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Econ 373

17 April 2021

Measuring Wellbeing

The Human Development Index (HDI) is a well-known measurement for well-being that concerns health, education, and income. In this paper, we take a more detailed look into this measurement to address inequality across countries.

First, we recalculate the HDI in 2019 using the data from 189 countries given by the UNDP as below.

$$HDI_3 = \sqrt[3]{Health\ DI\ *\ Edu\ DI\ *\ Income\ DI}$$

with the dimension indexes (DI) ranging from 0 to 1 (indexes exceeding 1 are converted to 1).

$$Health\ DI = \frac{Life\ expectancy\ at\ birth - 20}{85 - 20}$$

$$Edu\ DI = \left(\frac{Expected\ years\ of\ schooling - 0}{18 - 0} + \frac{Mean\ years\ of\ schooling - 0}{15 - 0}\right) / 2$$

$$Income\ DI = \frac{Ln\ (GNI) - Ln\ (100)}{Ln\ (75000) - Ln\ (100)}$$

We arrive at the HDI values with no errors compared to the given HDI.

Second, we expand our perspective on aspects that can impact human development by adding gender to the equation.

$$HDI_4 = \sqrt[4]{Health\ DI\ *\ Edu\ DI\ *\ Income\ DI\ *\ Gender\ DI}$$

with the gender dimension index containing the maternal mortality ratio (MMR) and the share of seats in parliament (SSP).

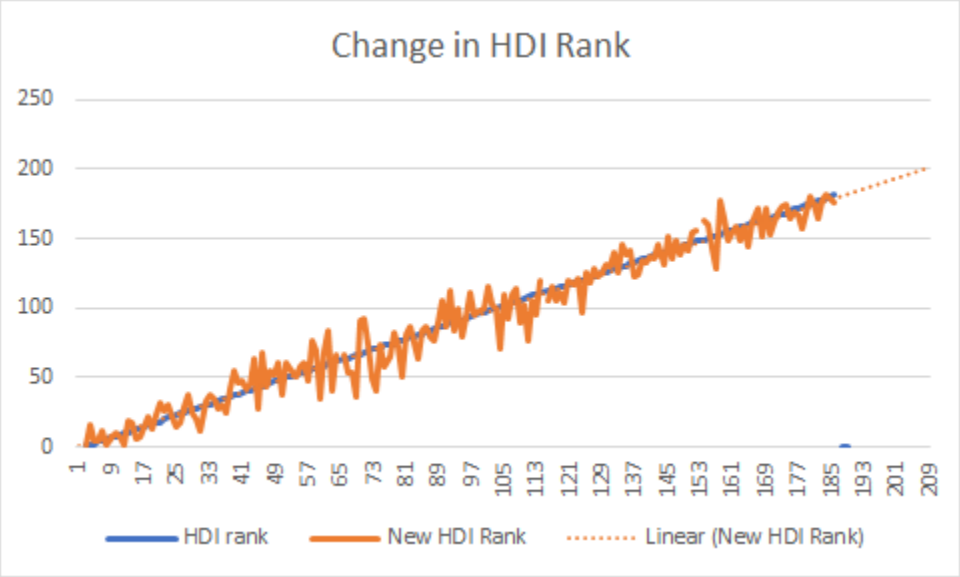
$$Gender\ DI = (MMR\ DI + SSP\ DI)/\ 2$$

where

$$MMR\ DI = 1\ - \frac{MMR - Min\ (MMR)}{Max\ (MMR) - Min\ (MMR)}$$

$$SSP\ DI = \frac{SSP - Min\ (SSP)}{Max\ (SSP) - Min\ (SSP)}$$

We observe some changes in the alternative HDI, which results in the different ranking of some countries. Additionally, since there are missing values in 8 countries, we omit them and rerank the original HDI of the 181 countries.



Overall, there is a positive trend in the new HDI rank, the best-fitted line of which, surprisingly, has the same slope as the original one. This indicates that the ranking is generally similar.

Regression Statistics	
Multiple R	0.978392611
R Square	0.957252102
Adjusted R Square	0.957013287
Standard Error	10.86304252
Observations	181

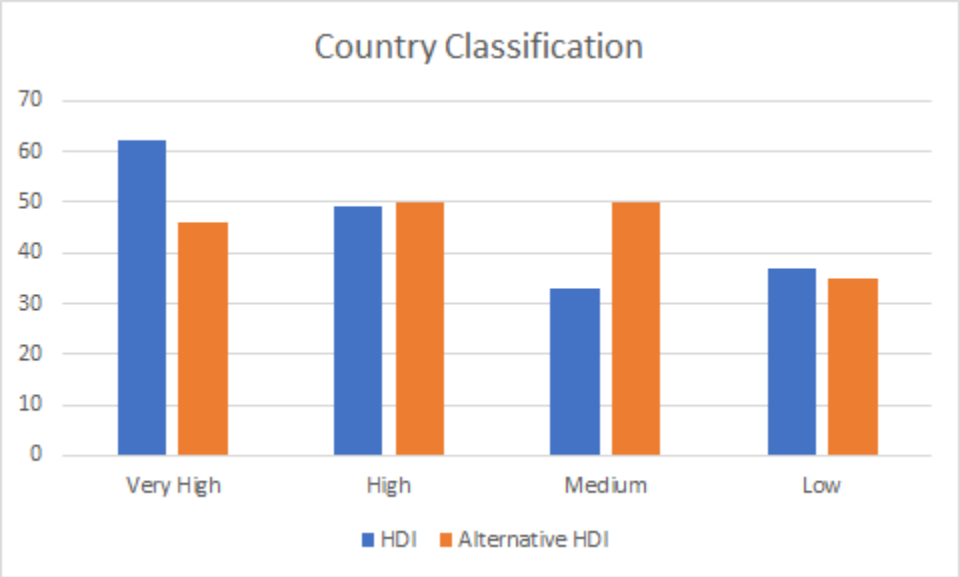
ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	473006.981	473007	4008.34	1.783E-124
Residual	179	21123.01902	118.0057		
Total	180	494130			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.124479885	1.619435329	1.311865	0.191246	-1.07116065	5.3201204	-1.07116065	5.32012042
X Variable 1	0.97867428	0.015458092	63.31146	1.8E-124	0.948170744	1.0091778	0.948170744	1.00917782

Along with the significant p-value of 0.19, the very high coefficient of determination shows that 95.7% of the total sum of squares (494130) is explained by the regression line. These changes in the HDI rank are mostly influenced by the high human development group (ranked 66 - 199 originally) as we can see a wide range of variability.

Lastly, in a close look at the first graph, the majority of these high development countries are reclassified as medium countries and some as very high. This explains a sharp increase in the number of medium development countries in regards to the alternative HDI. Moreover, almost one-fourth of the very high countries are now classified as high, the number of high development countries stays roughly the same despite major changes. Regarding countries with low development, no significant difference can be observed.



In conclusion, the alternative HDI shows the impact of specific indicators on measuring well-being. At first sight, its effect can be underestimated by the similar positive linear

development trend across countries. However, by adding another indicator, gender as in this case, the alternative HDI illustrates a more even distribution in the classification of development. This would heavily influence international policy involving funding allocation. Furthermore, changes in the outcome can also refer to the different weights each indicator has on each development group. Thus, it should be in consideration that the optimal Human Development Index also includes sub-indicators that correspond to specific countries.