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# Analyzing the Gender Disparity in Education Throughout the World

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**ABSTRACT**

*Gender inequality can be witnessed in the educational sphere affecting national economies, human resource development and the overall quality of life. The project examines this gender gap in education by obtaining data from one hundred and fifty eight different countries to determine the relationship between expected female years of education and gross national income per capita. Other explanatory variables including poverty headcount ratio, life expectancy, literacy rate, infant mortality rate and urban population are used to strengthen the model. It was seen that the expected education levels were positively correlated with GNI per capita, urban population and literacy rate while showing a negative correlation with poverty rates and infant mortality rate (IMR).*

***Keywords:*** *Education; Gender divide; Development; Literacy.*

## 1.0 Introduction

Education is a powerful tool that empowers people, make them aware and enable them to achieve their goals. It is crucial to a nation's overall development and productivity. It is the process of achieving knowledge, values, skills, beliefs and moral habits. People become capable enough to make informed choices and fight against any injustice. Women's literacy and education levels will help secure social equality, higher economic productivity and a tolerant democratic society. Thus, it is very essential to create provisions for educating all irrespective of gender for the betterment of the society as a whole.

According to global statistics, just 39 percent of rural girls attend secondary school. This is far fewer than rural boys (45 percent), urban girls (59 percent) and urban boys (60 percent). In 2013, UNESCO reported that nearly 25 percent of all girls in developing countries have not completed primary school, and that out of the 774 million people in the world who are illiterate, two-thirds are women.

The Convention on the Elimination of all Forms of Discrimination against Women (CEDAW, 1979), The Copenhagen Declaration (1995) and The Millennium Goals (2000) formulated action programs to establish gender equality in education to empower women for social justice and advancement. Goals 4 and 5 of the UN Development programme set sights on improving the quality of education around the world and reducing gender inequality among nations. The Education 2030 (2015) agenda under SDG4 recognizes that gender equality requires an approach that 'ensures that girls and boys, women and men not only gain access to and complete education cycles, but are empowered equally in and through education'. The Platform for Girls' Education, an UNGEI initiative launched a new research report and policy note - Transformative political leadership to promote 12 years of quality education for all girls - in 2020 to ensure quality education for all girls, especially the marginalized.

Developing nations suffer from more gender inequality as compared to their developed counterparts evident from looking at income levels, poverty rates and urban population percentage within a country. Based on research, the education levels for women should be highly correlated to income levels. Poverty would also be a key component in determining the years of schooling. Urban population, infant mortality statistics, life expectancy and literacy rates were chosen as further indicators. All these parameters will help us in determining the expected education level of women in a particular country.

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**2.0 Literature Review**

A World Development Report on Gender Inequality and Development released by the World Bank in 2012 shows a decreasing gender gap in school enrolment. Free primary education programs led to an increase in school enrolment among both boys and girls. Countries that implement programs informing women of future employment opportunities and benefits saw them staying in school longer than countries with no such programs. There is a comparative analysis between current day school enrolment rates for females aged 5-19 and the overall trend of female enrolment in the United States since the late 18th century. Many nations have lower enrolment rates today than the United States had in 1900. Educational inequality can also be linked to income inequality. Countries with less income gap witness less gender disparities between boys and girls. Education specializations also have gender disparity with STEM fields being dominated by men while humanities, fine arts and a vast majority of health fields being female dominated.

In the article, 'Schooling and Industrialization in China: Gender Differences in School Enrolment' written by Ming-Hsuan Lee, the decreasing gender gap in education over the past thirty to forty years is highlighted. At the end of the 1800s, 30-40% of men could read or write in the country, while only 2-10% of women could do the same. The 1982 census showed that among those born between 1928 and 1932, 60% of men were literate as compared to 17% women. However, the disparity reduced over time. More women were attending college than men by 2005. The same does not hold true for rural communities. Poor families spend more on their sons compared to their daughters. Chances of sending girls to schools were proportionate to the money their families had, as shown by the data. Industrial and service sectors employed women as these industries expanded. Industrialization increased women's employment allowing them to earn and contribute to the economy. Multiple laws and policies were formulated and implemented to promote gender equality in education such as the OneChild policy, and Promoting Nine-Year Compulsory Education in Poor Areas Focusing on Girls initiated and funded by the UN and the Chinese government. Living in a rural versus an urban setting greatly affected gender disparity in education. Urban areas faced less inequality as people have access to the benefits of Household Registration System there. Industrialization led to urbanization that opened up a lot of labor jobs to men affecting the value of male schooling and higher education prospects adversely.

In the Digital Gender Divide study, Alozi and Akpan-Obong examines the ownership of smartphones in sub-Saharan African countries to analyze the gender gap in the usage of Information and Communication Technologies (ICTs) and the reasons for this divide. A multivariate analysis was done on their survey data with independent variables like gender, age, education, urbanism, religion, marital status, employment status, income, internet liberalization and Westernization. The main regression analysis focuses on the actual internet access and usage frequency and a secondary analysis on cell and smartphone ownership is done to explain the DGD. Sample data used precisely represented sub-Saharan Africa with a median age of 35 years, women being poorer and less employed than men. The results show 32.7% men using the internet as compared to 23.6% women. On an average, men were 5.9% more likely to use the internet multiple times per day than women (60.9% and 55.0%, respectively). In conclusion, it states that 'being a woman reduces both the odds of use of the internet and the frequency of that use, as well as both ownership of cell and smartphones' (Alozi and Akpan-Obong 150). There is a digital gender divide in sub-Saharan Africa and is partially explained by the fact that "men control the design, distribution, leadership and content of technology, precluding a female perspective and also reinforcing patriarchal notions of technological content and applications" (Alozi and Akpan-Obong 155).

'Conceptualizing Gender Equality in Research on Education', an article by Sheila Aikman, Anjum Halai and Jolly Rubagiza conceives education quality using human capital theory, postcolonial critiques and the view of development as necessary social action for empowerment. Gender biases will adversely affect the quality of education one receives, thus it is important for low income countries to understand the root cause of such disparities not only in school but in day to day life. In this regards, it states that "education in low-income countries can only be of quality when it explicitly recognizes and helps to realize the rights and capabilities of all women and girls, and all men and

boys" (Aikman). Power structures must be changed to resolve existing biases, culture of silence must be dissolved and schooling must be provided for boys and girls irrespective of their identities or backgrounds. EdQual RPC also emphasizes on an in-depth analysis of gendered relationships and structures to assess quality also in terms of the value and nature of educational experience for girls and boys.

The article 'Measuring Gender Equality in Education: Lessons from Trends in 43 Countries' by Stephanie R. Paski, Katharine J. McCarthy, and Barbara S. Mensch tackles the problem of declining primary school enrolment throughout the globe. Data from 24 sub-Saharan African countries was examined from the late 1960s to the late 1990s. 45% of girls and 66% of boys attended school by the late 1960s. By the late 1990s the percentages increased to 73% of girls and 78% of boys. Completion of primary schools went from 46% for boys and 26% for girls up to 58% for boys and 53% for girls. Due to the economic downturn, population growth and structural adjustment programs during the late 90s, this progress however started to slow down. "The 2016 Gender Review accompanying UNESCO's annual Global Education Monitoring Report stated that, 'in 2014, gender parity was achieved globally, on average, in primary, lower secondary, and upper secondary education" (Paski). The research showed that the disadvantages affecting primary school enrolment of females have lessened and gender parity has been achieved in these 43 countries however the enrolment rates are still low in many other countries around the world. Women are facing many challenges in the way of getting quality education as compared to men.

A study by Hanmer and Klugman (2016) assessed the current standing of women in developing nations. Education helps individuals throughout their lives and determines the level of their economic participation. The study found that reducing the gender gap in education will help in increasing the overall equality between men and women. Education is essential in determining equality. Another study 'Gender Inequality and Economic Development: Fertility, Education and Norms' conducted by Kleven & Landais (2017) studies the role played by fertility in education equality and shows that decreasing fertility rates help in reducing the gender disparity. In a family with less children, the probability of them being properly educated is high increasing overall human capital, reducing inequality and improving national economy. They identify that poverty and development are major factors in determining the level of education women attain in a country. The study 'Women's Empowerment and Economic Development' shows that inequality between men and women arise due to poverty and lack of opportunity. Economic development will improve the condition of women. Gender inequality will reduce as poverty declines and improve the quality of lives people lead. It offers a pessimistic view of women empowerment and economic development mutually reinforcing each other. Policy actions are also necessary to bring about a change.

## 3.0 Data

**Table 1: Data and its Source**

| Variable | Strata name | Units | Years | Source |
|---|---|---|---|---|
| Life expectancy | LifeExp | Years | 2017 | World bank |
| Literacy rate | LitRate | % of people aged 15 and above | 2014-2020 | World bank |
| Percentage of urban population | UrbPop | % of Population | 2014-2020 | World bank |
| GNI per capita (PPP) | GNI | 2017 USD in PPP | 2014-2020 | World bank |
| Poverty headcount ratio @ $1.90/Day (PPP) | Pov | % of Population | 2014-2019 | World bank |
| Expected years of education (Female) | SchoolYears | Years | 2014-2019 | Human Development Reports (UNDP) |
| Infant mortality rate | IMR | per 1000 live births | 2014-2019 | World bank |
| Log(GNI per capita) | Log(GNI) | % change | | |
| Log(Expected years of education) | Log(SchoolYears) | % change | | |

## 4.0 Hypothesis

Poverty headcount ratio and infant mortality rate will be negatively correlated with average years of schooling while GNI per capita, urban population percentage and literacy rate will be positively correlated with the expected years of schooling. The dependent variable is the mean female expected years of education in a country, all the others being independent variables.

Income levels (measured in PPP in 1000's of dollars) and poverty rates (setting the poverty line at $1.90 per day) are important factors in determining the average years of female education. The belief that developed countries would see less gender disparity in education compared to developing countries leads to this idea. Several explanatory variables like poverty headcount ratio, life expectancy, infant mortality rate, literacy rate and urban population percentage have also been added to strengthen the model.

The regression is compiled using data from 158 different countries. The main source of data is the World Bank, an organization which keeps a detailed database of various statistics relating to population count, health and environment. Expected years of education (female) values are obtained from the Human development reports.

## 5.0 List of Countries

| | | | |
|---|---|---|---|
| Albania | Djibouti | Lebanon | Samoa |
| Algeria | Dominican Republic | Lesotho | Sao Tome and Principe |
| Angola | Ecuador | Liberia | Saudi Arabia |
| Antigua and Barbuda | Egypt, Arab Rep. | Lithuania | Senegal |
| Argentina | El Salvador | Luxembourg | Serbia |
| Armenia | Estonia | Madagascar | Seychelles |
| Australia | Eswatini | Malawi | Sierra Leone |
| Austria | Ethiopia | Malaysia | Singapore |
| Azerbaijan | Finland | Maldives | Slovak Republic |
| Bangladesh | France | Mali | Slovenia |
| Barbados | Gabon | Malta | South Africa |
| Belarus | Gambia, The | Mauritania | Spain |
| Belgium | Georgia | Mauritius | Sri Lanka |
| Benin | Germany | Mexico | St. Lucia |
| Bhutan | Ghana | Moldova | Sudan |
| Bolivia | Greece | Mongolia | Suriname |
| Botswana | Grenada | Montenegro | Sweden |
| Brazil | Guatemala | Morocco | Switzerland |
| Brunei Darussalam | Guinea | Mozambique | Tajikistan |
| Bulgaria | Guyana | Myanmar | Tanzania |
| Burkina Faso | Haiti | Namibia | Thailand |
| Burundi | Honduras | Nepal | Timor-Leste |
| Cabo Verde | Hungary | Netherlands | Togo |
| Cambodia | Iceland | Nicaragua | Tonga |
| Cameroon | India | Niger | Tunisia |
| Canada | Indonesia | Nigeria | Turkey |
| Central African Republic | Iran, Islamic Rep. | North Macedonia | Turkmenistan |
| Chad | Iraq | Norway | Uganda |
| Chile | Ireland | Oman | Ukraine |
| China | Israel | Pakistan | United Arab Emirates |
| Colombia | Italy | Panama | United Kingdom |
| Comoros | Jamaica | Paraguay | United States |
| Congo, Dem. Rep. | Jordan | Peru | Uruguay |
| Congo, Rep. | Kazakhstan | Philippines | Uzbekistan |
| Costa Rica | Kenya | Poland | Vanuatu |
| Cote d'Ivoire | Korea, Rep. | Portugal | Vietnam |
| Croatia | Kuwait | Qatar | Zambia |
| Cyprus | Kyrgyz Republic | Romania | Zimbabwe |
| Czech Republic | Lao PDR | Russian Federation | |
| Denmark | Latvia | Rwanda | |

## 6.0 Summary Statistics

**Table 2: Data Statistics**

| | School Years | GNI | Urb Pop | IMR | Lit Rate | Life Exp | Pov |
|---|---|---|---|---|---|---|---|
| **Obs** | 158 | 158 | 158 | 158 | 127 | 158 | 123 |
| **Mean** | 13.45611814 | 19496.29 | 58.1131 | 22.15169 | 83.45541 | 72.27416 | 10.31828 |
| **Median** | 13.675 | 12298.95 | 58.28464 | 14.175 | 92.45508 | 74.09863 | 1.525 |
| **Standard Deviation** | 3.290813929 | 19541.42 | 22.50903 | 20.56074 | 18.43644 | 7.615394 | 16.87565 |
| **Range** | 16.78333333 | 90710 | 87.278 | 86.28333 | 75.83149 | 31.31122 | 69.2 |
| **Minimum** | 5.05 | 789.8634 | 12.722 | 1.7 | 24.15727 | 52.24 | 0 |
| **Maximum** | 21.83333333 | 91499.86 | 100 | 87.98333 | 99.98876 | 83.55122 | 69.2 |

For Life Expectancy, Central African Republic came in with the lowest of all nations at 52.24 years while Switzerland has the highest, at 83.55 years. Qatar has the highest GNI per capita at 91499.86 while Burundi has the lowest (789.86). Speaking of Burundi, it has the lowest urbanized population at 12.72% and Kuwait has the highest at 100%. Australia has the highest expected years of schooling for females (21.83 years) while Niger has the lowest

expected years of female education (5.05 years). Poverty rate is the highest for Malawi (69.20%). Sierra Leone is the nation with highest IMR (87.98%), the lowest being Iceland (1.70%). Chad has the lowest literacy rate of 24.16% and Uzbekistan has the highest (99.99%).

## 7.0 Assumptions

It is assumed that women's level of education is only affected by a nation's GNI per capita, their poverty rate and the female literacy rate of the country. Gauss Markov guidelines for regression can be followed by the model.

**Table 3: Correlation Table**

| | School Years | GNI | Urb Pop | IMR | Lit Rate | Life Exp | Pov |
|---|---|---|---|---|---|---|---|
| **School Years** | 1 | | | | | | |
| **GNI** | 0.7071 | 1 | | | | | |
| **Urb Pop** | 0.6173 | 0.6725 | 1 | | | | |
| **IMR** | -0.8340 | -0.6370 | -0.5556 | 1 | | | |
| **Lit Rate** | 0.7899 | 0.4749 | 0.4622 | -0.8364 | 1 | | |
| **Life Exp** | 0.8304 | 0.7176 | 0.6124 | -0.9328 | 0.7434 | 1 | |
| **Pov** | -0.6502 | -0.5276 | -0.5510 | 0.7617 | -0.6710 | -0.7582 | 1 |

## 8.0 Results

**Table 4. Regression Results (Significant at **5% ***1%)**

| Variable | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 |
|---|---|---|---|---|---|
| Log (GNI) | 0.1965*** | | | 0.0569*** | 0.0837*** |
| **Std. Err.** | 0.0105 | | | 0.0213 | 0.0288 |
| UrbPop | | 0.0009*** | | 0.0003 | 0.0008** |
| **Std. Err.** | | 0.0002 | | 0.0003 | 0.0003 |
| IMR | | -0.0043*** | -0.002*** | -0.0016*** | -0.0009 |
| **Std. Err.** | | 0.0003 | 0.0006 | 0.0005 | 0.0008 |
| LitRate | | | 0.0027*** | 0.002*** | 0.0021*** |
| **Std. Err.** | | | 0.0006 | 0.0005 | 0.0006 |
| LifeExp | | | | | 0.0012 |
| **Std. Err.** | | | | | 0.0021 |
| Pov | | | -0.0004 | | 0.0007 |
| **Std. Err.** | | | 0.0005 | | 0.0005 |
| Intercept | 0.3182*** | 1.1596*** | 0.9289*** | 0.7244*** | 0.4823** |
| **Std. Err.** | 0.0429 | 0.0195 | 0.0628 | 0.0863 | 0.1918 |
| **Observations** | 158 | 158 | 92 | 127 | 92 |
| **R square** | 0.6911 | 0.7399 | 0.7072 | 0.77 | 0.7763 |

The parameters are linear in all the models. The data has been sampled randomly. There is no perfect collinearity between explanatory variables as shown in the table below. Zero conditional mean: The expected value of the error term, $\in$ is assumed to be zero for the multiple regression model. Homoscedasticity: The variance of the error term, $\in$ is expected to be constant.

Different regressions were run with the data, using every combination of independent variables that seemed relevant. Five models are listed here along with the value of the coefficients.

Model 1: log(SchoolYears) = 0.1965(log(GNI)) +0.3182

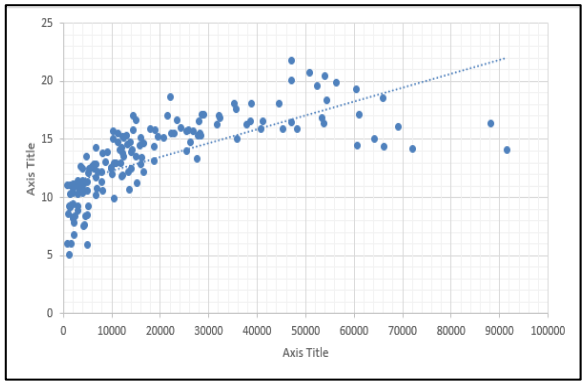
**Table 5: Regression Analysis- Model 1**

| Regression Statistics | |
|---|---|
| Multiple R | 0.831315 |
| R Square | 0.691085 |
| Adjusted R Square | 0.689105 |
| Standard Error | 0.065058 |
| Observations | 158 |

| ANOVA | | | | | |
|---|---|---|---|---|---|
| | **df** | **SS** | **MS** | **F** | **Significance F** |
| Regression | 1 | 1.477117 | 1.477117 | 348.9939 | 1.23E-41 |
| Residual | 156 | 0.66027 | 0.004233 | | |
| Total | 157 | 2.137387 | | | |

| | Coefficients | Standard Error | t Stat | P-value | Lower 95% | Upper 95% | Lower 95.0% | Upper 95.0% |
|---|---|---|---|---|---|---|---|---|
| Intercept | 0.318162 | 0.042938 | 7.409752 | 7.49E-12 | 0.233347 | 0.402978 | 0.233346819 | 0.402977895 |
| log(GNI) | 0.196505 | 0.010519 | 18.68138 | 1.23E-41 | 0.175728 | 0.217283 | 0.175727726 | 0.217282965 |

**Figure 1: Expected Years of Schooling Vs GNI Per Capita Scatter Plot**



- A simple regression between GNI per capita and expected years of schooling was run. At first, when the regression was run, there was an exponential relationship between the two variables. To combat this, each variable was put on a logarithmic scale to linearize it.
- GNI per capita showed a positive relationship between both variables, showing us that a 1% increase in GNI per capita would yield a 0.196% increase in the female expected years of schooling. These two variables have a positive linear relationship. It also has a P-value less than 0.01; it is statistically significant at the 1% level, indicating a strong relationship.
- The model has an R-squared value of 0.69, which shows moderate correlation between the variables.
- The simple linear regression model is a great basis for analyzing the correlation between GNI and years of schooling, however adding more explanatory variables in a multiple linear regression model can help add precision to the interpretation.

Model 2: log(*SchoolYears*) = 0.0009(*UrbPop*) – 0.0043 (*IMR*) + 1.1596

**Table 6: Regression Analysis- Model 2**

| Regression Statistics | |
|---|---|
| Multiple R | 0.862106 |
| R Square | 0.743227 |
| Adjusted R Square | 0.739914 |
| Standard Error | 0.059505 |
| Observations | 158 |

| ANOVA | | | | | |
|---|---|---|---|---|---|
| | **df** | **SS** | **MS** | **F** | **Significance F** |
| Regression | 2 | 1.588565 | 0.794282 | 224.3235 | 1.74E-46 |
| Residual | 155 | 0.548822 | 0.003541 | | |
| Total | 157 | 2.137387 | | | |

| | **Coefficients** | **Standard Error** | **t Stat** | **P-value** | **Lower 95%** | **Upper 95%** | **Lower 95.0%** | **Upper 95.0%** |
|---|---|---|---|---|---|---|---|---|
| Intercept | 1.159576 | 0.019458 | 59.59486 | 9.3E-109 | 1.121139 | 1.198012 | 1.121139157 | 1.198011912 |
| UrbPop | 0.000864 | 0.000254 | 3.404613 | 0.000844 | 0.000363 | 0.001365 | 0.000362681 | 0.001365233 |
| IMR | -0.0043 | 0.000278 | -15.4897 | 2.71E-33 | -0.00485 | -0.00375 | -0.004852 | -0.003754 |

- Infant Mortality Rate showed the expected negative correlation, as every one child increase in Infant Mortality decreased the expected level of female education by 0.0043%. It proves to be statistically significant at the 1% level with a p-value less than 0.01.
- As for urban population, every 1% increase in Urban Population increased expected level of female education by 0.0009%. It is also significant at the 1 % level with a p-value less than 0.01.
- Mortality has a t value of -15.49 and Urban Population has a t-value of 3.4, both of which are higher than the 1% t-value of 2.365.
- It has an R-squared value of 0.74, indicating a strong correlation.

Model 3: log(*SchoolYear*) = -0.002(*IMR*) + 0.0027 (*LitRate*) - 0.0004(*Pov*) + 0.9289

**Table 7: Regression Analysis- Model 3**

| Regression Statistics | |
|---|---|
| Multiple R | 0.84671 |
| R Square | 0.716918 |
| Adjusted R Square | 0.707267 |
| Standard Error | 0.055322 |
| Observations | 92 |

| ANOVA | | | | | |
|---|---|---|---|---|---|
| | **df** | **SS** | **MS** | **F** | **Significance F** |
| Regression | 3 | 0.682072 | 0.227357 | 74.28786 | 4.92E-24 |
| Residual | 88 | 0.269323 | 0.00306 | | |
| Total | 91 | 0.951395 | | | |

| | **Coefficients** | **Standard Error** | **t Stat** | **P-value** | **Lower 95%** | **Upper 95%** | **Lower 95.0%** | **Upper 95.0%** |
|---|---|---|---|---|---|---|---|---|
| Intercept | 0.928919 | 0.062818 | 14.78745 | 1.39E-25 | 0.804081 | 1.053756 | 0.804081 | 1.053756 |
| IMR | -0.00197 | 0.000566 | -3.4789 | 0.000785 | -0.0031 | -0.00084 | -0.0031 | -0.00084 |
| LitRate | 0.002663 | 0.00061 | 4.361659 | 3.5E-05 | 0.001449 | 0.003876 | 0.001449 | 0.003876 |
| Pov | -0.00035 | 0.000469 | -0.75145 | 0.454389 | -0.00129 | 0.00058 | -0.00129 | 0.00058 |

- Poverty Rates and literacy rates were added to the regression model to create a more specific picture.
- For every percentage increase in infant mortality rate, expected female education levels reduce by 0.002%. Mortality rate is still significant at the 1% level with a t-value of -3.48.
- Literacy rate is also statistically significant at 1% level in this model, with p-value much less than 0.01. Interpreting the coefficient shows that every 1% increase in the literacy rate increases expected female education levels by 0.0027%.
- Poverty variable is shown to be statistically insignificant as the p-value comes out to be 0.45.
- The R squared is 0.70 i.e. 70% changes in the expected years of schooling is explained by these variables.

Model 4: log(*SchoolYears*) = 0.0569(log(*GNI*)) + 0.0003(*UrbPop*) - 0.0016(*IMR*) + 0.002log (*School Years*) = 0.0569 (log(*GNI*)) + 0.0003(*UrbPop*)

**Table 8: Regression Analysis- Model 4**

| Regression Statistics | |
|---|---|
| Multiple R | 0.881675 |
| R Square | 0.777351 |
| Adjusted R Square | 0.770051 |
| Standard Error | 0.05145 |
| Observations | 127 |

| ANOVA | | | | | |
|---|---|---|---|---|---|
| | **df** | **SS** | **MS** | **F** | **Significance F** |
| Regression | 4 | 1.127528 | 0.281882 | 106.4867 | 7.76E-39 |
| Residual | 122 | 0.322947 | 0.002647 | | |
| Total | 126 | 1.450475 | | | |

| | **Coefficients** | **Standard Error** | **t Stat** | **P-value** | **Lower 95%** | **Upper 95%** | **Lower 95.0%** | **Upper 95.0%** |
|---|---|---|---|---|---|---|---|---|
| Intercept | 0.724381 | 0.086281 | 8.395576 | 9.77E-14 | 0.553578 | 0.895183 | 0.553578 | 0.895183 |
| log(GNI) | 0.056878 | 0.021273 | 2.673746 | 0.008528 | 0.014767 | 0.09899 | 0.014767 | 0.09899 |
| UrbPop | 0.000284 | 0.000295 | 0.963081 | 0.337412 | -0.0003 | 0.000867 | -0.0003 | 0.000867 |
| IMR | -0.00165 | 0.000467 | -3.54284 | 0.000562 | -0.00258 | -0.00073 | -0.00258 | -0.00073 |
| LitRate | 0.002032 | 0.000467 | 4.350112 | 2.84E-05 | 0.001107 | 0.002957 | 0.001107 | 0.002957 |

- GNI per capita, infant mortality rate and literacy rate were statistically significant at the 1% level with p-values lesser than 0.01.
- Interpreting their coefficients, we see that every 1% increase in GNI per capita increases the expected level of female education by 0.057%, every 1 child increase in Infant Mortality decreases the expected level of female education by 0.002% and 1% increase in literacy rate increases the years of schooling by 0.002%.
- The coefficient of urban population is not statistically significant and has a p-value of 0.34.
- The R squared comes out to be 0.77. 77% of changes in the expected level of female education can be attributed to the variables in this model.

Model 5: Log(*SchoolYears*) = 0.0837(log (*GNI*)) + 0.0008(*UrbPop*) – 0.0009 (*IMR*) + 0.0021 (*LitRate*) + 0.0012 (*LifeExp*) + 0.0007 (*Pov*) + 0.4823

**Table 9: Regression Analysis- Model 5**

| Regression Statistics | |
|---|---|
| Multiple R | 0.889421 |
| R Square | 0.79107 |
| Adjusted R Square | 0.776322 |
| Standard Error | 0.048358 |
| Observations | 92 |

| ANOVA | | | | | |
|---|---|---|---|---|---|
| | **df** | **SS** | **MS** | **F** | **Significance F** |
| Regression | 6 | 0.75262 | 0.125437 | 53.63926 | 7.72E-27 |
| Residual | 85 | 0.198775 | 0.002339 | | |
| Total | 91 | 0.951395 | | | |

| | **Coefficients** | **Standard Error** | **t Stat** | **P-value** | **Lower 95%** | **Upper 95%** | **Lower 95.0%** | **Upper 95.0%** |
|---|---|---|---|---|---|---|---|---|
| Intercept | 0.482298 | 0.191768 | 2.515009 | 0.013785 | 0.101012 | 0.863585 | 0.101012 | 0.863585 |
| log(GNI) | 0.083689 | 0.028808 | 2.905038 | 0.00468 | 0.02641 | 0.140967 | 0.02641 | 0.140967 |
| UrbPop | 0.000817 | 0.000349 | 2.338529 | 0.021708 | 0.000122 | 0.001512 | 0.000122 | 0.001512 |
| IMR | -0.0009 | 0.000842 | -1.06327 | 0.290671 | -0.00257 | 0.000779 | -0.00257 | 0.000779 |
| LitRate | 0.00207 | 0.000597 | 3.464343 | 0.000835 | 0.000882 | 0.003258 | 0.000882 | 0.003258 |
| LifeExp | 0.001158 | 0.002066 | 0.560201 | 0.576816 | -0.00295 | 0.005266 | -0.00295 | 0.005266 |
| Pov | 0.000688 | 0.000467 | 1.474095 | 0.14415 | -0.00024 | 0.001616 | -0.00024 | 0.001616 |

- The final model encompasses the broadest scope of variables in order to give the greatest quantification of development.
- GNI per capita and literacy rate are significant at 1% level while urban population is significant at the 5% level with a p-value of 0.02.
- Poverty, mortality rate and life expectancy are insignificant even at 10% level with p-values of 0.14, 0.29 and 0.58 respectively.
- It is noted that 1% increase in GNI per capita increases the expected level of female education by 0.084%, every 1% increase in urban population increases the expected level of female education by 0.0008% and 1% increase in literacy rate increases the years of schooling by 0.002%.
- The model has the R squared value 0.7763.

**Table 10: Unrestricted Model for F-test**

| Regression Statistics | |
|---|---|
| Multiple R | 0.889421 |
| R Square | 0.79107 |
| Adjusted R Square | 0.776322 |
| Standard Error | 0.048358 |
| Observations | 92 |

| ANOVA | | | | | |
|---|---|---|---|---|---|
| | **df** | **SS** | **MS** | **F** | **Significance F** |
| Regression | 6 | 0.75262 | 0.125437 | 53.63926 | 7.72E-27 |
| Residual | 85 | 0.198775 | 0.002339 | | |
| Total | 91 | 0.951395 | | | |

| | **Coefficients** | **Standard Error** | **t Stat** | **P-value** | **Lower 95%** | **Upper 95%** | **Lower 95.0%** | **Upper 95.0%** |
|---|---|---|---|---|---|---|---|---|
| Intercept | 0.482298 | 0.191768 | 2.515009 | 0.013785 | 0.101012 | 0.863585 | 0.101012 | 0.863585 |
| log(GNI) | 0.083689 | 0.028808 | 2.905038 | 0.00468 | 0.02641 | 0.140967 | 0.02641 | 0.140967 |
| UrbPop | 0.000817 | 0.000349 | 2.338529 | 0.021708 | 0.000122 | 0.001512 | 0.000122 | 0.001512 |
| IMR | -0.0009 | 0.000842 | -1.06327 | 0.290671 | -0.00257 | 0.000779 | -0.00257 | 0.000779 |
| LitRate | 0.00207 | 0.000597 | 3.464343 | 0.000835 | 0.000882 | 0.003258 | 0.000882 | 0.003258 |
| LifeExp | 0.001158 | 0.002066 | 0.560201 | 0.576816 | -0.00295 | 0.005266 | -0.00295 | 0.005266 |
| Pov | 0.000688 | 0.000467 | 1.474095 | 0.14415 | -0.00024 | 0.001616 | -0.00024 | 0.001616 |

Model 5 showed that poverty, infant mortality rate and life expectancy are statistically insignificant in analyzing the expected years of education. Therefore, an F-test was performed to test the joint significance of these variables. Model 5 is the unrestricted model while the restricted model is given as:

Log(*SchoolYears*) = 0.0905 (log(*GNI*)) + 0.0002 (*UrbPop*) + 0.003 (*LitRate*) + 0.4725

**Table 11: Restricted Model for F-test**

| Regression Statistics | |
|---|---|
| Multiple R | 0.868587 |
| R Square | 0.754444 |
| Adjusted R Square | 0.748455 |
| Standard Error | 0.053812 |
| Observations | 127 |

| ANOVA | | | | | |
|---|---|---|---|---|---|
| | **df** | **SS** | **MS** | **F** | **Significance F** |
| Regression | 3 | 1.094302 | 0.364767 | 125.9678 | 2.42E-37 |
| Residual | 123 | 0.356173 | 0.002896 | | |
| Total | 126 | 1.450475 | | | |

| | **Coefficients** | **Standard Error** | **t Stat** | **P-value** | **Lower 95%** | **Upper 95%** | **Lower 95.0%** | **Upper 95.0%** |
|---|---|---|---|---|---|---|---|---|
| Intercept | 0.472547 | 0.05115 | 9.239839 | 9.3E-16 | 0.371298 | 0.573795 | 0.371298 | 0.573795 |
| log(GNI) | 0.090495 | 0.019914 | 4.545444 | 1.3E-05 | 0.051077 | 0.129912 | 0.051077 | 0.129912 |
| UrbPop | 0.000209 | 0.000307 | 0.679985 | 0.497792 | -0.0004 | 0.000817 | -0.0004 | 0.000817 |
| LitRate | 0.003002 | 0.000396 | 7.577583 | 7.26E-12 | 0.002218 | 0.003786 | 0.002218 | 0.003786 |

The F-test value comes out to be 12.521, while the critical value for the 5% significance level is 2.712. This confirms that these two variables are jointly significant in our regression model.

### 8.1 Dummy variable regression

**Table 12: Dummy Variable Analysis**

| Regression Statistics | |
|---|---|
| Multiple R | 0.889485 |
| R Square | 0.791184 |
| Adjusted R Square | 0.773783 |
| Standard Error | 0.048632 |
| Observations | 92 |

| ANOVA | | | | | |
|---|---|---|---|---|---|
| | **df** | **SS** | **MS** | **F** | **Significance F** |
| Regression | 7 | 0.752728 | 0.107533 | 45.46688 | 5.8E-26 |
| Residual | 84 | 0.198666 | 0.002365 | | |
| Total | 91 | 0.951395 | | | |

| | **Coefficients** | **Standard Error** | **t Stat** | **P-value** | **Lower 95%** | **Upper 95%** | **Lower 95.0%** | **Upper 95.0%** |
|---|---|---|---|---|---|---|---|---|
| Intercept | 0.49767 | 0.205816 | 2.418031 | 0.017767 | 0.088382 | 0.906959 | 0.088382 | 0.906959 |
| log(GNI) | 0.07967 | 0.034532 | 2.307112 | 0.02351 | 0.010999 | 0.148342 | 0.010999 | 0.148342 |
| UrbPop | 0.000804 | 0.000357 | 2.254018 | 0.026798 | 9.47E-05 | 0.001514 | 9.47E-05 | 0.001514 |
| IMR | -0.00088 | 0.00085 | -1.03844 | 0.302043 | -0.00257 | 0.000807 | -0.00257 | 0.000807 |
| LitRate | 0.00209 | 0.000608 | 3.435489 | 0.000922 | 0.00088 | 0.0033 | 0.00088 | 0.0033 |
| Pov | 0.000656 | 0.000492 | 1.335 | 0.185483 | -0.00032 | 0.001634 | -0.00032 | 0.001634 |
| LifeExp | 0.00113 | 0.002082 | 0.542524 | 0.588894 | -0.00301 | 0.00527 | -0.00301 | 0.00527 |
| Developed? | 0.003908 | 0.018274 | 0.213833 | 0.831195 | -0.03243 | 0.040248 | -0.03243 | 0.040248 |

- A further test was conducted on this model by using a dummy variable to split the countries into two categories: Developed and Developing.
- This split was done using the UN's classification that a developed nation is one that has a GNI per Capita greater than or equal to $12,615.
- After running the regression with the dummy variable, its coefficient of 0.0039 indicated that developed nations had a slightly higher expected years of schooling for females than their developing counterparts, however, the variable was shown to be quite insignificant as it had a p value of 0.83.
- This is likely due to the fact that the GNI per capita is used to simplify development variable and is already included in the model. UN's definition of development is solely dependent upon income and no other factors.

## 9.0 Conclusion

In conclusion, the hypothesis of female years of schooling and GNI per capita being positively correlated is true. It is positively correlated with the mean schooling years in all the models with a statistical significance at 1% level. Each of these models have a high R squared value indicating a moderate/strong correlation between both the variables. The explanatory variables literacy rate and infant mortality also have a statistically significant effect on the female level of education and are considered to be the variables with the strongest effect on female education levels along with GNI per capita. The coefficient for literacy rate comes out to be positive indicating that level of education increases with increasing literacy rates. Poverty and life expectancy are not statistically significant even at the 10% level.

Better implementation of policy actions, infrastructure development and management in developing countries will assist women in pursuing education for longer periods of time, thus enabling them and creating a better workforce. As more women enter the workforce and help develop a nation's economy, more girls get access to proper education making them ready for better job opportunities, the resulting effect being a cyclical one. Awareness must be spread on the issues of female feticide and infant deaths.

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