A Cross-Country Analysis: the Effect of Income, Life Expectancy, and Education on the Human Development Index

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Abstract: Although the Human Development Index (HDI) has garnered criticism for its simplistic weighting scheme, the nationally-recognized index is still used by governments to determine the effectiveness of policy decisions. This study looked at the index's three main factors represented by income, health, and life expectancy and narrowed down the broad factors into separate proxy factors. The proxy variables were then analyzed against the HDI to determine which factors impacted the index the most. By identifying more relatable and specific variables, this study is especially unique in that it provides governments with a list of factors they can effectively target to improve their HDI rankings.

I. Introduction

With the onset of the 2016 United States presidential election, one major question continues to define the televised debates: how achievable is the American Dream? Human development is a concept directly related to this question. Measure for America, a social science initiative, even defines human development as “the real freedom ordinary people have to decide who to be, what to do, and how to live” (About Human Development). Mahbub ul Haq, moreover, describes human development as “a process for enlarging people’s choices” (Ul Haq, 1990). By expanding this question to a macroeconomic scale, our objective was to determine if income, health, or education related factors played the largest role in human development across countries. Ultimately, if countries knew which factors were the most significant in human development, they could then specialize their efforts on making the elusive American Dream a reality.

To quantify a country’s human development, Mahbub ul Haq and other economists (1990) created the Human Development Index (HDI). First published in the 1990 United Nations’ *Human Development Report*, the simplistic index computes a weighted average of a country’s life expectancy, education, and standard of living; then, each country is numerically ranked and placed in one of four categories: very high human development, high human development, medium human development, or low human development. A high ranking is synonymous with a high level of human development (Ul Haq, 1990). The rankings, furthermore, serve as a way policymakers and non-governmental organizations can compare countries to one another. They can also be used to determine the effectiveness of a government’s policy decisions and can, eventually, be translated into policy change. For instance, if two countries have the same level of Gross Domestic Product (GDP) per capita but one country has a lower HDI score, then that country should question the impact of its policymaking decisions on human development. The country could even look to the high-HDI countries’ decisions as examples for future policy work.

Since the HDI carries eminent implications for policy decisions, we chose the index as our study’s dependent variable. The variable’s relevance was also taken into account, as even the *New York Times* denotes the index as the only successful challenger of GDP and other growth-centric measures (Gertner, 2010). For the study, two multiple linear regressions were performed:

(1) HDI versus main components

(2) HDI versus proxy main components

The first regression was conducted as a starting point for the ultimate model (MLR 2). In the second regression model, proxy factors that correlated to the original HDI’s factors were used along with three separate control variables to account for the population, corruption, and gender inequality. MLR 2, moreover, was performed to determine which factor (i.e. income, health, or education) played the largest role in the HDI calculation across countries. By knowing what factor to prioritize, countries could then focus their respective efforts on that specific factor, allowing for more policy specialization. The hypothesis was that the education proxy factors will have the strongest correlation with HDI.

II. Literature Review

The HDI has garnered much criticism in the international field. For instance, Srinivasan (1994) pointedly criticized the index for its unequal, arbitrary weighting scheme. He disagreed with giving income, education, and life expectancy the same one-third weight. He, ultimately, failed to see how income impacts a country's human development as much as education. In a review analyzing Mahbub ul Haq's (1990) new HDI creation, Hopkins (1991), moreover, described this weighted process as "adding apples to oranges." By recognizing and understanding Srinivasan and Hopkins' logic, a regression analysis (MLR 2) was conducted to determine which component impacted the HDI the most. If income, education, or life expectancy factors impacted the HDI more than the other remaining components, MLR 2 would then support the notion that the HDI's weighting scheme is arbitrary.

Through an examination of cross-country inequality in HDI and real income per capita, Rati Ram (2008) concluded that there is a significant correlation between these two variables. Ram examined data from 150 countries collected over 5 year intervals, from 1975-2004, which allowed for the collection of statistically significant results. Ram commented on several trends and findings in the study of HDI and inequality, specifically with regards to countries that perform poorly in HDI measures. The study notes that regions that exhibit high levels of inequality (such as Sub-Saharan Africa) perform poorly in HDI measures due to factors, such as extreme poverty and low life expectancies, that are also endemic to such regions. Despite these findings, however, Ram discovered that the HDI and inequality measures varied significantly across regions, thus potentially making it difficult to draw a direct correlation on a cross-country basis.

HDI has additionally been criticized for its inability to represent domestic income inequality, especially with respect to countries that perform well in aggregate HDI measures. Grimm (2009) examined the individual components that comprise HDI in an effort to better compare the effects of inequality on human development both within and across countries. Through their comprehensive analysis, they concluded that there is a strong negative correlation between the level of human development and the level of inequality within a country.

In an examination of the health related factors of HDI, Engineer (2010) argued that measuring a long and healthy life based solely upon life expectancy is not entirely adequate for constructing a comprehensive index. Instead, Engineer aggregates the 'expected lost healthy years' and life expectancy in order to create a measure of a long and healthy life. However, Engineer found that their new measure of a long and healthy life had little determination on a country's HDI, as the change in the ratings is fairly negligible when compared to the HDI measured using life expectancy. With these new findings in mind, Engineer concluded that the health related factors of HDI may not be the most reliable or significant aspects of the index.

Through our examination of the literature, it is clear that many scholars have raised issues with the validity of the HDI's derivation. Srinivasan posited that education likely has a more significant effect on HDI than income related factors, which is a view that has been corroborated in part by other studies. Engineer found that the health related components are unreliable and not comprehensive enough for an index, therefore diminishing the usefulness of such measures. Finally, Grimm examined the income related factors of HDI, especially in regards to inequality in countries that perform well in HDI measures. Grimm noted that many countries suffer from large amounts of inequality while still performing well on the HDI, which raises concerns as the whether or not the income related factors used to calculate HDI are significant. With these studies as a basis for our paper, we hope to add to the existing literature by examining the educational factors of HDI, as it appears to be the most significant factor in the index.

III. Hypothesis

The HDI consists of three main components: GNI per capita, education and life expectancy. Since these components are so broad and undefined, economists find it difficult to determine what economic factor impacts the HDI the most. Thus, we categorized a variety of different variables that might have some impact or correlation with HDI into income, education, or life expectancy related factors. Our main hypothesis was that out of all these factors, the factors related to education would have the greatest impact on the HDI of a country.

The economic rationale behind this hypothesis was that education defines a country and that country's population. The global standing of a country is also heavily dependent on the level of education prevalent in the country. High levels of education directly lead to people leading more economically stable lives. Education also has a significant impact on the social development of that country's citizens. People tend to be socially, politically, and economically more aware just through being more educated. Thus, this reasoning led us to hypothesize that education and its factors would have a more significant impact on a country's Human Development Index.

IV. Data & Methods

List 1 in the Appendix shows all of the 188 countries used in the regressions. The number of countries that fell under each human development category is shown below in Figure 1. The data sources for the HDI, income factors, life expectancy factors, and education factors are listed below in Figure 2.

Figure 1: Human Development Rankings

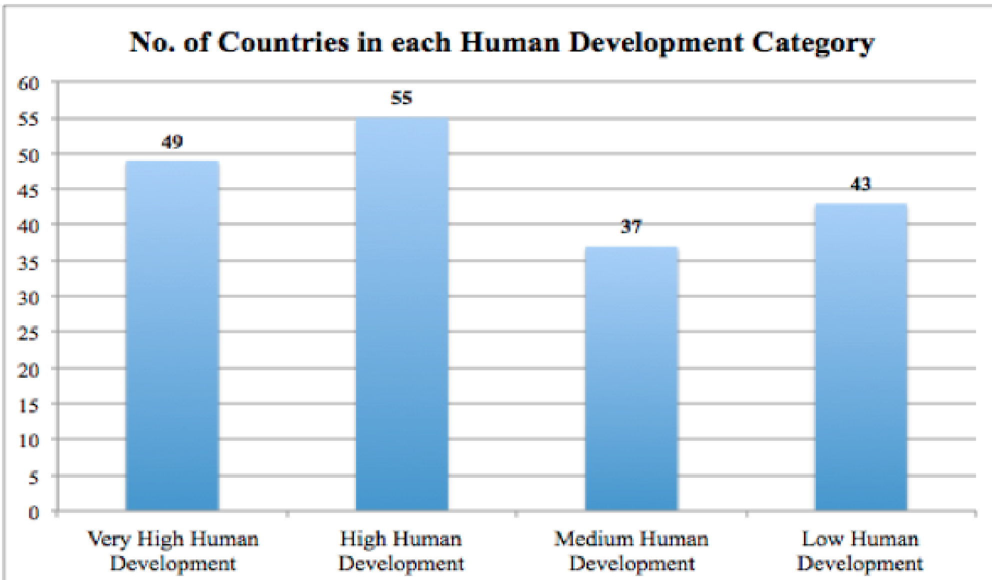


Table 1: Data Description

Name	Type	Application	Source	Year
Human Development Index (HDI)	Dependent		United Nations Educational, Scientific, and Cultural Organization (UNESCO) Institute for Statistics	2015
Main Components (i.e. GNP per capita, life expectancy, mean years of schooling, expected years of	Independent	SLR 1 SLR 2 SLR 3 SLR 4	World Bank, International Monetary Fund (IMF), United Nations (UN) Statistics Division	2015

schooling)		MLR 1		
Proxy Components (i.e. income, health, population with secondary education, literacy rate)	Independent	MLR 2 MLR 3	World Health Organization (WHO), UNESCO Institute for Statistics, International Labor Organization (ILO)	2015

A. MLR 1: HDI v. Main Components

The first MLR conducted was the HDI against its three main components. The income component was represented by Gross National Income (GNI) per capita, while the health component was represented by life expectancy. Education had two main components: expected years of schooling and mean years of schooling.

Table 2: Descriptive Statistics MLR 1

Variable	**Observations**	**Mean**	**Std. Dev.**	**Min**	**Max**
hdi	188	0.6925	0.1548	0.3480	0.9440
gnipcap	188	17,014.81	18,793.63	581.0	123,124.0
lifexp	188	71.1053	8.3833	49.0	84.0
eyrschool	188	12.8862	2.8683	4.1	20.2
myrschool	188	8.1101	3.0928	1.4	13.1

SLR 1: $hdi = \beta 0 + \beta 1 gnipercapita$

SLR 2: $hdi = \beta 0 + \beta 1 lifexp$

SLR 3: $hdi = \beta 0 + \beta 1 eyrschool$

SLR 4: $hdi = \beta 0 + \beta 1 myrschool$

MLR 1: $hdi = \beta 0 + \beta 1 gnipercapita + \beta 2 lifexp + \beta 3 eyrschool + \beta 4 myrschool$

1. *hdi*: a composite index measuring average achievement in human development through three components —a long and healthy life, knowledge, and standard of living

2. *gnipcapita*: aggregate income of an economy generated by its production, converted to international dollars using PPP rates, divided by midyear population
3. *lifexp*: number of years a newborn infant could expect to live
4. *eyrschool*: number of years of schooling that a child of school entrance age can expect to receive
5. *myrschool*: average number of years of schooling received by people ages 25 and older

B. MLR 2: HDI v. Proxy Components

The second multiple linear regression conducted was the HDI against its four proxy components along with an additional two factors and three control factors. The proxy variables included *cpi*, *fertrate*, *litrate*, and *seceduc*; a detailed description of how the proxy variables were selected can be found in Results. The additional three factors were *healthexp*, *unempbenefits*, and *govtexp*; all additional factors related to the three main components. The three control factors were selected to account for population (*pop*), corruption (*homicider*), and gender inequality (*gendineq*).

Table 3: Descriptive Statistics MLR 2

Variable	**Observations**	**Mean**	**Std. Dev.**	**Min**	**Max**
hdi	103	0.6925	0.1548	0.3480	0.9440
cpi	103	121.1254	24.46809	98.24216	288.6468
fertrate	103	2.862136	1.36379	1.28	6.86
litrate	103	82.61952	19.49237	28.70211	99.8959
seceduc	103	52.25968	26.53898	3.63	100
healthexp	103	6.461191	2.191714	2.187261	11.84411
unempbenefits	103	7.759223	14.53366	0	78.7
govtexp	103	15.28723	5.829894	2.80376	11.84411
(pop)	103	53.67124	186.1349	0.105782	1393.784
(homicider)	103	9.181553	12.369	0.2	90.4

(gendineq)	103	0.4024112	0.1728584	0.164223	0.7439604

( ) represents control variables

MLR 2 (unrestricted): ***hdi = β0 + δ0dev + β1cpi + β2fertrate + β3litrate + β4seceduc + β5healthexp + β6unempbenefits + β7govtexp+ β8pop + β9homicider + β10gendineq***

MLR 3 (restricted): ***hdi = β0 + δ0dev + β1fertrate + β2healthexp + β3gendineq***

1. *hdi*: same as in MLR 1
2. *dev*: dummy variable representing developed countries as 1 and developing or underdeveloped countries as 0
2. *cpi:* index that reflects changes in the cost to the average consumer of acquiring a basket of goods and services, generally representative of inflation
3. *fertrate*: average number of children that would be born to a woman
4. *litrate*: percentage of the population ages 15 and older who can read and write a short simple statement on their everyday life
5. *seceduc*: percentage of the population ages 25 and older that has reached at least a secondary level of education
6. *healthexp*: current and capital spending on health by the government, expressed as a percentage of GDP
7. *unempbenefits*: percentage of unemployed people ages 15–64 receiving unemployment benefits
8. *govtexp*: current and capital spending on education, expressed as a percentage of GDP
9. *(pop)*: de facto population in a country as of July 1 2015, expressed in millions
10. *(homicider)*: number of unlawful deaths purposefully inflicted on a person by another person, expressed per 100,000 people
11. *(gendineq)*: a composite measure reflecting inequality in achievement between women and men in three dimensions: reproductive health, empowerment and the labour market

C. Gauss-Markov Assumptions

1. *Assumption 1: Linear in Parameters*

   The first assumption is satisfied because all of the models can be written in the following way:

   $Y = \beta_0 + \beta_1 X1 + \beta_2 X2 + \beta k Xk + u$
2. *Assumption 2: Random Sampling*

All of the data was collected by the World Bank, IMF, UNESCO Institute for Statistics, UN Statistics Division, WHO, and ILO, so it is assumed these organizations conducted random sampling; therefore, the second assumption is satisfied.

3. *Assumption 3: No Perfect Collinearity*

   Since there is no perfect collinearity between the independent variables as evidenced by Table 1 and Table 2, the third assumption is also satisfied for both MLR 1 and MLR 2.

Table 4: MLR 1 Independent Variables Correlation Matrix

```
. correlate lifexp eyrschool myrschool gnipcap
(obs=188)
```

	lifexp	eyrsch~l	myrsch~l	gnipcap
lifexp	1.0000			
eyrschool	0.7869	1.0000		
myrschool	0.7348	0.8153	1.0000	
gnipcap	0.6251	0.6103	0.5701	1.0000

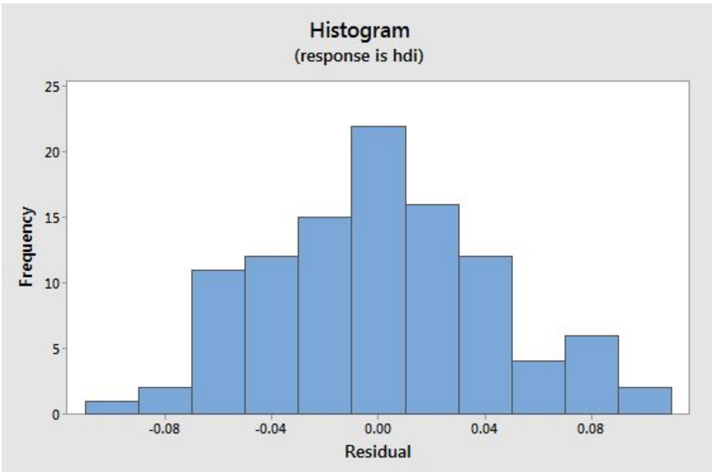
Table 5: MRL 2 Independent Variables Correlation Matrix

	cpi	fertrate	litrate	seceduc	health~p	unempb~s	govtexp	pop	homici~r	gendineq
cpi	1.0000									
fertrate	0.0670	1.0000								
litrate	-0.0977	-0.7933	1.0000							
seceduc	-0.0604	-0.7289	0.7886	1.0000						
healthexp	0.0059	-0.0237	0.0628	-0.0031	1.0000					
unempbenef~s	-0.1410	-0.4750	0.4216	0.5031	0.2760	1.0000				
govtexp	0.1037	-0.1922	0.2490	0.2360	0.2355	0.2294	1.0000			
pop	-0.0102	-0.0725	-0.0336	-0.0112	-0.1469	-0.0132	-0.0850	1.0000		
homicider	-0.0167	0.1251	-0.0552	-0.2237	0.1532	-0.2375	-0.0389	-0.0745	1.0000	
gendineq	0.1089	0.7431	-0.7371	-0.7278	-0.1566	-0.6599	-0.1668	-0.0014	0.2603	1.0000

4. *Assumption 4: Zero Conditional Mean*

The zero conditional mean assumption is assumed because a plot of the residuals shown below follows a normal distribution with a mean of zero. The histogram in Graph 1 is uniformly centered at mean = 0 and not skewed to the left or right. Thus, the zero conditional mean assumption is not violated.

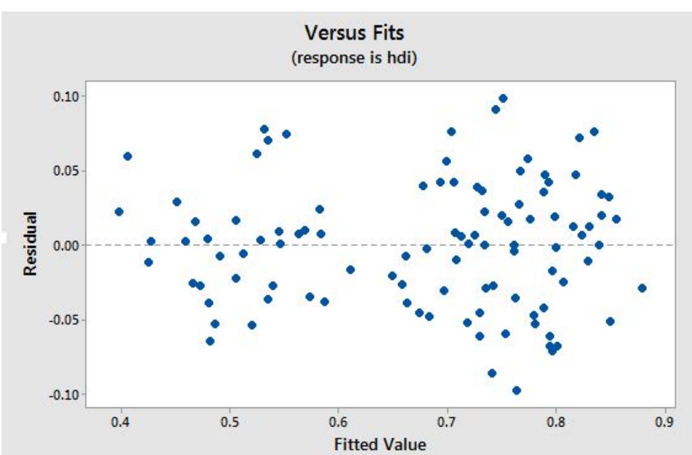
Graph 1: Residual Histogram



5. *Assumption 5: Homoscedasticity*

Homoscedasticity means that variance in the error term is the same for any of the explanatory variables. Graph 2 illustrates that the residuals do not exhibit any pattern or trend, they are scattered around randomly. Thus, illustrating that they have a constant variance. Since various explanatory variables are used in the regressions, the unknown errors in homoscedasticity are controlled. Thus, all five Gauss-Markov assumptions are satisfied and the regressions present the best linear unbiased estimators of the coefficients.

Graph 2: Residuals plotted against Fitted Line



V. Results

A. HDI v. Main Components (SLR 1, SLR 2, SLR 3, SLR 4, and MLR 1)

To begin the regression analysis, relationships of the different components with the HDI were analyzed to determine which of the components had the greatest impact on a country's HDI value.

Table 6: HDI v. Main Components

Dependent Variable: *hdi*					
Independent Variable	**SLR 1**	**SLR 2**	**SLR 3**	**SLR 4**	**MLR 1**
gnipcap	6.06e-06 (14.85)***	-	-	-	1.41e-06 (-4.64)***
lifexp	-	0.01661 (28.13)***	-	-	0.00611 (16.29)***
eyrschool	-	-	0.0492 (30.39)***	-	0.01488 (11.87)***
myrschool	-	-	-	0.04497 (27.99)***	0.01668 (15.91)***
Intercept	0.5893 (57.02)***	-0.4883 (-11.55)***	0.0586 (2.74)***	0.3279 (23.53)***	-0.09273 (11.03)***
No. of obs.	188	188	188	188	188
R-sq	0.5425	0.8096	0.8324	0.8081	0.9751

*Significant at 10%, **5%, ***1%

SLR 1 Equation: ***hdi = 0.5893 + 6.06e-06(gnipcap) + u***

SLR 2 Equation: ***hdi = -0.4883 + 0.01661(lifexp) + u***

SLR 3 Equation: ***hdi = 0.0586 + 0.0492(eyrschool) + u***

SLR 4 Equation: ***hdi = 0.3279 + 0.04497(myrschool) + u***

MLR 1 Equation: ***hdi = - 0.09273 + 1.41e-06(gnipcap) + 0.00611(lifexp) + 0.01488(eyrschool) + 0.01668(myrschool) + u***

As expected after performing significance tests, all the variables had large t-statistics and negligible p-values, making them significant at all significance levels. The primary objective of this analysis was to evaluate the relationship between the different independent variables and *hdi*, since the objective of this research paper was to determine which variable affects the HDI of a country the most.

Among all the simple linear regressions, *gnipcap* had the smallest t-statistic value (14.85) and the lowest R-square value of 54.25%, while *eyrschool* had the highest t-statistic value (30.39) and the highest R-square value of 83.24%. This affirms the hypothesis that the level of education would have the largest impact on the HDI. Even Regression 5, also known as MLR 1, supports the hypothesis, as *lifexp* and *eyrschool* were most significant with high t-values of 16.29 and 11.87 respectively. MLR also had a nearly perfect R-square value of 97.51%, which was expected because all the independent variables were the main components for calculating *hdi.* The ultimate goal of the regressions, however, was to provide a starting point for MLR 2: HDI v. the proxy variables. This starting point was achieved by determining how much of an impact each separate component had on the HDI index and how all the components together created the index.

B. HDI v. Proxy Variables (MLR 2 and MLR 3)

Proxy Variable Determination:

Since the R-square value for MLR 1 of 0.9751 was very close to 1, it was illogical to use the main components as independent variables in the regression; ultimately, all the main components would be significant which could diminish the effect of other variables used in the regression. The proxy variables were determined by finding correlations between that particular HDI component and a variety of other variables related to that component. The variables with the strongest correlations, whether positive or negative, to the main components were used in MLR 2. Proxy variables were used to determine if income, education, or health played the largest role in the HDI calculation when other variables were also involved in the analysis. This could be determined because the proxy variables selected for MLR 2 were not already present in the HDI calculation, unlike the variables selected for MLR 1.

Proxy Variable	**HDI Component**	**Correlation Coefficient**
cpi	GNI per capita (Income)	-0.2528
fertrate	Life Expectancy (Health)	-0.7823

seceduc	Mean Yrs. of Schooling (Education)	0.9477
litrate	Expected Yrs. of Schooling (Education)	0.7569

Table 7: HDI v. Proxy Variables

Dependent Variable: *hdi*		
Independent Variable	**MLR 2**	**MLR 3**
cpi	-0.0001451 (-0.77)	-
fertrate	-0.0153438 (-2.51)**	-0.0229688 (-3.85)***
litrate	0.0017982 (3.48)	-
seceduc	-4.78e-07 (0.00)	-
(healthexp)	0.0089995 (-3.95)***	-0.007338 (-3.32)***
(unempbenefits)	0.0008452 (1.91)	-
(govtexp)	0.0008654 (1.04)	-
(pop)	-0.0000226 (-0.93)	-
(homicder)	-0.0001935 (-0.48)	-
(gendineq)	-0.2225102	-0.3128743

	(-4.32)***	(-7.08)***
dev	0.0845659 (4.67)***	0.1202945 (7.58)***
Intercept	0.665496 (10.94)***	0.8371233 (26.36)***
No. of obs.	103	103
R-sq	0.9059	0.8829

*Significant at 10%, **5%, ***1%
( ) represents control variables

MLR 2 Equation:

hdi = 0.665496 + 0.845659(dev) - 0.0001451(cpi) -0.0153438 (fertrate) + 0.0017982(litrate) - 4.78e-07(seceduc) - 0.0089995(healthexp) + 0.0008452(unempbenefits) + 0.0008654(govtexp) - 0.0000226(pop) - 0.0001935(homicider) - 0.2225102(gendineq) + u

MLR 3 Equation:

hdi = 0.8371233 + 0.1202945(dev) - 0.0229688(fertrate) - 0.007338(healthexp) - 0.3128743(gendineq) + u

Looking at MLR 2, it is observed that *gendineq, cpi, homrate* & *pop* have negative coefficients and exhibit a negative relationship with the *hdi* variable. This is understandable because if either of those variables were increased by one unit, the *hdi* value would decrease by their respective coefficients, thus having a negative impact on that country's HDI value. On the other hand, *litrate, unempbenefits, healthexp*, and *govtexp* all have positive coefficients with the *hdi* variable. Moreover, this explains the fact that an increase in the literacy rate, unemployment benefits, or government expenditure on health care by one unit would increase the *hdi* variable by the coefficients of those variables. Thus, they would logically have a positive impact on the the HDI index of that country. The results of this regression correlates with our hypothesis that education and education-related factors would have a greater impact on the HDI index than income and life expectancy factors.

MLR 3 is essentially a filtered version of MLR 2. MLR 3 removes all the independent variables that were insignificant in MLR 2, because those variables failed the t-test at the 10%, 5% and 1% significance levels. The t-test failure, furthermore, implies that their coefficients were equivalent to 0 and, ultimately, had no effect on the *hdi* variable. *Genderineq* has the highest t-statistic (-7.08) out of all the quantitative variables which is logical because gender inequality is a prominent issue in the twenty-first century and encompasses a variety of other factors. This *genderineq* includes statistics such as the number of women in the government, percentage of female children given basic education, and the male to female ratio. The variable *dev* is a dummy variable that describes whether a country is developed or not; therefore, the variable's statistical significance illustrates the logical conclusion that developed countries would have a higher *hdi* value than developing or underdeveloped countries. Another important point to note was that no income-related variables were found to be significant in the regression analysis. We also acknowledge that omitted variable bias is present in our regressions, as we simply did not consider *all* the possible variables related to *hdi*.

<u>Robustness Test (F-Test):</u>

A robustness test was conducted to determine the joint significance of all of the insignificant variables: *cpi*, *litrate*, *seceduc*, *unempbenefits*, *govtexp*, *pop*, *homicidr*, *gendineq*. Therefore, the restricted model became:

$$hdi = \beta 0 + \delta 0 dev + \beta 1 fertrate + \beta 2 healthexp + \beta 3 gendineq$$

Since the F-statistic of 3.21 was greater than the F-critical value of 2.11, the null hypothesis that $\beta cpi = \beta litrate = \beta seceduc = \beta unempbenefits = \beta govtexp = \beta pop = \beta homicidr = \beta gendineq = 0$ was rejected in favor of the alternative hypothesis: the variables are jointly statistically significant. All of the variables should, therefore, be in our final model (also known as MLR 2):

$$hdi = \beta 0 + \delta 0 dev + \beta 1 cpi + \beta 2 fertrate + \beta 3 litrate + \beta 4 seceduc + \beta 5 healthexp + \beta 6 unempbenefits + \beta 7 govtexp + \beta 8 pop + \beta 9 homicider + \beta 10 gendineq$$

VI. Conclusion

The aim of this study was to determine and identify certain factors and variables that are not currently used in the HDI calculation but still have an impact on the HDI. Moreover, the three main HDI components representative of income, health, and education are extremely broad and complex issues, thus making it difficult for governments to specialize. For instance, governments cannot assume that in order to increase their HDIs, they need to focus on increasing either one of those main components. Thus, this study's uniqueness is that it identifies more relatable and specific factors that governments can effectively target to improve their HDI numbers and, in turn, increase their country's standard of living.

The hypothesis presented was that education-related factors would have the most impact on the HDI value. The reason for this hypothesis was that factors like literacy rate, government expenditures towards education, and the percentage of the population with secondary education would have the largest positive impact on the overall development of that country. Furthermore, education is the catalyst for an increase in income, as educated people generally have better economic conditions than lesser educated people; this is why our regression analysis determined that income-related factors are not of significance in the impact to HDI. Also, the significant variables, such as gender inequality and fertility rate, are generally byproducts of a country's education level. Moreover, countries with higher education levels generally have lower gender inequality and a lower number of children per family.

Based on our regression analysis and results, countries should focus their efforts on promoting gender equality to increase their HDI. Additionally, countries should implement family planning programs to decrease the total fertility rate while focusing on more directed and effective public healthcare solutions. By implementing targeted healthcare solutions, countries could provide quality medical treatment to those individuals who could not afford the expensive private medical care. Thus, we expect that if governments focus on these aforementioned variables that greatly impact HDI, countries will see improvements or upward trends in their HDI values overtime.

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VIII. Appendix

List 1: List of Countries Used

1.	Norway	95.	Libya
2.	Australia	96.	Tunisia
3.	Switzerland	97.	Colombia
4.	Denmark	98.	Saint Vincent and the Grenadines
5.	Netherlands	99.	Jamaica
6.	Germany	100.	Tonga
7.	Ireland	101.	Belize
8.	United States	102.	Dominican Republic
9.	Canada	103.	Suriname
10.	New Zealand	104.	Maldives
11.	Singapore	105.	Samoa
12.	Hong Kong, China (SAR)	106.	Botswana
13.	Liechtenstein	107.	Moldova (Republic of)
14.	Sweden	108.	Egypt
15.	United Kingdom	109.	Turkmenistan
16.	Iceland	110.	Gabon
17.	Korea (Republic of)	111.	Indonesia
18.	Israel	112.	Paraguay
19.	Luxembourg	113.	Palestine, State of
20.	Japan	114.	Uzbekistan
21.	Belgium	115.	Philippines
22.	France	116.	El Salvador

23.	Austria	117.	South Africa
24.	Finland	118.	Viet Nam
25.	Slovenia	119.	Bolivia (Plurinational State of)
26.	Spain	120.	Kyrgyzstan
27.	Italy	121.	Iraq
28.	Czech Republic	122.	Cabo Verde
29.	Greece	123.	Micronesia (Federated States of)
30.	Estonia	124.	Guyana
31.	Brunei Darussalam	125.	Nicaragua
32.	Cyprus	126.	Morocco
33.	Qatar	127.	Namibia
34.	Andorra	128.	Guatemala
35.	Slovakia	129.	Tajikistan
36.	Poland	130.	India
37.	Lithuania	131.	Honduras
38.	Malta	132.	Bhutan
39.	Saudi Arabia	133.	Timor-Leste
40.	Argentina	134.	Syrian Arab Republic
41.	United Arab Emirates	135.	Vanuatu
42.	Chile	136.	Congo
43.	Portugal	137.	Kiribati
44.	Hungary	138.	Equatorial Guinea
45.	Bahrain	139.	Zambia
46.	Latvia	140.	Ghana
47.	Croatia	141.	Lao People's Democratic Republic
48.	Kuwait	142.	Bangladesh

49.	Montenegro	143.	Cambodia
50.	Belarus	144.	Sao Tome and Principe
51.	Russian Federation	145.	Kenya
52.	Oman	146.	Nepal
53.	Romania	147.	Pakistan
54.	Uruguay	148.	Myanmar
55.	Bahamas	149.	Angola
56.	Kazakhstan	150.	Swaziland
57.	Barbados	151.	Tanzania (United Republic of)
58.	Antigua and Barbuda	152.	Nigeria
59.	Bulgaria	153.	Cameroon
60.	Palau	154.	Madagascar
61.	Panama	155.	Zimbabwe
62.	Malaysia	156.	Mauritania
63.	Mauritius	157.	Solomon Islands
64.	Seychelles	158.	Papua New Guinea
65.	Trinidad and Tobago	159.	Comoros
66.	Serbia	160.	Yemen
67.	Cuba	161.	Lesotho
68.	Lebanon	162.	Togo
69.	Costa Rica	163.	Haiti
70.	Iran (Islamic Republic of)	164.	Rwanda
71.	Venezuela (Bolivarian Republic of)	165.	Uganda
72.	Turkey	166.	Benin
73.	Sri Lanka	167.	Sudan

74.	Mexico	168.	Djibouti
75.	Brazil	169.	South Sudan
76.	Georgia	170.	Senegal
77.	Saint Kitts and Nevis	171.	Afghanistan
78.	Azerbaijan	172.	Côte d'Ivoire
79.	Grenada	173.	Malawi
80.	Jordan	174.	Ethiopia
81.	The former Yugoslav Republic of Macedonia	175.	Gambia
82.	Ukraine	176.	Congo (Democratic Republic of the)
83.	Algeria	177.	Liberia
84.	Peru	178.	Guinea-Bissau
85.	Albania	179.	Mali
86.	Armenia	180.	Mozambique
87.	Bosnia and Herzegovina	181.	Sierra Leone
88.	Ecuador	182.	Guinea
89.	Saint Lucia	183.	Burkina Faso
90.	China	184.	Burundi
91.	Fiji	185.	Chad
92.	Mongolia	186.	Eritrea
93.	Thailand	187.	Central African Republic
94.	Dominica	188.	Niger

STATA Output SLR 1: HDI v. GNP per capita

```
. regress hdi gnipcap

      Source |       SS       df       MS              Number of obs =     188
-------------+------------------------------           F(1, 186)     =  220.51
       Model |   2.4277073     1   2.4277073           Prob > F      =  0.0000
    Residual |  2.04773131   186  .011009308           R-squared     =  0.5425
-------------+------------------------------           Adj R-squared =  0.5400
       Total |  4.47543861   187  .023932827           Root MSE      =  .10493

------------------------------------------------------------------------------
         hdi |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     gnipcap |   6.06e-06   4.08e-07    14.85   0.000     5.26e-06    6.87e-06
       _cons |   .5892833   .0103352    57.02   0.000      .568894    .6096726
------------------------------------------------------------------------------
```

STATA Output SLR 2: HDI v. Life Expectancy

```
. regress hdi lifexp

      Source |       SS       df       MS              Number of obs =     188
-------------+------------------------------           F(1, 186)     =  791.10
       Model |  3.62349423     1  3.62349423           Prob > F      =  0.0000
    Residual |  .851944384   186  .004580346           R-squared     =  0.8096
-------------+------------------------------           Adj R-squared =  0.8086
       Total |  4.47543861   187  .023932827           Root MSE      =  .06768

------------------------------------------------------------------------------
         hdi |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      lifexp |   .0166051   .0005904    28.13   0.000     .0154405    .0177698
       _cons |  -.4882673   .0422677   -11.55   0.000    -.5716531   -.4048815
------------------------------------------------------------------------------
```

STATA Output SLR 3: HDI v. Expected Years in School

```
. regress hdi eyrschool

      Source |       SS       df       MS              Number of obs =     188
-------------+------------------------------           F(1, 186)     =  923.85
       Model |  3.72539699     1  3.72539699           Prob > F      =  0.0000
    Residual |  .750041615   186  .004032482           R-squared     =  0.8324
-------------+------------------------------           Adj R-squared =  0.8315
       Total |  4.47543861   187  .023932827           Root MSE      =   .0635

------------------------------------------------------------------------------
         hdi |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   eyrschool |    .049205   .0016189    30.39   0.000     .0460113    .0523987
       _cons |   .0585998   .0213616     2.74   0.007     .0164576     .100742
------------------------------------------------------------------------------
```

STATA Output SLR 4: HDI v. Mean Years of Schooling

```
. regress hdi myrschool

      Source |       SS       df       MS              Number of obs =     188
-------------+------------------------------           F(1, 186)     =  783.45
       Model |  3.61677703     1  3.61677703           Prob > F      =  0.0000
    Residual |   .85866158   186   .00461646           R-squared     =  0.8081
-------------+------------------------------           Adj R-squared =  0.8071
       Total |  4.47543861   187  .023932827           Root MSE      =  .06794

------------------------------------------------------------------------------
         hdi |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   myrschool |   .0449674   .0016065    27.99   0.000      .041798    .0481367
       _cons |   .3278686   .0139357    23.53   0.000     .3003762     .355361
------------------------------------------------------------------------------
```

STATA Output MLR 1: HDI v. Main Components

```
. regress hdi lifexp eyrschool myrschool gnipcap

      Source |       SS       df       MS              Number of obs =     188
-------------+------------------------------           F(4, 183)     = 1789.34
       Model |  4.36386303     4  1.09096576           Prob > F      =  0.0000
    Residual |   .11157558   183  .000609703           R-squared     =  0.9751
-------------+------------------------------           Adj R-squared =  0.9745
       Total |  4.47543861   187  .023932827           Root MSE      =  .02469

------------------------------------------------------------------------------
         hdi |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      lifexp |   .0061096   .0003751    16.29   0.000     .0053696    .0068496
   eyrschool |   .0148764   .0012529    11.87   0.000     .0124045    .0173484
   myrschool |   .0166748   .0010484    15.91   0.000     .0146063    .0187433
     gnipcap |   1.41e-06   1.28e-07    11.03   0.000     1.15e-06    1.66e-06
       _cons |  -.0927324   .0199941    -4.64   0.000    -.1321809   -.0532839
------------------------------------------------------------------------------
```

Correlation 1: Life Expectancy Proxy Variable

```
. corr lifexp disasters unempbenefits popgrowth healthexp fertilityrate
(obs=161)
```

	lifexp	disast~s	unempb~s	popgro~h	health~p	fertil~e
lifexp	1.0000					
disasters	-0.2510	1.0000				
unempbenef~s	0.5794	-0.2815	1.0000			
popgrowth	-0.5266	0.1890	-0.4537	1.0000		
healthexp	0.3541	-0.1121	0.5351	-0.3107	1.0000	
fertilityr~e	-0.7823	0.2551	-0.4817	0.7365	-0.2586	1.0000

Correlation 2: Income Proxy Variable

```
. corr gnipcap govtexp emp cpi gdp
(obs=152)
```

	gnipcap	govtexp	emp	cpi	gdp
gnipcap	1.0000				
govtexp	0.1472	1.0000			
emp	-0.1345	-0.1621	1.0000		
cpi	-0.2528	0.0316	0.0638	1.0000	
gdp	0.1450	0.0272	-0.0834	-0.0903	1.0000

Correlation 3: Education Proxy Variables

```
. corr myrschool eyrschool infantmortality seceduc litrate pubexp
(obs=132)
```

	myrsch~l	eyrsch~l	infant~y	seceduc	litrate	pubexp
myrschool	1.0000					
eyrschool	0.8398	1.0000				
infantmort~y	-0.7850	-0.8248	1.0000			
seceduc	0.9477	0.7826	-0.7473	1.0000		
litrate	0.8381	0.7569	-0.8237	0.7804	1.0000	
pubexp	0.2341	0.2719	-0.2106	0.2027	0.2030	1.0000

STATA Output MLR 2: HDI v. Proxy Factors (Unrestricted)

```
. regress hdi cpi fertrate litrate seceduc healthexp unempbenefits govtexp pop homicider gendineq dev

      Source |       SS           df       MS      Number of obs   =       103
-------------+----------------------------------   F(11, 91)       =     79.68
       Model |   1.7373146        11  .157937691   Prob > F        =    0.0000
    Residual |  .180364777        91  .001982031   R-squared       =    0.9059
-------------+----------------------------------   Adj R-squared   =    0.8946
       Total |  1.91767937       102  .018800778   Root MSE        =    .04452

-------------------------------------------------------------------------------
          hdi |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
--------------+----------------------------------------------------------------
          cpi |  -.0001451   .0001893    -0.77   0.445     -.000521    .0002308
     fertrate |  -.0153438   .0061169    -2.51   0.014    -.0274943   -.0031933
      litrate |   .0017982    .000517     3.48   0.001     .0007712    .0028252
      seceduc |  -4.78e-07   .0003059    -0.00   0.999    -.0006081    .0006072
    healthexp |  -.0089995   .0022763    -3.95   0.000    -.0135212   -.0044779
unempbenefits |   .0008452   .0004424     1.91   0.059    -.0000334    .0017239
      govtexp |   .0008654   .0008356     1.04   0.303    -.0007944    .0025252
          pop |  -.0000226   .0000244    -0.93   0.357    -.0000711    .0000259
    homicider |  -.0001935   .0004026    -0.48   0.632    -.0009931    .0006062
     gendineq |  -.2225102   .0515535    -4.32   0.000    -.3249149   -.1201055
          dev |   .0845659   .0181074     4.67   0.000     .0485977    .1205341
        _cons |    .665496   .0608232    10.94   0.000     .5446782    .7863138
-------------------------------------------------------------------------------
```

STATA Output MLR 3: HDI v. Proxy Factors (Restricted)

```
. regress hdi fertrate healthexp gendineq dev

      Source |       SS           df       MS      Number of obs   =       103
-------------+----------------------------------   F(4, 98)        =    184.72
       Model |  1.69311113         4  .423277782   Prob > F        =    0.0000
    Residual |  .224568244        98  .002291513   R-squared       =    0.8829
-------------+----------------------------------   Adj R-squared   =    0.8781
       Total |  1.91767937       102  .018800778   Root MSE        =    .04787

------------------------------------------------------------------------------
         hdi |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    fertrate |  -.0229688    .005961    -3.85   0.000    -.0347981   -.0111395
   healthexp |   -.007338   .0022128    -3.32   0.001    -.0117293   -.0029467
    gendineq |  -.3128743   .0441786    -7.08   0.000    -.4005454   -.2252032
         dev |   .1202945   .0158701     7.58   0.000     .0888008    .1517882
       _cons |   .8371233   .0317561    26.36   0.000     .7741044    .9001423
------------------------------------------------------------------------------
```