A Comparative Analysis on Selected Issues on Economics of Education in ASEAN Countries

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ABSTRACT

This study focuses on the contribution of education to GDP from the 10 ASEAN member countries. This compares the expenditure in education and the number of enrolees in the ASEAN. As the Philippines focuses on the implementation of the K-12 in 2016, and with the 2015 ASEAN integration, it is important for the country and the members of the ASEAN to determine their position regarding the contribution of education to GDP and compare their education expenditure and enrolees. This study determines the causality between the education expenditure and GDP in ASEAN. This study also used the structural stability test to examine the stability of the coefficients of the model between different time periods as this will provide insights concerning the stability or consistency despite the economic environment in previous years. The study made used of the specification error test to determine if there is specification error in the results. The study also used the unit root test in determining the stationarity of the time series data that may result to spurious regression output. The study used White heteroskedasticity test to determine if the variance of the residual is constant, unbiased and no outliers.

Keywords: education expenditure; economic growth; causality; ASEAN

1. INTRODUCTION

The role of education has been the emphasis of most countries in achieving economic development, especially in this globally competitive economic environment, particularly the ASEAN (Association of Southeast Asian Nations) integration. This signifies the importance of human capital in economic growth as countries invest in education, this will enhance human capital that will generate productivity (Manlagñit, 2011).

With the globalization and the ASEAN integration, it is important to determine the role of education in achieving economic growth. However, to achieve economic growth, countries should raise expenditure on education (Afzal et al, 2011). Raising education expenditure as an investment in human capital is considered as a primary foundation in achieving a significant level of economic development (Hassan and Ahmed, 2008; Wu, Tang, and Lin (2010), particularly for emerging and developing economies, like the ASEAN.

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Additionally, education provides opportunities for employment and therefore, generates revenue for the country as this boosts aggregate spending. As the endogenous growth theory aptly states, economic growth caused by accumulating human capital from education, and from having technical innovation can be highly substantial and sustainable for economic productivity (Jalil & Idrees, 2013); and that faster growth of human capital leads to faster economic growth in the general level (Grimm, 2005).

Vu, Hammes, & Im (2012) emphasized that education leads to higher productivity, as education contributes to higher social returns. The role of education in a nation's path to development cannot be taken for granted as labour productivity depends on education and that in due course, the individual's educational opportunities and attainment affects household income and economic growth (Afzal et al, 2010). Moreover, increasing education expenditure can lead to global economic advantages (Tarabini, 2010).

Economic growth is measured by using GDP growth rate. Hwang (2005) used real GDP per capita and population density as influencing factors on education expenditure emphasized that because of the high cost, education expenditure will increase. This is because of the influenced of the price changes, or inflation.

This paper examines the influence of inflation (price changes), unemployment, and population on education in ASEAN and further examines the causality between education and GDP growth rate.

2. LITERATURE

Empirical studies have examined the effects of education on economic growth. Jalil and Idrees (2013) emphasized the neoclassical growth model by way of accumulating human capital from education as a contribution to economic growth. This indicates that economic growth is affected by education that generates productivity of labor force. Since, education contributes in achieving economic growth, it is essential to invest more on education by increasing education expenditure (Tang and Yin, 2012). This human capital accumulation from increasing education expenditure is important in improving productivity and economic performance (Gounder and Xing, 2012). With this, competitive workers are expected to be employed (Abbott and Jones, 2012). Contrary to the findings of Cazzavillan et al. (2013) that educated labor force tend to decline their productivity in sub-Saharan Africa possibly because of low job opportunity in the region.

Moreover, Biagi and Lucifora (2008) highlighted that increasing educational attainment by accumulating human capital through education is associated to a decline in unemployment rate, since employers will demand workers with acquired skills (Hawley, 2004). This human capital accumulation will lead to competitive labor force, consequently, labor force will demand high-paying jobs (Kaas and Zink, 2011; Tilak, 2007) from the employers. Thus, high-paying jobs will motivate the population to acquire education because of its benefits (Biagi and Lucifora, 2008; Aakvik, Salvanes, Vaage, 2010 and Kumar, 2017). Hawley (2004) has shown that people with high level of education have increased their earnings and job opportunities. This high earning had increased the number of population who wanted to acquire education, specifically the number of enrolees (Kim, 2011).

This competitiveness of workers through human capital accumulation from education is significant in economic development. Chi (2008) mentioned that human

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capital accumulation played a significant role in achieving economic development, and this development was driven by human capital accumulation (Self and Grabowski, 2003). This shows the positive significant relationship between education and growth (Chen and Feng, 2000). This relationship shows the importance of education to achieve economic growth (Hanushek, 2013). This was supported by Doms, Lewis and Robb (2010) stating that highly educated population positively affects economic growth.

Several studies have shown the positive relationship of education to economic growth. However, some studies have shown that economic growth affects education. With the expansion of the economy, government can invest more and increase spending for education to accommodate the demand of the population to accumulate human capital. Studies have shown that education and economic growth can have a two-way relationship or bi-causality. Vu, Hammes, and Im (2012), Gylfason and Zoega (2003), and Hassan and Ahmed (2008) have shown that there is bi-causality between education and economic growth. To determine the causality of education and economic growth, Wu, Tang and Lin (2010) used the Granger causality model and found out that there is uni-directional or one-way causation from economic growth to human capital investment. This shows investment in education is affected by the economy, but causality will not reveal the relationship, it only reveals the causation of the series.

The Granger causality requires testing for cointegration test and stationarity test. Asteriou and Agiomirgianakis (2001) used the Johansen cointegration test to determine the long-run relationship between education and GDP in Greece where the study found that there is existing cointegration relationship between education and GDP per capita. Similar study conducted by Abu-Bader and Abu-Qarn (2003) found that the direction of causality is from government expenditure to economic growth, this shows that government should increase spending on education to achieve economic growth. This is supported by the study of Self and Grabowski (2003) stating that economic development leads to higher levels of education using causality test in Japan. Whereas, Afzal, et al. (2011) stated that there is bi-causality between education and economic growth, contrary to the findings for Pina and St. Aubyn (2005) stated that the causality from education to growth does not exist.

3. METHOD

This study examined the selected ASEAN indicators of education and its relationship to GDP (as this study also includes the causality between education and GDP). Time series (from 1970 to 2012) data on GDP, inflation rate, population, and unemployment rate were taken from World Development Indicators of World Bank (WB) database. Eq. 1 will estimate the relationship of inflation (INF), population (Pop) and unemployment rate (Unemp) on education (Educ). Education is measured by the number of enrolees in the primary, secondary, and tertiary levels. Eq. 2 and eq. 3 will determine the causality between education and GDP, whether there is bi-directional causality or uni-directional causality between education and GDP.

$$Educ_t = \beta_0 + \beta_1 INF_t + \beta_2 Pop_t + \beta_3 Unemp_t + e_t \quad \text{(eq. 1)}$$

$$Educ_t = \sum_{i=1}^{m} \alpha_i Educ_{t-i} + \sum_{k=1}^{m} \beta_k GDP_{t-k} + e_{t-k} \quad \text{(eq. 2)}$$

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$$GDP_t = \sum_{i=1}^{m} \gamma_i GDP_{t-i} + \sum_{k=1}^{m} \delta_k educ_{t-k} + v_{t-k} \quad \text{(eq. 3)}$$

This study used the trend model, eq. 4, to gain insights on the behaviour of the performance of ASEAN education for the period 1970 to 2012.

$$educ_t = \beta_0 + \beta_k time_{t-k} + \mu_{t-k} \quad \text{(eq. 4)}$$

The Structural stability test (eq. 5) determines the stability/consistency of the coefficients of the regression model between different time periods which can be obtained using Chow Breakpoint test. Structural change occurs when there is a change in the intercept, in the slope coefficients, or in both the intercept and the slope coefficients. The formula for the breakpoint test to determine the structural stability of the regression parameters is as follows: k is the number of regressors including intercept, n is the number of observations, RSS_R is the regression sum of squares restricted, and RSS_{UR} is the regression sum of squares unrestricted.

$$F = \frac{\left(RSS_R - RSS_{UR}\right)/k}{RSS_{UR}/\left(n_1 + n_2 - 2k\right)} \quad \text{(eq. 5)}$$

The Specification error test (eq. 6) determines the specification of the model regarding the inclusion of an irrelevant variable, or the exclusion of relevant variable, or the functional form of the model using the Ramsey RESET (Regression Equation Specification Error Test) test. A specification error creates biased or inconsistent regression estimators, and the inconsistency will still occur even when the number of observation increases. The formula for the Ramsey RESET test is as follows:

$$\hat{Y}_i = \hat{\beta}_1 + \hat{\beta}_2 X_{2i} + \hat{\beta}_{3i} X_{3i} + \gamma \hat{Y}_i^2 \quad \text{(eq. 6)}$$

Most of the time series data may have a random walk or non-stationarity, in other words, they may have a unit root. This means that the mean and variance are not independent of time, with this, non-stationary time series data will produce a spurious regression output, e.g., relationships are significant when in fact the results obtained a contemporaneous correlation rather than meaningful relationships. The widely used unit root test is the Dickey-Fuller test. The optimal lag length for the Augmented Dickey-Fuller (ADF) test is determined by minimizing the Akaike Information Criterion (AIC).

$$\Delta x_t = \alpha_0 + \alpha_1 t + \beta x_{t-1} + \sum_{i=1}^{m} \delta_j \Delta x_{t-i} + \varepsilon_t \quad \text{(eq. 7)}$$

The series will be integrated of order *d*, that is, $x_t \sim I(d)$, if it is stationary after differencing it *d* times. Cointegration indicates the long-run equilibrium relation. A series that is $I(0)$ is stationary.

$$\Delta y_t = y_t - y_{t-1} \quad \text{(eq. 8)}$$

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The study used White heteroskedasticity test to determine if the variance of the residual is constant, unbiased and no outliers. This determines if there is white noise in the regression.

$$e_i^2 = \beta_0 + \beta_1 educ + v_i \quad \text{(eq. 9)}$$

4. RESULTS AND DISCUSSIONS

Table 1 shows that the ASEAN unemployment rate is positively significant to the enrolment on primary education in the ASEAN. It shows that as the rate of unemployment increases, enrolment in primary education increases. This shows that since they are unemployed, enrolment in the primary level increases to become competitive and be employed in the future, stating that the foundation in developing the skills will be from the primary education. According to Abbott and Jones (2012), developing human capital will constitute to employability contrary to Cazzavillan et al. (2013).

The table also shows that ASEAN population is positively significant to the enrolment on primary education. It shows that as the rate of population increases, enrolment in primary education increases. This shows that as population increases, demand for primary education increases as well. Likewise, GDP growth is also positively significant to the enrolment on primary education. As the level of economy increases, enrolment in primary education increases. This implies that as the economy grows, demand for primary education increases since they now have the capacity to invest in primary education. However, inflation is insignificant in the model. It shows that though price changes, there are still enrolees in the primary level. Primary education is not affected by inflation.

Table 1. Dependent Variable: LOG(PRIMARY_EDUC_PUPILS)

Sample: 2005C01 2012C10
Included observations: 63

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	-1.729891	0.298254	-5.800060	0.0000*
INFLATION	-0.001647	0.007568	-0.217575	0.8285
GDP_GROWTH	0.044716	0.011345	3.941420	0.0002*
LOG(POPULATION)	0.952361	0.019313	49.31239	0.0000*
LOG(UNEMPLOYMENT)	0.142510	0.049983	2.851178	0.0060*
R-squared	0.983281			
Adjusted R-squared	0.982128		F-statistic	852.7702
Durbin-Watson stat	2.164225		Prob(F-statistic)	0.000000*

* indicates 5% level of significance

Table 2 shows the summary test from table 1. The Breusch-Godfrey serial correlation LM test shows that the model has no serial correlation error since the probability of the F-statistic is 0.9446, greater than 0.05 alpha. The Heteroskedasticity test shows that the model has no heterokedastic error since the probability of the F-statistic is 0.2928, greater than 0.05 alpha. The Chow Breakpoint test shows that the model has no structural breakpoint since the probability of the F-statistic is 0.8824, greater than 0.05 alpha. The Ramsey RESET test shows that the model has no specification error since the probability of the F-statistic is 0.2359, greater than 0.05 alpha.

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Table 2. Serial Correlation Test, Heteroskedasticity Test, Chow Breakpoint Test, Ramsey RESET Test (Primary education)

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	0.004880	Prob. F(1,57)	0.9446
Obs*R-squared	0.005393	Prob. Chi-Square(1)	0.9415
Heteroskedasticity Test: ARCH			
F-statistic	1.130395	Prob. F(1,50)	0.2928
Obs*R-squared	1.149620	Prob. Chi-Square(1)	0.2836
Chow Breakpoint Test: 2006C01 2006C10			
Null Hypothesis: No breaks at specified breakpoints			
Equation Sample: 2005C01 2012C10			
F-statistic	0.498665	Prob. F(10,48)	0.8824
Log likelihood ratio	6.226853	Prob. Chi-Square(10)	0.7959
Wald Statistic	4.986647	Prob. Chi-Square(10)	0.8921

Ramsey RESET Test			
	Value	df	Probability
t-statistic	1.197959	57	0.2359
F-statistic	1.435106	(1, 57)	0.2359
Likelihood ratio	1.566531	1	0.2107

Table 3 shows that unemployment rate is positively significant to the enrolment on secondary education in the ASEAN. It shows that as the rate of unemployment increases, enrolment in secondary education increases. This shows that since they are unemployed, the enrolment in the secondary education increases to become more competitive and be employed. The table also shows that population is positively significant to the enrolment on secondary education. It shows that as the rate of population increases, enrolment in the secondary education increases.

However, GDP growth is negatively significant to the enrolment on secondary education. As the level of economy increases, enrolment in secondary education decreases. This may show that since they finish their primary education and became employed, they tend to focus on their job instead of their schooling. With this, level of economy grows, and enrolment in the secondary level decreases since they are already employed. Moreover, inflation is negatively significant to the enrolment on secondary education. It shows that as the level of inflation increases, enrolees in the secondary level decreases. Students tend to discourage to go to secondary education and instead, they prefer to work more.

Table 3. Dependent Variable: LOG(SEC_EDUC_PUPILS)

Sample (adjusted): 1991C01 2012C09
Included observations: 147 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	-1.745820	0.227141	-7.686070	0.0000*
INFLATION	-0.008496	0.001968	-4.317894	0.0000*
GDP_GROWTH	-0.023971	0.007085	-3.383330	0.0009*
LOG(POPULATION)	0.947190	0.014828	63.87758	0.0000*
UNEMPLOYMENT	0.030114	0.010525	2.861083	0.0049*
R-squared	0.974411	F-statistic		1351.789
Adjusted R-squared	0.973690	Prob(F-statistic)		0.000000*
Durbin-Watson stat	2.883398			

* indicates 5% level of significance

Table 4 shows the statistical test of table 3, the serial correlation test, heteroskedasticity test, Chow breakpoint test, and the Ramsey RESET test. The table shows that the probability of the F-statistic of the Breusch-Godfrey serial correlation LM test is 0.3484 which is greater than 0.05 level of significance alpha stating that there is no serial correlation error in the regression output. The table also shows the probability of the heteroskedasticity test which is 0.0341 which is less than 0.05 alpha

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means that we need to accept the alternative hypothesis that there is heteroskedasticity in the regression. It shows that there is heterogeneity in the data used in the secondary education output.

Moreover, the table shows the probability of the Chow breakpoint test which is 0.0133 which is less than 0.05 alpha means that we need to accept the alternative hypothesis that there is a structural breakpoint in the secondary education output. Lastly, the table shows the probability of the Ramsey RESET test which is 0.0000 which is less than 0.05 alpha means that we need to accept the alternative hypothesis that there is misspecification error in the regression model. This states that the model for secondary education is mis-specified.

Table 4. Serial Correlation Test, Heteroskedasticity Test, Chow Breakpoint Test, Ramsey RESET Test (Secondary education)

Breusch-Godfrey Serial Correlation LM Test:				
F-statistic	1.062517		Prob. F(2,140)	0.3484
Obs*R-squared	2.197923		Prob. Chi-Square(2)	0.3332
Heteroskedasticity Test: ARCH				
F-statistic	4.622126		Prob. F(1,94)	0.0341
Obs*R-squared	4.499235		Prob. Chi-Square(1)	0.0339
Chow Breakpoint Test: 2002C01 2002C10				
Null Hypothesis: No breaks at specified breakpoints Varying regressors: All equation variables Equation Sample: 1991C01 2012C09				
F-statistic	2.363440		Prob. F(10,132)	0.0133
Log likelihood ratio	24.21204		Prob. Chi-Square(10)	0.0071
Wald Statistic	23.63440		Prob. Chi-Square(10)	0.0086
Ramsey RESET Test				
	Value	df	Probability	
t-statistic	4.829344	141	0.0000	
F-statistic	23.32256	(1, 141)	0.0000	
Likelihood ratio	22.50150	1	0.0000	

Table 5 shows that unemployment rate is negatively significant to the enrolment on tertiary education in the ASEAN. It shows that as the rate of unemployment increases, enrolment in tertiary education decreases. This shows that since they are unemployed, the enrolment in the tertiary education decreases. The table also shows that population is positively significant to the enrolment on tertiary education. It shows that as the rate of population increases, enrolment in the tertiary education increases. However, GDP growth is negatively significant to the enrolment on tertiary education. As the level of economy increases, enrolment in tertiary education decreases. This may show that since they finish their primary education and became employed, they tend to focus on their job instead of pursuing tertiary level. With this, level of economy grows, and enrolment in the tertiary level decreases since they are already employed. Moreover, inflation is negatively significant to the enrolment on tertiary education. It shows that as the level of inflation increases, enrolees in the tertiary level decreases. Students tend to discourage to go to tertiary education and instead, they prefer to work more.

Table 5. Dependent Variable: ENROLL TERTIARY PERCENT

Sample (adjusted): 1999C03 2012C10
Included observations: 90 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	-52.33699	22.22316	-2.355066	0.0208*
INFLATION	-0.159940	0.082050	-1.949284	0.0546**
GDP_GROWTH	-1.933489	0.476631	-4.056576	0.0001*
LOG(POPULATION)	5.256125	1.266338	4.150649	0.0001*

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UNEMPLOYMENT	-1.413208	0.462777	-3.053754	0.0030*
R-squared	0.394268	F-statistic		13.83154
Adjusted R-squared	0.365763	Prob(F-statistic)		0.000000*
Durbin-Watson stat	1.860228			

* indicates 5% level of significance, ** indicates 10% level of significance

Table 6 shows that the regression model has no serial correlation error since the probability of the F-statistic is 0.5473 which is greater than 0.05 level of significance alpha stating that we need to accept the null hypothesis of no serial correlation error in the regression output. The table also shows that the probability of the heteroskedasticity test is 0.7731 which is greater than 0.05 level of significance alpha stating that we need to accept the null hypothesis of no heteroskedasticity error in the regression output. The Chow breakpoint output also shows that the probability of the test is 0.0676 which is greater than 0.05 alpha states that there is no structural breakpoint in the regression. Lastly, the Ramsey RESET test shows that the probability is 0.2709 which is greater than 0.05 alpha states that there is no misspecification error in the regression model. These tests show that the regression model is consistent and can be used for analysis and recommendation.

Table 6. Serial Correlation Test, Heteroskedasticity Test, Chow Breakpoint Test, Ramsey RESET Test (Tertiary education)

Breusch-Godfrey Serial Correlation LM Test:				
F-statistic	0.365217		Prob. F(1,84)	0.5473
Obs*R-squared	0.389610		Prob. Chi-Square(1)	0.5325
Heteroskedasticity Test: ARCH				
F-statistic	0.084034		Prob. F(1,52)	0.7731
Obs*R-squared	0.087125		Prob. Chi-Square(1)	0.7679
Chow Breakpoint Test: 2006C1 2006C10				
Null Hypothesis: No breaks at specified breakpoints				
Varying regressors: All equation variables				
Equation Sample: 1999M03 2012M10				
F-statistic	1.841680		Prob. F(10,75)	0.0676
Log likelihood ratio	19.76248		Prob. Chi-Square(10)	0.0316
Wald Statistic	18.41680		Prob. Chi-Square(10)	0.0483
Ramsey RESET Test				
	Value	df	Probability	
t-statistic	1.108300	84	0.2709	
F-statistic	1.228330	(1, 84)	0.2709	
Likelihood ratio	1.306538	1	0.2530	

Table 7 shows the correlation matrix of the tertiary enrolment (in percent), inflation rate, GDP growth rate, log(population), and the unemployment rate. The result shows that tertiary enrolment and inflation rate are significant and negatively correlated to each other by 0.304305 or 30%. Tertiary enrolment and GDP growth rate are also significant and negatively correlated by 0.350916 or 35%. While log(population) or the population growth rate and tertiary enrolment are significant and positively correlated. Additionally, unemployment rate and tertiary enrolment are insignificant.

Table 7 Correlation of Tertiary enrolment rate, inflation, GDP growth rate, Log(Population), unemployment rate

Sample (adjusted): 1991C03 2012C10
Included observations: 132 after adjustments
Balanced sample (listwise missing value deletion)

Correlation t-Statistic Probability	TERTIARY	INFLATION	GDP_GROWTH	LOG(POPULATION)	UNEMPLOYMENT
TERTIARY	1.000000 -----				

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INFLATION	-0.304305	1.000000			
	-3.642347	-----			
	0.0004*	-----			
GDP_GROWTH	-0.350916	-0.102882	1.000000		
	-4.272774	-1.179293	-----		
	0.0000*	0.2404	-----		
LOG(POPULATION)	0.411268	-0.148780	-0.243274	1.000000	
	5.144379	-1.715445	-2.859658	-----	
	0.0000*	0.0886**	0.0049*	-----	
UNEMPLOYMENT	0.131090	0.002963	-0.220265	0.562534	1.000000
	1.507664	0.033782	-2.574641	7.757707	-----
	0.1341	0.9731	0.0112*	0.0000*	-----

* indicates 5% level of significance, ** indicates 10% level of significance

Table 8 shows the granger causality between tertiary enrolment and the GDP growth rate. The probability of 0.0098 which is less than 0.05 alpha shows that there is uni-directional or one-way causation, and the direction of the causation is from the tertiary enrolment to GDP growth rate. This shows that tertiary enrolment affects the GDP growth rate in the ASEAN region. While the table 9 shows the granger causality between secondary education enrolment and GDP growth rate and between primary education enrolment and GDP growth rate. The table shows that GDP growth rate granger cause secondary education enrolment, or there is a one-way causation or uni-directional. The direction is from GDP growth rate to secondary education enrolment. The table also shows the causality between GDP growth rate and primary education enrolment. The result shows that there is bi-causality between GDP growth rate and primary education enrolment. This means that primary education enrolment granger cause GDP growth rate and at the same time, GDP growth rate granger cause primary education enrolment.

Table 8. Granger causality test (Tertiary and GDP)

Pairwise Granger Causality Tests Tertiary
Sample: 1971C01 2012C10

Null Hypothesis:	Obs	F-Statistic	Prob.
GDP_GROWTH does not Granger Cause ENROLL_TERTIARY_PERCENT_	118	0.16243	0.6877
ENROLL_TERTIARY_PERCENT_ does not Granger Cause GDP_GROWTH		6.89016	0.0098*

* indicates 5% level of significance

Table 9. Granger causality test (Primary, secondary, and GDP)

Pairwise Granger Causality Tests
Sample: 1971C01 2012C10
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
GDP_GROWTH does not Granger Cause LOG(SEC_EDUC_PUPILS)	177	8.36394	0.0043*
LOG(SEC_EDUC_PUPILS) does not Granger Cause GDP_GROWTH		0.58965	0.4436
LOG(PRIMARY_EDUC_PUPILS) does not Granger Cause GDP_GROWTH	248	8.48498	0.0039*
GDP_GROWTH does not Granger Cause LOG(PRIMARY_EDUC_PUPILS)		7.58512	0.0063*

* indicates 5% level of significance

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5. CONCLUSION

The results show that the Tertiary education granger cause the GDP growth means that tertiary education influences the economy. While GDP growth granger cause secondary education means that the economy influences the movement in the secondary education. The causality between GDP growth and primary education shows bi-directional or bi-causality means that the economy influences the primary education and at the same time the primary education influences the economy. It shows that economic growth is dependent on the movement in education, particularly the primary education and the tertiary education. This shows that investing more in education is an important contributor to the economy.

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