The Impact of Human Development on Economic Growth: Emphasizing Bangladesh

Submitted by:
Jocelyn Veronica Biswas
ID # 121 173 006
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United International University

Supervised by:
Wahida Yasmeen, Ph.D.
Head & Associate Professor,
Department of Economics
United International University

Abstract:

Development is the key to surviving any new change in our way, be it biological or economical. Bangladesh, as a developing country has also been focusing on the human development policies to face the challenges of a growing economy. The aim of this research paper is to empirically test the significance and direction of the impact of human development measured with Human Development Index (HDI) on economic growth, measured with Gross Domestic Product (GDP) – in Bangladesh. 30 years (1990-2019) of time series data for the country, has been used to achieve the objective empirically. Using secondary data from World Bank, Macrotrends, and Country Economy, we have used the ordinary least squares (OLS) model for the test. Based on the research of Harrod (1939), we were anticipating a positive and significant impact of HDI on GDP. We tried to answer the question, how much and how significantly HDI is affecting the growth of GDP in Bangladesh. The rationale behind conducting this study is to contribute to making better policies directed toward economic growth and human development, so that it can eventually improve human welfare in Bangladesh. This research found a positive and significant effect of HDI on GDP. Though it is limited to only OLS regression models without further tests, this study can be further used by carrying out unit root tests to get better results.

Keywords: Bangladesh, Human Development Index (HDI), Gross Domestic Product (GDP), Time Series, OLS Regression, Economic Growth.

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1. Introduction:

Expansion of human freedom has been identified as the primary means to development by Amartya Sen, Nobel laureate in economics, in 1998. As of the twenty first century, attention toward improving human development policies have increased with a goal to enhance economic growth.

The aim of this research is to find the direction – positive or negative, the magnitude, and significance of the impact of Human Development Index (HDI) on Gross Domestic Product (GDP). Where, HDI is the aggregated measure for the human development and GDP is the aggregated measure showing economic growth. The question it intends to find an answer to is "What is the direction, magnitude and significance of the impact of HDI on GDP in Bangladesh?" The paper focuses on 30 years' secondary data (from 1990-2019) of the country observed, to empirically test the effect of HDI on GDP using Ordinary Least Squares (OLS) model.

The rationale behind conducting this research is to be able to explore considerable and substantial relationship of HDI to GDP, so that the information can contribute in making better policies that are directed towards human development. This can be achieved by creating policies created tailored to the exact issues of human development that can be improved. For instance, educational opportunities can be improved, which will increase the skills of the people and open up their job prospects, which can increase the chance of a higher employment and increased income; hence affecting GDP – as higher income leads to higher consumption, investment, and production. Thus, the study hopes to contribute to economic growth driven by an improvement in human development policies, eventually resulting in an overall greater welfare in Bangladesh.

Human development is the process of expanding the capabilities, opportunities, and wellbeing leading to increased freedom for the people in a country. It is different from the traditional approach in that it asks about the condition of the people making up the economy, rather than asking about the economy. It affects the people almost directly in the sense that it constitutes of human health, life expectancy, level of education, and income of the people. That is one reason human development is important. The importance of expanding capabilities, first pointed out by Amartya Sen (Todaro & Smith, 2015), means greater abilities for the people to do what they want to do and afford to take decisions financially and intellectually without any physical external constraints. Freedom from societal and political constraints are also a part of human development. Thus, focusing on enhancing human capital by increasing educational and job opportunities, and improving wellbeing by ensuring the affordability of any necessities and health benefits, human development plays a crucial role in affecting the condition of the people of a country. This is measured using the HDI created by Dr. Mahbub Haq in 1990, comprising health, education, and income of the people in a country. It was mainly constructed to measure the wellbeing of the people, with value ranging from 0, showing lowest development, to 1, showing highest human development.

Economic growth is the process that comprises increasing income and production of a nation. It is

measured using the GDP which focuses on number of goods and services produced in a nation. An increase in economic growth indicate an increase in income that leads to more investment, more creation of new firms, as a result an increase in employment, an increase in national consumption, thus higher tax revenues, leading to greater expenditure on public services and environment preservation policies; also, decreased national debt. However, economic growth needs to be balanced with other factors, otherwise an increase in income can increase expenditure on imports to a level that increases national debt, increases inequality due to uneven distribution of wealth and opportunities, and a rise in inflation that can lead to a recession. Thus, policies and conditions should be monitored in a way that it balances all the factors contributing to the welfare of the economy of the nation.

The effects of HDI on GDP has been found in many developing and developed nations, including Germany, Japan, United Kingdom and United States among the developed nations, and Nigeria, Pakistan, and Afghanistan among developing nations. Most nations showed a positive relationship between the two variables, except a few, such as China.

The Human Development Indicators that are used as measures are life expectancy, education, and purchasing power parity. Bangladesh, as a developing country is trying to incorporate changes to their policies to improve on these indicators. With a 72 years of average life expectancy as of 2018, 74.68% of literacy rate in 2019 – which is 0.77% higher than the previous year, and a per capita income of $5,139, Bangladesh stands 133rd among 189 countries in the HDI rank. UNDP also introduced 3 other indicators: Inequality-adjusted HDI, Gender Inequality Index, and Multidimensional Poverty Index.

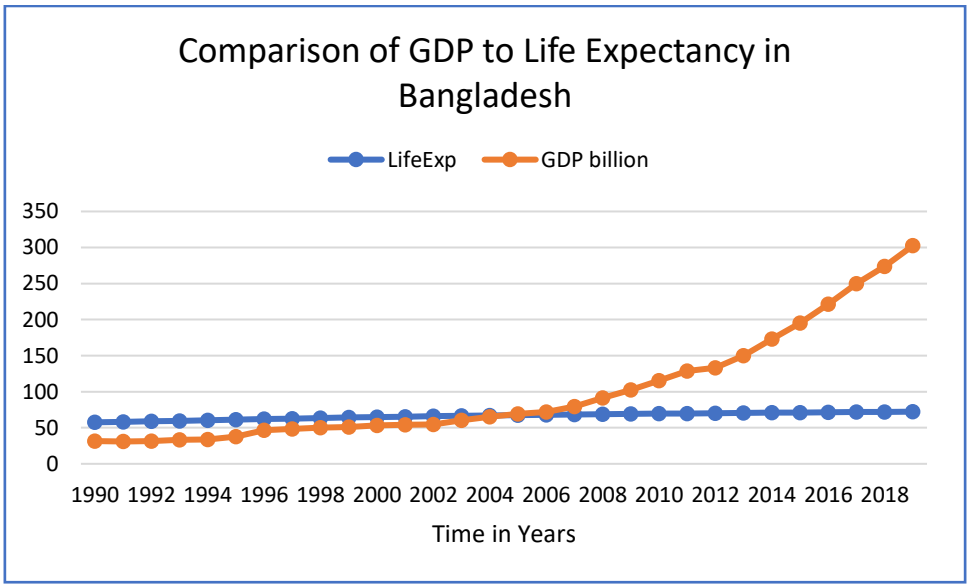

Figure 1: The chart shows a comparison between the changes in Gross Domestic Product (GDP) and Life Expectancy over the years 1990 to 2019, in Bangladesh.

The chart above, in Figure 1, shows the annual growth of GDP, measured in billion dollars, and the annual growth of life expectancy in Bangladesh. Plotting the two line-graphs together, makes it easier to compare the growth path of each of the elements at the same time. It can be observed that, from 1990 to 2004, GDP was slightly below the level of life expectancy, while both the variables were constantly increasing. After 2006, GDP kept increasing at a much higher rate, while life expectancy increased at a constant rate, and reached 72 years in 2018, while GDP increased from well below $50 billion to above $300 billion.

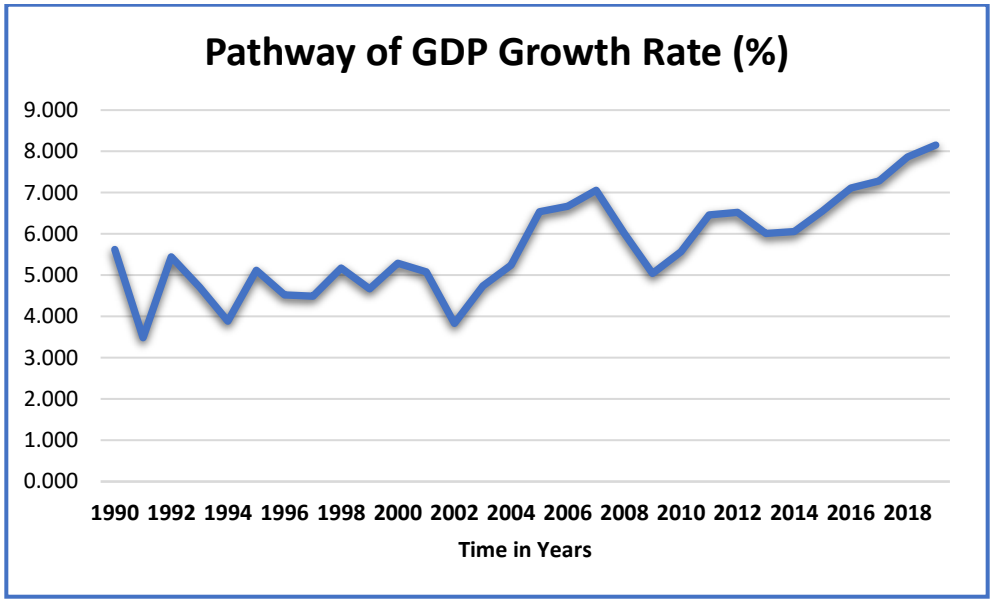

Figure 2: Graph showing the growth rate pathway of Gross Domestic Product (GDP) in percentage, from 1990 to 2019 in Bangladesh.

Above, in Figure 2, the line graph shows the annual growth rate of the GDP – measured in percentages, from the year 1990 through 2019, in Bangladesh. It can be observed from the chart that the rate of GDP growth followed a zigzag path, increasing and decreasing every year, from 1996 till 2000. After that the rate followed a slightly less fluctuating growth rate, and followed toward a more increasing pattern.

To compare the effect of the HDI on GDP growth rate, a graph is used below in Figure 3, showing the growth pathway of HDI in Bangladesh from the year 1990 to 2019. The chart shows a constantly increasing pathway indicating the growth of HDI. Comparing their growth pattern, it can be observed that after HDI crossed 0.5 in 2004, GDP growth rate also had a higher increasing pathway. While HDI kept increasing constantly, GDP growth rate also increased, but at a higher pace than before, with less fluctuations than earlier.

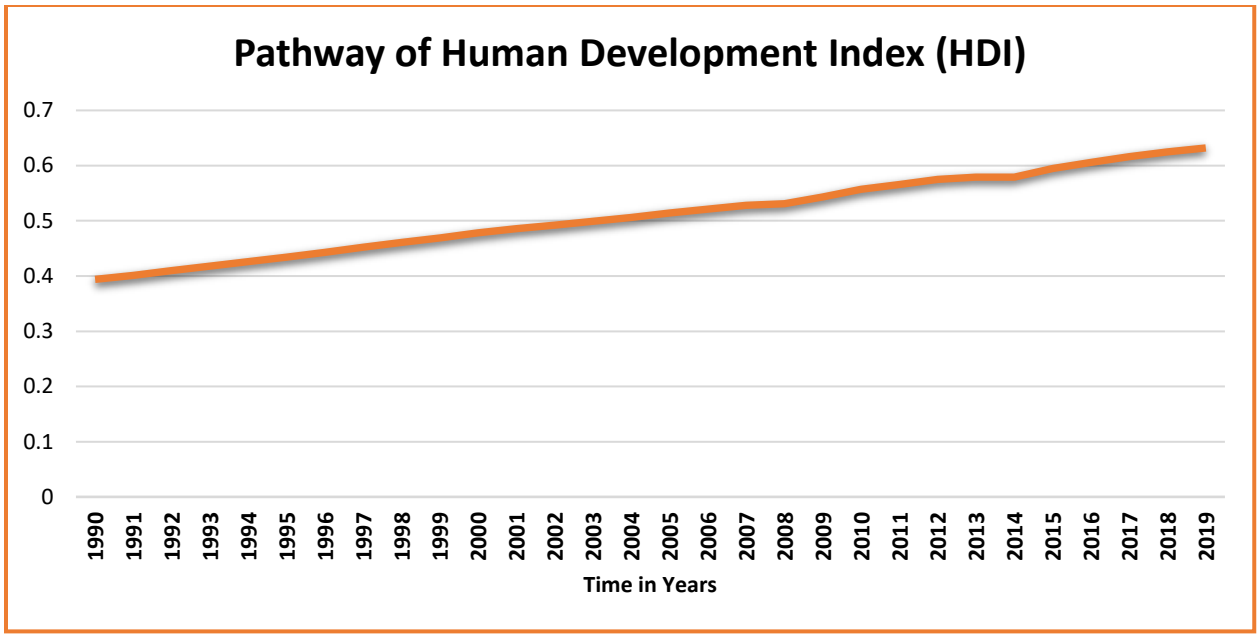

Figure 3:Graph showing the growth pathway of the Human Development Index (HDI) in Bangladesh, from 1990 to 2019.

In this study, descriptions and analysis are mainly quantitative, occasionally regarding to the theoretical background when necessary – to support the empirical methodology and to explain the results. With the help of data collected from World Bank and Macrotrends, online, the study runs tests using the OLS models to find out the impact of HDI on GDP.

The results showed that human development does positively affect economic growth. The research conveyed significant results on this relation between HDI and GDP. However, there were limitations that if controlled for might give a more accurate outcome for the study with the same dataset. Thus, this research can facilitate further research on this topic, and contribute to the research on the country, Bangladesh.

This paper discusses all these in detail, starting with the literature review, in Section 2, which explores and presents findings of previous research on this topic, and a theoretical framework for this study. Section 3 elaborates the methodology used to conduct the research, including a description for the data used, and the variables and models put to test. Section 4 presents the results, analysis of the results, and identifies limitations of the study. Finally, in Section 5, it ends with a summarizing conclusion.

2. Literature Review:

With the rapid industrialization of both developed and developing nations, there have been substantial improvements in technological innovations. This is leading focus to the human side of the development that has been theoretically proven to have a positive impact on the economic growth of countries. For this reason, empirical research has been done to understand the relationship, significance, and impact of HDI on GDP.

Countries such as UK, the US, China, and Pakistan have been found to be increasingly focusing on improving HDI to sustain their economic growth. Free public health services and increase in the number of educational institutions in the UK has led to an increase in the HDI by 0.169. This increased the growth rate from -2.0% to above 2.0%, in 2014. Programs in the US, such as higher number of scholarships for education, higher number of jobs, and better health care programs led to the increase of HDI from 0.826 to 0.915, with economic growth rate from -0.2% to 2.4%, in the same year. Pakistan faced a higher growth rate with a higher HDI, though the country faced more fluctuations due to other factors, including the role of the government and the unstable political situations. Mainly, all the three countries showed a positive relation between HDI and GDP. On the other hand, China sustained its growth rate well above 6.5% since 1980, while its HDI growth rate decreased and increased again. Only in this case, there seemed to be no relation between HDI and GDP. Although other countries such as Kuwait, Jamaica, Nepal, and Liberia, all showed a positive correlation between GDP and HDI; China's situation showed that no relationship exists between the two variables. Thus, evidence shows that a positive relationship does exist between HDI and GDP, though sometimes some countries, like China, implies no relation between them.

Most recently, in the paper of Rahman, Muhammad, and Ryan (2020), they empirically examined the direction, magnitude, and significance of the impact of human development on economic growth using panel data of 50 countries. Among them they used 25 developing and 25 developed countries. The research was conducted to encourage more expenditure on improving human productivity so that it can improve human capability and opportunity. Using HDI as an aggregated measure of human development, they found HDI positively and significantly impacts GDP growth. Using the fixed effects model, they found at 1% significance level, one unit of growth in HDI would increase economic growth by 25.85% for the developing countries, and by 44.77% for developed countries. In another model, they used life expectancy and gross enrollment ratio as the disaggregated measure for human development, which individually led to a significantly negative relation to GDP growth. They further pointed out that due to possible gaps in current policies, especially in the developing nations, expenditure in health and education are lower. They summed up the paper with recommendations from UNDP to increase the expenditure level by 5% for education, and by 20% for health.

In another study, Appiah, Amoasi, and Frowne (2019) conducted research on African nations, with data from years 1990-2015, to find significance and relationship between HDI and GDP. Controlling for inflation, capital, investment, and labor, they tested the effect of HDI on GDP.

Using the fixed and random effects estimations, they found a positive and significant impact of HDI on GDP. They concluded with the finding that investing in developing human capacities is important.

The importance of HDI for economic growth is evident as researches are being done to improve HDI. As UNDP (2019) reported the impact of inequalities in human development in Bangladesh in the Human Development Report 2019. The research was conducted to show the importance of inequalities on human development. They found that overall loss will be higher and HDI will be lower in the economy if inequality is greater. On Bangladesh, they found that it is performing better than two thirds of the countries, in controlling inequality. Policies are suggested to be directed towards reducing inequality, which can help people reach their full potential, improve social cohesion, and increase HDI which is necessary for the 2030 Agenda of Sustainable Development. Thus, it suggests the importance of a higher HDI for economic growth.

Correlation between GDP and HDI have been further analyzed in a research study (Hudakova, 2018), to show that both GDP and HDI are important for developing an economy. They found strong relations between HDI and GDP shown by correlation coefficients, with only regional differences in some cases. This study concluded with the analysis that improvement in HDI is essential to improve economic welfare.

Another research (Ulas & Keskin, 2015) compared economic performance to HDI among 20 countries, to understand the role of HDI on economic development. The study found a positive correlation between the two variables. They demonstrated a report on the economic performance of the sample countries, where the country, Germany, with the 5th highest HDI showed the best economic performance.

Teker and Guner (2015) also examined the relationship between GDP, HDI and other developmental indices. This was done to examine how much HDI can measure human welfare, as GDP cannot completely show the welfare of a country. Thus, using cross-sectional data of 14 years (2000-2013) from 12 developing and developed countries, the connection between HDI and GDP is analyzed from the descriptive statistics. While developing countries showed higher fluctuations in the relationship, developed countries showed a steadier trend. All countries, except Saudi Arabia, showed a positive relation between HDI and GDP. The study suggested that HDI can be used to measure economic growth.

A study by Grubaugh (2015) tested whether other growth models affected GDP and HDI the same way, since both GDP and HDI are said to be a good measure of economic growth. Using panel data from developed countries, HDI and GDP were kept as dependent variables, whereas population, population growth, investment, life expectancy, trade openness and other variables were used as other growth models. The findings showed similar effects of growth models on GDP and HDI, however, in the case of population growth, it is negatively related to GDP, whereas it is positively related to HDI. The study might show different results if conducted on developing

nations. Overall, the paper suggested HDI to be a good measure for development.

Relationship between GDP and HDI have been studied by Khodabakshi (2011), in a qualitative study, by observing trends of each variables, including adult literacy and life expectancy data of India within 30 years period. No correlation was suggested, but only the trends were observed and compared. This study only implied a connection between GDP and HDI that further studies could confirm through appropriate tests.

A two-way relationship between GDP and HDI has been studied by Ranis (2004), to analyze the linkage and describe how the variables affect each other. The paper also focused on the contribution of women's income towards factors affecting HDI. It was found that women are more likely to spend on food, education, health, and other factors that can improve HDI. Though the two-way linkage was positive, still other factors such as the number of private entrepreneurs, human capital, quality of public policy makers, and the effectiveness of investment decisions also affect the relationship between GDP and HDI. Thus, it is suggested that targeting and delivery of expenditure should be improved, so that all the other factors that hinder or facilitate the magnitude of effect of GDP on HDI and vice versa, can be controlled for.

Similarly, in another paper Ranis, Stewart, and Ramirez (2000) conducted a study to discover the connection between economic growth and human development, to help make better policies directed toward human and economic development. Using a cross-country regression of 35-77 developing nations, they found a two-way relation between GDP and HDI. They used lags to reduce any simultaneity bias that could occur from using OLS and found a strongly positive and significant relation of GDP to HDI and HDI to GDP. They pointed out that, even though HDI significantly affects GDP, growth in HDI might not necessarily lead to an improvement in GDP, and vice versa if other factors such as investment and health expenditures, are not at the level required to generate growth in either of them. Thus, they recommended that policies should be evolutionary – that is, they should make required changes to policies with time as the economy changes. This means, when and where needed, countries should identify those areas and build policies targeting those areas. They also emphasized again, that expenditure on HDI is necessary from the beginning to contribute to a lasting economic growth.

Therefore, most studies – that is, 9 out of 10 research suggests a significantly positive relationship of HDI to GDP. Other countries, as in the case of China, are very few that shows no existence of any relationship between the two variables. This study is designed to explore and explain those relationships between HDI and GDP empirically. It does not explain the other independent variables that are used as control variables, for it assumes a ceteris paribus condition for the research methods.

2.1 Theoretical Framework

According to the research that are reviewed, it shows that the model constructed and tested by Harrod (1939), holds in most cases. The theory has come to be proposed after a series of theories tested and proven significant, including:

- The classical growth model by Smith (1776) that showed the effect of foreign trade, capital accumulation, and labor force on economic growth, to be positive.
- The Harrod-Domar model of economic growth that presented the impact of savings, productivity, and capital-output ratio on economic growth, having a positive relationship.
- The Solow-Swan model that suggested the positive impact of larger number of labor force and physical capital on economic growth.
- The modern theory of endogenous growth that emphasizes on the development of human capital, increase in innovation, and greater investment in research and development (R&D), that is essential to ensure a sustainable economic growth.

Eventually, the development of the HDI has prompted the establishment of the connection of HDI to GDP. The index consists of three components (i) health, measured with life expectancy; (ii) education, measured with literacy rate and school enrollment; and (iii) standard of living, measured as per capita income. Each affecting economic growth, for instance improved health conditions can increase productivity and thus spur innovation and production, leading to economic growth. In a similar way, an increase in education can lead to greater technological innovations that will increase productivity and thus economic growth. Also, increased per capita income will naturally increase consumption, investment, and thus production, eventually contributing to the growth of GDP, or economic development.

Thus, based on the previous studies discussed earlier, we have developed a model, similar to the ones used in the paper of Rahman et al (2020). The model follows the OLS regression pattern:

$$y_t = \beta_0 + \beta_1 x_{1t} + \beta_2 x_{2t} + \beta_3 x_{3t} + \cdots + \epsilon_t$$

Here, y is the dependent variable, which is GDP in this topic of research. The subscript term 't' stands for time-period, in here it represents year. While β_0 shows the intercept, β_1, β_2 and are the coefficients of the independent variables denoted by $x_1, x_2,$ and likewise x_n. The error term is denoted by ϵ_{it} – to show the variations in GDP that cannot be explained by the independent variables used in the models employed in this study.

3. Methodology:

3.1. Datasets:

This empirical study has been conducted using secondary quantitative time series data which were downloaded online. Depending on the availability and ease of access, these data were collected from secondary sources. The World Bank Open Data, Macrotrends and Country Economy had free downloadable data which made it easier to acquire the required set of data for this study. All data were for Bangladesh since the study specifically emphasizes on the impact of HDI on GDP in this country. The data for Gross Domestic Product (GDP), GDP growth rate, foreign direct investment (FDI), FDI as a percentage of GDP, gross fixed capital formation, gross fixed capital formation as a percentage of GDP, and inflation as measured by consumer price index (CPI) annual growth have been collected from the World Bank Open data. For trade balance and trade as a percentage of GDP, data have been collected from Macrotrends. Only the data for Human Development Index (HDI) has been collected from Country Economy. Data was collected from World Bank because it uploads the most up to date and accurate data among all the other data sources. Macrotrends is also a leading data site with 100+ inflation adjusted data, since 2010. Data from Country Economy is also reliable; however, it might not be the most suitable source of data for conducting research that might affect investments practically. Thus, 30 years of data – from 1990 to 2019 – were used for this study.

3.2. Data Description:

A total of 6 variables were used to conduct this research. GDP was held as the dependent variable since the main aim of the study is to identify the changes in GDP due to a change in HDI. Likewise, the principal independent variable of interest is the HDI. FDI, trade balance, GFCF, and inflation were the other independent or control variables.

The reason for using these variables is all of them help explain the development of the economy through their own ways. GDP is employed as the dependent variable as it is normally used as the main measuring unit for assessing the development of the economy of a country. It is the measure of the value for the finished goods and services of a nation within a period, thus called the Gross Domestic Product. Since it represents the overall health of an economy, it seemed to be the best variable to see the effect on of other variables that has an impact on the economy.

HDI is used as the main independent variable because recently, after its creation in 1990, it has been used as the principal measure for human development and activities. This index accounts for the three factors of human performance, namely condition of health, level of education, and the amount of income per capita. Since having unfavorable health conditions prevents people from being able to work, it reduces productivity and thus makes a negative impact on the economy. Also, the more a population is less educated, the more unable they will be to make better decisions

for themselves and the less skill they are likely to have. This makes the population less productive and less efficient again. Moreover, the income level of an economy shows their purchasing power – low income leads to low consumption and low investment, leading to fewer new firms and businesses and less profit for businesses. Therefore, a good health, better education, and an efficient level of income is necessary for an economy to stay healthy. Because of the growing importance of HDI in the economy, this study employs it to see its impact on GDP in Bangladesh.

The reason for using FDI as a control variable is that it contributes to the economy by accounting for the direct investments of foreign countries to the host country, in this case Bangladesh. It includes investment in the establishment of a new businesses or ownership of business capitals by foreign countries in the host country. This can provide to the growth of the economy by creating more job opportunities for the domestic population. FDI can also lead to greater technological advancement and increased production. This can lead to higher income, thus higher saving, and higher investments. Eventually leading to the growth of new firms and higher outputs, which are generally positive for the development of an economy.

Trade balance is used as a control variable as it affects the growth of the economy through the balance of exports and imports. It measures the difference between net exports and net imports. Through trade an economy can reach a stage of fully utilizing the otherwise underutilized resources; it can promote economies of scale and proper division of labor by enlarging the size of the markets involved in trade; it increases the inflow of capital in developing nations from developed nations; it also motivates production of the imported products by spurring demand in the importing country and helps prevent monopoly by acting as an encouragement for the domestic producers to meet foreign competition. Moreover, trade facilitates the exchange of new technology, ideas, managerial skills, and skilled employees. This can lead to further technological development – thus higher production – increase of entrepreneurship, and higher employment. Hence, trade can positively impact the economic growth depending on the direction of balance.

The reason for using GFCF is that an increase in capital can mean an increase in production. Since there will be more capital to work with for every labor, considering all the capital and labor are being utilized optimally, efficiency of production will rise – resulting in an increase in production. Also, more workers can be hired if there are more capital that need operating. As a result, GFCF affects economic growth, while it is a measure of investments of producers deducting the disposal of fixed assets, which is the increase in capital stock.

Inflation is used as a control variable because a change in the level of inflation suggests a change in several factors in the economy, including the prices, purchasing power, and consumption. Inflation is normally caused due to a higher supply of money in the economy due to printing money, buying government bonds in the secondary market and more. In this paper it uses the Consumer Price Index (CPI) to account for inflation in the economy of Bangladesh. The CPI calculates the prices of the set of goods and services a household or individual buys in a given period. Since, in inflation there is a higher supply of money, the value of the currency declines,

and the purchasing power decreases. This is because holding a higher amount of money can increase the demand for consumption at a faster rate than the supply, which will lead the producers to produce faster and in larger quantities with higher costs; this compels the sellers to raise their prices to keep their profit same by meeting the price-cost ratio as before. A higher price level also means that workers would demand higher wages to be able to afford the same lifestyle before the price level rises. Thus, inflation plays an important role in the economy.

Table 1 below shows the statistical summary of the variables employed in this research paper for the country, Bangladesh. The average, standard deviation, minimum value, and maximum value of all the 6 variables are included, with GDP being the dependent variable and HDI, FDI, GFCF, and inflation being the independent variables.

It shows that the average GDP is $101.3459 billion, with a standard deviation of 77.91372. The minimum GDP was in the year 1991, with a value of $30.957 billion and maximum of $302.571 billion in the year 2019. While GDP growth rate has a mean of 5.67%, a standard deviation of 1.18%; with a minimum value of 3.485% in 1991 and maximum value of 8.153% in 2019.

HDI has a mean of 0.5112, and a standard deviation from the mean of 0.0713067. In the year 1990, the lowest HDI value was found, with a value of 0.394; while in the year 2019, the maximum value of 0.632 occurred.

The mean value of FDI in billions of dollars is $0.8806667 billion, and the standard deviation of 0.9546941 with a minimum value of 0 in the years 1990-1992 and 1995, and a maximum value of $2.83 billion in 2015. The mean value of FDI as a percentage of GDP is 0.64%, with a standard deviation of 0.52%, a minimum value of 0 in the years 1991, and a maximum value of 1.74% in the year 2013.

Trade balance in billions of dollars has an average of -6.318667, with a standard deviation of 5.593311. The minimum value was $-23.69 billion in 2018 and the maximum value was $-1.51 in 1992. The mean of trade as a percentage of GDP was -5.86%, with a standard deviation of 1.18%, with a minimum value of -8.64% in 2018, and a maximum value of -4.15% in 2002.

GFCF has a mean of $27.71123 billion, and a standard deviation of $25.33397 billion, with a minimum value of $5.201 billion in 1990, and a maximum value of $95.523 in 2019. The mean of GFCF as a percentage of GDP is 24.56%, with a standard deviation of 4.4%. The minimum level of GFCF occurred in year 1990 with a value of 16.46%, while in 2019 – a maximum value of 31.57% occurred.

The average inflation in Bangladesh over the 30 years, measured as the CPI is 6.126467, with a standard deviation of 2.27733. The minimum value was 2.007 in the year 2001, and the maximum value was 11.395, in the year 2011.

Table 1: Summary Statistics

Variables	Average	Standard Deviation	Minimum Value	Maximum Value
Gross Domestic Product (GDP)	101.3459	77.91372	30.957	302.571
Human Development Index (HDI)	0.5112	0.713067	0.394	0.632
Foreign Direct Investment (FDI)	0.8806667	0.9546941	0	2.83
Trade Balance (TR)	-6.318667	5.593311	-23.69	-1.51
Gross Fixed Capital Formation (GFCF)	27.71123	25.33397	5.201	95.523
Inflation (INF)	6.126467	2.27733	2.007	11.395
GDP Growth Rate (%)	5.6747	1.17968	3.485	8.153
FDI (% of GDP)	0.6416667	0.5245759	0	1.74
TR (% of GDP)	-5.864667	1.176657	-8.64	-4.15
GFCF (% of GDP)	24.56087	4.402888	16.459	31.57

3.3 Empirical Analyses:

3.3.1. Models Used:

The Ordinary Least Squares (OLS) regression model has been used to test for the significance and magnitude of the impact of HDI on GDP. This test minimizes the sum of squared residuals and estimates the parameters of the variables to identify how much and in which direction each

independent variable influences the dependent variable. It is a multiple linear regression test that can easily be used for time series data. Thus, the OLS regression model has been employed for the empirical calculations.

3.3.2. Description of Models:

The models employed in this research are inscribed below:

$$GDP_t = \beta_0 + \beta_1 HDI_t + \beta_2 FDIb_t + \beta_3 TRADEofgdp_t + \beta_4 INF_t + \in_t$$

$$GDP_t = \beta_0 + \beta_1 HDI_t + \beta_2 FDIb_t + \beta_3 TRADEofgdp_t + \beta_4 INF_t + \beta_5 t_t + \in_t$$

Both the equations follow a linear time series OLS regression model for the country, Bangladesh. GDP, which is Gross Domestic Product in billion dollars, is the dependent variable, since this study seeks to find out how the other independent variables bring about a change in GDP. The HDI, Human Development Index, is the principal independent variable, as the purpose of this paper is to observe its impact on GDP. FDIb is Foreign Direct Investment in billion dollars – it is used as one of the control variables, along with TRADEofgdp, which is trade balance as a percentage of GDP, and INF, which is inflation measured as Consumer Price Index (CPI). In the second equation, another variable is added which is t, the time trend, or the time index variable.

In the first equation, an OLS regression of GDP has been run on the independent variables HDI, FDIb, TRADEofgdp, and INF. In the second equation, GDP has been regressed on HDI, FDIb, TRADEofgdp, INF and a time trend. Thus, the second equation is the detrending version of the first regression model.

The subscript "t" denotes the time of the data on the corresponding variable. While β_0 denotes the OLS intercept estimate, $\beta_1, \beta_2,$ and β_3 denotes the estimate for the slope or coefficient of the explanatory variables – saying to what extent the independent variables can affect GDP, the dependent variable. The error term is shown by $\in_t$, which accounts for the effect on GDP that cannot be explained by the included independent variables at time "t", but other probable variables not included in the model.

3.4. Empirical Estimation:

According to Griffin (2000) and the previous research mentioned above, the direction of relation is supposed to be positive between HDI and GDP. Since an increase in HDI means an increase in the capability of humans to participate in the economy more efficiently, any increase in HDI would mean an improvement to GDP.

FDI has also shown a positive influence on economic growth. According to Grossman and Helpman (1991) and Tiwari and Mutascu (2011), researched evidence suggested that due to a

growth in FDI, an increase in investments encourages the creation of employment opportunities. Thus, FDI is expected to be positively related to GDP.

Trade openness affects GDP positively or negatively depending on the balance of exports and imports, as is discussed earlier. Research conducted by Islam (1998) and Iqbal (1998) cited in Rahman et al (2020) have found significant results showing a positive impact of trade on economic growth. Trade affect the economy in ways, discussed earlier, including driving technological development and increasing ideas and capital further.

An increase in GFCF has shown evidence to encourage an increase in the economic growth. Research by Solow (1956), Swan (1956), and Ugochukwu and Chinyere (2013) have results showing that an increase in the capital stock can act positively for the economy as more labor can be hired to operate them, increasing employment and production at the same time.

Inflation is generally expected to have a negative impact on economic growth, as evidence have been found in the papers researched by Barro (1996), and Ibarra and Trupkin, et al. (2011) cited in Rahman et al (2020). An increase in inflation is supposed to negatively drive the growth of the economy, as an increase in prices and an unhealthy level of money supply can bring the value of the currency down, reducing the purchasing power of the people. Thus, this paper expects a negative effect of inflation on GDP, in Bangladesh.

4. Empirical Results:

The table below introduces the names of the variables used in this study, and descriptions for the names to show which variable each indicate.

Table 2: Variable Description

Variable Names	Variable Description
GDPb	Gross Domestic Product in billion dollars
HDI	Human Development Index
FDIb	Foreign Direct Investment in billion dollars
TRADEofgdp	Trade Balance as a percentage of GDP
INF	Inflation as Consumer Price Index (CPI)
t	Time trend

The results found in this research are summarized in the tables below:

Table 3: Results for OLS Regression – Without and With the Trend Variable

Variables	Results	Without Trend	With Trend
HDI	**Coefficient**	666.4336	5170.88
	Standard Error	(187.2167)	(1755.354)
	t statistic	3.56	2.95
FDIb	Coefficient	29.05409	40.3924
	Standard Error	(15.21119)	(14.42533)
	t statistic	1.91	2.80
TRADEofgdp	**Coefficient**	−1.635322	−0.6600732
	Standard Error	(6.275906)	(5.680936)
	t statistic	−0.26	−0.12
INF	Coefficient	−4.450838	−2.303371
	Standard Error	(2.733887)	(2.605927)
	t statistic	−1.63	−0.88
t index (trend)	**Coefficient**	-	−37.70609
	Standard Error	-	(14.62549)
	t statistic	-	−2.58
_cons (intercept)	Coefficient	−247.2446	−1982.896
	Standard Error	(96.79217)	(678.8791)
	t statistic	−2.55	−2.92

Table 4: Further Results of OLS Regression

	Without Trend	With Trend
No. of Observations	30	30
F (4, 25)	39.22	-
F (5, 25)	-	39.80
Prob > F	0.0000	0.0000
R- squared	0.8626	0.8924
Adjusted R-squared	0.8406	0.8699
Root MSE	31.11	28.098
P-value for HDI	0.002	0.007

4.1 Results and Analyses:

The tables above showed the results obtained after running the OLS regressions. There were 2 main regression models, one without using the t index, and another using the t index, which is the detrended equation. All the regression results are found at 5% significance level.

i. $GDP_t = -247.24 + 666.43HDI_t + 29.05FDIb_t - 1.64TRADEofgdp_t - 4.45INF_t$

ii. $GDP_t = -1982.89 + 5170.88HDI_t + 40.39FDIb_t - 0.66TRADEofgdp_t - 2.3INF_t - 37.7t_t$

The first equation shows a positive impact of HDI on GDP. It shows that ceteris paribus, one unit increase in HDI will increase GDP by $666.43 on average. After detrending the equation and running the regression, in the second equation, it shows that the impact of HDI on GDP is still positive, but the effect has increased. In the second regression model, using the time trend the relation shows that a unitary increase in HDI will cause the GDP to rise by $5,170.88 on average – considering all other variables to be constant.

The other control variables also show a relationship to GDP. Both the equations show the average impact of the control variables on GDP, holding all other variables constant. In the first equation, an increase in FDI will increase the GDP by $29.05, whereas the magnitude of impact increases after including the time trend variable in the second equation, showing that an increase in FDI will cause GDP to rise by $40.39. This supports the empirical estimation and theoretical studies on the

relation of FDI to GDP. Similarly, without the time trend, equation 1 shows a unitary increase in trade balance will cause GDP to fall by $1.64, while including the time trend shows the same unit increase in trade balance will cause GDP to fall by $0.66. This relationship is quite contrary to the empirical and theoretical estimations discussed in this paper. However, a possible reason for a negative relationship could be, an increase in trade is being an obstacle for domestic firms, rather than being an encouraging factor. The relation between GDP and inflation have been as expected theoretically and as shown by previous studies, inflation negatively affects GDP. If inflation increased by one unit, then GDP is supposed to fall by $4.45 shown in the equation without the trend. Including the trend variable shows, an increase in inflation will cause GDP to decrease by $2.30.

Though this study cannot explain for the other control variables, the impact of HDI on GDP can be acknowledged because both the equations showed a significant relation of HDI to GDP. That is, as shown in Table 4, with a p-value of 0.002 without the trend and 0.007 with trend. Which means, there is 0.2% and 0.7% chance of the coefficient of HDI occurring due to random chance – which is very low. With high R-squared and adjusted R-squared values, as shown without trend at 86% and 84%, and with trend at 89% and 86% respectively, it is further evident that the impact of HDI on GDP is significant. This indicates that the independent variables can explain or account for a change of the dependent variable, GDP, by 86%. Also, the t statistic found, shown in Table 3, shows a higher value, without trend showing 3.56 and with trend showing 2.95 – suggesting that the coefficient for HDI is significant, as the ratio of the coefficients to the standard errors is high. The change in the t-statistic after including the trend variable also implies a possible trend existed in the model before detrending it. Again going back to Table 4, it can be said that since the F statistic can be rejected at 5% interval, and the P value corresponding to it shows 0.00% probability of our results being described by random chance alone, it can be said our coefficients are worth of acknowledgement. However, as the value of Root Mean Square Error (MSE) are higher in both the regressions, it shows that there is a significant deviation from the mean; thus, on average much of our prediction missed reaching a better result. This can be due to the presence of stationarity or unit root that has not been tested for in this paper. However, the magnitude and direction of impact of HDI on GDP has been significant, and in accordance with previous research.

4.2 Limitations:

Though this study achieved the aim of finding out the magnitude and significance of the impact of HDI on GDP, a few limitations could be further improved, which could make the research outcomes even better. For instance, this study does not test for unit root, which keeps the untested possibility of the model containing non-stationarity that is not identified. A serial correlation test could be done using the Durbin Watson test, which is not tested in this study. Thus, because of time constraints, these few tests could not be included in the paper.

5. Conclusion:

Summing up the paper, it aimed to find the magnitude and significance of the direction of impact of Human Development Index (HDI) on Gross Domestic Product (GDP). In other words, the main purpose of the paper was to determine the effect of human development on economic growth. It focused on Bangladesh, with a time series data, of the variables, only of Bangladesh. The data have been collected from reliable online sources, such as the World Bank Data, Macrotrends and Country Economy. Thirty years of data, from 1990 to 2019, have been used to observe the relation through regressions. This has been an important study to research because of the growing need for human development as most countries are becoming more industrialized. The significance of improving the condition of development has been increasing as the reasons for economic growth are becoming more apparent, showing the value of human health, education, income, and other important factors contributing to the development of human capabilities. Thus, to identify the impact, the OLS regression model has been used. Since the impact of HDI on GDP was the principal goal of the paper, GDP has been held as the only dependent variable, while HDI was held as the main independent variable, beside the other control variables – Foreign Direct Investment (FDI), trade balance, Gross Fixed Capital Formation (GFCF), and inflation, which is measured with the Consumer Price Index (CPI).

The results have proven that human development can drive the growth of the economy in Bangladesh toward betterment. It showed a significant positive impact of HDI on GDP. However, the study could be made more accurate if it tested for the presence of a unit root or non-stationarity. Thus, this study can be further improved by testing for unit roots, random walk, and serial correlations, and correcting the presence of any unwanted criteria that might lead to a biased outcome. Also, future studies can use panel data with an increased number of countries while keeping the size of the time covered, and test through different approaches to confirm the significance of the defining parameters and the absence of biased results.

Therefore, this research has further added to the previous studies that provided evidence and research outcomes showing the significantly positive impact of HDI on GDP. This emphasizes the importance of HDI for the wellbeing of an economy. That is investing in the development of health facilities, educational facilities, and higher income opportunities will eventually lead to a high performing economy with a higher GDP, and thus increase welfare of the people. This effect can be further maximized considering the role of technological advancement, since the world is becoming more digital with rapid technological innovations. Considering this, Bangladesh can further develop its economy by focusing more on the human development factors – by facilitating access to hospitals, making education affordable for all, and investing in new projects that will result in higher number of skilled workers and greater job opportunities – since it will result in a significant increase in GDP.

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