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## **Part 1: Overview and data description**

### *1. A literature reviews*

In their study, Ahamd and Arshad (2007) conducted an analysis of human development in Pakistan. They utilised micro-level household data obtained from both rural and urban sections of the country. The researchers employed a quadratic spline specification to estimate Engel equations for a total of 22 commodity groups. This study discovered that there were several intriguing shifting trends in the classification of commodities into requirements and pleasures, as observed across different income ranges. The findings indicate that the implementation of a uniform tax structure may have varying implications on budget allocation and household welfare across different income classes. The Engel curve, which elucidates the connection between overall expenditure and the allocation of expenditure towards the acquisition of a particular consumer commodity, has been regarded as the initial foundation for examining household budgets. Upon doing the study, the findings indicated that across both rural and urban families, the elasticity for total expenditure of all 22 commodity categories had positive values for all income brackets. However, it was observed that the middle-income class regarded wheat as an inferior consumable. Urban households prioritize wheat, health, and housing as essential needs, whereas rural households prioritize not only clothing and footwear, but also view wheat, housing, and tobacco as indispensable demands. Furthermore, in the case of commodities that possess elevated health benefits such as healthcare, dairy products, sugar, edible oils, meats, poultry, and fish. Urban households typically exhibit a stronger predilection.

In the study conducted by Purohit (2008), an examination was undertaken to analyze the correlation between human development and income. Through a comparative analysis of various levels of states, the researcher discovered that in wealthier states, the development of impoverished

districts had been overlooked. Additionally, the researcher identified variations in the sensitivity of human development across the selected states. The results of the two-way regression analysis indicate that the implementation of a more appropriate development strategy has the potential to increase the income of a state. There were differences in both duration and parameter between states with high levels of wealth and those with low levels of wealth. By implementing enduring strategies at the district level over an extended duration, it is possible to mitigate inequality through the use of social and economic infrastructure policies.

Castells-Quintana et al. (2019) further expand upon the aforementioned study by examining the impacts of foreign direct investment (FDI). This study center's on the examination of ASEAN nations in terms of bilateral flow, economic convergence, and social convergence of six home countries. Among these countries, three are classified as medium HDI, while the remaining three are categorized as high-HDI source countries. The Generalised Method of Moments (GMM) is utilised in this study, utilizing data from the period spanning 2013 to 2017. The findings indicate that there is a negative relationship between the GDP of home countries and the convergence of HDI. This suggests that when the GDP of home countries decreases, the disparities in their HDI relative to source countries tend to widen. The economic progress of the investing nation, along with its investment principles, the level of economic convergence, and the outflow of FDI from the home country to other nations, do not have a significant impact on the home country's HDI. Therefore, the elements associated with foreign direct investment (FDI) that contribute to the HDI of countries with lower HDI levels include the total FDI inflows from source countries to all countries, as well as the proportion of FDI from source countries specifically directed towards the home country compared to all nations.

## 2. Data description

The following table presents a summary of the essential descriptive statistics pertaining to the dataset.

*Table 1: Descriptive statistics of the given dataset*

	hdi	pop	growth	fdi	gini	gee
Mean	0.625	60,121,710.824	5.179	3,376,321,424.543	0.480	-0.421
Median	0.646	8,539,741.000	5.298	404,025,395.196	0.474	-0.460
Std. Dev	0.098	201,251,503.759	4.086	12,559,648,056.903	0.090	0.563
Variance	0.010	4.05E+16	16.697	1.58E+20	0.008	0.317
Kurtosis	-0.944	31.252	5.123	58.587	-0.152	-0.011
Skewness	-0.501	5.544	-1.079	7.354	0.447	0.074
Range	0.389	1.30E+09	26.698	104117482727 1/5	0.422	2.723
Minimum	0.411	55,258.000	-13.129	-8,788,860.127	0.321	-1.630
Maximum	0.800	1.30E+09	13.569	1.04E+11	0.743	1.093
Count	74	74	74	74	74	74

The given dataset contains 74 middle income countries. HDI, the main concern of the report, has an average of 0.625, indicating a medium level of development. The distribution appears to be normal with a skewness of -0.501, while the standard deviation is 0.098, suggesting a small disperse among observations.

### Part 2: Initial estimation

To estimate the regression, the following equations are formed:

$$\text{Model 1: } HDI_i = \alpha + \beta_1 * gee_i + \varepsilon_i$$

$$\text{Model 2: } HDI_i = \alpha + \beta_1 * gee_i + \beta_2 * gini_i + \beta_3 * growth_i + \beta_4 * fdi_i + \varepsilon_i$$

Intuitively speaking, economic growth and FDI both have impacts on human development, although it might be indirect. The only dimensional economic measure in calculating HDI is GNI, which is the output of both economic growth and FDI. Hence, the above relationship is normally

perceived as positive, as being pointed in empirical evidence of and Banerjee and Newman (1993), Belloumi et al. (2015), and Coelho et al. (2019).

By contrast, the influence of government effectiveness on HDI is more blur (Danish and Baloch 2019). The concept of effective governance can be characterized by the government's ability to develop and execute well-founded policies, as well as the social and economic dynamics that occur between the populace and the state (Danish et a. 2018). Governments that are effective are more inclined to formulate and implement robust and efficient policies that contribute positively to the advancement of human development. Frequently, greater allocations towards human development expenditures can be attributed to countries' efforts in addressing the growing need for human resources (Davis and Quinlivan 2006). The impact of democratic political institutions on human development is largely acknowledged to be favorable. According to Chen's (2008) study, it was observed that democratic governments allocate a greater proportion of their resources towards education, resulting in higher rates of gross school enrolment compared to non-democratic governments.

According to Vollmer and Zielger (2009), the impact of democracy on human development is substantial, irrespective of the level of GDP. The manner in which policies are formulated and implemented is contingent upon the calibre and efficacy of political administrations. The enhancement of human development is expected to exhibit greater efficiency when coupled with the presence of functional political institutions (Summak et al. 2010). A significant positive correlation was discovered between government efficacy and human development. For instance, it has been seen that nations characterized by more accountability, political stability, and governmental efficacy exhibit reduced rates of infant mortality and elevated levels of literacy

(Latif et al. 2018, Khan et al. 2019). Additionally, it was discovered that enhancements in government performance yield significant benefits in relation to human development.

Scholars have paid limited attention to the impact of income disparity on the Human Development Index (HDI). In their study, Castells-Quintana et al. (2019) conducted an analysis to assess the relationship between income inequality and the Human Development Index (HDI) as well as its individual components. This analysis was performed using a panel dataset consisting of 117 nations, covering the time period from 1970 to 2010. Upon conducting analysis, they have discovered compelling data that supports a negative long-term correlation between inequality and human development. Furthermore, it was also noted that there exist several short-term correlations between inequality and distinct aspects of human development. One study highlights the favorable impact of economic development (Jayanthakumaran 2012), while another study reveals the negative influence on educational outcomes, suggesting specific mechanisms of transmission (Coelho2015). Furthermore, it has been seen that these correlations exhibit a greater degree of prominence in nations characterized by limited levels of economic and social progress.

Drawing from the above literature review, government effectiveness, GDP growth, and FDI are expected to have positive influence on HDI; whereas the coefficient of Gini is expected to be negative. The following table presents the regression outputs:

*Table 2: Regression outputs of model 1 and model 2*

VARIABLES	Model (1)	Model (2)
gee	0.067*** (0.019)	0.079*** (0.018)
gini		-0.438*** (0.117)
growth		-0.001 (0.003)
fdi		1.377e-13

	Model (1)	Model (2)
<b>VARIABLES</b>		(8.063e-13)
Constant	0.654*** (0.132)	0.871 *** (0.063)
p-value	0.000	0.000
R-squared	0.149	0.302
Adjusted-R square	0.137	0.263

### Part 3: Interpretation

1.

Model 1:

$$HDI_i = 0.654 + 0.067 * gee_i + \varepsilon_i$$

The coefficient of determination, known as R-squared, is a metric used to assess the goodness of fit for linear regression models. This statistical metric assesses the fraction of the variability in the outcome variable that can be explained by the collective influence of the predictor factors. Model 1, which includes Government effectiveness (GEE) as the sole explanatory variable, demonstrates the ability to account for up to 14.9% (0.149) of the observed variation in the sample's HDI.

$$HDI_i = 0.871 + 0.079 * gee_i - 0.438 * gini_i - 0.01 * growth_i + (1.377e - 13) * fdi_i + \varepsilon_i$$

By introducing three more variables, model 2 successfully accounted for 30.2% (R<sup>2</sup>=0.302) of the variance in the Human Development Index (HDI) among the nations included in the dataset. In contrast to the initial mode, this represents a substantial enhancement, as a larger R<sup>2</sup> value corresponds to a greater degree of precision in prediction. The observed rise in the model can be attributed to the additional explanatory capabilities that three newly introduced variables provide.



In numerous instances, the incorporation of a random independent variable failed to provide any meaningful contribution towards elucidating the observed variability in the target variable. Thus, the provision of such a proposal may be misleading, as it implies that this variable possesses predictive utility for the outcome. Nevertheless, the decline in the Adjusted R-squared value indicates that the recently incorporated variable inadequately captures the fundamental pattern in the dependent variable. The utilization of Adjusted R-squared is evidently more advantageous in regression models that encompass many variables. This methodology would facilitate the execution of a comparative examination of models that exhibit differing quantities of independent variables.

2. Hypothesis stating:

Ho: The four variables exhibit no discernible predictive power on the Human Development Index (HDI) ( $\beta_i = 0$ )

Ha: Model 2 with four variables exhibit discernible predictive power on the Human Development Index ( $\beta_i \neq 0$ )

Observing from ANOVA table, model 2 yields a F-statistic of 7.507 on 4 and 69 DF, which is translated into a p-value of  $0.000 < 0.05$ . Hence, the null hypothesis has been rejected. Based on the available sample data, it can be inferred that model 2 demonstrates a superior fit to the data compared to the intercept-only model.

3.

Government effectiveness and Gini coefficient were found to have significant influence on HDI of countries in the dataset.

- **Hypothesis testing for Government effectiveness (gee)**

Ho: Government Effectiveness has no impacts HDI of countries in the dataset ( $\beta_1 = 0$ )

Ha: Government Effectiveness has significant influence on HDI ( $\beta_1 \neq 0$ )

Given that the p-value is less than the significance level of 0.05 ( $p < 0.05$ ), we can conclude that the null hypothesis is rejected. This indicates that Government effectiveness does indeed have a statistically significant impact on HDI. Specifically, when the coefficient is 0.079, a one-unit improvement in government effectiveness is associated with a corresponding increase of 0.079 in HDI.

- **Hypothesis testing for Gini coefficient (gee)**

Ho: Gini coefficient has no impacts HDI of countries in the dataset ( $\beta_2 = 0$ )

Ha: Gini coefficient has significant influence on HDI ( $\beta_2 \neq 0$ )

Given that the p-value is less than the predetermined significance level of 0.05 ( $p < 0.05$ ), the null hypothesis is rejected. Therefore, it can be inferred that the Gini coefficient does indeed have a statistically significant impact on the Human Development Index (HDI). Specifically, when the Gini coefficient increases by one unit, it will decline by 0.438units, as indicated by the coefficient of -0.438.

4.

The positive coefficients of Government Effectiveness, Gini coefficient, and FDI correlate well with the author's expectation and previous empirical literature. By contrast, growth variable, however, exhibits a negative coefficient, implying a negative influence. In addition, no evidence was found supporting a statically significant relationship between economic growth and HDI. The

same applies for FDI, both variables have p-value of far larger than the significant level (0.872 and 0.864 respectively).

5.

Theoretically speaking, model 2 would be more preferable owing to superior R-squared compared to that of model 1 (0.302 and 0.149 respectively). This affirms a stronger explanatory power of model 2. However, to adopt this model for further prediction, this model must satisfy several assumptions of the OLS method.

*Table 3: OLS assumptions test*

Test of multi-collinearity: VIF				
gee	gini	growth	fdi	
	1.081	1.143	1.167	1.062
Test of Homoscedasticity				
Chisquare		2.154		
df		1		
p-value		0.142		

Additionally, the following figure presents the Q-Q plot of the residuals, which is close to the normal distribution. Thus, model 2 satisfies all required assumptions of OLS.

## Part 4: Further estimation

The following table displays the regression outputs of three additional models:

*Table 4: The regression outputs of additional estimation models*

<b>VARIABLES</b>	Model (3)	Model (4)	Model (5)
gee ( $\beta_1$ )	0.049** (0.019)	0.067** (0.022)	0.054*** (0.015)
gini ( $\beta_2$ )	-0.445*** (0.107)	-0.420*** (0.107)	-0.360*** (0.091)
growth ( $\beta_3$ )	-0.001 (0.002)	-0.001 (0.002)	0.001 (0.002)

	Model (3)	Model (4)	Model (5)
<b>VARIABLES</b>			
fdi ( $\beta_4$ )			-4.991e-13 (6.350e-13)
highfdi ( $\beta_5$ )	0.077*** (0.022)	0.063*** (0.023)	
gee*highfdi ( $\beta_6$ )		-0.056 (0.038)	
Incomegroup3 ( $\beta_7$ )			-0.110*** (0.016)
Constant	0.837*** (0.059)	0.838*** (0.059)	0.866*** (0.049)
p-value	0.000	0.000	0.000
R-squared	0.412	0.429	0.583
Adjusted-R square	0.378	0.387	0.553

1. Hypothesis stating for the dummy variable of FDI

H0: There is no discernible disparity in HDI between economies characterized by low levels of FDI and those characterized by high levels of FDI ( $\beta_5 = 0$ )

Ha: There is no discernible disparity in HDI between economies characterized by low levels of FDI and those characterized by high levels of FDI ( $\beta_5 \neq 0$ )

Given that the p-value is less than the predetermined significance level of 0.05 ( $p < 0.05$ ), it is appropriate to reject the null hypothesis. This implies that there exists a statistically significant disparity in the Human Development Index (HDI) between nations with low and high FDI. Specifically, when the coefficient is 0.077, economies classed as highfdi have a HDI that is 0.077 units higher than that of lowfdi countries.

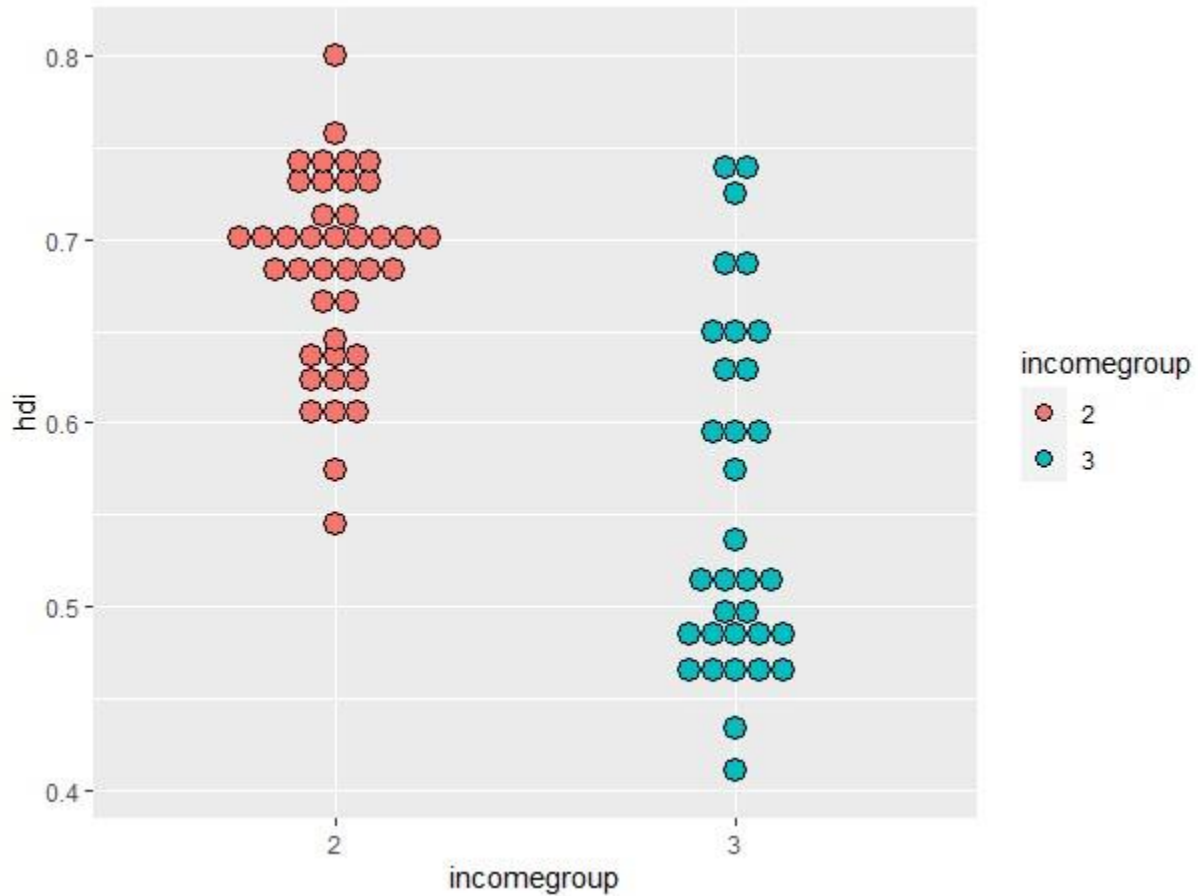
2. Hypothesis stating for the interaction between highFDI and gee

H0: There is no influence of highfdi variable on the effects between government effectiveness and HDI ( $\beta_6 = 0$ )

Ha: : There is indeed significant influence of highfdi variable on the effects between government effectiveness and HDI ( $\beta_6 \neq 0$ )

According to this model, the anticipated effect of a further rise in the government effectiveness index on HDI varies between nations with high foreign direct investment (FDI) and those without. The p-value exceeds the predetermined significance level of 0.05, leading to the retention of the null hypothesis. The impact of government effectiveness on the Human Development Index (HDI) remains consistent regardless of whether the country in question is categorized as high or low in terms of FDI

3. Since income level is one of the HDI's three pillars, it is imperative to consider the effects of different income levels on HDI. The following figure depicts HDI of two income classes in the dataset.



Apparently, HDI of income group 2 locates above HDI of income group 3, implying a possible difference between two groups. Acknowledging this effect, model 5 redoes the model 1 and adds the fifth variables of income group:

*Model 5: HDI<sub>i</sub>*

$$= 0.866 + 0.054 * gee_i - 0.360 * gini_i + 0.001 * growth_i + (-4.991e - 13) * fdi_i - 0.110 * incomegroup3 + \varepsilon_i$$

Income group is a categorical variable. Compared to other models, model five yields the highest R-squared, indicating this model has superior predictive power and therefore receiving strongest recommendations from the author. With R-squared of 0.583, model 5 is able to explain nearly 60% of variations in HDI value.

- With a coefficient of 0.054, an unit increase in government effectiveness would improve the HDI by 0.054
- With a coefficient of -0.360, an unit increase in inequality would deteriorate HDI by 0.360 unit
- Economic growth and FDI are found to have no significant effects on HDI
- Given  $p\text{-value}=0.00 < 0.05$ , a lower-middle income economy (incomegroup3) has a HDI of .110 lower than that of an upper middle-income economy.

## **Part 5: Conclusion**

This report aims to reexamine determinants of HDI. Drawing from a cross-study analysis on a sample contains of 74 middle-income countries, the author found significant impacts of government effectiveness and inequality on HDI. This finding is perfectly aligned with empirical research of Adenle et al. (2015) and Castells-Quintana et al. (2019). However, the report found no evidence of economic growth or FDI as determinants of HDI. Despite this, there is indeed a difference in HDI between countries receiving more foreign capital. A similar pattern emerges when the author investigates impacts of income group on HDI. In particular, there is strong evidence of difference between lower and upper middle-income groups. A considerable difference in HDI between two sub-classes, which are belong to the same group of income, indicates a possibility of even a higher gap in HDI among income groups, for instance, between middle and high-income group. Looking at the future, since the government effectiveness and Gini coefficient are two key determinants of HDI, governments in these countries must focus on improving GEE (as it provides positive impacts) and lowering inequality (negatively affects HDI).

One potential approach to address the aforementioned problem is to expedite the use of E-government as a transformative tool. E-government, also known as electronic government, refers to the application of digital technologies, such as the internet and mobile devices, in order to deliver government services and distribute information to the broader populace (Davies et al. 2006). The main goal of e-government is to improve the scope of governmental services provided to individuals in a manner that is efficient and cost-effective, while also promoting ideals of transparency, accessibility, and accountability. One of the key advantages attributed to the adoption of e-government is its potential to improve the efficiency of the conventional paper-based system (Li and Shang 2023). The potential benefits of e-government deployment include the optimization of administrative operations, reduction in reliance on physical paperwork, and the realization of cost and time reductions. This can be achieved through the digitalization of government services and information. The use of e-government has the capacity to augment government transparency by enabling public accessibility to information pertaining to government activities and the execution of policies (Nookhao and Kiattisin 2023). This phenomenon facilitates the development of a more knowledgeable and engaged population, hence fostering increased accountability and improved decision-making processes.



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