Does Education Expenditure have a Positive Impact on Economic Growth? A Panel Data Estimation of Five Developing Countries

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A Major Research Paper Submitted to
Saint Mary's University, Halifax, Nova Scotia
in Partial Fulfillment of the Requirements for
the Degree of Master of Applied Economics Program

Date: 7/25/2020

Program Director and Supervisor: Dr. Ather Akbari

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ABSTRACT

The quality of human capital is essential for a nation to grow and keep up with the growing pace of development and innovation. Education is being recognized as a key contributing factor to the sustainable growth of a nation. This paper seeks to find if more investment in human capital will fuel the growth of developing countries. Five Asian developing countries have been selected to study the impact of their public education expenditure on economic growth. The cointegration test shows that education expenditure has a long-run equilibrium relationship with growth. Next, the Random Effect Model used for the panel regression suggests that there is a positive and significant relationship between education expenditure and the GDP per capita. The result implies that to achieve a sustainable growth plan, countries should invest more in public education. In this way, they will be able to reduce unemployment, increase the standard of living, and also eradicate poverty.

Keywords: Education expenditure, Human Capital, and growth.

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INTRODUCTION

Human capital is a broad concept. There are many factors that determine human capital like education, training, healthcare, skills, qualification, etc. According to Becker (2009), the most successful companies are those that manage their human capital effectively, which is by investing in their employees. These investments include education, workplace training, health care, and research for information related to prices and income. Becker also added that most data shows that individuals with higher education attainment and skill earn more compared to the rest of the population. It can also be said that the unequal distribution of income is positively correlated to educational attainment.

Education is considered a merit good, and most economists would agree that it is a crucial instrument, if not one of the most essential factors in determining the long-run growth of an economy. Education facilitates the accumulation of skills and knowledge, improves an individual's work practices and contributes to society's well-being.

An economy is usually slow in growth when the literacy rate is low. Less education means that the labor force will lack the knowledge and skills required to be efficient in production. When compared, developed countries are way ahead in every prospect than developing countries, which is due to the high level of education achieved by their population. (Lucas 1967) explained using an endogenous growth model in which human capital is one of the leading economic growth factors. He further mentions that human capital accumulation is possible through the expansion of education. This, in turn, will have a positive effect on the productivity of the labor force. When workers in the labor

force are more educated and acquire quality working skills, this will increase their efficiency and the nation's total output, causing the economy to grow.

Due to globalization and technological innovation, developing countries find it challenging to cope with the emerging pace of development, generally because a large population is uneducated and lacks the necessary skills to fit the job market. Most of the population in developing countries earn low income and suffer from poverty. To keep up with the rest of the world, the United Nations (UN) set a millennium development goal, targeting access to primary education for all. Developing countries have recognized the importance of investment in human capital, including education, and consider it essential for economic growth. So far, the enrollment rate at primary schools with all developing nations has reached 91 percent (United Nations, 2020). Now individuals want to invest in educating themselves as more education and training means attaining more skills. At present, the percentage of GDP spent on education in developing countries selected for this study is given in the table below:

Table 1: % of GDP spend on education

Country	Bangladesh	Bhutan	India	Pakistan	Nepal
Percentage of GDP spent on education	1.98%	6.64%	3.72%	5.16%	2.89%

Table 1: This table contains the amount spent on education as a GDP percentage for five selected countries. The data collected was for the official website of the world bank (World Bank, 2020).

Moreover, with better skills, an individual is more likely to land a better and secured job and earn more. Any person with higher education is sought at workplaces and considered more productive. Besides, if a large population has higher education attainment, it creates new and better job opportunities, increases their income level, and increases the national income of the economy. Hence, increasing education expenditure and education attainment will contribute to the growth of the economy as the population's standard of living increases. According to the study of Mekdad (2014), education is considered a sustainable growth path for economic opulence, and it is crucially important to fight against unemployment. Education helps to bring a balance and maintain social equity while ensuring individuals with a solid foundation about culture vitality and awareness.

For this study, five developing countries: Bangladesh, Bhutan, India, Nepal, and Pakistan have been selected. The reasons for selecting these countries are 1) the availability of data, 2) similarity of culture, and 3) similarity of their economic situations. Some of the data had to be interpolated, and details of interpolation of data are elaborated in the Appendix. The main question addressed in this paper is if education expenditure creates a positive or negative impact on the growth of these countries. The period of the analysis is from 2000 to 2018. A few panel unit root tests have been done to check for stationarity among the variables to analyze the impact. Most of the tests show that the Panel is stationary except the Liven-Lin-Chu test. Next, the cointegration test suggested that the variables are cointegrated and have a long-run and positive relationship. Furthermore, the Hausman test reveals that the Random effect model is a suitable panel regression model for this study. The regression results say that education expenditure has a long-

term relationship with growth and has a positive and significant impact on these developing countries' growth.

The rest of this paper is organized in the following sections: section 2 contains related literature reviews on education expenditure and its impact on economic growth. Section 3 deals with the variable description and data sources and discusses the theoretical aspects and the methodological approach adopted for this analysis. Section 4 provides us with the finding of the study. Finally, section 5 delivers the conclusion of the paper and policy implication for developing countries.

LITERATURE REVIEW

Based on human capital theory, education plays a vital role in the growth of an economy. Investment in education will not result in robust economic growth forthright; it is instead a potential catalyst in a country's long-run impact in growth charter. It is to be said that investment in education shall increase the productivity rate and cause technological growth improvement. Therefore, this paper wants to see if the education expenditure in developing countries facilitates its growth. As a form of reference, this section revises a few works done by eminent scholars in this field, which provide meticulous insights while developing our notion in this regard.

Renowned economist Andrew Weiss (Weiss, 1995) holds that individuals who are more educated and have long years of working experience receive higher wages; this then

increases employee productivity and facilitates growth. Furthermore, (Romer 1990) contends that a stable growth rate in an economy depends on the extent of research development, which in turn depends on the extent of research development, which in turn depends on the level of human capital in the economy. Underdeveloped human capital is one of the obstacles to economic growth, especially for developing countries. Less education means that people possess fewer skills and knowledge required for the development of a country. Underdeveloped human resources are considered to be a manifestation of low productivity, factor immobility, and limited specialization in occupations that minimize economic growth incentives.

The cognitive skills of a nation's population have a substantial effect on its economic growth rate. Mankiw et al. (1992) considered an extension to the Solow (1956) growth model and found that there lies a positive and significant relationship between education and economic growth. Schultz (1963) also demonstrates that raising the labor force's education level would be a significant contributor to the country's growth for both developing and developed economies.

Over the years, many studies have been conducted to examine the relationship between education expenditure and the country's economic growth. Many studies have found that the government's education expenditure has a positive and long-lasting impact on the growth of an economy. For developing countries, the results were diverse. Some studies showed that education expenditure has had a positive impact on the growth of the economy. However, other studies indicated that education expenditure was negatively

and not statistically significantly affecting the growth rate of an economy. Hicks (1980) used multiple regression analysis for 83 developing countries and found that investment in human capital led to an increase in the growth rate. Devarajan (1996) conducted a regression analysis on the impact of public spending on education, health, infrastructure, etc. on economic growth, and found that education expenditure negatively and statistically insignificantly affected the economic growth. Benhabib (1994) found in a cross-country data of 42 countries that an expansion of human capital may not necessarily be significantly associated with the economic growth rate. Engelbrecht (1997), in his empirical investigation on OECD countries, provided a contrast: human capital is not only found to affect the total factor of productivity in a country but is also considered to be an essential input to the new growth theories. Blankenau (2007) conducted a panel estimation on 23 developed countries, considering budget constraints and found that public expenditure on education has a positive impact on long term growth of an economy.

Similarly, Kızılkaya (2014) study on selected OECD countries also implied that taking capital investment as a control variable, expenditure on education has a positive impact on the growth of these countries. A recent study by Mallick (2016) using a panel data analysis with a sample period of 1973 to 2012 on 14 major Asian countries argues that the education sector is a vital ingredient of economic growth in all the 14 countries studied. Moreover, the Padroni Cointegration (1999, 2004) test proves the existence of a long-run equilibrium relationship between expenditure on education and the economic growth in all countries included in the study.

There were also other studies related to education expenditure and economic growth constructed using time series models. Some studies have checked for the causal relationship between education expenditure and economic growth. Few studies reported that education expenditure and economic growth have a unidirectional causal relationship meaning that it is a one-way causal relationship, while other studies concluded that they have a bidirectional causal relationship. Bidirectional causal relationship means that both x and y cause each other. Islam (2007) performed a multivariate causality test on Bangladesh using a sample period of 27 years from 1976 to 2003. The empirical result of the study found that there is bidirectional causality between education expenditure and economic growth in Bangladesh. Mallick (2015) investigated the causal relationship between education expenditure and economic growth in India during the period 1951 to 2012. The study implied that the government should focus more on investing in education to facilitate better human development, which can be a significant contributor to the growth of the Indian economy. The study also found that a one-sided causal relationship runs from education expenditure to economic growth. Tamang (2011) tries to redefine the relationship between education expenditure and economic growth of India. The results indicate the existence of a long-run relationship between the two. If the government increased education expenditure by 1%, then the GDP per labor is said to grow by 0.11%. A study on Pakistan using time series analysis found that education has a long-term impact on the economic growth of that country Kakar (2011). Another study by Chaudhary (2009) used the Johansen (1988) Cointegration test and Toda and Yamamoto (1995) causality test in vector autoregressive (VAR) analysis

for Pakistan. The empirical results for the causality test show that there is a unidirectional causality running from economic growth to higher education, and the cointegration test reveals that they have a long-run relationship.

This paper will follow the previous works and derive some conclusions from exploring the education and economic growth correlation in developing countries like Bangladesh, Bhutan, India, Pakistan, and Nepal.

METHODOLOGY, DATA, AND ECONOMETRIC MODEL

Methodology

This section of the paper aims to discuss the theoretical standpoint of education expenditure and its impact on economic growth and its methods to analyze and estimate the impact on developing countries. In order to understand the impact of education expenditure on economic growth an aggregate production function has been specified for the economy as below:

$$Q = Af(L, K) \qquad (1)$$

Here Q is the level of output of an economy, or its Gross Domestic Product (GDP), L and K are the amounts of labor and capital required to produce a certain level of output, and A is a measure of the productivity of inputs which is a function of several variables including the human capital variables such as education and training. Other variables that

also impact “A” include motivation of labor force, environmental factors, political factors, regulations, etc.

Education is considered to enhance an individual's skills and increase labor productivity by making them more knowledgeable. A skilled labor force enhances the efficiency of production at the workplace. This can have a positive effect on the growth of the economy.

The above production function can be converted to a per worker form by dividing both sides with L to get:

$q = Af(k)$ where $q= Q/L$ and $k = K/L$).

Assuming a Cobb-Douglas production function, the above general form can be written as:

$q = Ak^{\alpha}$, where α is a constant parameter.

Separating the effect of education from A, it can be derived:

$q = Ak^{\alpha}e^{\beta}$ where e is public expenditure on education on a per-worker basis.

To linearize the above function, it can be written in log form as under:

$$Lnq = LnA + \alpha Lnk + \beta Lne \quad (2)$$

Since the study is based on panel data for five countries and 19 years, the equation can be re-written as:

$$Lnq_{it} = LnA + \alpha Lnk_{it} + \beta Lne_{it} \quad (3)$$

Where i = i-th country (1-5) and t = year (1-19, denoting years 2000 to 2018).

The stochastic error term "Є" has been included to the above equation to estimate the parameters using regression analysis. The final regression equation is written as under:

$$Lnq_{it} = LnA + \alpha Lnk_{it} + \beta Lne_{it} + Є \quad (4)$$

It is assumed that each country's labor force grows at the same rate as its population does so that each variable in the equation is considered on a per capita basis instead of on a per-worker basis.

Data

For this study, data collection is based on education expenditure and GDP per capita for five developing countries in Asia with a sample period of 19 years from 2000 to 2018. The five developing countries chosen for this study are Bangladesh, Bhutan, India, Pakistan, and Nepal. The reason for selecting these countries was the availability of data and because these countries share similarities in culture and economic scenarios. All the data collected were from the World Bank publications (World Bank, 2020). This study utilizes a panel data set to analyze and estimate the outcome education expenditure has on the economic growth of these countries.

The dependent variable is the GDP per capita. The growth in GDP per capita represents the economic growth of the countries. Furthermore, the primary variable of interest or, in other words, the independent variable is the government expenditure on education. The data for education expenditure was converted to expenditure per capita by dividing with the total number of populations in each country. Moreover, there were a few missing

data for education expenditure, which were filled using the interpolation method in Microsoft Excel. The method of interpolation is elaborated in the Appendix.

Estimates of regression models based on panel data have their econometric issues, including stationarity of data series, cointegration, and the nature of the impact of data units (in this case, five countries) on regression parameters. These issues and their tests are briefly discussed next in the coming paragraphs.

Econometric Model

Panel Unit Root Test for stationarity of data series

In order to check if the variables are cointegrated or have a meaningful relationship, Granger and Newbold (1974) suggest that a regression result is not always reliable if the data used in the study are non-stationary. Thus, the unit root properties of the variables used in the panel estimation are checked in the first place. There is a necessity to examine whether the variables are stationary or non-stationary (moving along the trend line). For this panel estimation, three different types of tests have been conducted to check for unit root. The unit root tests used in this study are the Levin-Lin-Chu (2002), Im-Pesaran-Shin (2003), and the Fisher (2001) type ADF. All the tests above assume that under the null hypothesis, all series are non-stationary, and the alternative hypothesis is that at least one or all series in the panel is stationary. As this study uses a balanced panel dataset, it is possible to test for the Levin-Lin-Chu and Im-Pesaran-Shin unit root test. Unlike the

other two tests, the Fisher type Augmented Dicky Fuller test does not need a balanced panel.

Panel Cointegration Test

To understand the long-run equilibrium relationship of the variables, the next step will be to check for cointegration. In this study, two types of cointegration tests have been applied, the Pedroni (1999) cointegration test and the Kao (1999) Cointegration test. The Pedroni cointegration test proposes a heterogeneous panel cointegration test that allows testing for cointegration between variables. The null hypothesis of these tests states that there is no cointegrating relationship against the alternative hypothesis that suggests cointegration exists among the variables.

Panel Regression

In a panel dataset obtained by pooling cross-sectional and time-series data, it is crucial to determine if the model should be estimated as a fixed effect model or a random effect model. The fixed-effect model is applicable if the individual cross-sectional unit-specific effects are correlated with the independent variables. It creates different fixed values for each cross-sectional unit. In this model, it is assumed that the slope of the coefficients given does not change. The estimated coefficients only show the differences among time series data and cross-sectional data or sometimes show the differences among both types of data.

In the random effect model, the individual-specific effects are uncorrelated with the independent variable. While in the fixed-effect model, the parameters or the group means are fixed and not random, random variables in the random effect model, and the group means are random samples from the population.

In mathematical terms, the two types of models can be explained by writing the derived model as:

$$lnGDP_{it} = \beta_0 + \beta_1 lnX_{1it} + \beta_2 lnX_{2it} + w_{it} \quad (5)$$

The equation presents the annual rate of GDP per capita (GDP_{it}). The subscript i (i=1,2,…,5) and t (t=1,2,…,19) index the countries and time periods, respectively. lnX_{1it} represents the log of education expenditure per capita, and lnX_{2it} represents the log of gross capital formation per capita. The gross capital formation in this equation acts as a proxy for investment in capital stock.

$$w_{it} = u_{it} + \varepsilon_i$$

In the fixed-effect model, ε_i is the i^{th} cross-sectional unit or group-specific constant term. In the random effect model, ε_i is the i^{th} cross-sectional unit or group-specific random term. The random effect model estimators are considered to be consistent and efficient if appropriately chosen. Furthermore, the fixed-effect model estimators are always consistent but not necessarily efficient. Lastly, to find which model is appropriate for this study, a Hausman (1981) test is conducted. The null hypothesis for the Hausman test is that the Random Effect model is the appropriate model, and the alternative hypothesis

suggests that the fixed effect model is the appropriate model. The equation for the Hausman test is given below:

$$\chi^2 = \left[\hat{\beta}_{(FEM)} - \hat{\beta}_{(REM)}\right]' \left[VC(\hat{\beta}_{(FEM)} - VC\left(\hat{\beta}_{(REM)}\right)^{-1}\left[\hat{\beta}_{(FEM)} - \hat{\beta}_{(REM)}\right] \sim \chi^2_{(K-1)} \qquad (6)$$

If $\chi^2 > \chi^2_{0.05;(K-1)}$, then it is to be concluded that REM is the appropriate model for regression in this study.

RESULTS

This study aims to analyze the effect government spending on education has on the economic growth of these developing countries. Both GDP and education expenditure are converted to per capita by dividing them by the total number of populations, and the unit of measure is in constant 2010 U.S dollars. In this way, the data are adjusted to the inflation rate. However, before proceeding to the regression analysis of these variables, it is necessary to make the data suitable for the analysis. For this, Granger and Newbold (1974) consider that it is wise to check for the stationarity and long-term relationship of the variables; otherwise, the regression results may not be reliable or spurious.

To test for stationarity of data series, three types of unit root tests have been conducted on each of the variables. The three different types of tests include the Levin-Lin-Chu (2002), Im-Pesaran-Shin (2003), and the Fisher type ADF (2001). The null hypothesis for

all the tests mentioned above assumes that all series are non-stationary, and the alternative hypothesis is that at least one or all series in the Panel is stationary.

Table 2: Unit Root Tests

Method	GDP		Education Expenditure		Gross Capital Formation	
	T statistics	P-Value	T statistics	P-Value	T statistics	P-Value
Levin-Lin-Chu	3.8346	0.9999	0.4331	0.6675	2.7142	0.9967
Levin-Lin-Chu (10 lags)	0.7112	0.7615	-1.1067	0.1342	6.1323	1.0000
Im-Pesaran-Shin	3.0290	0.9988	-2.8692	0.0021	-6.1279	0.0000
Im-Pesaran-Shin (4 lags)	2.7233	0.9968	-4.2023	0.0000	-7.4605	0.0000
Fisher-type ADF	15.1807	0.1256	31.5334	0.0005	30.3075	0.0008

Table-1 Unit Root Test for GDP, Education Expenditure, and Gross Capital Formation. To understand the unit root test's significance level, looking into the p-value of the statistics is suggested. The p-value determines the significance of the statistics. If the probability value is less than $p < .001$, then the test is considered significant, and the null hypothesis can be easily rejected.

The panel unit root test results of GDP per capita, education expenditure per capita, and gross capital formation per capita are displayed in Table 2. According to all the unit root tests performed, the results indicate that the variable GDP per capita has unit root; in other words, GDP is non-stationary. The GDP is not stationary as the p-values for all the

test are above 0.01. Table 2 also shows that the variable education expenditure also has unit root but only according to the test of Levin-Lin-Chu. Im-Pesaran-Shin and the Fisher type ADF suggest otherwise, according to these two tests, education expenditure is stationary and does not have a unit root, as the p-values are less than 0.01. Similarly, the unit root tests for gross capital formation provides the same results. Except for Levin-Lin-Chu, all other test revels that the panel series of Capital formation is stationary.

Since there is an evidence of the existence of unit root among both the series, education expenditure and GDP, detected from the test results in Table-1, it can be concluded that both the series are non-stationary under the Levin-Lin-Chu test even though results from Im-Pesaran-Shin and Fisher type ADF suggests otherwise. Next to check if education expenditure and GDP have a long-run relationship; in other words, do these two variables have a meaningful relationship, and are they cointegrated? For this, two types of cointegration test have been performed, the Pedroni test for cointegration, and the Kao test on the panel data.

Table 3: Pedroni Cointegration Test

Method	statistics	p-value
Modified Philips-Perron t	-1.1148	0.1325
Phillps-Perron t	-3.3197	0.0005
Augmented Dicky Fuller t	-4.0007	0.0000

Table-3 Pedroni Cointegration Test. The cointegration test is performed to see if the variables selected have a long-term, meaningful relationship or not. For understanding the statistical significance of the test and the results, look into the p-value. The lower the p-value, the more significant the results are. If p>.001, then the null hypothesis will not be rejected.

The following hypothesis is assumed for the Pedroni cointegration test:

H_0 = There is no cointegration among the variables.

H_A= There is cointegration among the variables

Table- 3 Pedroni Cointegration test suggests that the variables are cointegrated as the p-values of the Augmented Dicky Fuller, and the Phillps-Perron t-test is less than 0.01. Hence, the null hypothesis can be rejected, and it can be said that Education expenditure and GDP are cointegrated.

Furthermore, after confirming the existence of cointegration among the variables, the Kao cointegration test can be performed to evaluate further. The Kao cointegration results are provided in Table-4.

Table 4: Kao Cointegration Test

Method	statistics	p-value
Modified Dicky Fuller t	-2.8543	0.0022
Dicky Fuller t	-2.5867	0.0048
Augmented Dicky Fuller t	-0.9593	0.1687
Unadjusted Modified Dicky Fuller t	-3.2738	0.0005
Unadjusted Dicky Fuller t	-2.7126	0.0033

Table-4 Kao Test for cointegration. The Kao cointegration test is viral when testing for panel cointegration. Again, to find the significance level of the results in the Kao cointegration test, the main focus of concentration is on the statistics' p-values. If $p < .001$, then it can be concluded that the results are statistically significant and trustworthy. If $p > .001$, then the null hypothesis will not be rejected, which will result in no cointegration among the variables.

With insight into the results provided in Table-4 Kao test, it can be seen that all the tests reveal the presence of cointegration among the variables as the p-values for all the tests is below 0.01 except the Augmented Dicky Fuller t-test. Finally, the conclusion based on the cointegration test that in these developing countries, education expenditure and GDP are cointegrated and move together along the trend through time.

Next, proceedings with the panel data regression estimates, the Hausman test's implication is to determine whether the Fixed Effect Model or the Random Effect Model is valid for a panel regression on the five developing countries. According to the Hausman test, the Random Effect Model is more suitable and yields more effective results for the regression. Since the chi-square calculated value is smaller than the chi-square's critical value at a 5% level of significance 0.38 < 3.84, the null hypothesis is to be rejected; and the Random effect model has been chosen.

Table 5: Random Effect Model Regression Results

Ln (GDP)	Coefficients	Std.Err	z-values (normal statistics)	R^2	N	Number of countries
ln_EXP	0.6666	0.0459	14.52	0.8085	95	5
ln_CAP	0.0358	0.0223	1.60			
Cons	4.3787	0.1676	26.11			

Table-5 Random Effect Model. The random effect model estimator is usually consistent and efficient if the variables are appropriately chosen. To understand the significance level, the REM depends on the z statistics. The z-value is considered significant if the value is over 1.96. The R-square used in this model is the within estimator. The within R-square is the r-square from the mean-deviated regression, i.e., the ordinary r-squared from the running OLS on the transformed data.

In the Random Effect Model for regression, it can be seen that education expenditure has a positive and statistically significant effect on economic growth for all the developing countries selected for this study. From the results provided in Table-5, it can be concluded that a 1% increase in the expenditure on education will bring about a 0.67% increase in the GDP per capita of these developing countries. Therefore, it can be said that education expenditure is positively and statistically significantly related to the growth at all levels of significance in these developing countries. The within estimate of the R-square value in the random effect model has been used. The R-square value is 0.8085, which suggests that the model is a good fit. The regression results show that the coefficient of gross capital formation is positive but not significantly related to the GDP in these countries.

CONCLUSION

In the present study, a comprehensive data set of five developing Asian countries and an attempt to understand the relationship between expenditure on education and the growth of these economies, have been taken into account.

In the first step of the analysis, tests for the stationarity of the variables have been performed. The finding is: the variables are stationary in the panel series. After this step, a panel cointegration test was conducted, and the test reports that a panel cointegration relationship exists among the variables selected for the five Asian developing countries. Later, it has undertaken the Hausman Test statistics to investigate whether the Fixed Effect Model or the Random Effect Model would be suitable for the regression. The

Hausman test reports that the Random Effect Model yields more practical and significant results for all the countries subjected to this study.

Based on the final regression model selected, the study concludes that education expenditure has a positive and statistically significant effect on the GDP per capita of these five countries. Education expenditure is expected to increase the GDP per capita of these nations by 0.67%. In other words, a 1% increase in education expenditure will bring about a 0.67% increase in the GDP per capita of these nations. Hence, the study establishes a quantitative relationship between education and economic growth in developing countries. This is in confirmation with the findings of previous studies that have been reviewed in this paper. Investment in human capital raises the labor force's productivity and efficiency, which leads to an increase in national output. Thus, investment in education is the key to economic progress. Investment in human capital will help countries implement new technological innovations while being cost-effective. Hence, countries should strive to invest more in high-quality education and ensure that everyone receives a certain degree of education. This is also important for long-term sustainable economic development. Their governments should provide subsidies to the education sector to make it affordable for the population to achieve their education attainment for better human capital formation. Also, given the current expenditure on education as a percentage of GDP is very low for few countries selected in this study. For governments to allocate more budget towards the development of the economy, the governments of developing countries should build a proper tax system so that people do not evade taxes. This way, the government will be able to generate revenue to spend on

economic development. This study intends to help policymakers by providing them insight to make informed decisions while distributing public funds to competing uses, including health, education, infrastructure, transportation, etc.

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APPENDIX

Interpolation of data

This study focuses on finding if the government's education expenditure creates an impact on the economic growth of five selected developing countries in Asia. The data for these countries were initially collected from the world bank website. The data collected had a few missing values in different years for different countries. There were a total of 11 missing data.

To fill up the missing data, a method called interpolation has been used. This method is used in excel to calculate for missing data. For calculating the missing value functions named: forecast.Ets and forecast.Linear has been used. This function helps to predict future or missing values on a timeline based on a series of existing values, by using an exponential smoothing algorithm. Linear

forecast was used only for country 5 for the years 2000 and 2001, and for the remaining data, the ETS forecast was applied.

The composition of the function forecast.ets is:

FORECAST.ETS(target_date, Values, timeline)

Target_date: a date for which we want to predict a value.

Values: the collection of historical values that are known or given to us for which we want to forecast the next point.

Timeline: the independent collection of dates or time, corresponding to each of the values.

The composition of the function forecast.linear is:

FORCAST.LINEAR (x, known_y's, Known_x's)

X: is the numerical x-values for which we want to forecast a new y-value. (X is the years)

Known_y's: an assortment of known y-values. (values of education expenditure)

Known_x's: an assortment of known x-values. (An array of the years selected for the study)