Government Expenditure on Education and Economic Growth: An Econometric Study

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Abstract. The increase in government expenditure on education is commonly considered to have a positive effect on economic growth by raising GDP per capita. This essay aims to examine the effectiveness of education investment in driving economic growth. The panel Ordinary Lease Square (OLS) model is used to establish a regression model with data sets for Asian least developed, developed, and developing countries from 1995 to 2015 and a case study on China and Malaysia. The regression model manifests public spending on education as having a stimulative effect on economic growth in countries that have a stable and relatively more developed economy. The case study investigated the relationships between six factors relating to the government's expenditure in education and found that investment in secondary schools has a strong relationship with prominent economic returns.

Keywords: Government expenditure; education; economic growth; panel OLS estimator.

1. Introduction

1.1. Research Background and Related research

The significance of education on economic growth has constantly been argued. The study conducted by Mingat et al. found substantial distinctions between countries on investment in the education sector among countries. They proposed that even not taking the systematic differences in education across developed and less-developed countries into consideration, government priority is another factor that countries set differently in allocating public spending [1].

John Baffes and Anwar Shah argue that: "Public investment in human resource—developed followed by private investment provides the most important stimulus for economic growth", and their research on productivity of public spending based on the endogenous-growth theory, also gives an empirical support to the government's strategy of enlarge public spending on education and training, in order to empower human capital in a nation. For both developed and low-income countries, the average development capital was "twice as much as the private capital stocks", they found, which supports an expected strong relationship between larger government expenditure on education with economic growth [2].

Another study was conducted by Mallick et. al. on 14 Asian countries and concluded that government investment in the education sector is "an essential determinant of economic growth in the long term" [3]. In their evidence they suggested that government investment in education could generate an unskillful labor force, thereby, what drives economic growth is the productivity improvement that can result in an increase in national output levels [4].

This paper will discover the relationship between government expenditure on education and economic growth. In this paper, the efficiency of government public expenditure on education will be discussed by taking the economic return, which is the national economic growth, as a determinant. In this condition, if a government is allocating its expenditures effectively, then its expenditure on education spending should stimulate a nation's economic growth, based on what Baffes and Shah propose [4]. Therefore, this nation could say it had allocated its government budget effectively to improving human capital. We hypothesise that government expenditure on education will lead to higher economic growth.

Additionally, in this paper, four major regression models will be experiment on developed, developing, and least developed Asian countries, thereby, we also aimed to suggest possible implications that countries with different economic and political priorities could follow, to maximize their efficiency in allocating public expenditure from the point of view of education spending, to achieve greater economic growth.

2. Methodology

2.1. A review of Asian countries

This paper will utilize the statistical method of panel Ordinary Lease Square to build simple regression models. The population selected in all three models was Asian. Samples are selected based on random sampling. The ten Asian countries sampled to experiment with the first regression model in Figure 1 include China, Japan, Sri Lanka, Kazakhstan, the Philippines, India, Thailand, Nepal, Mongolia, and Iran. In the sample, there are developed countries, developing countries, and least developed countries (LDCs).

The second regression model in Figure 2 is established with four least developed Asian countries: Laos, Bhutan, Nepal, and Bangladesh, and the third regression model in Figure 3 samples five developed or developing Asian countries: China, Japan, India, Mongolia, and Thailand. In these three regression models, the economic return of the ratio of government expenditure on education to GDP imposed on the percentage changes of GDP per capita, PPP (constant international dollars), will be discussed by taking data between 1995 and 2015 in Asian countries.

2.2. Variable clarification

The first regression model for the ten Asian countries consists of an independent variable of the share of educational expenditure on total government spending and a dependent variable of the change rate of GDP per capita, PPP (constant 2017 international dollars), from 1995 to 2015. The ten countries selected through random sampling included in this empirical analysis are as follows: China, India, Iran, Japan, Kazakhstan, Thailand, Nepal, Mongolia, Sri Lanka, and the Philippines; on the other hand, the second model only takes the first five countries into account.

Purchasing power parities (PPPs) are "the rates of currency conversion that try to equalize the purchasing power of different currencies by eliminating the differences in price levels between countries" [10]. The final expenditures are sampled by the basket of goods and services and have been adjusted for inflation and exchange rates. This indicator is expressed as a national currency rate against the US dollar, and in this essay, the data for GDP per capita, PPP (constant 2017 international $), representing economic growth, is collected from the World Bank and Our World In Data. Besides, the portion of current government operating expenditures on education is referred to as education expenditures. Via these two variables, this empirical model is designed to estimate the dynamic efficiency of education expenditure on the economic growth of the respective Asian countries.

3. A case study of China and Malaysia

An extended case study was conducted on China and Malaysia, with the objective of estimating the relationship between multiple factors relating to education expenditure and economic growth. Two countries, China and Malaysia with similar economic structures were selected for further analysis and comparison.

3.1. Model specification

This model is established based on the research conducted by Craigwell et al. [4]. This paper extends to build a regression model that utilizes a panel Ordinary Lease Square (OLS) model and comprises two data sets for China and Malaysia. The case study of China and Malaysia provides a

review of the efficiency of the Chinese and Malaysian governments' spending on education from the perspective of economic growth.

Through the tested statistics in the two OLS models below, the efficacy of government expenditure on multiple components of public infrastructure and the education system is calculated. (1)
The regression model is below [5]:

$$l\_GDPpercapita_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \varepsilon \quad (1)$$

Table 1. Indicators relates to economic return of public investment in education [4]

Indicators	Description
GDPpercapita	Logarithm dependent variable for i observation, the determinant for economic growth
X_1	Urban population as a percent of total population
X_2	Public expenditure as a percent of total government expenditure
X_3	Pupil-teacher ratio in primary and secondary schools (pupils per teacher)
X_4	Trained teachers in primary and secondary education (in percentage)
X_5	Foreign direct investment as a percent of GDP
X_6	GNI per capita

3.2. Variables clarification

In this case study of China and Malaysia, six variables directly relating to the education system, are analyzed, with data over a twenty-year time period of 1995–2015. Information used in this empirical study was collected from multiple sources and databases, including The Word Bank, Our World in Data, Global Data, Index Mundi, and the profile "Secondary Education Regional Information Base" of Malaysia. The seven variables were selected based on the original study of Bynoe et. al, the variables selection was also limited by the available data can only be collected through viable sources, and this empirical case study aims only to analyze the variables active to the efficiency of returns on government spending in different aspects of the education system.

Real GDP per capita (not nominal) was used to eliminate the effect of inflation in order to compare data across twenty years and was computed for logarithms to present linear changes. In this model, urban population is used to measure the number of people living in urban areas as a percentage of the national population. It is calculated based on a rate estimated using World Bank population data.

Public expenditure is expressed as a percentage of national GDP, to enable a comparison between these two countries to be made. In this model, the public expenditure consists of government investment in educational institutions of all learning levels, financial aid to public and private corporations, scholarships, and grants.

Pupil-teacher ratios of primary schools, secondary schools, and above in education are separately calculated in the "Descriptive Summary Statistics". This variable measured the average ratio between the number of pupils and the number of teachers in schools. The relative efficacy of the returns of the government's spending on improving the number of Trained teachers as a percentage of the total number of teachers, in primary and secondary schools, is calculated for Malaysia. Teachers as being trained can be judged by their experience of receiving the minimum organized teacher training, in the form of pre-service or in-service, that is required by a country. The national income per capita is quantified by the index of GNI per capita measured in current US dollars.

The variables "urban population", "foreign direct investment" and "income per capita" all have an indirect correlation with growth in real GDP and economic growth. Theoretically, government spending allocated to the education sector has a direct positive effect on educational attainment, which

will further lead to improvement in labor productivity. The government's financial support on education is a supply-side policy that has the potential to boost the long-term aggregate supply by improving human capital, as T.W. Schults argued in his "Human Capital" theory, is essential in influencing economic growth.

A higher percentage of urban population is expected to lead to higher regional human capital, and, thereby, income and consumption levels. Also, George Psacharopoulos found that those countries that value human capital and education level as more important tend to reinvest their foreign direct investment into the education sector [6].

4. Model and Data

4.1. An analysis of Asian countries

The empirical models are simple regression models based on econometric analysis, which are used to estimate the relationship between the expenditure on education and the growth rate pf GDP per capita, PPP (constant 2017 international $) by calculating the government spending as a % share of GDP. Additionally, the Ordinary Least Squares Estimator (OLS estimator) is expected to evaluate the coefficients of the linear regression model, through the equation $Y_i = b_0 + b_1X_i + e_i$, where Y represents the changes in percentage of GDP per capita, and X represents changes in government's public expenditure on education. The significance level is set at 5%.

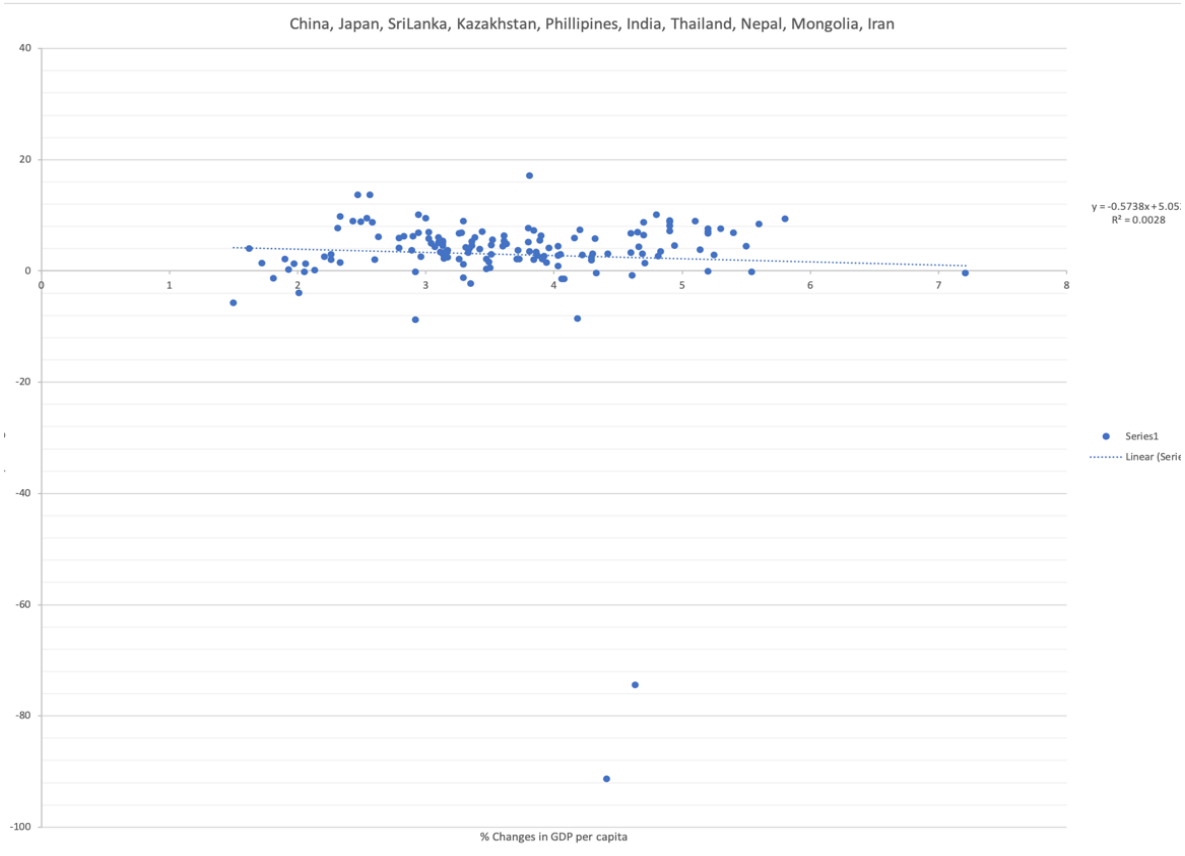

Fig. 1. Relationship between government spending on education and economic growth, regression model of ten Asian countries

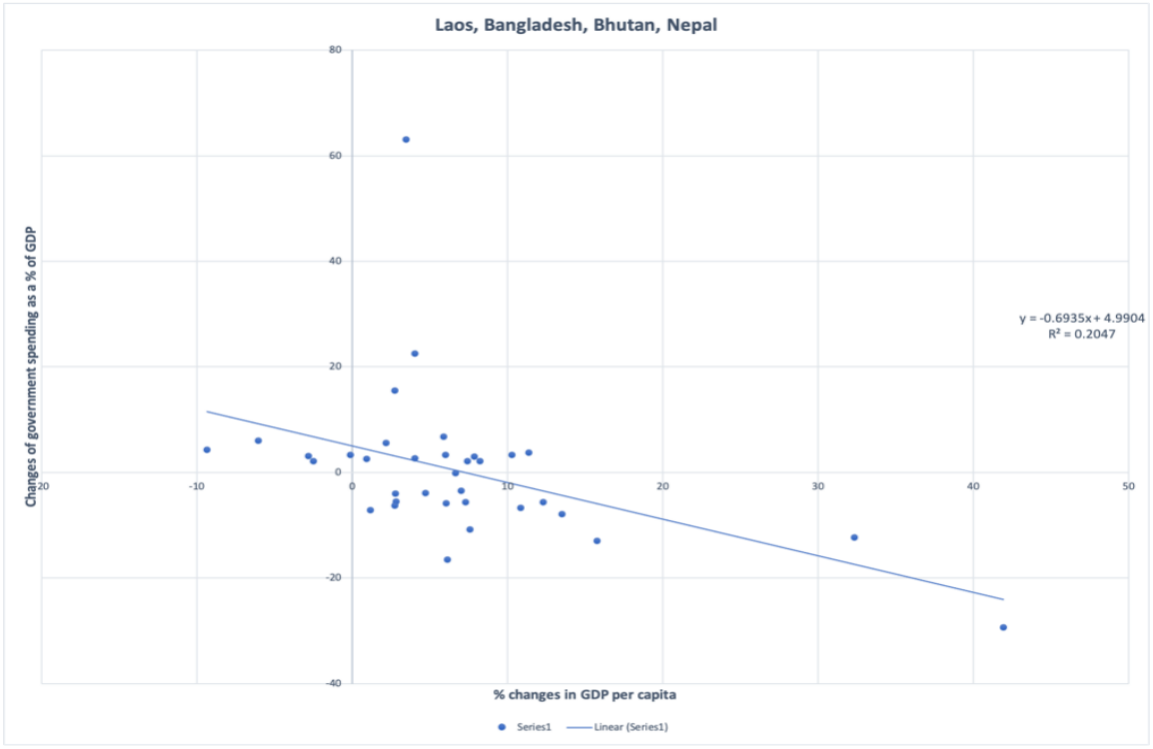

Fig. 2. Relationship between government spending on education and economic growth, regression model of four Asian least developed countries

Fig. 3. Relationship between government spending on education and economic growth, regression model of five developed and developing Asian countries

The model in Fig. 1 is the regression of ten countries sampled by random sampling. This model presents no direct correlation between government investment in education and GDP growth since the coefficient of the regression does not have a prominent value. The samples selected randomly are China, India, Iran, Japan, Kazakhstan, Thailand, Nepal, Mongolia, Sri Lanka, and the Philippines. The regression coefficient, which manifests the share of education expenditure on the total government expense, is proposed to have a weak relationship with economic growth, in terms of GDP per capita, of the 10 Asian countries, with a figure of -0.5738.

The R-squared is low and equal to 0.28%, showing a high degree of dispersion of the datapoint. Although the regression model in Figure 1 has not manifested the supply-side policy of education investment, which has a prominent promotion significance for economic growth, the researchers found the discrete datapoints are identified to derive from relatively less developed countries, such as Nepal and Sri Lanka.

The researcher then hypothesized that the relationship between the government's expenditure on education and GDP growth may present itself differently depending on the socio-economic situation of the country. This socio-economic situation involves factors such as economic development, population, action, et cetera. Therefore, a new hypothesis is established: the relationship between the X and Y variables in this model may be related to the level of national development. The null hypothesis is that the level of economic return of government investment in education is irrelevant to the nation's level of economic development.

Two simple regression models in Figs. 2 and 3 are established, respectively, for testing the authenticity of the hypothesis. The second model in Fig. 2 experimented with four Asian least developed countries suggested by the United Nations; the third model in Fig. 3 tested six Asian developed and developing countries.

Table 1. Regression statistics for a five developed and developing countries manifestation

t-stat	2.01004354	P-value	1.19E-46
Coefficient	3.00145141	Standard error of regression	0.10398374
R-Squared	0.39490545	Adjusted R-Squared	0.38802937

The six developed and developing countries sampled for the regression model in Figure 3 are: China, Japan, India, Mongolia, and Thailand. These countries were relatively less exposed to the 1997 financial crisis and had more developed or stable economies in the long term. According to Table 1 and the statistical references of the third model in Figure 3, the positive coefficient of 3.0014 indicates a positive relationship between increase in government expenditure in education and economic growth. The P-values of 1.19E-46 manifest a large significance to the positive relationship tested by the regression, between public expenditure in education and economic growth in developed and developing countries.

In the second model in Fig. 2, four least developed countries, Laos, Bangladesh, Bhutan and Nepal were sampled to test the hypothesis of education return has relevance with level of economic growth. A negative coefficient of -0.6935 demonstrate an inverse relationship between government expenditure in education and economic growth. The two regression models in Figure 2 and 3 rejected the null hypothesis, and conform to the hypothesis: the level of economic return of public investment in education, is in relevance with the level of economic development of a nation.

A comparison of models in Figs. 2 and 3 shows that the country's overall economic level and productivity do influence the effect of government spending on education on GDP growth. The first regression model analyzing the least-developed countries illustrates an inverse correlation between education expenditure and economic growth. This does not reject the hypothesis. To conclude, only after a certain level of economic development can the government expenditure of a nation on its education sector have a prominent economic return.

4.2. A case study of China and Malaysia

The comparison of two regression models on developed (and developing) and least developed countries in Figs. 2 and Fig. 3 shows a positive correlation between high levels of economic growth and returns of government expenditure on education. Six variables related to the education system were selected for further regression analysis in China and Malaysia, with the objective of investigating relationships between specific variables and a positive economic return on public expenditure on education.

Table 2 and Table 3 show the statistics of all variables measured. The urban population in Malaysia is higher than in China by a percentage nearing 23%; however, China has conspicuously higher public

expenditure as a share of the national GDP of about 15%. The economic structure of China and Malaysia is similar, and the level of foreign direct investment occupied as a share of GDP in both countries is similar, in Malaysia, it is 3.55285714, and in China, it is 3.3625. The income per capita in China with a mean of 2854.7619$ is significantly lower than the mean of 6328.09524$ in Malaysia.

Table 2. Descriptive Summary Statistics of China

(Independent) Variables	Median	Mean	Standard Deviation	Minimum	Maximum
Urban population (% of total population)	42.522	42.7185238	7.86100118	30.961	55.5
Public expenditure (% of GDP)	97.0834452	96.1241053	2.01091443	91.4784779	98.3488958
Foreign direct investment, net inflows (% of GDP)	3.5	3.3625	0.84528102	1.6	4.6
Total pupil-teacher ratio, primary	17.55452	19.12071	3.09047723	16.23079	24.15677
Total pupil-teacher ratio, secondary	16.9041	15.9020231	2.06569369	15.45224	19.5765
Income per capita (Current US$)	1760	2854.7619	2429.06488	540	7890

Table 3. Descriptive Summary Statistics of Malaysia

(Independent) Variables	Median	Mean	Standard Deviation	Minimum	Maximum
Urban population (% of total population)	66.59	64.6742857	9.74759743	29.5	74.21
Public expenditure (% of GDP)	82.5599369	85.086545	8.12713659	74.9481321	103.93486
Foreign direct investment, net inflows (% of GDP)	3.49	3.55285714	1.35965489	0.06	5.14
Total pupil-teacher ratio, primary	16.89527	16.2278586	3.47140364	11.4126	21.80374
Total pupil-teacher ratio, secondary	18.3783	18.9651672	3.07136351	14.8	25.47
Total trained teachers in primary education (percentage)	95.3520777	95.3520777	2.3123519	91.0259933	99.9343872
Total trained teachers in secondary education (percentage)	98.4714737	97.9936093	1.54494557	94.2297516	99.950882
Income per capita (Current US$)	5270	6328.09524	2737.40136	3380	11140

4.3. Regression analysis

The regression model was estimated using panel OLS analysis for two datasets of countries, China and Malaysia, over the years. The significant level set for this empirical study is 10%, as shown in Table 4 and Table 5.

Table 4. Regression Analysis Output of China

Dependent variable: Log of GDP per capita (economic growth)

(Independent) Variables	Coefficient	Standard Error	t-Stat	p-value
Urban population (% of GDP)	8.90132875	0.03964169	224.544634	5.3552E-34
Public expenditure (% of total population)	10.1798107	1.86683927	5.45296577	2.9202E-05
Foreign direct investment, net inflows (% of GDP)	10.2689828	0.11607081	88.4717079	1.21E-20
Total pupil-teacher ratio, primary	12.2392331	0.40468623	30.2437598	1.5507E-09
Total pupil-teacher ratio, secondary	10.4689752	0.26214855	39.935278	1.926E-11
Income per capita (Current US$)	9.62120754	0.01865202	515.826529	7.3648E-41

Table 5. Regression Analysis Output of Malaysia

Dependent variable: Log of GDP per capita (economic growth)

Variables	Coefficient	Standard Error	t-Stat	p-value
(Independent) Urban population (% of total population)	8.94070281	0.16716046	53.485752	3.4872E-22
Public expenditure (% of GDP)	9.75130372	0.41075009	23.740235	1.382E-15
Foreign direct investment, net inflows (% of GDP)	9.8666868	0.10818128	91.2051195	1.4311E-26
Total pupil-teacher ratio, primary	10.5877368	0.04169519	253.931874	5.1788E-35
Total pupil-teacher ratio, secondary	10.451333	0.09484099	110.19848	3.9585E-28
Total trained teachers in primary education (percentage)	7.89164315	1.55084543	5.08860715	6.5252E-05
Total trained teachers in secondary education (percentage)	8.28370243	2.51960018	3.28770513	0.00387107
Income per capita (Current US$)	9.43359103	0.02769293	340.649785	1.9521E-37

With nearly half of Malaysia's population living in urban areas and China's 65% percentage, both China and Malaysia can be said to be socio-economically well developed. However, strikingly, the correlation between government spending on education and economic growth in China is positive, with a coefficient of 2.7763, and an R-Square value of 0.7887, whereas the coefficient in Malaysia is 0.0421, smaller than in China and with a low R-Square value of 0.2185. This relatively low R-Square value of the regression of Malaysia manifests a large dispersion of its data points, which is an embodiment of the instability of its economy during 1995–2010, as shown in Figs. 4 and 5.

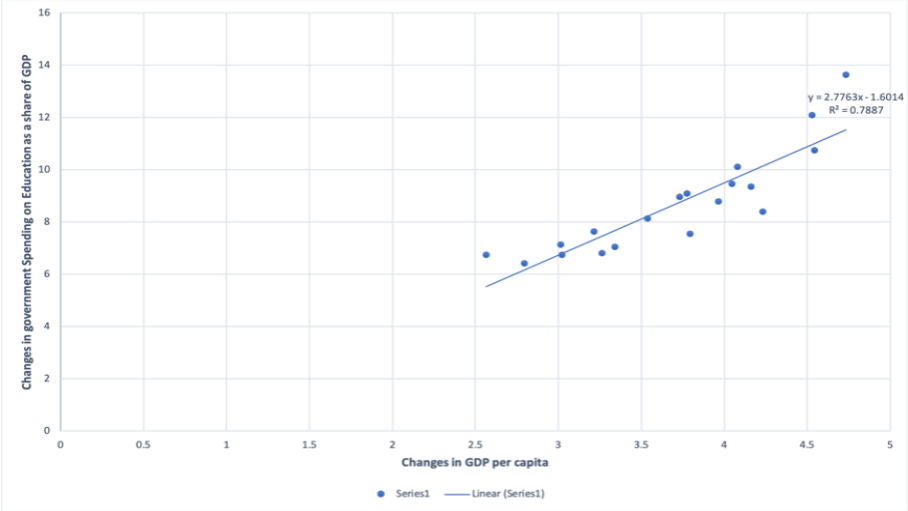

Fig. 4. Relationships between China government expenditure on education and economic growth

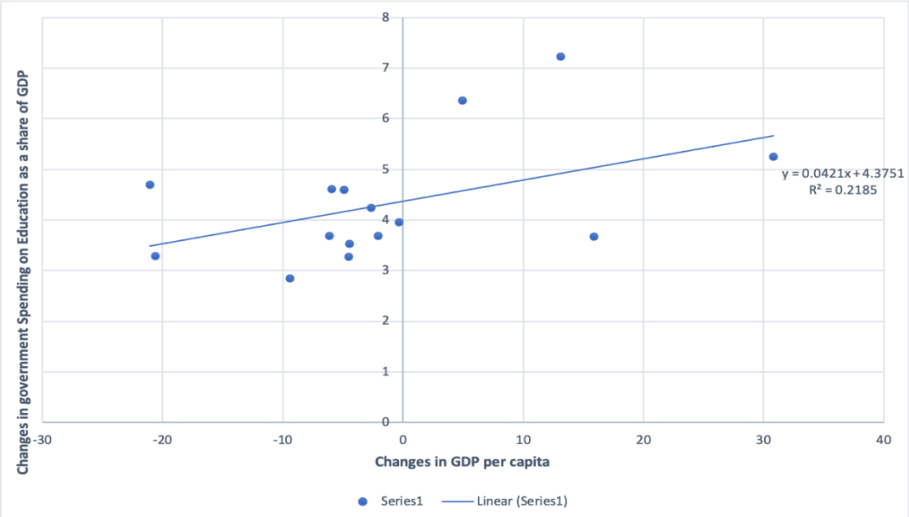

Fig. 5. Relationships between Malaysia government expenditure on education and economic growth

The economic structures of China and Malaysia are highly similar, in that both countries have a mixed planned and market economy that heavily relies on manufacturing industries to lead economic growth. Also, agriculture is the basic industry in both countries. The governments of both countries have played a strong interventionist role that stimulates economic development, and both governments have provided comprehensive policies toward public education and valued human capital investments [7].

Table V compares the statistics of China and Malaysia in the variables. As China and Malaysia have a similar economic structure, by comparing the differences in statistics between these two countries, factors that have the potential to cause Malaysia to have a weaker correlation between government investment in education and economic growth can be identified. The public expenditure in China as a share of GDP is 96.1241053%, higher than the 85.086545% of Malaysia. China also has a larger total pupil-teacher ratio in secondary education compared to Malaysia. Therefore, these two variables may play a significant role in driving economic growth from the many education-related relative variables, as shown in Table 6.

Table 6. An Analysis of the most significant variables in China and Malaysia (Mean of each)

	China	Malaysia
Total pupil-teacher ratio, primary	19.12071	16.2278586
Total pupil-teacher ratio, secondary	15.9020231	18.9651672
Foreign direct investment, net inflows (% of GDP)	3.3625	3.55285714
Public expenditure (% of GDP)	96.1241053	85.086545

Moreover, both countries shared their four most significant variables that have a correlation with economic growth: Total pupil-teacher ratio in primary school (12.2392331, 10.5877368), Total pupil-teacher ratio in secondary school (10.4689752, 8.28370243), FDI (10.2689828, 9.8666868), public expenditure as a share of GDP (10.1798107, 9.75130372), and GNI per capita (9.62120754, 9.43359103). These are the variables that were tested and found to bring the largest economic returns to countries that are considered "profitable".

The crucial role played by primary school education, tested by both OLS models, coincided with the result tested by Psacharopoulos in his model of education level and rate of return [6]. Based on the analysis of Psacharopoulos, investment in primary education is known as the most “profitable”, followed by secondary education, which means economically, they can give the highest economic growth, as shown in Fig. 6.

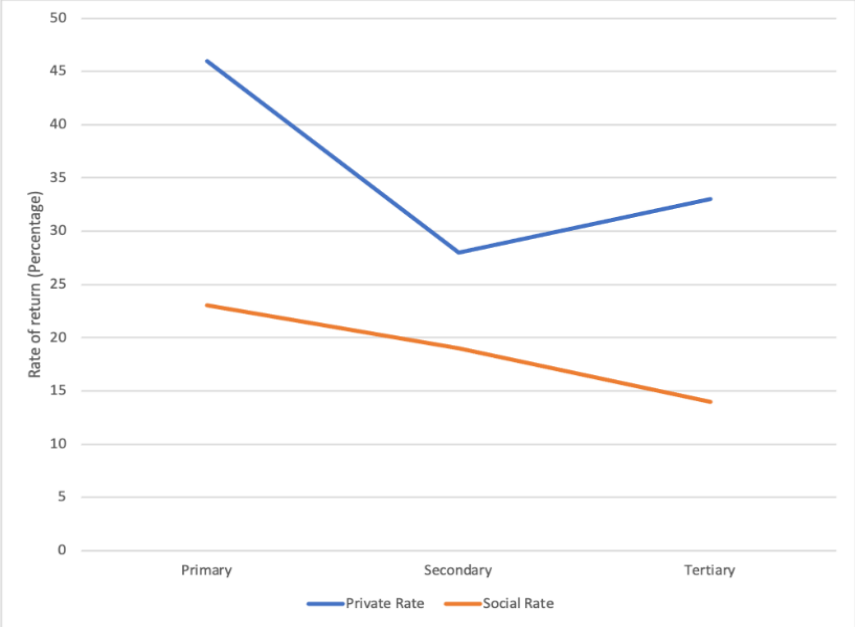

Fig. 6. Difference between rate of return of levels of education [8]

5. Limitation

This paper aimed to use education spending as a variable influencing economic growth, but the study encountered a couple of limitations. Some of the data had multiple gaps in time periods as a result of the limited scope of data collection in some Asian countries. The total number of observations across which the regression was computed was consequently constrained.

According to the statistical references in Table I, a low R-squared level indicates a very low goodness of fit of the regression to the datapoints, and this may derive from a relatively large quantity of outliers of data from countries during financial crises. Also, time lags may exist in the education feedback related to the different education systems of each country. In order to measure the relationship between education and GDP more accurately, the GDP changes after the investment in education should be taken at a given time, such as one year or five years. From this, a conclusion can be drawn about the highest return on investment in education in the years after investment.

One limitation of the cast study of China and Malaysia is the inclusion of biases and limiting the selected number of variables. As this case study is an extension of the research of Craigwell et al., and the major goal of this paper is to investigate the efficiency of education expenditure as a variable, the seven variables were selected from a wider range of variables measured by Bynoe et. al.. However, there are other variables that may play an important role in stimulating economic growth and school efficiency. Even though, due to the long time span this study covered, some of the other data variables had gaps in time periods, it is unavoidable that some of the other unselected variables relating to education expenditure may have a larger driving effect on economic growth.

Additionally, because the data used to build this model were collected from 1995 to 2015, there were two continental and global financial crises that happened, which created many outliers in the data of GDP/GNI per capita and government expenditure. Moreover, China and Malaysia were impacted by the 1997 Asian financial crises and the 2008 global financial crises to a different degree, as China sustained GDP growth of 8.8% in 1997 and 7.8% in 1998 [8], while Malaysia fell into its national financial crises that lasted until 1999 [9]. Two countries also endured several other national economic recessions; therefore, a comparison of China and Malaysia may not give the most viable reference to the more "profitable" sector of the education system or of public institutions to invest in for a stable or expanding economy. Also, as both of these countries were economically developed the variables that give the highest coefficients or "profitability," in Tables III and IV might not be equally applicable to countries in other regions, at a different level of development.

Last, generally speaking, in almost all countries, government spending on education only occupies a small share of total government expenditure, therefore, the efficacy of government investment tested in this case study could not represent the general efficiency of government spending with respect to economic growth.

6. Conclusion

The result tested in the first regression model in Fig. 1 opposed common sense in the analysis, and it rejected our hypothesis, demonstrates that a higher portion of education spending is likely to lead to lower economic growth. However, based on this model, we constructed the second and the third model in Figs. 2 and 3, which confirm our second hypothesis, that is the level of economic return of government expenditure in education has relevance to the level of economic development of the nation. The comparison of the second and the third model in Figs. 2 and 3 shown that government investment in education can stimulate economic growth in countries that already have a good development level.

From this research, several policy implications can be drawn. According to the simple regression models in Section I, countries with a relatively weak economy are advised not to prioritize heavily investing in the public educational sector as it may not be as effective as in developed countries; on the other hand, for those that have developed to a certain level, such as those developing and

developed countries, the suggestion is to reinvest the foreign investment in education since FDI and the growth rate of GDP have a very strong positive relationship.

Besides, the case studies on China and Malaysia are examined to show a similar trend in priorities of investment. Among all those variables relating to education, governments are supposed to pay more attention and heavily invest in primary school education in order to improve GDP. In the analysis, another important factor that plays a significant role is the pupil-teacher ratio, which demonstrates that governments should dedicate resources to training teachers in high quality, and probably establishing more schools to reduce the pupil-teacher ratio is another possible pathway. Moreover, for those countries that have a relatively strong economy, the central government could place the priority of investing in constructing cities and infrastructure behind the priority of investing money in public education. This is because a higher urban population as a per cent of the total population may not be a key factor that can drive national GDP compared to the vital role played by investing in constructing primary schools. Ultimately, reducing socioeconomic inequalities may become a driver of economic growth for governments [10].

The statistical relevance of public spending on education should compel governments at specific economic development levels to make sufficient investments in their educational systems. The Bahamas' government must implement sustainable fiscal policies in order to ensure the economy's productivity and long-term viability as a developing country. Bynoe et al. (2012) found in their research that governments should distribute resources in a way that helps each level of education fairly in order to strengthen the educational system. With basic school at the base, secondary education in the middle, and higher education at the top, most educational systems are set up in a hierarchical manner. Because of this structure, studies have recommended that more investments be made in postsecondary education since this level can yield the biggest returns for society. Furthermore, pupils are more likely to succeed in their subsequent education if they have a solid educational foundation starting in primary school.

The efficacy of government spending is frequently decreased by significant economic gaps and restricted access to public goods. In order to guarantee accessible education for those who cannot afford it, precise rules must be set to assure the effectiveness of public spending on education.

Last, for those developing countries that achieve high economic development and for those developed countries, Mingat et al. discussed a tendency of theirs in their paper, namely that they tend to invest more in primary schools, but higher levels of education can provide more economic returns when lower levels of education are generally prevalent.

Authors Contribution

All the authors contributed equally and their names were listed in alphabetical order.

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