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RESEARCH ARTICLE

The Contributions of Human Capital to the Philippine GDP Per Capita

Jullian Miguel C. Barcelon[a], Tcheky Nicole D. Cabrera[b*], Kristine April S. Suin, Ph. D.[c]
[a,b,c]*Department of BA Economics, University of Santo Tomas, Manila, Philippines*

* *Corresponding author*

Abstract:

The Philippines suffered from learning loss due to school closures induced by the COVID-19 pandemic. The effects of the pandemic did not only anticipate in one direction as it posed a domino effect from one sector to another. Investing in human capital would help the country bounce back from such a loss (Sultana et al., 2022), yet it always costs a real expense (Brewer, Hentschke & Reide, 2010). To reduce the cost associated with education, the government must also boost employment (Atalay, 2015). With that, this paper aims to investigate the effects of human capital indicators determined by the World Economic Forum on Philippine GDP per capita from 1981 to 2020 for Education, from 2000 to 2020 for Health and Employment, and from 1998 to 2020 for Enabling Environment using Ordinary Least Squares Method. The findings revealed that seven sub-variables have positive effects on GDP per capita—Tertiary Enrolment Rates; Life Expectancy and Water, Sanitation, and Hygiene; Capacity for Innovation and Scientific-Technical Journal Articles; Mobile Users and Internet Users. While the rest have negative effects—Primary Enrolment Rate; Fertility Rate; Labor Force Participation; Social Mobility. The results suggest that the government prioritizes Enabling Environment and Health as these sectors need more assistance.

***Keywords*:** Contribution, Human Capital, Philippine, GDP Per Capita, Multiple Regression, EViews, Mean Imputation, Log Transformation

1. Introduction

1.1. Background of the Study

The Philippines has had an increasing population for two decades since the beginning of the 21st century. As the number of people increases, the government must provide and ensure high-quality human development policies that are measured through the Human Capital Index. Human capital is the variable of an individual's accrued experience in education, health, and migration. Most works of literature measure the human capital index through education and health, but beyond that, there are scant resources that study variables like employment and their respective environment (Sultana et al., 2022).

The four main variables of human capital are education, health & wellness, workforce & employment, and enabling environment, according to the World Economic Forum (2013). Hoffmann and Muttarak (2017) believed that formal education conducted in classrooms or nonformal is important in preparing students for disaster risks or empirically in everything. They think that education enhances the knowledge acquisition of the learners and their decision-making regarding the future benefits of economic activities. A study found that in the Philippines' case, the average years of education have a positive correlation to GDP per capita, with a 10% growth in average years resulting in a 0.70% increase in GDP per capita (Sultana et al., 2022). Health is also crucial for cognitive and non-cognitive learning and for students to participate well in class. Moreover, students' learning ability may be affected by dynamic relationships with whom they interact with including parents and friends (Villa, 2017). Sultana et al. (2022) said that a higher life expectation leads to an increase of 10% in GDP per capita where the relationship between life expectancy and economic growth is better observed in the long run. These factors that affect students will later transcend to their workplace.

To further improve the rising employment rate of the Philippines, even with the slight disruption during the pandemic that affected numerous businesses, Khan and Chaudry (2019) encouraged the government from developing countries to enhance different training programs as this will increase productivity and decrease poverty. To enjoy employment stability, higher education attainment must be observed as this poses wider skills and capabilities leading to high income (Cairó & Cajner, 2016).

To enable the prosperity of human resources, an environment that supports economic activities is recommended to attain zero to little waste of allocated resources. In a report by the World Economic Forum (2013), an enabling environment consisting of the availability of infrastructure, legal framework, collaborative development, and social mobility will enhance the daily lives of people, therefore, reducing lag in the process of performing tasks.

With that, this paper aims to estimate the effect of each variable of the Human Capital Index based on the World Economic Forum (2013) such as education, health, employment, and enabling environment on the development of the economy in the Philippines. The sub-objectives of the study are as follows:

- To explore the human capital variables such as education, health, employment, and enabling environment as the sources of the Philippine GDP per capita.
- To observe the effects of education from 1981 to 2020, health and employment from 2000 to 2020, and enabling environment from 1998 to 2020 on the Philippine GDP per capita.
- To discern which among the human capital variables has a major contribution to the Philippine GDP Per Capita.

1.2. Statement of the Problem

This study focuses on predicting the average value of GDP per capita based on the fixed values of education, health, employment, and enabling environment within their respective timeframes. More specifically, it aims to answer the following question: Is there a positive effect of education, health, employment, and enabling environment on GDP per capita?

To know the significance of each variable on the development, we include the following variables:

- **Education:** Primary Enrolment Rate and Tertiary Enrolment Rate.
- **Health:** Fertility Rate, Life Expectancy, and Water, Sanitation, and Hygiene.
- **Employment:** Labor Force Participation, Capacity for Innovation, and Scientific and Technical Journal Articles.
- **Enabling Environment:** Mobile Users, Internet Users, and Social Mobility.

1.3. Formulation of Hypothesis

Does growth in human capital variables (education, health, employment, and enabling environment) contribute to the Philippine GDP per capita?

H_0**:** Education, health, employment, and enabling environment do not contribute to the Philippine GDP per capita.

H_a**:** Education, health, employment, and enabling environment contribute to the Philippine GDP per capita.

1.4. Significance of the Study

The findings of the study will impart relevant knowledge to society considering that human capital is concerned with individuals' personal well-being and work opportunities. More specifically, this study will benefit the following individuals and organizations.

Health Department. This study's findings will serve as input to the development and policy planning of the department to help more than three million Filipinos who rely on unsafe and unsustainable water sources, and seven million who lack access to improved sanitation. This study prompts the said department to ensure safe drinking water, sanitation, and hygiene to reduce diarrheal disease deaths. Water sanitation does not only affect individuals' health, it also contributes to their livelihoods, school attendance, and dignity.

Labor Department and Employers. With the emergence of digital technology, this study emphasizes the need to raise the quality of human resources to adapt to changing demands in the labor market. Skill gaps remain a major concern of unemployment in the Philippines because of the numerous available jobs to be filled by either underqualified or overqualified labor forces. The results will also provide employers with the knowledge to increase employee engagement and productivity through continuous training and seminars that will boost the company's revenue.

Telecommunications Sector. This study points out the importance of infrastructures in developing human capital such as the Internet as a major tool for effective teaching. It also seeks to solve the pervasive network congestion affecting the quality of mobile connectivity in the Philippines. The said sector plays an important role in bridging the digital divide in the country and creating new jobs in its field.

Government. This study will provide information for the government to consider reskilling and upskilling programs in their projects for Filipino citizens and create new jobs that are suitable for

their skills. It also raises the idea of boosting employment to help minimize the government expenditure associated with other sectors.

1.5. Scope and Limitations

The general intent of this paper is to focus on the variables of the Human Capital Index based on the World Economic Forum (2013), which are education, health, employment, and enabling environment to assess the importance of providing high-quality investments through these sectors that will benefit the Philippines through gross domestic product per capita (GDP).

1.5.1. Scope and Limitations: Education

This study tackles the data studying the education variable from 1981 to 2020. A total of 40 observations will be tested for further analysis of its performance and its effect on the Philippine GDP per capita. The two sub-variables which make up education are (1) primary enrollment rate and (2) tertiary enrollment rate. The data collected included some constraints like sparse and a gap period. To fill in the missing values, a statistical treatment of mean imputation is conducted by averaging the whole data and dividing it by its total number.

1.5.2. Scope and Limitations: Health

From 2000 to 2020, the health variable consisted of three sub-variables which has a total of 21 observations. These sub-variables were: (1) fertility rate, (2) life expectancy, and (3) water, sanitation, and hygiene proxied by people using safety-managed sanitation. Although the data under this variable was complete, the results yielded undesirable outcomes after the diagnostic test. Therefore, the data were transformed into the logarithmic form using EViews software. The variables were tested for the second time, however, some test results remained insignificant hence, the researchers considered using a replacement. A limitation was also identified when the researchers were only able to gather a few observations on the main variable and sub-variables based on their relevance, completeness, and accuracy to the research topic.

1.5.3. Scope and Limitations: Employment

The employment variable is crucial to identifying the employability of the labor force considering the educational attainment and health factor. Its scope is the period is from 2000 to 2020 with 21 observations. Three sub-variables are tested in this paper namely (1) labor force participation rate, (2) capacity for innovation proxied by industry, innovation, and infrastructure, and (3) scientific and technical journal articles. The data collected from the World Bank yields a sparse result for the third sub-variable, so an imputation method was applied. After this process, more diagnostic tests were applied, yet all resulted in an unfavorable output, therefore, a treatment by logarithmic transformation was conducted.

1.5.4. Scope and Limitations: Enabling Environment

This variable envelops the three initial variables of this paper. The enabling environment allows humans to perform all their acquired knowledge and transform raw materials into output. Its sub-variables are: (1) mobile users, (2) internet users, and (3) social mobility proxied by outbound mobility ratio, all regions, both sexes. The period that was tested comprises 1998 to 2020 with a total of 23

observations. Given that the latter sub-variable lacks seven observations, mean imputation was applied to complete the number of data sets.

2. Review of Related Literature

2.1. Review of Related Literature

The World Economic Forum (2013) has identified four variables to measure the Human Capital Index. The first three are the core variables of human capital—education, health, and employment, and the last one consists of the collective factors that enable these three variables to generate higher returns, called the enabling environment.

The education pillar contains variables relating to the quantitative and qualitative components of education at the primary and tertiary levels which contains data on the present and future labor markets. The health and wellness pillar contains variables that measure a population's fertility rate, and overall physical and mental health from water consumption and other related factors. The workforce and employment pillar aims to measure the experience, talent, knowledge, and training of the working-age population of a nation. The enabling environment pillar includes the infrastructure, legal system, and other elements that permit returns on human capital.

2.1.1. Education

Early economists such as Adam Smith, John Stuart Mill, and Alfred Marshall suggested that an individual's skills may affect their economic status (Brewer et al., 2010) because talents and skills can be acquired by studying or entering formal education or apprenticeships that can be costly. These talents are called fixed and realized capital that improves the skills of a worker and reimburses the expense with a profit. Brewer et al. (2010) further posited that earnings typically increase with education level and climb at an increasing rate in the first few years following graduation. They then continue to increase at a slower rate until people are near retirement. Atalay (2015) said that education and lifelong learning are the fundamental conditions for growing human capital. In underdeveloped countries, when the length of education increases, individual and social expenses also increase. With that, the government must boost employment during education to enhance human capital and reduce the alternative costs associated with education.

2.1.2. Health

Human capital investments result in greater returns when the mortality rate of people is low because the working life is longer (Bloom et al., 2018). The change in life expectancy stimulates demographic shifts which are marked by immediate and working-age survival rates, with minimal change in young and old-age survival. This trend implies an increase in the working population which then results in a decline in old-age dependency ratios (Cervellati et al., 2017). One of the causes of early-life stagnation or poor cognitive skill was poor household conditions, inaccessible to clean water for consumption, and lack of nutritious food intake (Spears & Lamba, 2015; Lin et al., 2013; Glewwe et al., 2001). In a study conducted by Hansen (2013), he found that an additional year of life expectancy has a positive effect on the education of a child.

2.1.3. Employment

Based on gender, the most employed in the health and social sectors are women, comprising 70% in the field as compared to men. However, there is the presence of a gender pay gap of roughly 11%, presenting inequality and discrimination between genders which may lead to less motivation among women (Boniol et al., 2019). Aside from gender, the employment rate among youth is also increasing. However, they are likelier to be employed in jobs with dangerous work or long hours and low pay or shift to entrepreneurship (Camba, 2020). Overall, the Philippines may experience an aging population progressively and must focus on the factors that will encourage more youths in labor participation for the economy to continuously move.

2.1.4. Enabling Environment

The business-enabling environment includes all the macro-level, government-influenced factors that have an impact on businesses along the entire value chain (McKague & Siddiquee, 2014). Prior to technological advancement, the business-enabling environment focused more on regulations governing business activity and factors of production, market transactions, infrastructure, and macroeconomic policies and conditions.

Technology and employment have a long-standing contentious relationship. Frontier technologies, like prior technical advancements, are likely to both create and eliminate jobs. There also exists a widening gap between low- and high-skilled non-routine jobs, since jobs at medium-skill levels have fallen, even though the overall impact on employment is still unclear (United Nations, 2019). To aid productivity diffusion, firms must sharpen their incentives for faster adoption of new technology and foster a market environment where resources are distributed to the most productive firms. Incentives for research and development (R&D) spending, business-university R&D partnerships, and patent protection all have a place, but there are trade-offs that should be considered when designing policies that support innovation (Andrews et al., 2015).

2.2. Synthesis of Literature

Most literature pertains to education and health as the two major components of human capital as a variable in sustainable growth from the short to the long term (Hansen, 2013; Villa, 2017; Hoffmann & Muttarak, 2017; Atalay, 2015). European researchers (Agüero et al., 2022; Égert et al., 2020) think that primary education is critical in developing young learners in competency, and to participate in classes, children must be provided with necessities such as a healthy diet, cognition, and an environment far from domestic violence which is an intergenerational transmission. However, in the case of China, investments in education are to ensure longer political reign (Chang & Wu, 2022). This highlights the importance of having a competent government as corruption may hinder the development of human capital as seen from previous literature (Dutta et al., 2017). The Philippines has a low investment of human capital per child due to low income, as opposed to Sweden and Switzerland, which have high levels of human development and high positive benefits of money (Mason et al., 2016; Resce, 2021).

Government-funded investments towards human capital and its components such as education, health, employment, and enabling environment enable sustainable growth. The variables of human capital are subdivided and regrouped for each literature; therefore, it does not answer the question of

the components in the case of the Philippines. Thus, the researchers analyzed the contributing factors of these variables to further assist in a better policy-making process in the country.

2.3. Theoretical Framework

Human capital is a term coined by Schultz (1961) in which he claimed that spending on humans would yield returns and does not diminish over time. In the four factors of production, labor consists of humans who have varying educational attainment at the same time, producing outputs in the form of goods and services. Now, to better understand the contribution of human beings to the development of a country, the human capital theory states that investment in education yields productivity growth because the skills acquisition and competency of human beings were developed during schooling. According to Wuttaphan (2017), the emergence of a knowledge-based economy brought the perception that knowledge and skills are a competitive advantage that can only be built through continuous learning acquisition. He also states that based on the different levels of acquired education, people with higher attainment can yield more output. The human capital theory is not only limited to education but also extends to health, employment, and training which contributes to production (Fleischhauer, 2007).

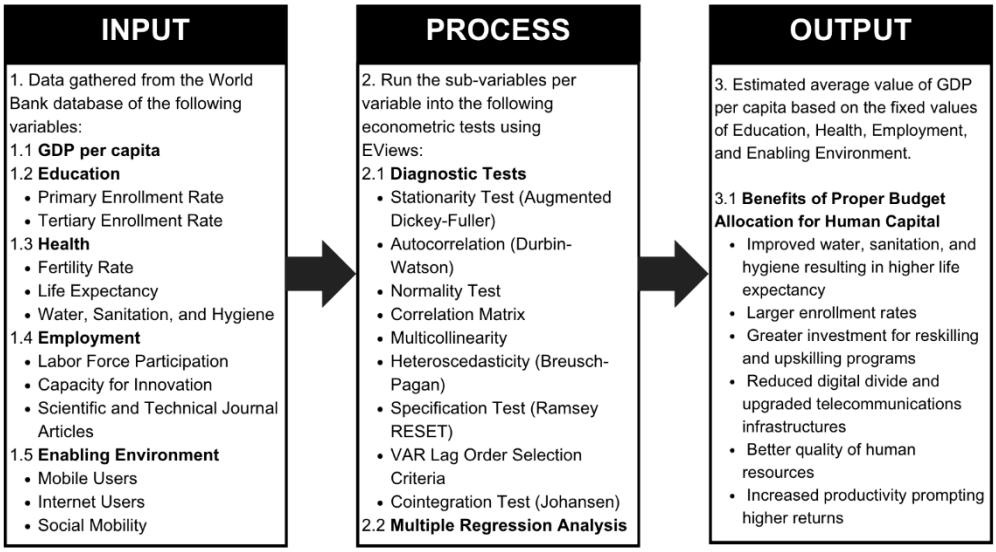
According to the new growth theory, human desire is what propels economic growth and productivity at ever-increasing rates. This theory embodies that production, which is defined as the transformation of resources into outputs through technologies, will drive prosperity and that one of the driving forces for this is knowledge (Robbins, n.d.). Knowledge can increase opportunities, resulting in sustainable growth in the future (Cortright, 2001). Under the new growth theory, a firm can achieve continuous profit maximization by focusing on the improvement of knowledge that has a zero marginal cost and an intangible asset that does not deteriorate.

2.4. Conceptual Framework

The conceptual framework of this study can be seen in Figure 1 which portrays how the human capital variables affect the Philippine GDP per capita. We first source our data through the World Bank for GDP per capita and human capital variables. Each variable has sub-variables that contribute to and affect their data based on the World Economic Forum. We then select the three variables based on the following: (1) completeness of data, (2) usefulness, (3) relevance to the Philippines. After data collection, the sub-variables will be run per variable into econometric tests as indicated in the process table. The econometric tests to be conducted will allow us to identify the effects of these variables on the GDP per capita which will be discussed under the output table. The results of forecasting will provide figures that the government may consider in allocating a budget for human capital. With proper budget allocation, it will lead to improved water, sanitation, and hygiene, higher enrollment rates, higher investment for reskilling and upskilling programs, reduced digital divide and upgraded telecommunications infrastructures, better quality of human resources, and increased productivity resulting in higher returns.

Figure 1.

The Conceptual Framework of the Study



3. Research Methodology

3.1. Model Specification (Empirical Model)

The model construction of this paper is based on the classical multiple linear regression model which is beneficial for understanding the effect of multiple independent variables on the dependent variable. In this paper, we aim to study how the effect of respective variables like education, health, employment, and enabling environment can attain economic development by looking at the GDP per capita. To further dissect the Human Capital Index, each variable consists of three sub-variables affecting their economic performance. We will be using four models to test the three independent sub-variables per variable against the dependent variable. The following models illustrated below provide an overview of this study.

Model 1 (Education):

$$LNGDP = \beta 0 + \beta 1\ EDU\_PER + \beta 2\ EDU\_TER + \mu t$$

Where:

LNGDP = Log GDP per capita

EDU_PER = Primary Enrollment Rate

EDU_TER = Tertiary Enrollment Rate

Model 2 (Health):

$$LNGDP = \beta 0 + \beta 1\ LNHLT\_FR + \beta 2\ LNHLT\_LE + \beta 3\ LNHLT\_WSH + \mu t$$

Where:

LNGDP = Log GDP per capita

LNHLT_FR = Log Fertility Rate

LNHLT_LE = Log Life Expectancy

LNHLT_WSH = Log Water, Sanitation, and Hygiene

Model 3 (Employment):

$$LNGDP = \beta 0 + \beta 1\ LNEMP\_LFP + \beta 2\ LNEMP\_CI + \beta 3\ LNEMP\_STJ + \mu t$$

Where:
LNGDP = Log GDP per capita
LNEMP_LFP = Log Labor Force Participation
LNEMP_CI = Log Capacity for Innovation
LNEMP_STJ = Log Scientific and Technical Journal articles

Model 4 (Enabling Environment):

$$LNGDP = \beta 0 + \beta 1\ ENV\_MU + \beta 2\ ENV\_IU + \beta 3\ ENV\_SM + \mu t$$

Where:
LNGDP = Log GDP per capita
ENV_MU = Mobile Users
ENV_IU = Internet Users
ENV_SM = Social Mobility

3.2. Research Design

This study will use a quantitative approach to measure the significance of education, health, employment, and enabling environment to the GDP per capita of the Philippines. This research will also offer possible solutions to policymakers and even readers. Additionally, the sourced data has an evident trend among the chosen period while staying true to the sub-variable's respective values.

3.3. Research Procedure

The researchers gathered secondary data from literature related to the topic. After data collection, the researchers examined and analyzed the relation of the information to the overall objective of the study. However, due to time constraints and limited on-site visits due to the COVID-19 pandemic, the gathered secondary data was limited to the ones coming from libraries or other physical sources.

3.4. Data Sources and Instruments

Secondary data was collected from a government publication called the World Bank. The World Bank is one of the largest sources of funding and knowledge for developing countries. It is a global partnership with 189 member countries and is composed of 5 institutions that aim to reduce poverty, increase shared prosperity, and promote sustainable development.

3.5. Statistical Treatment

Statistical treatment of mean imputation is conducted to fill in the years that the values are missing at random. Such treatment is recommended to narrow and eliminate gaps in the study and is conducted by getting the summation of values per variable and sub-variable (Glas, 2010). After such, the result is then divided by the number of observations of the sub-variables. The pre-testing process of imputation is known as the Missing Completely at Random (MCAR) analysis that identifies missing values that are not caused by assuming that missingness is unrelated to any unobserved data (response

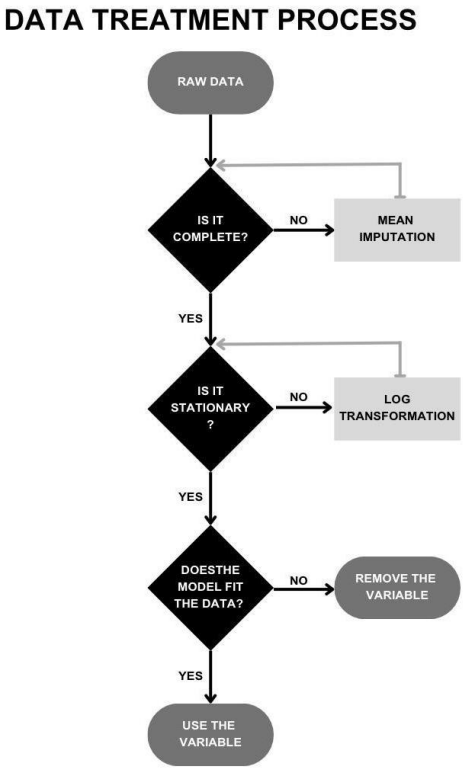
and covariate). MCAR analysis posits that the likelihood of a missing data value is independent of any observation in the data set (Jamshidian & Mata, 2007). The data is now complete and divided into four major variables: education, health, employment, and enabling environment.

Mean imputation, as a statistical treatment in this study, is done by dividing the sum of all values *Xi* by the number of observations *n* as shown in the equation below. The mean will be inserted into the missing values from the data set.

$$\text{Value of Mean} = \frac{\Sigma Xi}{n}$$

Figure 2 illustrates the process we used in treating the data. First, we identify if the raw data is complete. We fill in the missing values by performing mean imputation to have a sufficient number of observations. Second, we run the data through a stationarity test to check for the presence of unit roots. Log transformation is applied to treat non-stationary variables. Third, we test if the model fits the data through the Ramsey RESET test. In the case of the education variable, the model is still unspecified after transforming the sub-variables into logarithms. When EDU_SER was removed from the model, it passed the Ramsey RESET test.

Figure 2



3.6. Ethical Considerations

The data used in this paper comes from the World Bank (2014; 2019) and World Economic Forum (2013). Additionally, the literature included in this paper was properly cited, given credit, and does not assume ownership of the previous works. The purpose of the cited research, articles, and journals was to support such claims found in the data analysis of the paper. No plagiarism or

falsification of data was practiced in this paper and is open for criticism to further improve its structure in the future or for other purposes.

4. Results and Discussion

4.1. Diagnostic Tests

The test result for the Stationarity test, which is an Augmented Dickey Fuller test (ADF) under the first difference had probability values that show a greater and lesser result in contrast with the significance level. To start with, the values of EDU_PER, EDU_TER, LNHLT_LE, LNHLT_IMR, LNEMP_LFP, LNEMP_CI, LNEMP_STJ, ENV_MU, ENV_IU, and ENV_SM were all lower than the probability value and the t-test indicating that there was no unit root in the variables and a stationary data. This meant that the variables could produce accurate results.

On the other hand, for variables like LNGDP, and LNHLT_WSH whose results were greater than the probability value and the t-test, this meant that there may be biases within the results produced. Therefore, the second difference would help determine if such results would be consistent with the initial test.

Table 1

Stationarity Test (Augmented Dickey-Fuller Test)

FIRST DIFFERENCE			
Variables	**Sub-variable**	**Probability Value**	**Test Statistic (5% level)**
LNGDP		0.0772	-2.7371
EDU	**PER**	0.0000	-5.7367
	TER	0.0000	-6.4155
LNHLT	**FR**	0.0061	-4.0659
	LE	0.0007	-5.1058
	WSH	0.4823	-1.5606
LNEMP	**LFP**	0.0000	-7.6661
	CI	0.0001	-39.0494
	STJ	0.0023	-4.5396
	MU	0.0178	-3.584
	IU	0.0007	-5.0564

ENV	**SM**	0.0004	-5.3369

Source: Barcelon and Cabrera (2023)

As seen in Table 2, the Durbin-Watson test scores of the education, health, employment, and enabling environment variables were positively correlated. This might be caused by the similarity in the data acquired. However, such a test was only limited to the first difference.

Table 2

Autocorrelation (Durbin-Watson Test)

Variables	Durbin-Watson
EDU	0.9476
LNHLT	1.4287
LNEMP	1.9802
ENV	0.7373

Source: Barcelon and Cabrera (2023)

For this test, the probability values of EDU and ENV were higher than 0 while LNHLT and LNEMP were lower. The results of the Jarque-Bera test presented significantly low values, which proved that the variables were not normally distributed. The kurtosis of four variables were leptokurtic in nature.

Table 3

Normality Test

Variables	Jarque-Bera Value	Probability Value	Kurtosis
EDU	4.3348	0.1145	Leptokurtic
LNHLT	8.4573	0.0146	Leptokurtic
LNEMP	87.6521	0.0000	Leptokurtic
ENV	0.1278	0.9381	Leptokurtic

Source: Barcelon and Cabrera (2023)

The test below shows the correlation of each independent variable towards the dependent variable. The result of EDU_PER had a weak linear correlation, while EDU_TER had a positive linear correlation with LNGDP. Such instances could be interpreted as positive results that might lead to a violation of the assumption.

Table 4.1

Correlation Matrix (EDU)

Sub-variables	LNGDP
PER	-0.3905
TER	0.7869

Source: Barcelon and Cabrera (2023)

As for the health variable and its correlation towards the dependent variable, the result of LNHLT_FR had a negative linear correlation, while LNHLT_LE and LNHLT_WSH had positive linear correlations with the dependent variable.

Table 4.2

Correlation Matrix (LNHLT)

Sub-variables	LNGDP
FR	-0.9876
LE	0.9734
WSH	0.9857

Source: Barcelon and Cabrera (2023)

The result of EMP_LFP had a negative linear correlation with the LNGDP, and such instances indicate that the variable may not violate the fifth assumption. On the other hand, LNEMP_CI and LNEMP_STJ had positive linear correlations with the dependent variable.

Table 4.3

Correlation Matrix (LNEMP)

Sub-variables	LNGDP
LFP	-0.6375
CI	0.8159
STJ	0.8833

Source: Barcelon and Cabrera (2023)

The results of ENV_MU and ENV_IU had positive linear correlations, while ENV_SM had a weak linear correlation with LNGDP. It can be observed that the ENV_MU and ENV_IU are close to the correlation value of 1.0.

Table 4.4

Correlation Matrix (ENV)

Sub-variables	LNGDP
MU	0.9693
IU	0.9549
SM	0.1572

Source: Barcelon and Cabrera (2023)

To detect multicollinearity in the data being tested, the variables were examined through regression analysis. Based on the results, the centered Variance Inflation Factors (VIF) of EDU, LNHLT, and LNEMP against LNGDP detected no multicollinearity as indicated by the centered VIF value of less than 10. As for LNHLT, the centered VIF detected high multicollinearity for LNHLT_FR, LNHLT_LE, and LNHLT_WSH as indicated by the centered VIF value of more than 10, which needed treatment.

Table 5

Multicollinearity

Variables	Sub-variables	Centered VIF Result
EDU	**PER**	1.0113
	TER	1.0113
LNHLT	**FR**	79.7570
	LE	24.2696
	WSH	75.3623
LNEMP	**LFP**	1.5535
	CI	2.8031
	STJ	2.1326
ENV	**MU**	7.9133

	IU	7.6258
	SM	1.1064

Source: Barcelon and Cabrera (2023)

The Breusch-Pagan test is used to examine the presence of heteroscedasticity in the data by interpreting the results of the p-values. Based on the results, all p-values of EDU variables were higher than 0.05–EDU_PER and EDU_TER. This indicated that the series is heteroskedastic and has the possibility to produce biased results. The same applies for LNHLT and LNEMP where all p-values of LNHLT (LNHLT_FR, LNHLT_LE, and LNHLT_WSH) and all p-values of LNEMP (LNEMP_LFP, LNEMP_CI, and LNEMP_STJ) were higher than 0.05. In contrast, all p-values of ENV variables were lower than 0.05–ENV_MU, ENV_IU, and ENV_SM. This indicates that the series is homoscedastic and does not have the possibility to produce biased results.

Table 6

Heteroscedasticity (Breusch-Pagan Test)

Variables	Sub-variables	P-values
EDU	**PER**	0.1644
	TER	0.6825
LNHLT	**FR**	0.1909
	LE	0.1152
	WSH	0.6160
LNEMP	**LFP**	0.4730
	CI	0.9963
	STJ	0.2663
ENV	**MU**	0.0550
	IU	0.0074
	SM	0.0014

Source: Barcelon and Cabrera (2023)

Ramsey RESET test is a specification test used to determine whether there is a nonlinearity in the regression model. The results of this test revealed that the p-values of EDU, LNHLT, LNEMP, and ENV under f-stat are greater than 0.05, indicating that the functional form is correct, and the model does not suffer from omitted variables.

Table 7

Specification Test (Ramsey RESET)

Variables	P-values (f-stat)
EDU	0.6504
LNHLT	0.6713
LNEMP	0.8827
ENV	0.3799

Source: Barcelon and Cabrera (2023)

Lag refers to the time delays between the cause and effect of a variable. Researchers recommend using one to two lags for annual data, four lags for quarterly data, and 12 lags for monthly data (Isanov & Kilian, 2005). Using too many lagged values results in a lesser degree of freedom, while insufficient lagged values cause misspecification n and biases in the model, which must be prevented. The VAR lag order selection criteria were used to determine the optimal number of lags to be used in the study. EViews provided four criteria, seen in Table 8, which were: likelihood ratio (LR), final prediction error (FPE), Akaike information criterion (AIC), and Hannan-Quinn information criterion. The table shows that LR, SC, and HQ approved using two lags, while FPE and AIC approved using three lags for EDU. The rule-of-thumb is to select the criterion with the lowest value which is FPE at 0.0631. LNHLT approved using one lag as indicated by AIC at -29.0712. LNEMP approved using one lag by AIC at -15.0937. Meanwhile, ENV approved using one lag by FPE at 0.0039. The table shows that it will take a two to three-year time delay for EDU, and one year for HLT, EMP, and ENV for the outcomes to commence if the government will conform to the estimated budget allocation obtained from the multiple regression analysis.

Table 8

VAR Lag Order Selection Criteria

Variables	LagL	LR	FPE	AIC	SC	HQ
EDU	2	28.0109*			6.7436*	6.1516*
	3		0.0631*	5.7089*		
HLT	1	142.9543*	2.91e-18*	-29.0711*	-28.0754*	-28.8767*
EMP	1	131.2727*	3.42e-12*	-15.0937*	-14.0980*	-14.8993*
ENV	1	120.3544*	0.0039*	5.7656*	6.7574*	5.9992*

*Indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error

AIC: Akaike information criterion HQ: Hannan-Quinn information criterion

Source: Barcelon and Cabrera (2023)

Johansen cointegration allows testing cointegrating relationships between several non-stationary time series data. This test is used to determine whether the past value of the variables can predict the present value of another in the long run. The null hypothesis indicates that there is no cointegration among the variables. To reject the null, the p-value must be greater than 0.05, or the trace statistic must be greater than the critical value. The table shows two variants of these tests available: rank test (trace) and eigenvalue test. There is a tabulated critical value for testing the rank of the matrix (r). In the trace test, the r must be equal to zero for the first null hypothesis, whereas r must be equal to or greater than one for the first alternative hypothesis. If the first H_0 is rejected then do the second, which must be indicating that the rank is either zero or one. However, researchers suggest using the trace test than the eigenvalue test when these two statistics provide conflicting results because the latter does not consider all the smallest eigenvalues.

Table 9

Cointegration (Trace test vs Maximum Eigenvalue Test)

Trace Test	
Null Hypothesis	**Alternative Hypothesis**
r = 0	r ≥ 1
r ≤ 1	r ≥ 2
Maximum Eigenvalue Test	
Null Hypothesis	**Alternative Hypothesis**
r = 0	r = 1
r ≤ 1	r = 2
*Denotes the rejection of the null hypothesis at the 0.05 level	

Note. Adapted from *Personal Income Tax Elasticity in Turkey: 1975-2005,* by Yesim, K., & Sapci, O. (2005).

In this table, the trace test results show that there is no cointegration, indicating no long-run relationship between the variables since the p-values were above 0.05, and the trace statistics were less than the critical values at all levels.

Table 10.1

Cointegration Test (EDU)

Cointegration Rank Test (Trace)				
Hypothesized No. of CEs	**Eigenvalue**	**Trace Statistic**	**0.05 Critical Value**	**Probability****
None	0.3642	27.2243	29.7971	0.0963
At most 1	0.2321	10.9186	15.4947	0.2165
At most 2	0.0384	1.4094	3.8415	0.2352
The trace test indicates no cointegration at the 0.05 level *denotes rejection of the hypothesis at the 0.05 level **MacKinnon-Haug-Michelis (1999) p-values				
Cointegration Eigenvalue Test				
Hypothesized No. of CEs	**Eigenvalue**	**Max-Eigen Statistic**	**0.05 Critical Value**	**Probability****
None	0.3642	16.3056	21.1316	0.2075
At most 1	0.2321	9.5093	14.2646	0.2462
At most 2	0.0384	1.4094	3.8415	0.2352
Max-eigenvalue test indicates no cointegration at the 0.05 level *denotes rejection of the hypothesis at the 0.05 level **MacKinnon-Haug-Michelis (1999) p-values				

Source: Barcelon and Cabrera (2023)

In this table, the trace test shows that there were two cointegrating equations from 'None' to 'At most 1,' indicating a long-run relationship between the variables since the p-values are below 0.05, and the trace statistics were greater than the critical values except for 'At most 2' and 'At most 3.'

Table 10.2

Cointegration Test (LNHLT)

Cointegration Rank Test (Trace)				
Hypothesized No. of CEs	**Eigenvalue**	**Trace Statistic**	**0.05 Critical Value**	**Probability****
None*	0.8574	75.5522	47.9561	0.0000
At most 1*	0.7733	38.5496	29.7971	0.0038
At most 2	0.4200	10.3505	15.4947	0.2547

At most 3	4.94E-05	0.0009	3.8415	0.9760
The trace test indicates 2 cointegrating equations at the 0.05 level *denotes rejection of the hypothesis at the 0.05 level **MacKinnon-Haug-Michelis (1999) p-values				
Cointegration Eigenvalue Test				
Hypothesized No. of CEs	**Eigenvalue**	**Max-Eigen Statistic**	**0.05 Critical Value**	**Probability****
None*	0.8574	37.0025	27.5843	0.0023
At most 1*	0.7733	28.1991	21.1316	0.0043
At most 2	0.4200	10.3496	14.2646	0.1900
At most 3	4.94E-05	0.0009	3.8415	0.9760
Max-eigenvalue test indicates 2 cointegrating equations at the 0.05 level *denotes rejection of the hypothesis at the 0.05 level **MacKinnon-Haug-Michelis (1999) p-values				

Source: Barcelon and Cabrera (2023)

In this table, the trace test shows that there are 4 cointegrating equation from 'None' to 'At most 3,' indicating a long-run relationship between the variables since the p-values are below 0.05, and the trace statistics were greater than the critical values.

Table 10.3

Cointegration Test (LNEMP)

Cointegration Rank Test (Trace)				
Hypothesized No. of CEs	**Eigenvalue**	**Trace Statistic**	**0.05 Critical Value**	**Probability****
None*	0.9584	109.1071	47.8561	0.0000
At most 1*	0.7101	48.7134	29.7971	0.0001
At most 2*	0.5887	25.1874	15.4947	0.0013
At most 3*	0.3696	8.7652	3.8415	0.0031
The trace test indicates 4 cointegrating equations at the 0.05 level *denotes rejection of the hypothesis at the 0.05 level **MacKinnon-Haug-Michelis (1999) p-values				
Cointegration Eigenvalue Test				
Hypothesized No. of CEs	**Eigenvalue**	**Max-Eigen Statistic**	**0.05 Critical Value**	**Probability****

None*	0.9584	60.3938	27.5843	0.0000
At most 1*	0.7101	23.5260	21.1316	0.0226
At most 2*	0.5787	16.4222	14.2646	0.0224
At most 3*	0.3696	8.7652	3.8415	0.0031
Max-eigenvalue test indicates 4 cointegrating equations at the 0.05 level *denotes rejection of the hypothesis at the 0.05 level **MacKinnon-Haug-Michelis (1999) p-values				

Source: Barcelon and Cabrera (2023)

In this table, the trace test shows that there are 4 cointegrating equations from 'None' to 'At most 3,' indicating a long-run relationship between the variables since the p-values were below 0.05, and the trace statistics were greater than the critical values.

Table 10.4

Cointegration Test (ENV)

Cointegration Rank Test (Trace)				
Hypothesized No. of CEs	**Eigenvalue**	**Trace Statistic**	**0.05 Critical Value**	**Probability****
None*	0.8712	91.7010	47.8561	0.0000
At most 1*	0.6950	48.6588	29.7971	0.0001
At most 2*	0.5340	23.7256	15.4947	0.0023
At most 3*	0.3067	7.6909	3.8415	0.0055
The trace test indicates 4 cointegrating equations at the 0.05 level *denotes rejection of the hypothesis at the 0.05 level **MacKinnon-Haug-Michelis (1999) p-values				
Cointegration Eigenvalue Test				
Hypothesized No. of CEs	**Eigenvalue**	**Max-Eigen Statistic**	**0.05 Critical Value**	**Probability****
None*	0.8712	43.0422	27.5843	0.0003
At most 1*	0.6950	24.9333	21.1316	0.0139
At most 2*	0.5340	16.0346	14.2646	0.0260
At most 3*	0.3067	7.6909	3.8415	0.0055
Max-eigenvalue test indicates 4 cointegrating equations at the 0.05 level *denotes rejection of the hypothesis at the 0.05 level **MacKinnon-Haug-Michelis (1999) p-values				

Source: Barcelon and Cabrera (2023)

4.2. Multiple Regression Analysis

The regression output shows that a 0.0172 unit decrease in EDU_PER and a 0.0485 increase in EDU_TER, result in a one unit increase in LNGDP. The table also shows that there is a high reliability of the predictive power of the coefficient of EDU_TER, whereas there is a low probability of the coefficient of EDU_PER. The obtained p-value of less than 0.05 indicates that the variables are significant to one another, and the f-stat concludes that the variables fit the regression model. In fact, 71.48% of the variables can be explained by the model. EDU_SER was originally included in the model but was removed as it failed the diagnostic tests. However, the remaining variables are still relevant in the study since primary education serves as the foundation of basic knowledge such as reading, writing, and numeracy skills to advance to other levels (Etor et al., 2013) while tertiary education prepares students for future employment by honing their occupational skills (Brennan, 1985). Some studies suggest that secondary education does not help students prepare for higher education as most students still experience culture shock in college (Engle et al., 2006). Thomsen (2015) claims that there is a need to shorten the schooling years in secondary education to ensure the long-term viability of tax and social security systems by allowing individuals to work longer. Links between school-based knowledge and human capital accumulation are necessary to avoid overburdening or under-stimulating students.

Table 11.1

Model 1 (EDU)

Sub-variables	Coefficient	Standard Error	t-Statistics	Probability
PER	-0.0172	0.0049	-3.5210	0.0012
TER	0.0485	0.0057	8.5413	0.0000
R-squared = 0.7148		Prob(F-statistic) = 0.0000		
Adjusted R-squared = 0.6994		F=statistic = 46.3689		
Durbin-Watson stat = 0.9476				

Source: Barcelon and Cabrera (2023)

The regression output shows that a 1.2020 unit decrease in LNHLT_FR, a 2.7116 increase in LNHLT_LE, and a 0.5875 increase in LNHLT_WSH, result in a one unit increase in LNGDP. The table also shows that there is a high reliability of the predictive power of the coefficients of all HLT variables. However, the obtained p-value of more than 0.05 indicates that the variables were insignificant to one another, and the f-stat concludes that the variables fit the regression model. In fact, 97.78% of the variables can be explained by the model.

Table 11.2

Model 2 (LNHLT)

Sub-variables	Coefficient	Standard Error	t-Statistics	Probability
FR	-1.2020	0.7011	-1.7144	0.1046
LE	2.7116	3.6364	0.7457	0.4660
WSH	0.5875	0.6005	0.9785	0.3416
R-squared = 0.9778 Adjusted R-squared = 0.9739 Durbin-Watson stat = 1.4287		Prob(F-statistic) = 0.0000 F=statistic = 249.7734		

Source: Barcelon and Cabrera (2023)

The regression output shows that a 0.4806 increase in LNEMP_CI, a 1.7205 unit decrease in LNEMP_LFP, and a 0.2374 increase in LNEMP_STJ, result in a one unit increase in LNGDP. The table also shows that there is a high reliability of the predictive power of the coefficients of LNEMP_CI and LNEMP_STJ, whereas there is a low probability of the coefficient of LNEMP_LFP. The obtained p-value of less than 0.05 indicates that the variables are significant to one another except for LNEMP_CI, and the f-stat concludes that the variables fit the regression model. In fact, 89.60% of the variables can be explained by the model. This means that an increasing labor force is not enough to increase the country's productivity and output. Investment in scientific journals and innovations is necessary to balance the effect of variable inputs on outputs in the long run—the concept that diminishing marginal returns affirms (Brue, 1993).

Table 11.3

Model 3 (LNEMP)

Sub-variables	Coefficient	Standard Error	t-Statistics	Probability
LFP	-1.7205	0.5932	-2.9005	0.0100
CI	0.4806	0.3475	1.3828	0.1846
STJ	0.2374	0.0422	5.6276	0.0000
R-squared = 0.8960		Prob(F-statistic) = 0.0000		

Adjusted R-squared = 0.8776	F=statistic = 48.7985
Durbin-Watson stat = 1.9802	

Source: Barcelon and Cabrera (2023)

The regression output shows that a 0.0048 unit increase in ENV_IU, a 0.0032 increase in ENV_MU, and a 0.1870 decrease in ENV_SM, result in a one unit increase in LNGDP. The table also shows that there is a high reliability of the predictive power of the coefficients of ENV_MU, ENV_IU, and ENV_SM. The obtained p-value of less than 0.05 indicates that the variables are significant to one another, and the f-stat concludes that the variables fit the regression model. In fact, 96.45% of the variables can be explained by the model. According to Iversen et al. (2021), social mobility refers to the socioeconomic status of an individual. An example of this is the ability to move from a lower to a higher level of education. The results reveal that several people are already pursuing higher education, but the low-quality telecommunications infrastructures of the country, as represented by MU and IU in this study, hinder the economy from thriving.

Table 11.4

Model 4 (ENV)

Sub-variables	Coefficient	Standard Error	t-Statistics	Probability
MU	0.0032	0.0006	5.3078	0.0000
IU	0.0048	0.0016	3.0578	0.0065
SM	-0.1870	0.1347	-1.3883	0.1811
R-squared = 0.9645		Prob(F-statistic) = 0.0000		
Adjusted R-squared = 0.9589		F=statistic = 171.9577		
Durbin-Watson stat = 0.7373				

Source: Barcelon and Cabrera (2023)

4.3. Synthesis

The findings suggest that education, health, employment, and enabling environment are positively correlated with each other based on the results of autocorrelation tests (Durbin-Watson and Breusch-Godfrey) and correlation matrix. Similarly, Higgins et al. (2008) claimed that education is a social determinant of health. Adults with a greater level of education enjoy better health and live longer than their less educated counterparts (Raghupathi & Raghupathi, 2020). While education as a primary contributor to human capital has significant externality effects that span generations such as "technological, social, or environmental and economic to non-economic" (Bareke et al., 2021, para. 5) factors. This makes a notable contribution to the social and economic development of society (Bareke et al., 2021). The researchers emphasized the importance of tertiary education in influencing mortality

rate, life expectancy, child vaccination, and enrollment rates, as well as the importance of premature mortality in measuring health quality. However, education and health may have a complicated relationship due to the presence of various potential variables that include interrelationships between demographic and family background factors (Raghupathi & Raghupathi, 2020). Health can also substitute for human capital, indicating that better health of the labor force causes "higher productivity, higher income, and higher investment in human capital" (Bareke et al., 2021, para. 21). Accumulation of human capital also advances technological innovation and reduces poverty, making sustainable development a reality (Bareke et al., 2021).

In contrast, the multicollinearity test indicated that the sub-variables of education, employment, and enabling environment had no multicollinearity, while the opposite applied for the sub-variables of health. In the presence of autocorrelation, these results are more likely to be fabricated and unreliable. This may lead to poor understanding and forecasting as revealed by the heteroskedasticity tests (Breusch-Pagan), except for the sub-variables of the enabling environment. Marginson (2019) argued that education and work have a heterogeneous relationship. He criticized that the human capital theory failed the test of realism. Education is seen not as a "site of self-investment in cognitive formation […], but as a system for signaling a competitive position that delivers economic returns" (p. 6) based on the screening theory of education. Though investing in human capital contributes to the competitiveness of an individual, "family cultural capital and social capital networks" (p. 6) also affect an individual's employability and earnings.

The regression output showed that a 0.0172 decrease in PER and a 0.0485 increase in TER results in one unit increase in GDP per capita, but it requires a two to three-year delay for education to take effect on GDP per capita according to VAR lag order selection criteria. As per LNHLT, a 1.2020 decrease in FR, a 2.7116 increase in LE, and a 0.5875 increase in WSH, will increase one unit in GDP per capita after a year. For LNEMP, a 1.7205 decrease in LFP, a 0.4806 increase in CI, and a 0.2374 increase in STJ, will lead to a unit increase in GDP per capita after a year. Lastly, the results of ENV indicated that a 0.0032 increase in MU, a 0.0048 increase in IU, and a 0.1870 decrease in SM, will increase one unit in GDP per capita after a year.

However, the normality test indicated that the data did not follow a normal distribution wherein the mean, median, and mode of the distribution are equal. This indicated a low forecast feasibility as the r-squared values ranged from 73%-95% only. The functional form was also correct, and the four models did not suffer from omitted variables, according to the specification test (Ramsey RESET).

The study also found an underlying gap between the results and some existing literature used in the study, since the researchers claimed that tertiary education significantly contributed more to per capita growth which contradicted the statement of Gümüş and Kayhan (2012). It is because most employers prefer hiring college graduates who will then be part of the labor force in building the economy. Moreover, one obstacle in conducting this research was the incompleteness of data which the researchers countered by treating the incomplete data of Internet users. Most of the existing studies cover smaller observations instead of treating the data. In our case, the researchers failed to find a similar study that performed mean imputation or other treatments to come up with larger observations for Internet users.

5. Summary, Conclusion, and Recommendations

5.1. Summary

This paper identified how four economic variables namely, education, health, employment, and enabling environment impact the GDP per capita of the Philippines. For each variable, there was an average of two or three sub-variables that contributed to the overall performance of the former. The data for this study was sourced from sources like the World Bank (2014; 2019), World Economic Forum (2013), and others. From then on, data sources were examined based on the completeness and accuracy of trends, and for instance, incomplete data, and applicable literature are sought for additional information in testing. It is also worth noting that treatment of data was conducted such as mean imputation to make up for the number of observations. Afterward, the data was tested and measured to answer the formulated research questions in this paper. The results were then analyzed to see whether they were in line with the research hypotheses. Results showed that the coefficients of EDU_TER, LNHLT_LE, LNHLT_WSH, LNEMP_CI, LNEMP_STJ, ENV_IU, and ENV_MU had a positive impact on the GDP per capita. On the other hand, variables like EDU_PER, LNHLT_FR, LNEMP_LFP, and ENV_SM had a negative impact. It enables us to answer the research questions that human capital plays a huge role in the development of the Philippines as it comprises different sectors as viewed in GDP per capita. This study simply explains that accrued development for each stage of human development may influence productivity and other aspects economically. A great period for testing is the period before the introduction of technology and the entry of the 21st century as it involves another great technological advancement such as the introduction of the Internet and equipment and machinery that assists human productivity. Lastly, the paper was able to discern which sector must be prioritized as a primer in human development since it is intertwined with other sectors. However, this could only be attained after completion of certain aspects like the grade level and reaching the appropriate age to perform in the employment sector. Based on the r-squared of the four models, enabling environment needs more assistance from the government followed by health, employment, and education at the bottom of the list. The results are promising because prioritizing a specific sector ensures sustainable growth for the country and serves as literature for policymakers on what sectors are ideal for investment under human capital. This paper is open to criticism as one of the major setbacks experienced is the availability of literature to serve as another source, background, and comparison for the results shown.

5.2. Conclusions

This study found linkages between education, health, employment, and enabling environment in affecting the GDP per capita. For instance, in education, the enrolment rate from primary schooling and the tertiary level will determine their contribution to the economy. It is also crucial that from birth, the health and fitness of a child for cognitive, rational, or other forms of learning are suitable to improve their overall health. Health and wellness are not only considered important during their schooling period but rather throughout their lives. Performing tasks and duties are interconnected with physical and mental health which trickles into an increase in the productivity of a person. However, the direct and intercorrelation between health and education is still a debatable discussion among other economists as the former may be used as a substitute for the human capital itself according to researchers like Raghupati (2020).

5.3. Recommendations

Although the education and the health sectors are the starting point of human capital to unlock other variables such as employment and enabling environment, a general recommendation arising from the findings of the study is that government policy must lean towards the enabling environment and health sectors because these sectors have the most contribution in the Philippine GDP per capita growth. More specifically, the researchers recommend for the government body to:

1. Provide all students better access to education through scholarship grants, especially at the tertiary level.
2. Reassess the current education system and produce globally competitive individuals through skills training programs and seminars.
3. Strengthen the healthcare system that will ensure the well-being of the students and their class participation.
4. Fund research and innovations to create more job opportunities.
5. Invest in information technology infrastructure to improve our social networks.

5.4. Areas for Further Research

The incompleteness of data related to the research topic was a challenge in testing and future researchers may investigate other statistical treatments to fix the issue. Structural stability (Chow) tests could also be conducted to identify the breakpoints in the data that may help the researchers understand the reason behind the missing data. Since the study was limited to the human capital variables used by the World Economic Forum, future researchers may opt to use different sets of variables or create their own index, provided that their model fits the data to obtain higher accuracy of results, and their study is supported by existing literature.

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