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The Puzzle of Economic Development

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I. Introduction

The present study aims to find if there is a relationship between the Human Development Index (HDI) indicators like Life Expectancy, Education, etc. on the Gross National Income (GNI) per capita of countries. The study further explores whether the development levels of a nation are determined by its geography or not. The HDI is published by the United Nations Development Programme (UNDP).

Indicators of growth and development

According to the traditional economic theory, there is a difference between the growth and development of nations. Usually, growth is determined by indicators such as the Gross Domestic Product (GDP) and the Gross National Product. But development is a multi-dimensional concept that depends on indicators such as health, education, income inequality, life expectancy at birth, etc. In this respect, the concept of HDI was introduced. It is determined by Life Expectancy at birth, Expected years of schooling, mean years of schooling, and GNI per capita.

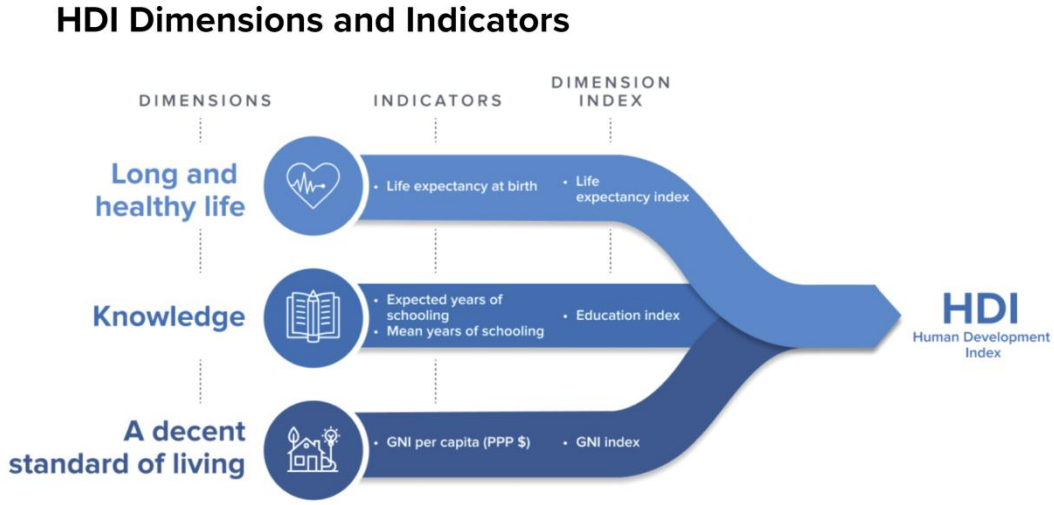

Figure 1

Source: https://hdr.undp.org/data-center/human-development-index#/indicies/HDI

A major breakthrough in economics came around 1960 that recognized the fact that not only the income of a country but other factors are also important for the well-being of individuals.

II. Literature review

There are widespread pieces of literature that highlight that there is a relationship between health indicators like Life Expectancy and education of individuals (indicators of HDI) and the National Income of a country.

Khodabakhshi (2011) aims to analyze the trends in HDI over 30 years, from 1980 to 2010. Specifically, we explore the relationship between Gross Domestic Product (GDP) and three key human resource indicators in India. The research model considers GDP or income as the dependent variable and longevity, health, and education as independent variables, utilizing the latest (2010) formula outlined by the United Nations. The study seeks to assess the interplay and mutual effects of these indicators on the Indian economy. He finds a significant trend that the Life Expectancy Index demonstrates a more

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pronounced impact on per capita GDP growth. Additionally, the education indicator portrays a superior growth pattern compared to the other indices. It is essential to highlight that the overall growth of the Human Development Index (HDI) has been predominantly shaped by the influences of per capita gross domestic production and the evolution of the education index. Conversely, the changes in life expectancy have had a relatively minor impact on the overall growth trend.

Keskin and Ulas (2017) computed and ranked the mean Human Development Index (HDI) scores for the years 2010–2014, and made a comparison between the rankings of economic performances and HDI scores. The analysis revealed a notable correlation between HDI and economic performance, as evidenced by Spearman's rank correlation coefficient of 0.804. Moreover, eight countries emerged in the top 10 rankings for both HDI and economic performance. Subsequent studies will analyse additional countries and different indicators to provide a more comprehensive understanding of these relationships.

Ngangue and Manfred (2015) in their study aim to explore the influence of life expectancy on the growth of Gross National Income (GNI) per capita in Developing Countries (DC). Utilizing a dynamic panel encompassing 141 DC from 2000 to 2013, the findings indicate a positive impact of enhanced life expectancy on economic growth in DC. However, the outcomes exhibit variability when categorizing DCs based on their income levels. Specifically, the observed effect is found to be statistically insignificant in middle-income DC.

Chatterjee and Mishra (2020) put forward that the role of geography in development is evident through the uneven distribution of resources, economic activities, literacy, and health conditions. They addressed the prevalence of underdevelopment by examining a set of causative factors with spatial connections that interact in a highly intricate manner, involving not only each other but also various elements associated with society, culture, politics, and the environment. These interactions contribute to shaping the complex pattern of development. When analyzing a district, province, or an entire country, the interplay of these factors results in varying degrees of development (or underdevelopment) across different points within that specific spatial domain.

Krugman (1999) in his article examines the interplay between centripetal forces (such as forward and backward linkages in production and increasing returns in transportation) and centrifugal forces (such as factor immobility and land rents) and how they can lead to a self-organizing process where symmetric locations assume distinct economic roles. The discussion encompasses geographic models that explain the global division into industrial and developing countries, the emergence of regional inequality within developing countries, and the rise of large urban centers. The article also addresses briefly policy considerations, highlighting the challenges in drawing policy conclusions from economic geography models.

Research Questions

The study mainly deals with the following research questions:

What is the functional form of the relation between GNI per capita and Life expectancy at birth?

Is there a relation between indicators of health and education and the GNI per capita of different nations?

Is the HDI impacted by the geographical location of a nation?

Data

The study utilizes the data set of Human Development Index data accessed from the United Nations Development Programme (UNDP) (https://hdr.undp.org/data-center/human-development-index#/indicies/HDI). The dataset provides information for HDI score, HDI rank, Life Expectancy at birth, Expected years of schooling, Mean years of schooling, Gross national income (GNI) per capita for all countries for the year 2021. For all the data analysis Python is used.

Data Analysis

Research question 1: What is the functional form of the relation between GNI per capita and Life expectancy at birth?

To find answers to this question a visual inspection of the graph is done. In Figure 2, a scatter plot of GNI per capita versus Life expectancy at birth is plotted and a curve is fitted.

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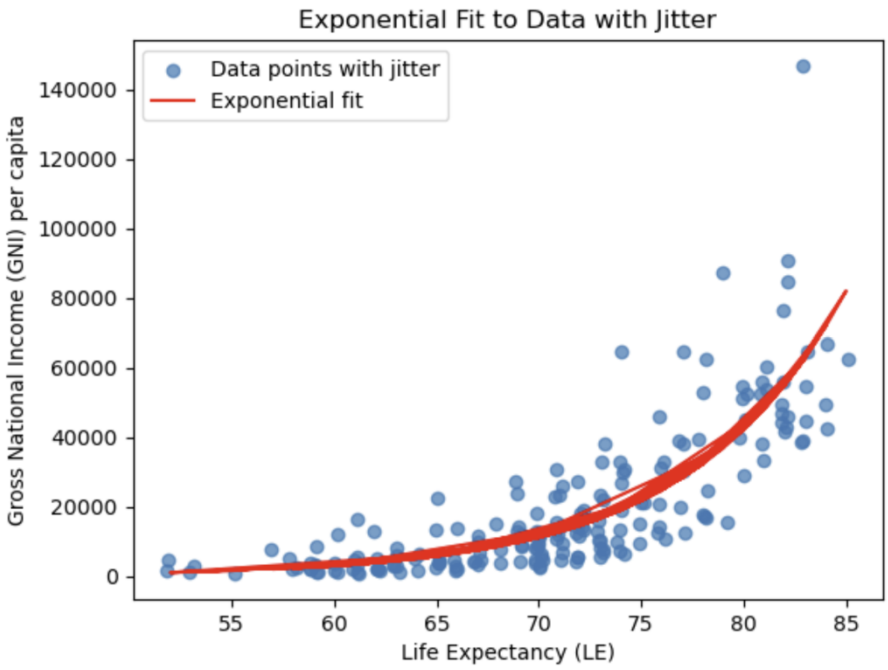

Figure 2: Scatter plot of GNI

As it is clear from the figure that the relationship between GNI per capita and Life Expectancy at birth is clearly exponential. Hence, from this study, I conclude that the functional form of the relationship could be something like:

$$GNI\ per\ capita = c + e^{Life\ Expectancy}$$

Research question 2: Is there a relation between indicators of health and education and the GNI per capita of different nations?

For exploring this question, first a joint scatter plot of all the relevant variables is explored.

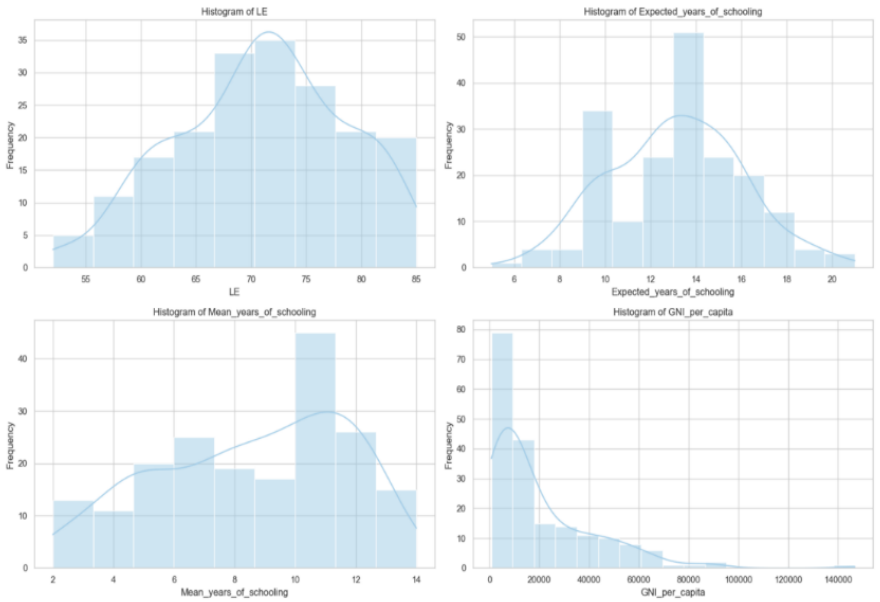

Figure 3

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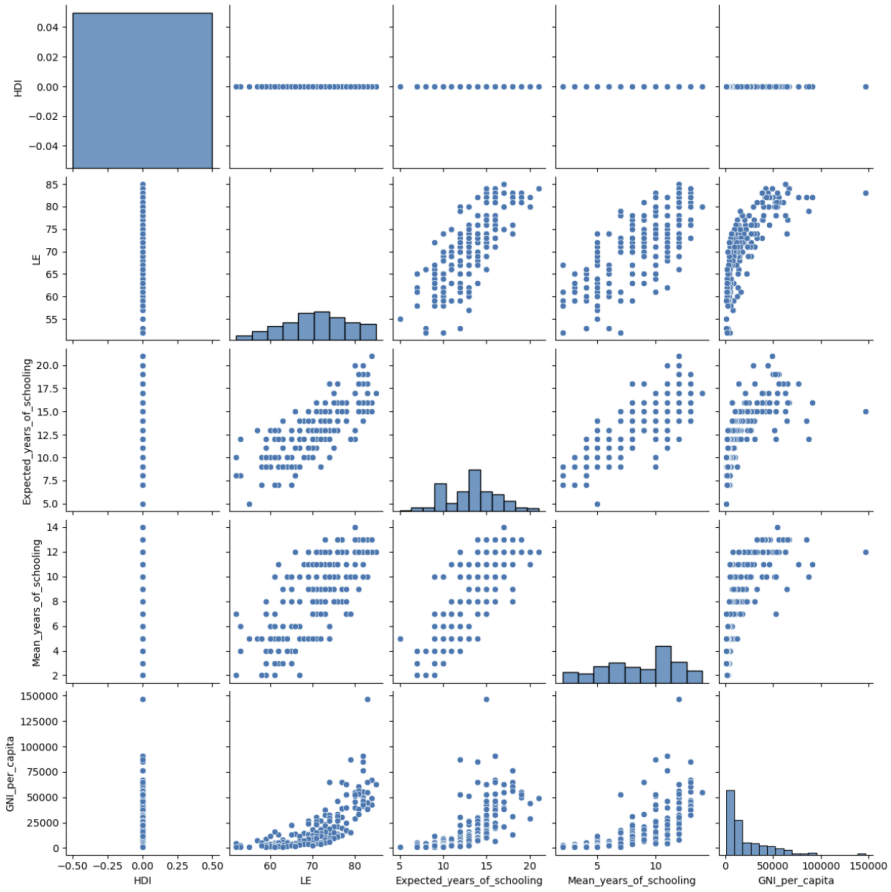

Figure 4

As can be observed from Figure 3, there is an overall positive relationship or a positive correlation between GNI per capita and Life expectancy at birth, Expected years of schooling, and Mean years of schooling. Then a multiple linear regression is done with GNI per capita as the dependent variable and Life Expectancy and Mean years of schooling.

Table 1 presents the results.

OLS Regression Results

Dep. Variable:	GNI_per_capita	R-squared:	0.569
Model:	OLS	Adj. R-squared:	0.564
Method:	Least Squares	F-statistic:	124.1
Date:	Wed, 13 Dec 2023	Prob (F-statistic):	4.33e-35
Time:	13:48:44	Log-Likelihood:	-2098.4
No. Observations:	191	AIC:	4203.
Df Residuals:	188	BIC:	4213.
Df Model:	2		
Covariance Type:	nonrobust		

	coef	std err	t	P>|t|	[0.025	0.975]
const	-1.069e+05	1.16e+04	-9.248	0.000	-1.3e+05	-8.41e+04
LE	1588.1299	200.457	7.923	0.000	1192.696	1983.564
Mean_years_of_schooling	1719.0068	488.347	3.520	0.001	755.663	2682.350

Omnibus:	136.040	Durbin-Watson:	1.195
Prob(Omnibus):	0.000	Jarque-Bera (JB):	1593.709
Skew:	2.546	Prob(JB):	0.00
Kurtosis:	16.203	Cond. No.	797.

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.

Table 1

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Null Hypothesis: There is no relationship between GNI per capita and indicators of health and education Alternative Hypothesis: There is a relation between GNI per capita and indicators of health and education The R-squared value is 0.569, indicating that approximately 56.9% of the variance in GNI per capita is explained by Life Expectancy at birth and Mean years of schooling. Here, the F-statistic is 124.1, and the associated p-value is very close to zero (Prob (F-statistic) < 0.05). This suggests that the overall model is statistically significant. On average, for each year increase in Life Expectancy at birth the GNI per capita is expected to increase by 1588.13 dollars, holding other variables constant. Also, on average, for each additional year of mean schooling, the GNI per capita is expected to increase by 1719.01 dollars, holding other variables constant. The p-values associated with both coefficients are very low ($P>|t| < 0.05$), indicating that both Life Expectancy and Mean years of schooling are statistically significant predictors of GNI per capita.

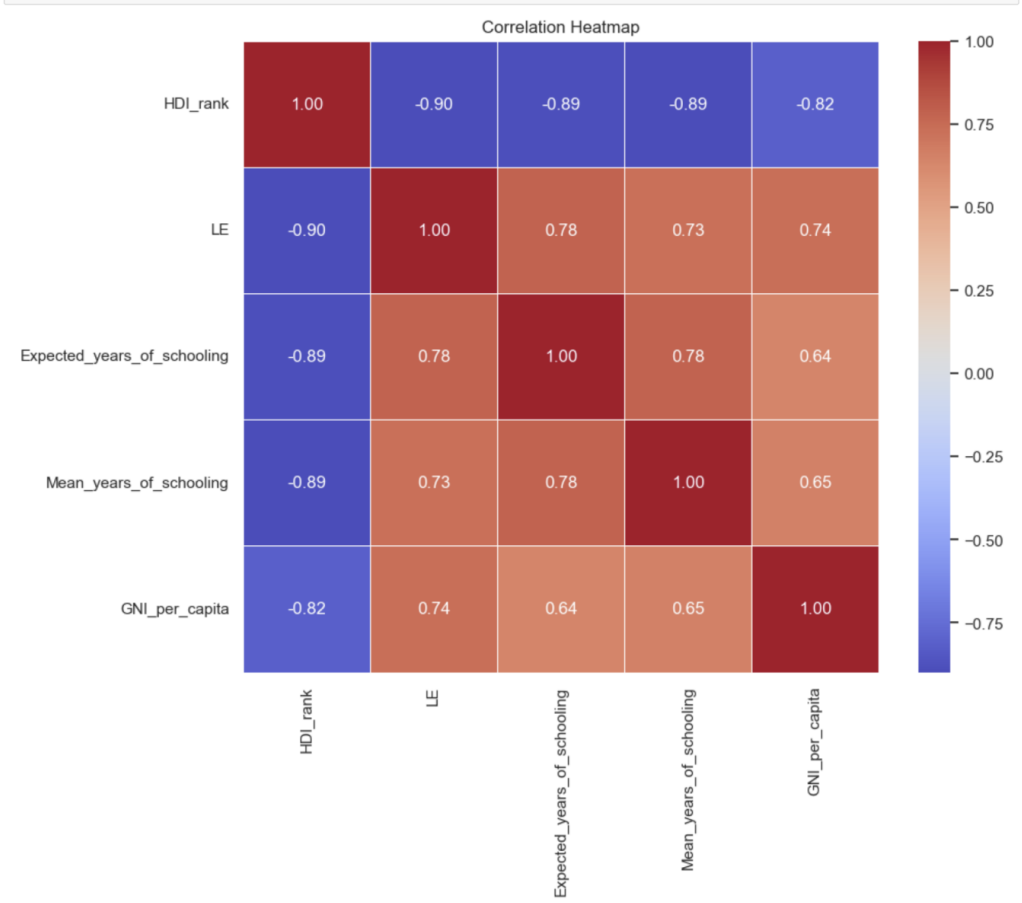

Figure 5

With a correlation coefficient of -0.79, a robust negative correlation is observed between HDI rank and GNI per capita. As the Human Development Index (HDI) rank decreases (indicating lower human development), GNI per capita tends to increase. The correlation coefficient is 0.79, signifying a strong positive correlation between Life Expectancy (LE) and GNI per capita. Higher life expectancy is linked with higher GNI per capita. A substantial positive correlation of 0.77 is found between the expected years of schooling and GNI per capita. Higher expected years of schooling correspond to higher GNI per capita. The correlation coefficient is 0.73, indicating a positive correlation between the mean years of schooling and GNI per capita. Higher mean years of schooling are associated with higher GNI per capita.

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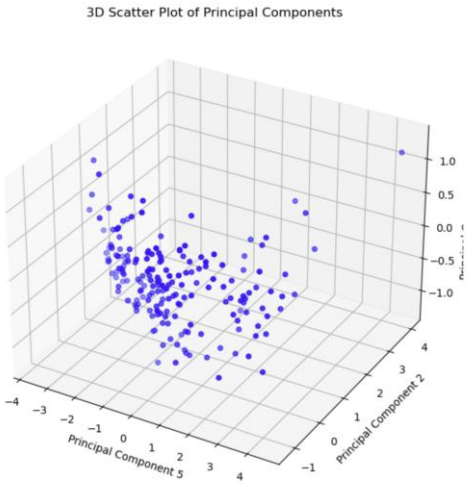

Figure 6

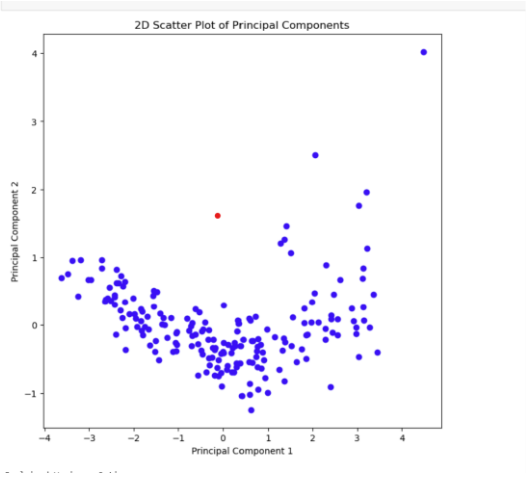

Figure 7

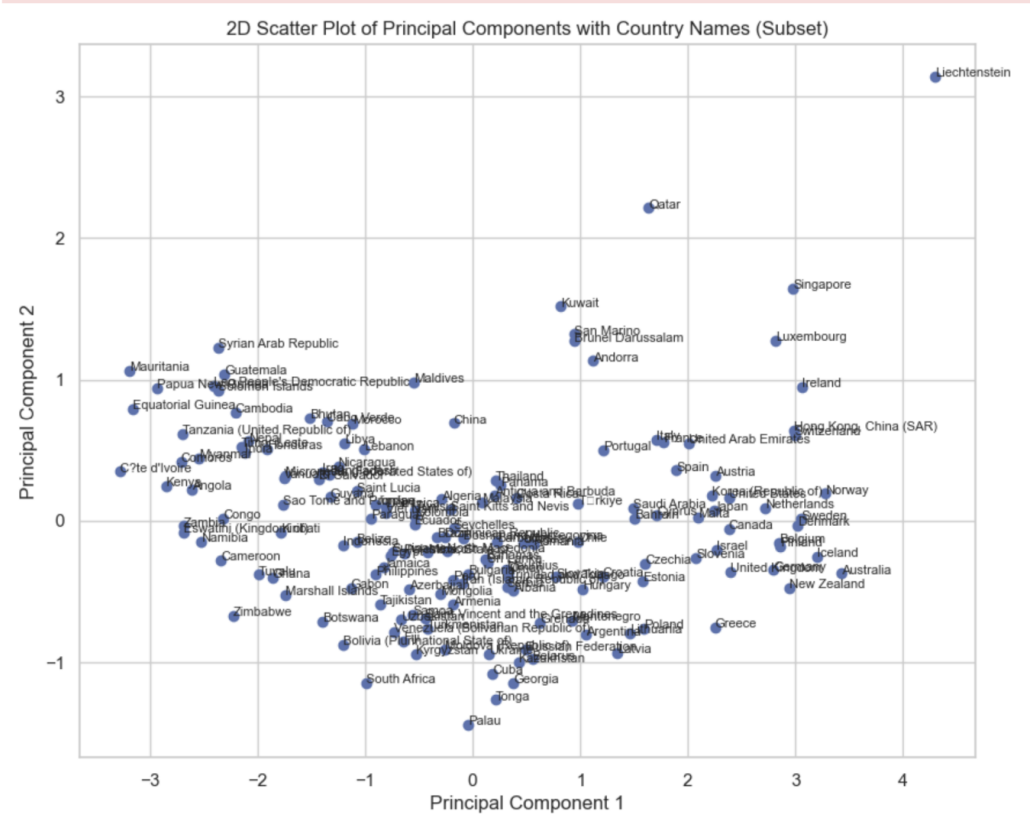

Figure 8

PC1 accounts for about 79.08% of the variability in the original data. PC2 contributes an extra 9.92% to the overall explained variance. Collectively, PC1 and PC2 elucidate roughly 89.00% of the total variance in the original dataset. In this case, it seems that all features contribute positively, with the largest contribution coming from Mean years of schooling, followed by Expected years of schooling. In PC2, the contributions are smaller overall. GNI per capita has a notable positive contribution, while Life Expectancy at birth and Expected years of schooling have negative contributions.

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Does geography affect development?

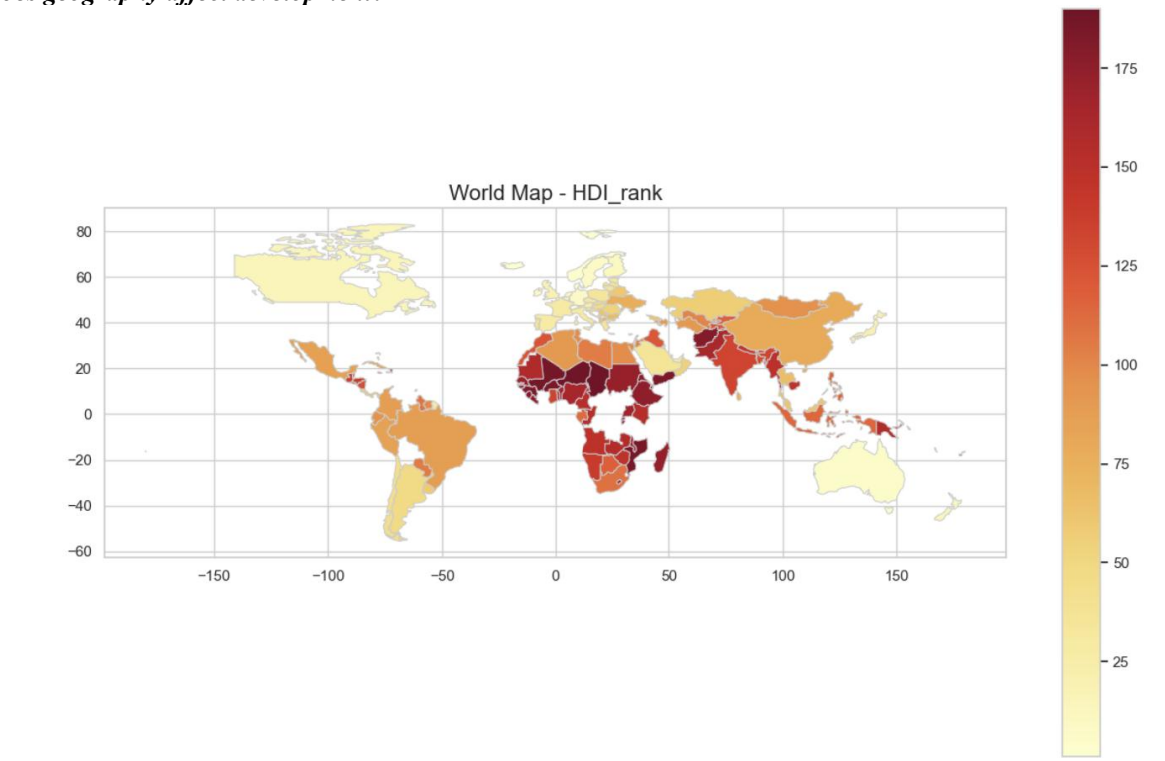

Figure 9

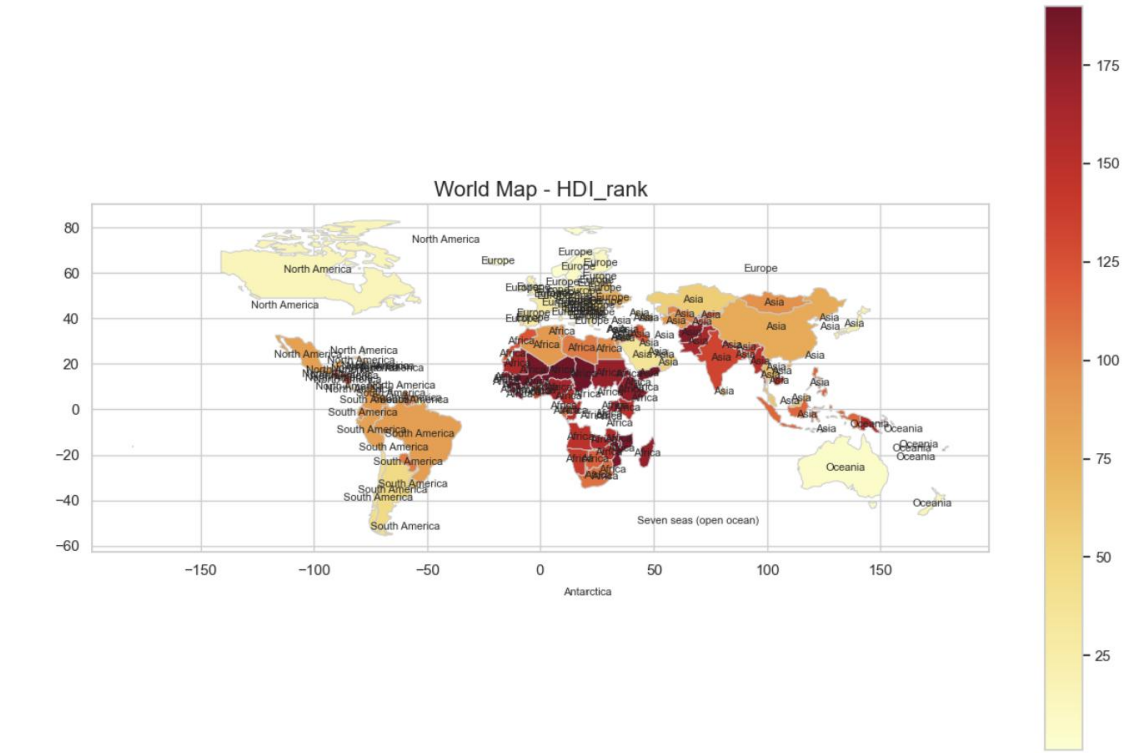

Figure 10

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From the figure, it is noted that countries mostly in Asia and Africa rank a bit lower than countries in Europe, America, or Australia. Countries with lower economic development denoted by a higher HDI Rank are mostly located in the African continent and a few in Central Asia. It is observed that countries in Oceania, North America, and Europe score mostly high on economic development. Hence, there seems to be strong evidence to support the hypothesis that economic development is indeed influenced by the geography of nations.

III. Conclusion

This study aimed to investigate the relationship between Human Development Index (HDI) indicators and Gross National Income (GNI) per capita, as well as explore the potential impact of a nation's geography on its development levels. A multiple linear regression model was applied, revealing that Life Expectancy and Mean Years of Schooling are significant predictors of GNI per Capita. A visual inspection and curve fitting suggested an exponential relationship between GNI per Capita and Life Expectancy at birth. The evidence from the study indicates a strong connection between a nation's economic development and its geographical location.

References

[1]. Khodabakhshi, A. (2011). Relationship between GDP and human development indices in India. In Society of Interdisciplinary Business Research (SIBR) 2011 Conference on Interdisciplinary Business Research.
[2]. Krugman, P. (1999). The role of geography in development. International regional science review, 22(2), 142-161.
[3]. Mishra, M., Chatterjee, S., Mishra, M., & Chatterjee, S. (2020). On Contouring Human Development (pp. 31-64). Springer Singapore.
[4]. Ngangue, N., & Manfred, K. (2015). The impact of life expectancy on economic growth in developing countries. Asian Economic and Financial Review, 5(4), 653.
[5]. United Nations Development Programme (UNDP). (2021). Human Development Index data center. Data retrieved in 2024 from https://hdr.undp.org/data-center/human-development-index#/indicies/HDI.
[6]. Ulas, E., & Keskin, B. (2017). Is there a relation between HDI and economic performances?. In New Trends in Finance and Accounting: Proceedings of the 17th Annual Conference on Finance and Accounting (pp. 61-70). Springer International Publishing.