	0.7428	0.7453	80	78	2
Jordan	0.8335	0.8182	0.7015	0.6973	0.7415	0.7369	81	84	-3
Thailand	0.8402	0.8509	0.6408	0.752	0.7398	0.7429	82	81	1
Peru	0.8433	0.8309	0.6723	0.714	0.7397	0.7361	83	86	-3
Ecuador	0.8634	0.8545	0.6652	0.7035	0.7393	0.7368	84	85	-1
China	0.861	0.8818	0.6307	0.7392	0.7377	0.7436	85	79	6
Fiji	0.7716	0.78	0.7766	0.6665	0.7364	0.7391	86	82	4
Saint Lucia	0.8492	0.8382	0.6766	0.6925	0.7355	0.7323	87	88	-1
Mongolia	0.7662	0.7655	0.7374	0.7023	0.7348	0.7346	88	87	1
Jamaica	0.8588	0.8545	0.6778	0.6684	0.73	0.7288	89	89	0
Colombia	0.8343	0.8218	0.6295	0.7325	0.7273	0.7236	90	92	-2
Suriname	0.7889	0.7836	0.6299	0.7668	0.725	0.7233	91	93	-2
Tunisia	0.8459	0.8491	0.643	0.6993	0.7246	0.7255	92	91	1
Dominican Republic	0.8254	0.82	0.6218	0.7324	0.7217	0.7201	93	94	-1
Saint Vincent and the Grenadines	0.816	0.8109	0.6566	0.7012	0.7216	0.7201	94	95	-1
Tonga	0.8152	0.8364	0.7663	0.5993	0.7207	0.7269	95	90	5
Libya	0.7964	0.7945	0.616	0.7497	0.7164	0.7159	96	96	0
Belize	0.7704	0.7673	0.7037	0.6496	0.7062	0.7052	97	99	-2
Samoa	0.8257	0.8473	0.7015	0.6018	0.7038	0.7098	98	97	1
Maldives	0.8763	0.9	0.5606	0.7013	0.701	0.7073	99	98	1
Uzbekistan	0.76	0.7709	0.7396	0.612	0.7007	0.704	100	101	-1
Moldova (Republic of)	0.7959	0.8164	0.7254	0.5917	0.699	0.705	101	100	1
Botswana	0.6847	0.6709	0.6583	0.7535	0.6977	0.693	102	104	-2
Gabon	0.6913	0.6764	0.618	0.7929	0.6971	0.6921	103	106	-3
Paraguay	0.8154	0.8218	0.6133	0.6653	0.693	0.6948	104	103	1
Turkmenistan	0.7036	0.7236	0.6293	0.7467	0.6915	0.698	105	102	3
Egypt	0.7896	0.7673	0.6009	0.6966	0.6914	0.6848	106	107	-1
Indonesia	0.7546	0.7655	0.6219	0.6964	0.6888	0.6921	107	105	2
Viet Nam	0.8606	0.8473	0.6171	0.6007	0.6833	0.6797	108	111	-3
Philippines	0.7437	0.7473	0.6368	0.6692	0.6818	0.6829	109	109	0
El Salvador	0.8196	0.8018	0.5836	0.6568	0.6798	0.6748	110	112	-2
Bolivia (Plurinational State of)	0.7499	0.7727	0.6563	0.6223	0.6741	0.6808	111	110	1
South Africa	0.5794	0.6255	0.7054	0.7243	0.6664	0.6837	112	108	4
Kyrgyzstan	0.7814	0.7982	0.7213	0.5186	0.6636	0.6683	113	113	0
Iraq	0.7635	0.7273	0.4996	0.7182	0.6495	0.639	114	117	-3
Cabo Verde	0.8237	0.8036	0.5339	0.6197	0.6483	0.643	115	115	0
Morocco	0.8355	0.82	0.5028	0.6459	0.6474	0.6434	116	114	2
Nicaragua	0.8494	0.7964	0.5423	0.5831	0.6452	0.6315	117	120	-3
Namibia	0.6933	0.6818	0.5464	0.6921	0.64	0.6365	118	118	0
Guatemala	0.801	0.7673	0.5079	0.6431	0.6396	0.6305	119	121	-2
Guyana	0.7154	0.7091	0.5679	0.6392	0.638	0.6361	120	119	1
Micronesia (Federated States of)	0.758	0.7727	0.6485	0.5278	0.6378	0.6419	121	116	5
Tajikistan	0.7628	0.7655	0.658	0.4922	0.6275	0.6282	122	122	0
Honduras	0.8205	0.8164	0.5178	0.5739	0.6247	0.6237	123	123	0
India	0.7434	0.72	0.5349	0.6098	0.6236	0.6169	124	124	0
Bhutan	0.767	0.7491	0.4521	0.6435	0.6065	0.6018	125	126	-1
Timor-Leste	0.7464	0.7473	0.4943	0.6018	0.6055	0.6057	126	125	1
Vanuatu	0.8016	0.8109	0.5263	0.5036	0.5967	0.599	127	127	0

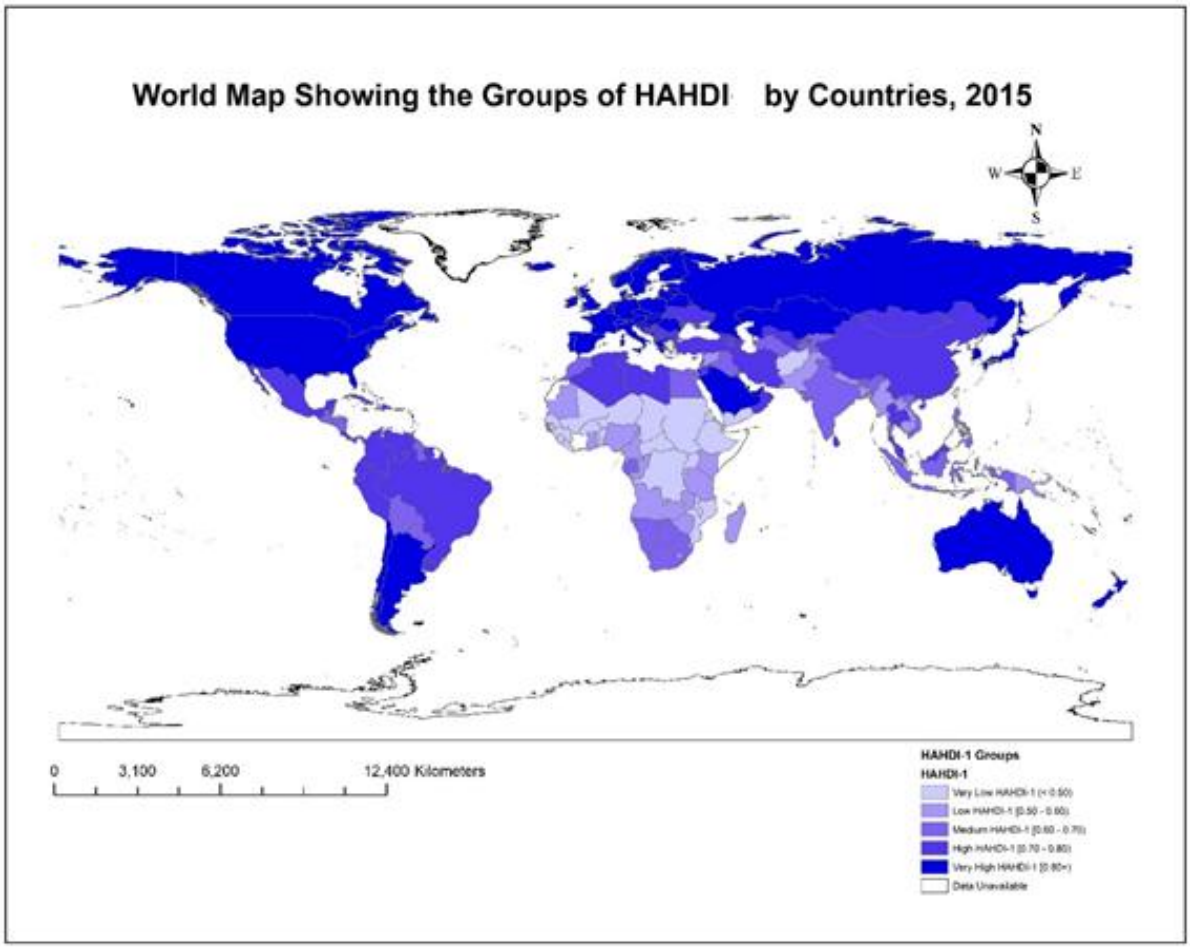
Table to be continued…									
Equatorial Guinea	0.5832	0.5691	0.4394	0.8114	0.5924	0.5876	128	129	-1
Congo	0.6599	0.6655	0.5201	0.6054	0.5923	0.5939	129	128	1
Kiribati	0.7112	0.7036	0.5901	0.4847	0.5881	0.586	130	130	0
Lao People's Democratic Republic	0.7169	0.6891	0.4739	0.5924	0.586	0.5784	131	133	-2
Zambia	0.628	0.6127	0.5774	0.5355	0.5791	0.5743	132	134	-2
Ghana	0.6389	0.6418	0.5509	0.551	0.5788	0.5797	133	132	1
Bangladesh	0.7998	0.7709	0.4575	0.5301	0.5788	0.5718	134	135	-1
Sao Tome and Principe	0.7166	0.7091	0.5095	0.5172	0.5737	0.5717	135	136	-1
Cambodia	0.7509	0.6927	0.4586	0.5185	0.5631	0.5482	136	140	-4
Nepal	0.7691	0.7491	0.475	0.476	0.5582	0.5533	137	139	-2
Myanmar	0.7095	0.7109	0.4102	0.5892	0.5556	0.5559	138	137	1
Kenya	0.6487	0.6473	0.5182	0.5076	0.5547	0.5543	139	138	1
Pakistan	0.7133	0.6873	0.3948	0.5919	0.5504	0.5436	140	141	-1
Swaziland	0.4453	0.5618	0.545	0.6526	0.541	0.5846	141	131	10
Syrian Arab Republic	0.7639	0.6527	0.4175	0.4826	0.5359	0.5085	142	149	-7
Angola	0.503	0.4709	0.4824	0.6256	0.5335	0.5219	143	143	0
Tanzania	0.7002	0.6218	0.4405	0.4842	0.5306	0.51	144	148	-4
Nigeria	0.5086	0.5036	0.477	0.6038	0.5271	0.5254	145	142	3
Cameroon	0.5532	0.5509	0.493	0.5084	0.5175	0.5168	146	146	0
Papua New Guinea	0.658	0.6618	0.4193	0.4985	0.5162	0.5172	147	145	2
Zimbabwe	0.6031	0.5836	0.5443	0.4177	0.5156	0.51	148	147	1
Solomon Islands	0.7401	0.7655	0.4446	0.4151	0.515	0.5208	149	144	5
Mauritania	0.6652	0.6382	0.3773	0.5382	0.5131	0.5061	150	150	0
Madagascar	0.7002	0.6709	0.4923	0.3897	0.5121	0.5049	151	151	0
Rwanda	0.6884	0.6655	0.4256	0.4204	0.4976	0.492	152	155	-3
Comoros	0.6703	0.6527	0.4693	0.3915	0.4975	0.4931	153	154	-1
Lesotho	0.4628	0.4836	0.5026	0.529	0.4974	0.5047	154	152	2
Senegal	0.722	0.6964	0.355	0.4703	0.494	0.4881	155	156	-1
Uganda	0.6032	0.6182	0.4666	0.4253	0.4928	0.4969	156	153	3
Haiti	0.6634	0.6436	0.4254	0.4241	0.4928	0.4879	157	157	0
Sudan	0.6728	0.6527	0.3175	0.5513	0.4902	0.4853	158	158	0
Togo	0.6181	0.5964	0.489	0.383	0.4874	0.4816	159	160	-1
Benin	0.6117	0.5909	0.4138	0.4509	0.4851	0.4795	160	161	-1
Yemen	0.6777	0.6855	0.3497	0.4737	0.4824	0.4842	161	159	2
Afghanistan	0.6262	0.5873	0.3976	0.4424	0.4794	0.4692	162	164	-2
Malawi	0.6751	0.5673	0.4454	0.3585	0.4759	0.4491	163	166	-3
Côte d'Ivoire	0.4906	0.4909	0.4152	0.5218	0.4737	0.4738	164	162	2
Djibouti	0.6507	0.6509	0.3105	0.5243	0.4731	0.4732	165	163	2
Gambia	0.6225	0.6145	0.3581	0.4131	0.4516	0.4496	166	165	1
Ethiopia	0.6862	0.6564	0.318	0.4114	0.4478	0.4412	167	167	0
Mali	0.5919	0.5655	0.3118	0.4682	0.4421	0.4354	168	168	0
Congo (Democratic Republic of the)	0.6009	0.5782	0.4747	0.2895	0.4355	0.4299	169	170	-1
Liberia	0.6337	0.5945	0.4232	0.2901	0.4269	0.4179	170	171	-1
Guinea-Bissau	0.5459	0.5727	0.3528	0.3953	0.4238	0.4307	171	169	2
Sierra Leone	0.4818	0.4436	0.3741	0.412	0.4203	0.4089	172	175	-3
Eritrea	0.6798	0.6491	0.2674	0.408	0.4202	0.4137	173	174	-1
South Sudan	0.5559	0.5436	0.297	0.4434	0.4183	0.4152	174	173	1
Mozambique	0.5458	0.5382	0.3685	0.362	0.4176	0.4156	175	172	3
Guinea	0.6033	0.5764	0.3305	0.3564	0.4142	0.4079	176	176	0
Burundi	0.571	0.5855	0.3947	0.292	0.4038	0.4071	177	177	0
Burkina Faso	0.6001	0.5927	0.2617	0.4128	0.4017	0.4001	178	178	0
Chad	0.4907	0.4745	0.2802	0.4518	0.3961	0.3917	179	179	0
Niger	0.6452	0.6218	0.2059	0.3301	0.3526	0.3483	180	181	-1
Central African Republic	0.484	0.4709	0.3382	0.2675	0.3524	0.3492	181	180	1

Interpretation of the Results from Discriminant Analysis:

DISCRIMINANT ANALYSIS FOR THE ORIGINAL HDI WITH 4-GROUP CLASSIFICATION:

The **TABLE: 7.2a** is showing the Group Statistics where it is evident that the mean values for LEI, EI and II are highest in Very High HDI group and as we move downwards from Very High HDI group to Low HDI group, we see a continuous deterioration in each of the mean values for LEI, EI and II for that respective group and these mean values are the least for the LOW HDI group.


World Map Showing the Groups of HDI by Countries (Published for UNDP, 2016)
N
W
E
S
0
3,200
6,400
12,800 Kilometers
HDI Groups
HDI
Low HDI (<0.55)
Medium HDI [0.55 - 0.70)
High HDI [0.70 - 0.80)
Very High HDI [0.80+)
Data Unavailable


World Map Showing the Groups of HAHDI by Countries, 2015
N
W
E
S
0
3,100
6,200
12,400 Kilometers
HAHDI-1 Groups
HAHDI-1
Very Low HAHDI-1 (< 0.50)
Low HAHDI-1 [0.50 - 0.60)
Medium HAHDI-1 [0.60 - 0.70)
High HAHDI-1 [0.70 - 0.80)
Very High HAHDI-1 [0.80+)
Data Unavailable

7.2a Group Statistics				
LEVEL		Mean	Std. Deviation	Valid N Unweighted
VERY HIGH	LEI	0.917	0.049	48
	EI	0.831	0.070	48
	II	0.890	0.061	48
HIGH	LEI	0.838	0.039	52
	EI	0.702	0.056	52
	II	0.733	0.062	52
MEDIUM	LEI	0.742	0.069	40
	EI	0.557	0.084	40
	II	0.613	0.087	40
LOW	LEI	0.610	0.081	41
	EI	0.397	0.081	41
	II	0.439	0.088	41
Total	LEI	0.786	0.128	181
	EI	0.635	0.176	181
	II	0.682	0.179	181

TABLE: 7.2b provides strong statistical evidence of significant differences between means of all 4 groups over all 3 component dimensions (LEI, EI and II). Most importantly all of the 3 indices are producing very high values of F statistics. The pooled Within-Group Matrices are also supporting the use of these 3 independent variables as the intercorrelations are low.

7.2b Tests of Equality of Group Means					
	Wilks' Lambda	F	df1	df2	Sig.
LEI	0.216	213.525	3	177	.000
EI	0.166	297.286	3	177	.000
II	0.168	293.227	3	177	.000

The main assumption in DA is that, the variance-covariance matrices are equivalent. For this assumption to hold, log determinants for these 4 groups should be equal which is in this case not mate properly. The corresponding eigen values indicate that the model explains 93.12% of the variation in the grouping variable (i.e. which HDI group a particular country belongs to) through the 1st discriminant function.

The Wilks' Lambda table indicates that only in the first row the Wilks' Lambda is significant (p<.000) but not in the 2nd and 3rd row, which means over and above the 1st discriminant function, the 2nd and 3rd functions do not contribute much and only 6.7% of the total variability remained unexplained by the 1st discriminant function. From the Structure matrix, we find that, the order of importance of the predictor variables from high to low is II, LEI and EI with Income playing as the strongest predictor to determine to which group a particular country belongs.

FINAL DISCRIMINANT EQUATION:

*D_{11}= (9.159) * LEI + (7.926) * EI + (8.154) * II + (-17.794)*
*D_{12}= (11.043) * LEI + (1.916) * EI + (-9.522) * II + (-3.410)*
*D_{13}= (8.503) * LEI + (-11.229) * EI + (5.149) * II + (-3.062)*

CLASSIFICATION ACCORDING TO GROUP CENTROIDS TABLE:

The **TABLE: 7.2c** showing the group centroids suggests that a country with a given set of LEI, EI and II values can be categorized into a particular group and the rule is that, the country with discriminant function value closer to the centroid of a group is predicted as belonging to the said group.

A visualization of the predicted grouping by means of DA can be obtained from **Figure: 8.1**

7.2c Functions at Group Centroids			
LEVEL	Function		
	1	2	3
VERY HIGH	4.448	-.165	-.016
HIGH	1.429	.212	-.044
MEDIUM	-1.574	.014	.151
LOW	-5.484	-.090	-.072
Unstandardized canonical discriminant functions evaluated at group means			

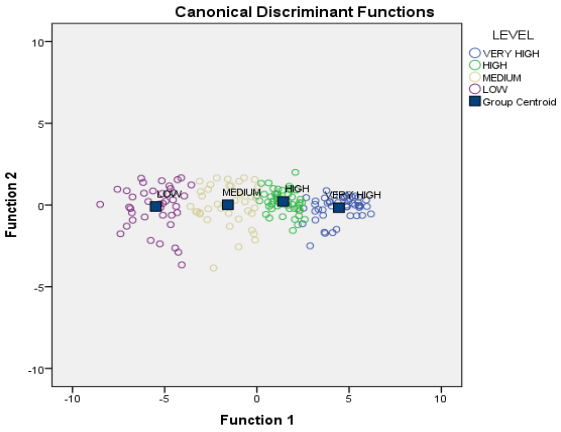


Fig. 8.1 Canonical Determinant Functions and Group Centroids for the 4-Group Classification of HDI

CLASSIFICATION RESULTS:

The **TABLE: 7.2d** shows that 3 countries originally belonging to Very High HDI group have been classified wrongly in High HDI groups. A total of 4 countries originally belonging to Medium HDI group have been

classified wrongly, 3 of them being wrongly included in High and the other being wrongly identified as member of Low HDI group. Altogether out of every 100 countries, more than 4 countries are being misclassified according to the existing classification technique whereas for cross validated grouped cases the percentage of correctly classified countries further drops to 93.9%.

Now we will see whether our modified HDI and the new classification can improve the Discriminant Analysis results or not.

7.2d Classification Results[a,c]						
	LEVEL	Predicted Group Membership				Total
		VERY HIGH	HIGH	MEDIUM	LOW	
Original	VERY HIGH	45 (93.8%)	3 (6.3%)	0 (0.0%)	0 (0.0%)	48 (100.0%)
	HIGH	0 (0.0%)	52 (100.0%)	0 (0.0%)	0 (0.0%)	52 (100.0%)
	MEDIUM	0 (0.0%)	3 (7.5%)	36 (90.0%)	1 (2.5%)	40 (100.0%)
	LOW	0 (0.0%)	0 (0.0%)	1 (2.4%)	40 (97.6%)	41 (100.0%)
Cross-validated[b]	VERY HIGH	45 (93.8%)	3 (6.3%)	0 (0.0%)	0 (0.0%)	48 (100.0%)
	HIGH	0 (0.0%)	52 (100.0%)	0 (0.0%)	0 (0.0%)	52 (100.0%)
	MEDIUM	0 (0.0%)	6 (15.0%)	33 (82.5%)	1 (2.5%)	40 (100.0%)
	LOW	0 (0.0%)	0 (0.0%)	1 (2.4%)	40 (97.6%)	41 (100.0%)
a. 95.6% of original grouped cases correctly classified.						
b. Cross validation is done only for those cases in the analysis. In cross validation, each case is classified by the functions derived from all cases other than that case.						
c. 93.9% of cross-validated grouped cases correctly classified.						

DISCRIMINANT ANALYSIS FOR THE HAHDI WITH 5-GROUP CLASSIFICATION:

The **TABLE: 7.3a** is showing the Group Statistics where it is evident that the mean values for HALI, EI and II are highest in Very High HDI group and as we move downwards from Very High HDI group to Very Low HDI group, we again see a continuous deterioration in each of the mean values for HALI, EI and II for that respective group and these mean values are the least for the Very Low HDI group.

7.3a Group Statistics				
LEVEL		Mean	Std. Deviation	Valid N unweighted
VERY HIGH	HALI	0.911	0.050	49
	EI	0.835	0.061	49
	II	0.883	0.061	49
HIGH	HALI	0.838	0.033	52
	EI	0.696	0.052	52
	II	0.733	0.074	52
MEDIUM	HALI	0.756	0.054	25
	EI	0.587	0.071	25
	II	0.645	0.074	25
LOW	HALI	0.647	0.087	26
	EI	0.482	0.056	26
	II	0.537	0.086	26
VERY LOW	HALI	0.592	0.064	29
	EI	0.367	0.071	29
	II	0.408	0.071	29
Total	HALI	0.780	0.131	181
	EI	0.635	0.176	181
	II	0.682	0.179	181

TABLE: 7.3b provides strong statistical evidence of significant differences between means of all 5 groups over all 3 component dimensions (HALI, EI and II). Most importantly all of the 3 indices are producing very high values of F statistics. The pooled Within-Group Matrices will also support the use of these 3 independent variables as the intercorrelations are low. These results can be treated as the very first justification for our classification.

7.3b Tests of Equality of Group Means					
	Wilks' Lambda	F	df1	df2	Sig.
HALI	0.181	199.579	4	176	.000
EI	0.118	328.023	4	176	.000
II	0.158	234.572	4	176	.000

In order to validate the assumption regarding the equality of the variance-covariance matrices, the log determinants for these 5 groups are examined and are found to vary less. On the other hand, the eigen values provides that the model explains 95.06% of the variation in the grouping variable (i.e. which HDI group a particular country belongs to) through the 1st discriminant function. Now this explained variation is higher than the previous case.

The Wilks' Lambda table indicates that only in the first row the Wilks' Lambda is significant ($p<.000$) but not in the 2nd and

3rd row, which means over and above the 1st discriminant function, the 2nd and 3rd functions do not contribute much and only 4.6% of the total variability remained unexplained by the 1st discriminant function, which again indicates an improvement over the original 4-group classification for original HDI.

From the Structure Matrix, we find that, the order of importance of the predictor variables from high to low is HALI, EI and II with Healthy Life Expectancy Index (HALI) playing as the strongest predictor to determine to which group a particular country belongs. This is again an indication that in our proposed 1st modification HAHDI, the contribution of HALI is significant.

FINAL DISCRIMINANT EQUATION:

D_{21}= *(8.632) * HALI + (11.418) * EI + (8.823) * II + (-19.997)*
D_{22}= *(15.222) * HALI + (-4.359) * EI + (-6.512) * II + (-4.662)*
D_{23}= *(3.395) * HALI + (-11.100) * EI + (8.721) * II + (-1.539)*

CLASSIFICATION ACCORDING TO GROUP CENTROIDS TABLE:

The **TABLE:7.3c** showing the group centroids suggests that a country with a given set of HALI, EI and II values can be categorized into a particular group and the rule is that, the country with discriminant function value closer to the centroid of a group is predicted as belonging to the said group. A visualization of the predicted grouping by means of DA can be obtained from **Figure: 8.2.**

7.3c Functions at Group Centroids

LEVEL	Function		
	1	2	3
VERY HIGH	5.200	-.184	-.012
HIGH	1.660	.285	-.029
MEDIUM	-1.080	.083	.142
LOW	-4.168	-.409	-.012
VERY LOW	-7.094	.096	-.039

Unstandardized canonical discriminant functions evaluated at group means

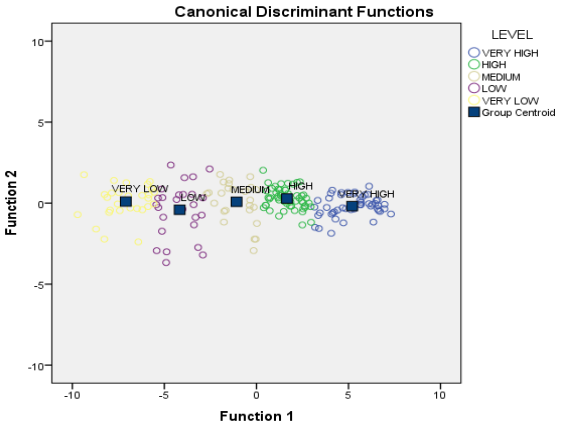


Fig. 8.2 Canonical Determinant Functions and Group Centroids for the 5-Group Classification of HAHDI

CLASSIFICATION RESULTS:

The **TABLE: 7.3d** shows that our newly proposed classification is yielding a more improved result than the previous one as only 4 countries are misclassified according to our classification technique.

7.3d Classification Results HAHDI

	LEVEL	Predicted Group Membership					Total
		VERY HIGH	HIGH	MEDIUM	LOW	VERY LOW	
Original	**VERY HIGH**	46 (93.9%)	3 (6.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	49 (100%)
	HIGH	0 (0.0%)	52 (100.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	52 (100%)
	MEDIUM	0 (0.0%)	0 (0.0%)	25 (100.0%)	0 (0.0%)	0 (0.0%)	25 (100%)
	LOW	0 (0.0%)	0 (0.0%)	1 (3.8%)	25 (96.2%)	0 (0.0%)	26 (100%)
	VERY LOW	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	29 (100.0%)	29 (100%)
Cross-validated[b]	**VERY HIGH**	45 (91.8%)	4 (8.2%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	49 (100%)
	HIGH	0 (0.0%)	52 (100.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	52 (100%)
	MEDIUM	0 (0.0%)	2 (8.0%)	23 (92.0%)	0 (0.0%)	0 (0.0%)	25 (100%)
	LOW	0 (0.0%)	0 (0.0%)	1 (3.8%)	25 (96.2%)	0 (0.0%)	26 (100%)
	VERY LOW	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (3.4%)	28 (96.6%)	29 (100%)

a. 97.8% of original grouped cases correctly classified.
b. Cross validation is done only for those cases in the analysis. In cross validation, each case is classified by the functions derived from all cases other than that case.
c. 95.6% of cross-validated grouped cases correctly classified.

According to the table, 97.8% of the original groped cases are classified correctly, which is again another improvement over the existing HDI and its classification. As we consider the cross validated grouped cases, the percentage of correctly classified countries drops to 95.6% which is better than the previous case.

DISCUSSION

In our newly constructed HDI, As we look at the world map and the distribution of countries according to the existing HDI with respect to the 4-group classification and the modified HDI-HAHDI with respect to the new classification, we find the entire North America has retained the position in all 2 rankings, whereas some countries of Europe are seen to lose ground in their rankings with respect to HAHDI. Highly developed European countries like Germany, Sweden, Belgium, Finland are found to slip down the ranking due to incorporating HALE instead of LEB in the formulation of new HDI. In fact when the distribution of different diseases and injuries among different population sub-groups are considered, these high income European countries in spite of having relatively high Life Expectancy at Birth are slipping down the rankings due to a relatively higher burden of diseases and as we try to capture both the fatal and non-fatal health outcomes in HDI, the years lived with fatal and non-fatal diseases combined with the ageing problem are partially obliterating the good scores and effects of substantial development in the other two dimensions.

Next, if we look at the Western and Southwestern Asia, most of the high income countries like Qatar, Oman, Kuwait, Saudi Arabia are found to lose some ground in the new ranking which further indicates that the inability to sustain the logevity in terms of full health is imposing a considerable negetive impact on overall developmental status of these high income countries which the existing HDI is blatantly ignoring.

The similar things can be concluded about Indian subcontinent as well, though India has retained her position (124) in both the rankings. African and Sub-Saharan countries however have maintained a consistent but poor show with respect to both the HDIs, where many countries which are originally categorized in Low HDI group according to the existing HDI with 4-group classification have entered Very Low HDI group with respect to HAHDI with new 5-group classification. Here the matter of concern is that, the existing classification has failed to provide a mutually exclusive classification and thus it has combined two different groups into one group just to increase the intra-group variabilities and misclassification errors.

Information on the distribution of different diseases and injuries is an important tool for monitoring population health and thus provides evidence base to construct effective health policy and service planning. Effective implementation of such health policies and programmes among different sub-population groups which are found to be affected by a particular disease or health condition in turn improves and develops the country as a whole. By integrating the idea of burden of disease with Human Development, the eradication of different factors and determinants of fatal and non-fatal diseases among population sub-groups can actually raise the status of a country as development is all about the aggregate achievement in all spheres of life and its equitable distribution among every community and sub-population groups in the country.

From a policy perspective, emphasizing the ability to sustain logevity in terms of fully healthy life in HDI establishes the need for a pragmatic approach to promote human development while also stimulating growth that could improve the resources for good health and well-being. The new policy instruments and approaches could and should be geared to not only advancing growth but also promoting human development through reducing the burden of diseases which could strengthen the growth effects of policies as well as help sustain high growth.

CONCLUSION

From the study, we have found that HAHDI with 5-group classification fares better that the existing HDI with 4-group classification. This perhaps also signifies the need to consider some kind of combinations

of the standardized measures of mortality and morbidity in future so see how good these new indices can capture the actual picture of global and regional disparity in health. It is believed that Income is having the highest contribution in the existing HDI which have already been tested and validated in the previous section, but our HAHDI is found to consider its Health Adjusted Life Expectancy Index (HALI) as the strongest predictor or contributor to determine which country will fall in which HDI group.

In spite of emerging as a better composite index to measure Human Development, our refined or modified HDI has a serious limitation. The Healthy Life Expectancy values at birth are not available for a few countries for which the Life Expectancy values at birth are available, hence while calculating the HAHDI values so that we can rank the countries and compare those rankings with the existing ranking according to the HDI values, we had to omit those countries for which the respective Healthy Life Expectancy values at Birth are not available for 2015-2016.

To comment on the existing classification for HDI, we feel that combining 2 groups having significant variation in their respective group mean values for all three dimensions of development is not an acceptable classification at all. Still there are scopes to improve the health index further by incorporating different weights to the components of mortality and morbidity in the health index and we can also think of adjusting these measures for inequality in future. For now, HAHDI together with the 5-group classification can be considered as a valid and composite refinement of the existing HDI with a huge scope of potential developments in future

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