

Impact of Education, Population, and Unemployment towards Poverty Rate World Wide

Abstract

This study aims to discover the nexus of poverty, education, population demographics and unemployment. Data from various sources were collected and assembled for 174 countries, and then we apply multiple regression models to determine variables that significantly impact poverty rate. Initially we hypothesized that the higher the unemployment rate, dependency rate, and high population size, the more the poverty rate. On the other hand, the higher the mean years of education, the lower the poverty rate, and vice versa. It turns out that only dependency rate and education has a significant impact toward poverty rate in particular for country with poverty rate below 20%. Our final model had good predictive power and allowed us to predict the poverty rate.

I. Background and significance

Poverty entails more than the lack of financial resources and resources to support the minimum standard of living. Poverty manifests itself also through hunger and malnutrition, limited access to various basic services, social disparity and lack of participation in decision-making processes. Poverty has been a constant battle, and reality for many countries worldwide for decades. There are varying “initiating causes” resulting in poverty, therefore there’s no ‘one catch all’ solution to poverty. Poverty rarely has a single cause; marginality [1], education [2], as well as cultural and behavioral [3] are some root causes of Poverty.

Understanding factors contributing to poverty and how they correlate with each other is a salient step to sustainably reduce poverty. Through data analysis and multiple regression models on both developed and developing countries we aim to understand the significance of factors mentioned towards poverty, and provide recommendations on how governments can progressively eliminate poverty.

Several studies have pointed that lower labor productivity usually results in lower economic growth and higher unemployment and poverty [4, 5]. On the contrary, a high dependency rate in a family or in the case of developing countries leads to lower productivity of such labor forces. Thus, there is a positive relationship between dependency rate and poverty. It is also expected that better and longer education an individual undergoes, will result in higher people to work. Which indicates that the higher the education level, the higher the employment rate and reduce poverty [6]. Specifically, entrepreneurship education is one of the significant strategies to alleviate poverty [7, 8].

Based on the literature review, we hypothesize that a high unemployment rate, high dependency rate, and high population size will have positive correlation with poverty, while a high number of mean years of education will have a negative correspondence with poverty.

II. Materials and Methods

The data is independently collected from 174 countries worldwide in the year of 2019. We combined data from 4 data sets to conduct our analysis. The data includes four candidate predictor variables and one response variable (poverty), all of which are described in Table 1.

First, we summarized and visualized the data, trying to understand the behavior of each variable and find out any outlier in the data. Scatter plots and correlation matrix are created to

Table 1. Variables, description and data source for the analysis

Variables	Description	Data Source
Poverty	Measures 'monetized' consumption and income of each country in the year indicated	Global Extreme Poverty (https://ourworldindata.org/extreme-poverty)
Dependency rate	Measures as the ratio between non-working age (0-14, >65) to the whole population	World Development Indicators: Population Dynamics (http://wdi.worldbank.org/table/2.1)
Unemployment Rate	Measures the number of people in working age without work but desire and actively seeking it as a percent in the total labor force of a country	Unemployment Rate by Country 2019 (https://knoema.com/blizore/unemployment-rate-by-country-2019-data-and-charts)
Population	Measures the total population of both sexes in each country in the year indicated	Population data (https://population.un.org/wpp/Download/Standard/Population)
Mean years of schooling	Measures the average number of years spent in school in each country's population	Global Education (https://ourworldindata.org/global-education)

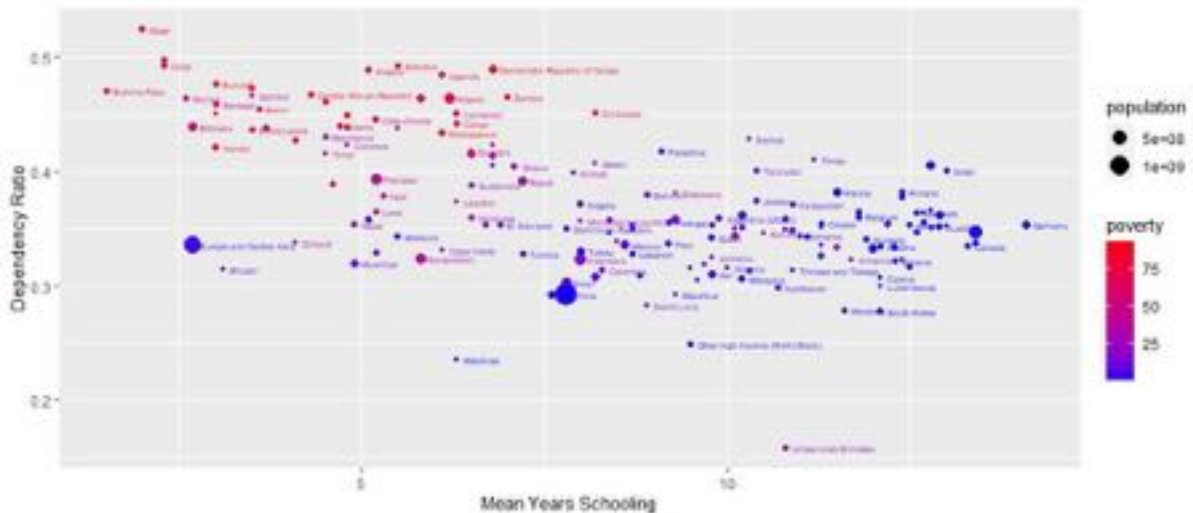


Figure 1. Data visualization for mean years of schooling, dependency rate, population and poverty

show the relation of candidate predictors and dependent variable. The ggplot2 package enable us to plot the four variables in one window. This is very helpful to understand the data and how the variables correlate. Then, we applied multiple regression to measure the correspondence the candidate predictors and response variables. The best model is chosen based on the R-squared, namely the higher the R-Squared the better. In addition, we also took advantage of Akaike Information Criterion (AIC) to compare the fit of several candidate models.

III. Results

In the data we obtained, poverty rate worldwide ranges from 2.44% up to 93.27%, while dependency rate ranges from 15.87% up to 52.44%. The unemployment rate is much better than the poverty and dependency rate, i.e. from 4.6% up to 28.47%, while the average length in years that people spend in school is 8.35. Figure 1 shows the relationship between variables in the study. It is clearly seen that countries with high dependency rates and short years of schooling tend to have high poverty rates. Population seems to have no effect on the poverty rate in a country. The correlation coefficient matrix of the variables is shown in Table 2. Among four predictor variables, dependency rate and mean years of schooling have a strong correlation with poverty.

The first multiple regression model was created by including all the potential predictors. It turns out that the estimated coefficients of regression for the *dependency rate* and the *mean years of schooling* are not significantly equal to zero. Interestingly, contrary to popular belief, this is not the case with *unemployment* and *population*.

We check which model is preferred by the AIC using stepAIC() from the MASS packages in R. The recommended model is the one includes *dependency rate* and *mean years of schooling* with AIC of only 1446.3 as compared to the 1448.4 of the original model that uses all predictor variables. The second model only has an R^2 value of 0.717, a decrease from that of the original model at 0.7201.

Table 2. Correlation coefficient matrix

	Poverty	Dependency rate	Unemployment	Population	Mean years schooling
Poverty	1.0000				
Dependency rate	0.7648	1.0000			
Unemployment	-0.0675	-0.0346	1.0000		
Population	-0.0949	-0.1924	-0.0973	1.0000	
Mean years schooling	-0.7413	-0.5671	0.0214	-0.0232	1.0000

We refined the model by adding second-order terms and interactions of dependency rates and mean years of schooling. The model

$$y = \beta_0 + \beta_1x_1 + \beta_2x_2 + \beta_{11}x_1^2 + \beta_{12}x_1x_2 + \varepsilon \dots\dots\dots (1)$$

where x_1 is dependency rate and x_2 is the mean years of schooling, provides an F-value of 137.5, p-value smaller than 2.2e-16, residual standard error of 13.93 and R^2 value of 0.7671. However, the only significant estimate is the second order of dependency rate. Eliminating the intercept from model (1) yields a very high R^2 of 0.8608, and all estimates are significantly non-zero. This is the best model, we presumed.

We further suspect that there are differences in data patterns between poverty levels. Therefore, we separate the response variables into two categories, i.e. the poverty rate less than or equal to 0.20 (rich countries) and more than 0.20 (poor countries). Then we apply a regression model with the Dependency rate, the mean years of schooling and the interaction between the two. For poor countries, these two variables have a significant effect on poverty rates, while for rich countries the length of study and the interaction term have no effect on poverty rates. t- table for both samples is shown in Table 3. R^2 for poor countries is 0.937, much higher than for rich countries (that of 0.5863).

Table 3. t-tables of multiple regression for poor countries and rich countries

Coefficients:	Poor countries				Rich countries			
	Estimate	Std. Error	t value	Pr(> t)	Estimate	Std. Error	t value	Pr(> t)
DependencyRate	147.017	14.329	10.260	5.48e-15 ***	37.9680	5.0290	7.550	1.82e-11 ***
MeanYearsSchooling	-10.260	2.855	-3.594	0.000644 ***	-0.2562	0.3981	-0.644	0.521
DependencyRate: MeanYearsSchooling	22.195	8.515	2.607	0.011435 *	-1.8516	1.1869	-1.560	0.122

IV. Discussion and Conclusion

Poverty is one of the problems faced by many countries and will continue to be felt if the root of the problem is not fixed. This analysis helps indicate which factors are best suited for modeling poverty rates. The first attempt in multiple regression modeling comes up with rejecting the hypothesize that a high unemployment rate, and large population will have positive correspondence with poverty. Further analysis confirms that high number of mean years of education has a negative correspondence with poverty rate, and dependency rate has positive correspondence with poverty rate, as well as the interaction between the two significant variables.

For future study, we should analyze whether those Dependency Rate is caused by Old group or Young age-group. For country with high Dependency Rate, and majority of this Dependency Rate comes from Young age-group, then it is natural to expect that they will be better in the future (when this Young age-group becomes productive).

But recalling there are still shortcomings in this analysis, such as lack of adequate data and natural phenomena so that our data doesn't use the latest but from 2019. Hopefully, with improvement on dependency rate and mean years of schooling, many countries can overcome poverty. And further analysis can use the recent and complete data so the result will be more accurate.

V. References

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APPENDIX

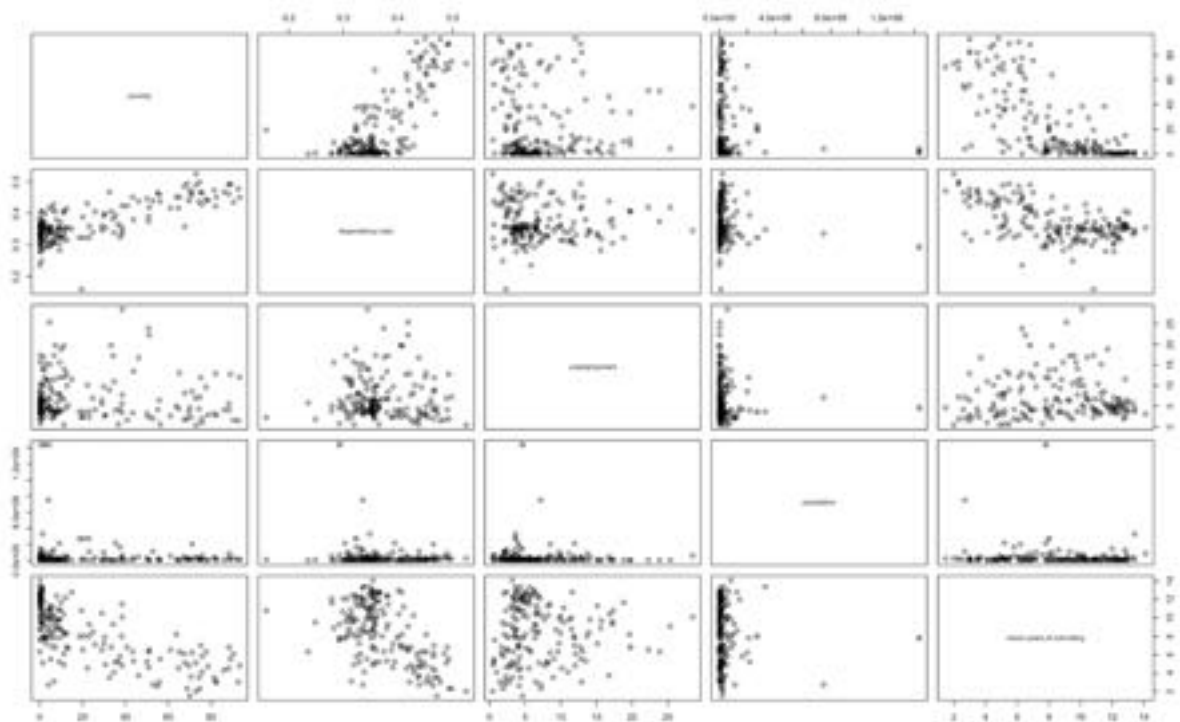


Figure A. Matrix plot of each variable, showing correlation and relationship between pair of variables.

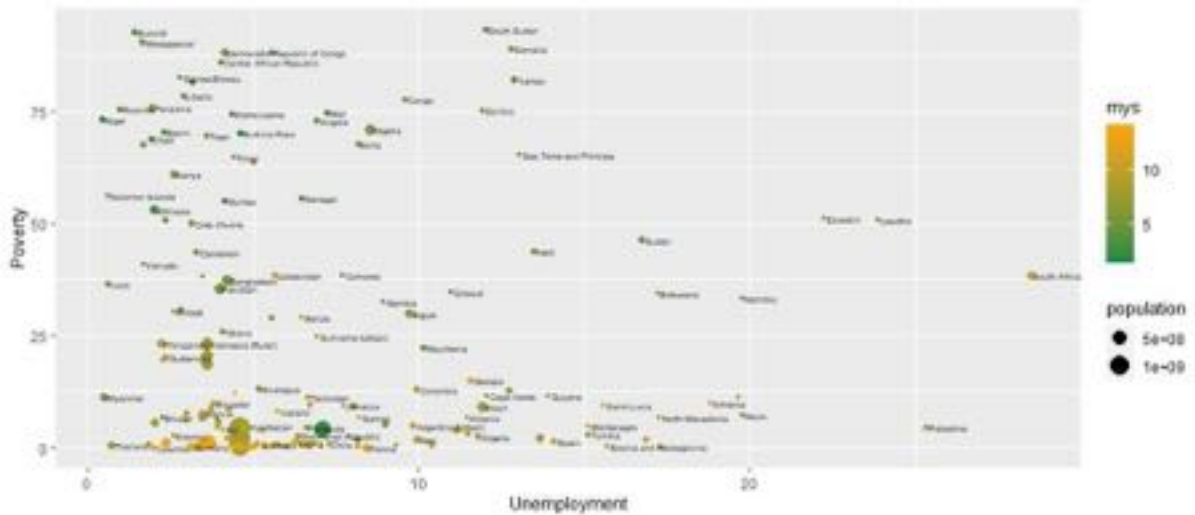


Figure B. Scatter plot of unemployment versus poverty rate, layer by mean years of schooling and population (the size of the bubble)

The scatter plot of unemployment (percentage of the labor force) and the poverty rate shows that some countries with low unemployment rates are still poor. On the other side, there is a country like Palestine which has low poverty although the unemployment rate is high. Even so, countries that have a high mean year of school or can be said to be highly educated will have a low poverty rate. It's perhaps because its people are educated so their job opportunity is higher and can help to improve their countries' economy.