Modelling Crude Birthrate with Cross-Sectional Data

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Introduction

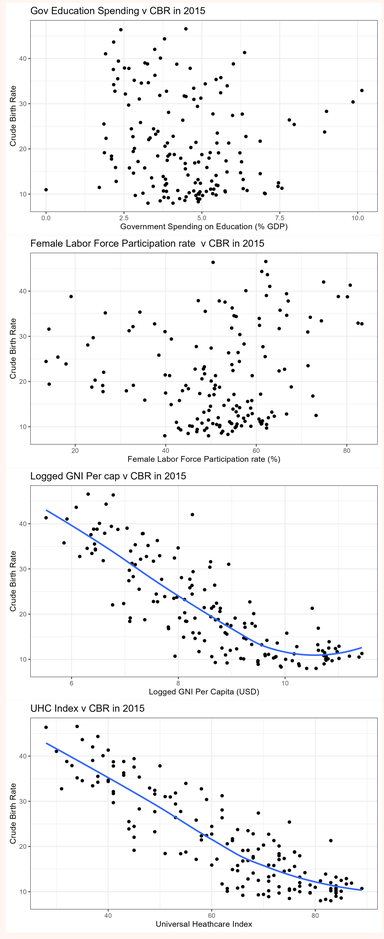
My research poster is about modeling crude birthrate with cross-sectional data from 2015, focusing on 157 countries. The key variables of interest in this study are income, education, universal health care index, and female labor force participation rate. The motivation behind this research is the global decline in birth rates, which has significant implications for population growth, economic development, and social welfare.

Key Variables

- **C**rude Birthrate: Number of Births per 1000 population
- **G**NI per Capita: Measurement of income
- **U**HC Index: Universal Healthcare Index
- **G**overnment Spending on Education (% GDP): Measurement for Education
- **F**emale Labor Force Participation rate

Exploratory Data Analysis

From the following EDA, we can observe a clear negative relationship between CBR and logged GNI per capita, as well as CBR and UHC Index. No clear relationship can be observed with the remaining two variables.



Linear Regression Model

To model the relationship between the variables, two models linear regression models have been chosen.

1. $Y = \beta_0 + \beta_1 X_1 + \beta_2 log(X_2) + \beta_3 X_3 + \beta_4 X_4$
2. $Y = \beta_0 + \beta_1 X_1 + \beta_2 log(X_2) + \beta_3 X_3$

Y = Crude Birthrate
X_1 = UHC Index
X_2 = GNI Per Capita (% GDP)
X_3 = Government Expenditure on Education (% GDP)
X_4 = Female Labor Force Participation Rate

Regression Results

	Dependent variable:	
	Crude Birth Rate	
	(1)	(2)
Universal Health Care Index	−0.467***	−0.475***
	(0.054)	(0.054)
Logged GNI Per Capita	−1.567***	−1.519**
	(0.587)	(0.588)
Government Spending on Education (% GDP)	0.673***	0.736***
	(0.247)	(0.244)
Female Labor Force Participation Rate	0.040	
	(0.028)	
Constant	59.009***	60.844***
	(3.004)	(2.715)
Observations	157	157
R^2	0.794	0.792
Adjusted R^2	0.789	0.787
Residual Std. Error	4.801 (df = 152)	4.816 (df = 153)
F Statistic	146.665*** (df = 4; 152)	193.646*** (df = 3; 153)
Note:		*p<0.1; **p<0.05; ***p<0.01

We can observe from Model 1 that the estimator for the variable Female Labor Force Participation rate is not statistically significant. As a result, we have excluded this variable from the second model. The remaining coefficients are statistically significant with 95% confidence.

Interpretation of Model 2

Intercept term:
On average, for a country with a UHC Index of 0, GNI per Capita of 1, and Government spending on education of 0, they would have a crude birthrate of around 61.
Coefficient for UHC Index:

$$\beta_1 = \frac{\Delta Y}{\Delta X_1} = -0.475$$

For every unit increase in Universal Health Care Index, the Crude Birthrate decreases by 0.475.
Coefficient for UHC Index:

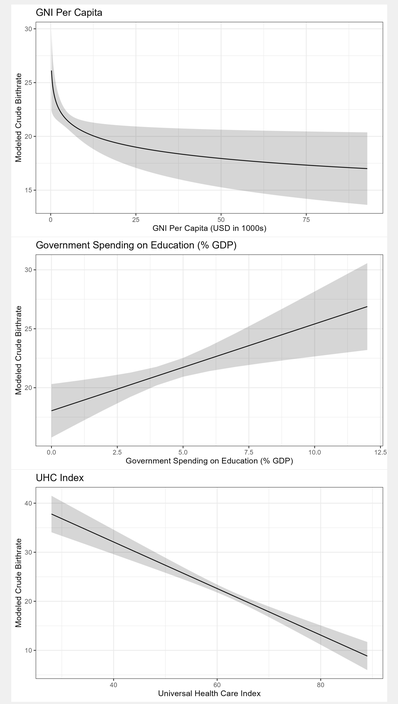
$$\beta_2 = \frac{\Delta Y}{\%\Delta X_2} = -1.519$$

For each percent increase in GNI per Capita, Crude birthrate decreases by 1.519.
Coefficient for Government Spending on Education (% GDP):

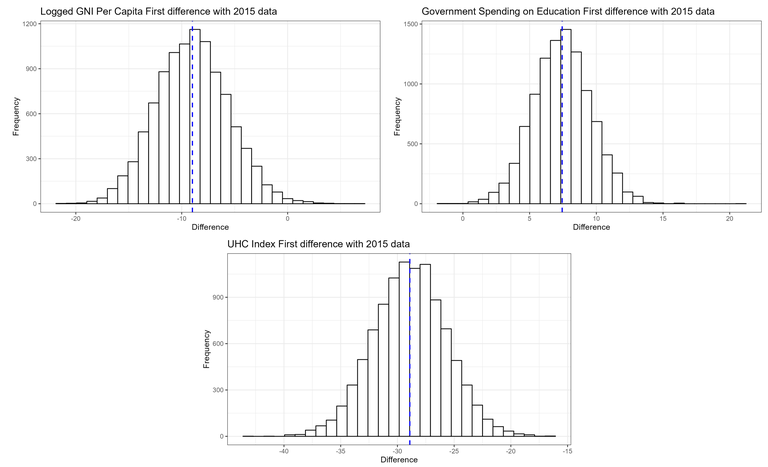
$$\beta_3 = \frac{\Delta Y}{\Delta X_3} = 0.736$$

For every unit increase in % GDP spent on education, the Crude Birthrate increases by 0.736.

Predicting with Covariates Held at Mean



First Difference with Bootstrap



Conclusion

Based on our analysis, the results indicate a negative correlation between crude birthrate and GNI per capita, as well as a negative linear association between crude birthrate and universal health care index. However, contrary to popular belief and previous research findings, we found a positive linear relationship between government spending on education and crude birthrate. This unexpected result warrants further investigation and highlights the need for additional research to better understand the complex relationship between education and birth rates.