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# Making the Grade: The Contribution of Education Expenditure to Economic Growth

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## Abstract

Does education expenditure promote long-run economic growth? Empirical evidence is inconclusive. This paper addresses the question of how education expenditure influences economic growth using a long run growth accounting model analyzing 179 countries from 1970 to 2014. Overall, the results indicate that education expenditure does positively affect growth. However, when the sample is split into different criteria based on economic prosperity of the countries in question, the results change. In non-oil countries education expenditure increases economic growth, in developing countries education expenditure has a negative impact and in OECD countries the impact is non-significant.



## Keywords

Education Expenditure, Economic Growth, Healthcare Expenditure, Long-Run Growth Accounting Model, Cross Country Analysis

## 1. Introduction

Countries with policies designed to foster and encourage a well-educated populace consistently demonstrate superior standards of living when compared to those that do not (Prettner, 2016). With the speed of social and economic changes brought about by technological growth, human capital is proving ever more essential as countries struggle to prevent the displacement of their labour forces by capital-intensive production. Adequate funding for education helps to maintain a productive labour force with in-demand skills, which complements technological growth. There are additional improvements in market productivity attributable to the human capital gained from schooling. Positive externalities arising from education can spur economic growth through other endogenous factors such as technological innovation. For example, Prettner demonstrated that human capital accumulation is the leading factor behind research and development and technological diffusion in countries that engage in free trade. This supports the idea that human capital gained through education promotes technological advancement. Meng and Ye (2009) argued in favour of education funding by emphasizing that human capital development through schooling boosts production efficiency and household utility gained from knowledge.

In addition to production efficiency, human capital acquired through education is beneficial to the economy because of its positive effect on social capital. For example, Papagapitos and Riley (2008) and Dincer (2011) demonstrated that there is a positive correlation between education and trust. Trust is of importance because it defines how socialized a country's markets are. Countries with high levels of trust have more cohesive trading environments, which lead to better economic performance within society (Ahmad and Hall, 2017). Furthermore, societies with higher levels of human capital accumulation have higher voter turnout (Campante and Chor, 2012). This leads to outcomes that are more reflective of the desires of the citizens and in turn, builds more trust in democratic processes. This is a growing and important issue with the rise of fringe populist groups that threaten free trade and investment, environmental policies, beneficial public expenditure, and many other important public policy issues.

This paper will argue that government intervention is necessary to build and maintain a well-educated population, which is a socially optimal outcome that markets cannot achieve on their own. While the consensus is that education leads to productivity growth through a variety of factors, the question is whether it ought to be publicly funded, and if so, how much money a government should devote to education. With the appropriate Pigouvian subsidy, countries can ensure that the social marginal cost of education is equal to its benefit. However, the focus of this paper will not be on the ideal level of education expenditure or how it should be funded. It will instead examine education's overall impact through cross-country analysis, with panel data from 179 different countries from 1970 to 2014. This paper explores how an increase in government expenditure for education increases human capital accumulation and fosters economic growth. Through use of a long-run growth accounting model shaped after Mankiw, Romer and Weil (1990), this paper is able to examine the influence of education expenditure, healthcare expenditure, population growth rates, savings, human capital, and exports on long-run economic growth.

Overall, the findings in this paper demonstrate that education expenditure generally

promotes economic growth, contingent on pre-existing economic and institutional factors. In the initial aggregate sample, education expenditure has a positive influence on long-run economic growth. After including healthcare expenditure to absorb government expenditure variation, the world sample remains positive and statistically significant. However, when split up into three different criteria based on the country's level of economic prosperity and institutional quality, the results become less definitive. The findings demonstrate that education expenditure is beneficial, but it can be harmful to an economy when governments allocate expenditures improperly.

The rest of the paper is structured as follows: Section Two presents the literature review; Section Three discusses the data; Section Four outlines the econometric methods and modelling parameters, and analyzes the results. Section Five concludes the paper.

## 2. Literature Review

Education's influence on economic growth can manifest in a variety of ways. In the economic literature, the most prevalent argument in favour of education expenditure is that it is a *de facto* investment in human capital, which positively affects economic growth. Mankiw, Romer and Weil (1990) demonstrated this by including human capital accumulation, as measured by the share of the population enrolled in secondary school, in their Augmented Solow Model. The paper found that differences between savings, population growth rate, and human capital explains 78% of the variations in GDP per capita across countries. Without the inclusion of human capital, the Solow Model only accounts for 59% of cross-country variation, meaning that enrolment in secondary schooling can explain 23% of the variation in economic growth across countries (Mankiw, Romer and Weil, pg. 414-420). The results indicate that population growth, savings, and human capital are the three main variables that determine international variation in economic growth. Musila and Belassi (2004) expanded on this argument by including education expenditure as an additional independent variable in the Augmented Solow Model. Specifically, the paper investigated the impact of government education expenditures on real GDP in Uganda from 1965 to 1999. The results show that government expenditure allocated towards education was a fundamental driver of Uganda's economic growth in the short and long run. The paper further concludes that education funding is crucial for development, especially in emerging economies. Blankenau, Simpson and Tomljanovich (2008) examined the impact of education expenditure in 23 developed countries from 1960 to 2000. To combat any omitted variable bias, the paper controlled for the impact of taxation and government budget constraints. The results demonstrate that education expenditure has a significant positive impact on long-run economic growth in developed countries. The paper suggests that other findings with ambiguous results for education expenditure overestimate the role of public education expenditure financing. If funded properly, the negative consequences of taxation will not distort gains from education expenditure in developed countries.

A large number of empirical studies analyzing the effect of education expenditure on economic growth contradict the findings in this body of literature. Al-Yousif (2008) explored the impact of education expenditure in the six Gulf Cooperation Council countries from 1977 to 2004 by using education expenditure as a proxy for human capital. The results were country specific, and the paper concludes that the effect of education expenditure on economic growth is bidirectional. Conrad (2011) looked at how human capital development

affects growth in five Caribbean countries from 1970 to 2004 using the Augmented Solow Model. To determine the different returns from years of schooling, the paper used different education levels as an instrumental variable for human capital development. The results demonstrate that human capital accumulation has different effects on output depending on the number of years spent in school. For basic education, such as elementary school, there is a negative correlation with economic growth. Conrad argued that primary schooling is not a high enough level of education to increase returns to physical capital, but also found that human capital development is beneficial beyond primary school in countries with a higher Human Development Index. Meng and Ye (2008) used panel data from 29 different provinces in China between 1989 and 2005 to further argue that the benefits of education expenditure depend on the initial social and economic environment in which the funding occurs. The paper's results show that the contribution of education expenditure to economic growth depends on many endogenous factors such as capital investment and urbanization. In non-urbanized areas, education expenditure is harmful to the economy because of a "brain drain" that nudges educated workers towards cities. Many public goods and services are more accessible in urbanized areas. As a result, there is a tendency for educated citizens to migrate towards urban centres, especially in countries with lower GDP per capita.

Consequently, education funding creates a positive feedback loop and enables successful economies to remain prosperous. It can also force poorer economies into a poverty trap due the loss of human capital and wasted expenditure. This tautological explanation reinforces other arguments on the importance of complementary goods to facilitate economic growth through education expenditure. Agenor and Neanidis (2011) studied the socially optimal level government expenditure towards healthcare, education, and infrastructure as proportions of GDP using an endogenous growth framework. After accounting for production and consumption externalities, the results demonstrate that the supply of services, such as education, are heavily dependent on the infrastructure and healthcare provided within an economy. Furthermore, the paper concludes that spending below growth maximizing rates on infrastructure and education and reallocating the leftover funds towards health services end up being socially optimal by boosting labour productivity and consumption in a more efficient manner. Eggoh, Houeninvo and Sossou (2015) similarly explored the impact of education and healthcare expenditure in 49 African countries from 1990 to 2010 using a Generalized Method of Moment and an Ordinary Least Squares regression. The paper suggests that education and healthcare expenditure both negatively affect economic growth due to corruption and inefficiency in these countries. The results also indicate that the two public services are interdependent, and thus, a certain level of health expenditure is required to expect positive effects from education expenditures and vice versa.

There is an extensive body of work regarding the effects of education expenditure on long-run economic growth. Many of these papers, such as Musila and Belassi (2004), Al-Yousif (2008), and Meng and Ye (2008), examined the impact of education expenditure by looking at specific countries or social environments and extrapolated broader impacts based on their findings. Although the results are significant within their areas of interest, their external validity is debatable. Alternatively, Blankenau, Simpson, and Tomljanovich (2008) and Eggoh, Houeninvo, and Sossou (2015) took a broad approach in assessing education funding by looking at how it influences growth in developed and developing countries, respectively.

This paper will take the broad approach and examine the impact of education in 179 countries across the world from 1970 to 2014 through use of a slightly modified version of the Augmented Solow Model, consistent with Mankiw, Romer, and Weil (1990), Musila and Belassi (2004), Al-Yousif (2008), and Conrad (2011). The empirical approach uses a General Least Squares equation. In addition, this paper will include healthcare expenditure and an interactive term in the regression to see how complementary goods affect education expenditure. After finding the aggregate impact of the variables in question, the paper splits the world sample into three other criteria to examine how their influence differs in low-level, mid-level, and high-level economies.

## 3. Data discussion

The data on total government expenditure devoted to education and healthcare expenditure, as a percentage of GDP, are from the World Bank Database (2014). Data come from Penn World Tables (2015) on expenditure-side real GDP at chained PPPs (in mil. 2011US$), human capital index, population (in millions), share of gross capital formation at current PPPs, and share of merchandise exports at current PPPs. The panel data range from 1970 to 2014 across 179 countries. I use the expenditure side of real GDP at chained PPPs (in mil. 2011US$) as my measure of GDP per capita (GDP). Year-on-year population growth is my measure of population growth rate (POPG). The human capital index (HC) is an index formulated based on years of schooling (Penn World Tables). I measure total expenditure on education as a percentage of GDP (EDU) as a percentage of a country's total GDP spent by the ministry of education. It is a compilation of three measures: current funding, capital, and transfers. It also includes transfers from international agents, for example, through developmental aid (World Bank Database). Health expenditure as a percentage of GDP (HEALTH) is measured by private and public funding towards healthcare as a percentage of GDP. The data run through national health accounts, which monitor health system resource flows (World Bank Database). HC, share of gross capital formation at current PPPs (SAVINGS), EDU, and HEALTH are kept as is. GDP and POPG are modified to fit the long run growth accounting model. To measure how these variables determine long-run economic growth, they are tested against the dependent variable GDP, which will be my measure of economic growth. A summary of my data is shown below in Table 1.

The Solow Model is an economic growth theory used to predict the outcome of explanatory variables in growth accounting for decades. The model proclaims that given a fixed population growth and savings rate, a country can reach a steady state equilibrium for output per worker. Solow hypothesized that the savings allocated towards capital investment can offset economic losses incurred by capital depreciation and population growth Musila and Belassi (2004). However, as proposed in Mankiw, Romer, and Weil (1990), Solow's assumptions are exaggerated when it comes to the impact of savings and the population growth rate. Their alternative model, which they dub the Augmented Solow Model, includes the accumulation of human and physical capital, which reduces the magnitude of both savings and the population growth rate.

**Table 1 – Data Summary**

| Variable | Observations | Mean | Std. Dev | Min | Max |
|---|---|---|---|---|---|
| GDP | 8269 | 13380 | 20238 | 161.6 | 238585 |
| EDU | 3315 | 4.36 | 1.85 | 0 | 44.33 |
| HEALTH | 3364 | 6.1 | 2.3 | 1.4 | 17.1 |
| POPG | 8450 | 0.48 | 1.8 | -5.9 | 22.1 |
| SAVINGS | 8629 | 0.22 | 0.21 | -2.03 | 14.57 |
| HC | 7169 | 2.06 | 0.72 | 1 | 3.75 |
| EXPORTS | 8629 | 0.23 | 0.26 | -1.3 | 3 |

I use the foundation of this model and include EXPORTS as well as my two other independent variables of interest. I expect that POPG will have unknown and thus arbitrary effects on GDP based on levels of human and physical capital accumulation. Therefore, in my cross-country analysis, I predict that POPG will have a non-significant impact, while both HC and SAVINGS will have a positive effect on GDP.

My reasonings behind these predictions are as follows: firstly, a population increase will decrease the ratio of capital to labourer. However, an increase in population could be beneficial for a country depending on its level of human and physical capital. Thus the effect of a country's POPG is contingent on factors other than the capital labour ratio and will remain ambiguous. Secondly, HC complements physical capital while simultaneously increasing the productivity of the labour force. Thirdly, SAVINGS facilitates physical capital formation, which also positively affects output. I also expect EXPORTS to positively impact GDP because the mutual benefits from trade are always considered positive. I predict that HEALTH will positively impact GDP because a healthy workforce will be more productive. Finally, I predict that EDU will have a positive impact on long-run economic growth, based on the assumption that increased funding towards education will enhance teacher quality and quantity and provide for superior facilities and amenities. Students will have better tools to assist in their education process, which will positively contribute to their human capital accumulation. Consequently, GDP will increase as school funding increases.

Weaknesses in the data may arise because the data on EDU may not accurately portray how much funding is actually allocated to education. Some poor countries may allocate a large share of their public spending towards education, but that may not be nearly as much in real dollars as a rich country allotting a small share of its public expenditure. Moreover, the data only account for the funding that the education ministry receives; they

do not account for how funds are allocated by the ministries. So even if funds were allocated appropriately, officials have the choice as how they allocate funding *within* the field of education, such as books and supplies, administration, teachers, or infrastructure. Some of the expenditures may be misguided or inefficient. Another issue that may distort the results is that the expenditure data appear to be lower in countries where the private sector has a large share in total funding for education (World Bank Database, 2014). This is an infrequent issue, but it nonetheless does create noise for the variable in question and may bias my results towards zero.

## 4. Results

The hypothesis of this paper is that government expenditure allocated towards education funding will positively influence long-run economic growth across countries. Before running the regression, it is necessary to ensure that the data are not influenced by any unidentified factors. To start, 20 outliers are removed from the sample, all of which are from Qatar, Kuwait and Cote D'Ivoire. In addition, I run a variety of tests and find that there is serial correlation and heteroskedasticity in the data. Serial correlation indicates that an explanatory variable in my data set is correlated with itself throughout the available time series data, causing its standard error to appear smaller than it actually is. Heteroskedasticity indicates that the variability of an explanatory variable grows larger over time. To address heteroskedasticity, the regression includes a heteroskedastic but uncorrelated error structure that alters the standard error of the explanatory variables. In order to eliminate serial correlation, a General Least Squares regression model is used. This determines statistical significance in a regression that has correlation between the errors and eradicates any bias that may arise from serial correlation. In order to do this, the General Least Squares regression includes an autocorrelation coefficient in each variable of the regression, which eliminates the serial correlation in the error. As a result, no explanatory variable is linear so there will be no R squared or adjusted R squared. Other than this alteration, the model is similar to the standard Ordinary Least Squares model and serves the same purpose. The empirical equation is shown below.

$$GDP^*_{i,t} = \beta^*_0 + \beta_1 \ln(EDU^*_{i,t}) + \beta_2 \ln(HEALTH^*_{i,t}) + \beta_3 \ln(EDU^*_{i,t} * HEALTH^*_{i,t}) + \beta_4 \ln(POPG^*_{i,t}) + \beta_5 \ln(SAVINGS^*_{i,t}) + \beta_6 \ln(HC^*_{i,t}) + \beta_7 \ln(EXPORTS^*_{i,t}) + \sum_{1971}^{2014} \delta_s TF^*_s + \sum_{j=2}^{179} a_j EF^*_j + \mu_{i,t}$$

Where: $GDP^*_{i,t} = GDP_t - \rho GDP_{t-1}$

$\beta^*_0 = \beta_0 - \rho\beta_0$

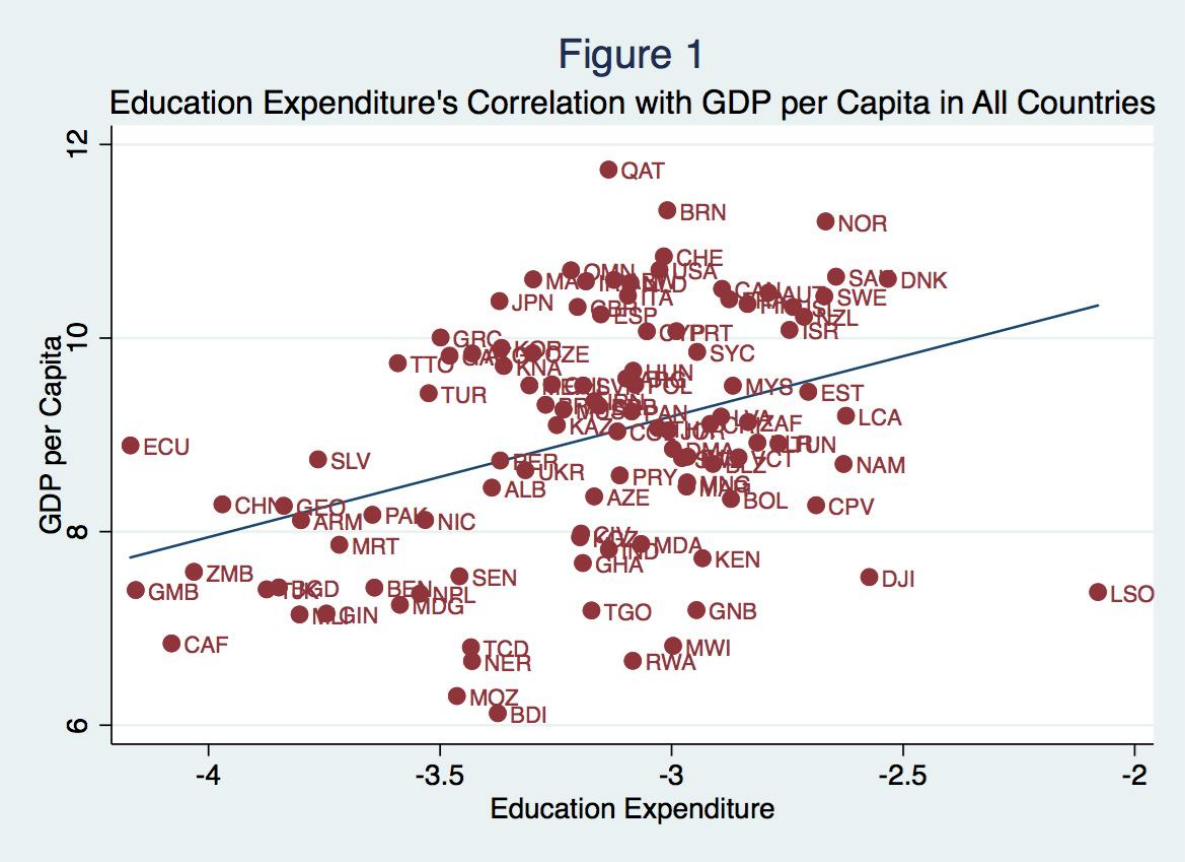
$X^*_{i,t} = X_{i,t} - \rho X_{i,t-1}$ *where X is all explanatory variables*

After eliminating the influence of these unobservable factors, I regress EDU on GDP, while including other control variables and fixed year effects. The results are shown in Table 2 below. In the fifth column, after controlling for year fixed effects and including all the independent variables from the long run growth accounting model, I find that the coefficient for EDU remains statistically significant at the .1% level. The regression results show that countries that allocate a 1% increase in funding, as a percentage of GDP to their education ministries, grew by 0.128%. Figure 1 further illustrates the relationship between education expenditure and GDP across all countries in 1999. As predicted, population growth rate is non-statistically significant while savings, human capital and exports remain statistically significant.

**Table 2 – GLS Estimates Across All Countries**

| GDP | Regression 1 | Regression 2 | Regression 3 | Regression 4 | Regression 5 |
|---|---|---|---|---|---|
| EDU | 1.186*** (0.0352) | 0.981*** (0.0305) | 0.808*** (0.0323) | 0.285*** (0.0230) | 0.128*** (0.0221) |
| POPG | | -0.0553*** (0.0160) | -0.417*** (0.0145) | -0.0357*** (0.00921) | -0.0127 (0.00811) |
| SAVINGS | | | 1.254*** (0.0255) | 0.647*** (0.0262) | 0.547*** (0.0249) |
| HC | | | | 2.900*** (0.0319) | 2.516*** (0.0406) |
| EXPORTS | | | | | 0.315*** (0.0117) |
| Constant | 12.98*** (0.139) | 9.834*** (0.145) | 11.90*** (0.154) | 8.514*** (0.0988) | 8.791*** (0.103) |
| Fixed Effects | Yes | Yes | Yes | Yes | Yes |
| N | 1523 | 1523 | 1523 | 1523 | 1523 |

Standard Error in Parenthesis * p <0.05, ** p <0.01, *** p <0.001




To further explore the relationship between EDU and long-run growth, I add HEALTH to my regression to determine whether other government funded programs will absorb EDU. I also include an interactive term (EDU*HEALTH), which multiplies EDU by HEALTH, in the regression. If statistically significant, this interactive term demonstrates that there is no unique effect of EDU without HEALTH and vice versa. Their influence on growth is contingent upon each other's funding within a country. As mentioned in Agenor and Neanidis (2011), a healthy population will accumulate human capital through schooling at more efficient rates. Given this finding, it seems evident that EDU will also have a greater impact on long-run growth when complemented by other public spending programs, such as healthcare spending. Moreover, one can extrapolate that this effect is not limited to just healthcare, but works with many other government-funded programs. To demonstrate this empirically, I regress my joined education and healthcare spending variables to see how they influence GDP, both collectively and individually. The results can be seen in Table 3 below. EDU's significance persists throughout the entire regression and, not surprisingly, is much greater when HEALTH and EDU*HEALTH are included. In column 7, EDU*HEALTH demonstrates how a 1% increase in healthcare and education spending (2% of GDP collectively) will raise GDP by (.264+0.741+1.208)= 2.233%. Likewise, when holding HEALTH constant at 0, I find that a 1% increase in EDU increases GDP by an impressive 0.741% across all countries.

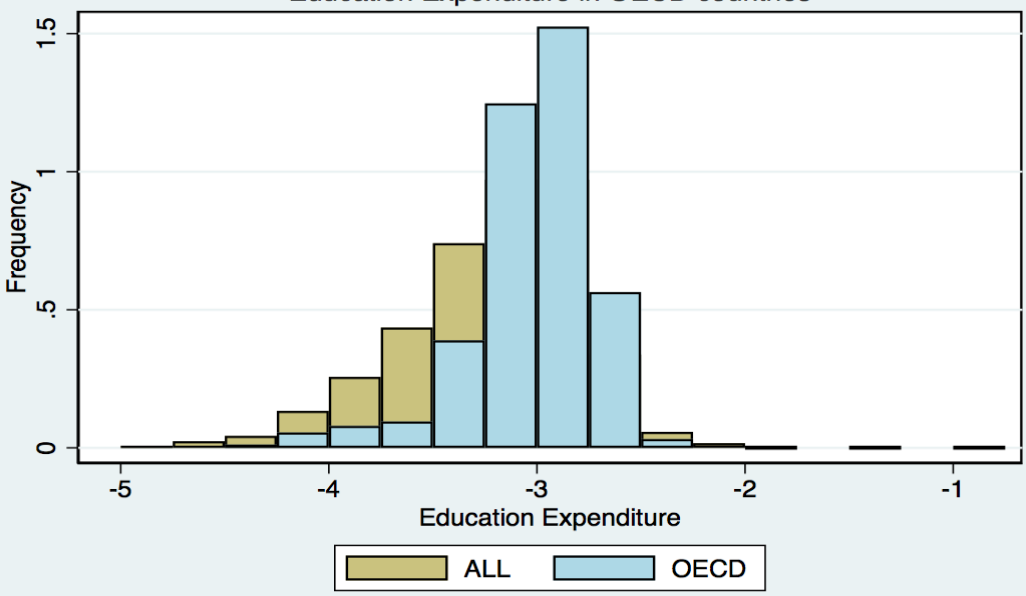
**Table 3 – GLS Estimates Across All Countries Including Healthcare Spending and an Interactive Term**

| GDP | Regression 1 | Regression 2 | Regression 3 | Regression 4 | Regression 5 | Regression 6 | Regression 7 |
|---|---|---|---|---|---|---|---|
| EDU | 1.186*** (0.0352) | 0.857*** (0.0355) | 4.821*** (0.200) | 4.276*** (0.196) | 3.097*** (0.195) | 1.145*** (0.106) | 0.741*** (0.129) |
| HEALTH | | 0.872*** (0.0360) | 5.295*** (0.0107) | 4.340*** (0.217) | 3.653*** (0.214) | 1.382*** (0.123) | 1.208*** (0.139) |
| EDU * HEALTH | | | 1.348*** (0.0255) | 1.192*** (0.0655) | 0.917*** (0.0660) | 0.334*** (0.0381) | 0.264*** (0.0432) |
| POPG | | | | -0.439*** (0.0157) | -0.320*** (0.0146) | -0.0299*** (0.00840) | -0.00911 (0.00794) |
| SAVINGS | | | | | 1.294*** (0.0376) | 0.688*** (0.0259) | 0.563*** (0.0246) |
| HC | | | | | | 2.743*** (0.0330) | 2.326*** (0.0417) |
| EXPORTS | | | | | | | 0.320*** (0.413) |
| Constant | 12.98*** (0.139) | 14.48*** (0.137) | 27.40*** (0.620) | 22.29*** (0.650) | 21.69*** (0.626) | 12.28*** (0.347) | 11.94*** (0.413) |
| Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| N | 1523 | 1523 | 1523 | 1523 | 1523 | 1523 | 1523 |

Standard Error in Parenthesis * p <0.05, ** p <0.01, *** p <0.001

In the fourth table, I divide the initial sample from the first regression into three other criteria to determine whether a country's economic development influences the significance of EDU. The first column lists the results from Table 3; they are the benchmark. In column 2, I limit my sample to 34 OECD member countries to see the changes that occur when measuring EDU in prosperous economies. The results for EDU are not statistically significant. I attribute this lack of significance to the fact that there is very little variation in EDU among these countries when compared to the rest of the world. The model measures how variations of the independent variable influences GDP, but there is little variation among EDU in this sample. Therefore, the result will be non-significant. This inhibits my ability to examine whether education spending might cause the variation within the long-run growth of these countries. Figure 3 demonstrates this relationship below. The third column is a measure of developing countries, which are classified as lower-middle income countries with a GDP per capita of less than $3,955 (in U.S. dollars) (World Bank Database, 2014). The results are negative and significant at a 0.1% level. As predicted in Eggoh, Houeninvo and Sossou (2015), the results show that EDU has a negative impact on GDP in developing countries. It is possible that this is because HC absorbed the gains from secondary schooling these areas. However, I attribute these findings to four other possible factors. First, there is a lack of spending towards other complementary public goods such as infrastructure. Without other programs in place to support human capital accumulation through schooling, EDU will have a negligible impact on economic growth. Second, poorer countries often have weaker institutions and more corruption, which may lead to improper allocation of funds. Arguably, it benefits corrupt public officials to distribute funding disproportionally towards the elite – with whom they may have mutually beneficial relationships – than to allocate funding in service of lower-income households, who have no power and little influence in the public sphere. Third, the majority of developing countries are agricultural states, and therefore human capital accumulation does not supplement physical capital and does not lead to greater production output. Lastly, my measure is a percentage of GDP, and therefore a 1% increase in EDU in poor countries will not be as significant as it is in richer countries.

Figure 3



Finally, in the fourth column I include a sample of countries for which oil production is not the dominant industry. I exclude large oil exporting countries because they are often outliers due to their high GDP but low standard of living. Furthermore, as specified in Mankiw, Romer and Weil (1990), these countries gain the majority of their income through "the extraction of existing resources, not value added," which may misrepresent the impacts of the explanatory variables in the long run growth accounting model. This sample renders results that are even more robust than the benchmark sample. I attribute this rise in funding efficiency to the fact that by limiting the sample to non-oil countries, I have rid the sample of many outliers that may distort my results downwards. According to these results, I conclude that the findings support my initial hypothesis in countries that use government funds appropriately and transparently.

**Table 4 – GLS Estimates for All Countries, OECD Countries, Developing Countries and Non-Oil Countries**

| | **All** | **OECD** | **Developing** | **Non-Oil** |
|---|---|---|---|---|
| EDU | 0.741*** | -0.289 | -1.327*** | 1.379*** |
| | (0.129) | (0.311) | (0.233) | (0.139) |
| HEALTH | 1.208*** | .485 | -1.725*** | 1.917*** |
| | (0.139) | (0.389) | (0.276) | (0.152) |
| EDU * HEALTH | 0.264*** | -0.109 | -0.430*** | 0.474*** |
| | (0.0432) | (0.129) | (0.0780) | (0.0475) |
| POPG | -0.00911 | 0.0480*** | -0.139*** | -0.127*** |
| | (0.00794) | (0.00743) | (0.0176) | (0.0103) |
| SAVINGS | 0.563*** | 0.0616 | 0.242*** | 0.424*** |
| | (0.0246) | (0.0412) | (0.0282) | (0.0257) |
| HC | 2.326*** | .899*** | 0.916*** | 2.481*** |
| | (0.0417) | (0.0440) | (0.0490) | (0.0385) |
| EXPORTS | 0.320*** | 0.199*** | 0.0896*** | 0.233*** |
| | (0.413) | (0.0122) | (0.0134) | (0.0112) |
| Constant | 11.94*** | 11.05*** | 1.811* | 13.04*** |
| | (0.413) | (0.936) | (0.828) | (0.452) |
| Fixed Effects | Yes | Yes | Yes | Yes |
| N | 1523 | 468 | 435 | 1008 |

Standard Error in Parenthesis * p <0.05, ** p <0.01, *** p <0.001

The results demonstrate that EDU has a positive and statistically significant impact on GDP across the world. However, the results could be even more precise for developing and OECD countries with better data. The most prominent issue with the data is that education expenditure is measured by how much money the ministry of education receives as a percentage of a country's GDP. As noted above, this is problematic as it does not account for whether the funds are properly or efficiently distributed. If data were available on the amount spent per school across countries, the modelling could dispose of the assumption that the ministry's funding is properly allocated, which would likely produce more robust results. Moreover, the results in the regression above would be better detailed if the data contained information on the funding for the various levels of education within a country. This would allow for examination of how primary school funding would differ from secondary or post-secondary school funding. This would be beneficial because the returns to post-secondary education funding are somewhat distortionary, whereas secondary school funding has a clear and significant positive impact on economic growth. If the expenditures were separated, the results would more precisely explain the effects of education expenditure. However, in spite of its limitations, the data satisfy the fundamental necessities for my regression and allow me to examine education expenditure through a macro lens.

## 5. Conclusion

This study examines whether government expenditure allocated towards education positively influences long-run economic growth in a cross-country analysis. To account for omitted variable bias arising from other government expenditures, this paper includes healthcare expenditure to absorb education variation, and an interactive term to determine how interdependent the two complementary services are. A long run growth accounting model run using a General Least Square regression rendered results that indicate that education and healthcare expenditure's impact on growth is heavily contingent upon the pre-existing economic and institutional environment. An aggregate regression across all countries is statistically significant for education expenditure, healthcare expenditure, and the interactive term. When split up, the results varied contingent upon the economic development of the countries in question. My findings corroborate those of Agenor and Neanidis (2011) and Eggoh, Houeninvo, and Sossou (2015), which indicate government expenditures complement each other and that healthcare expenditure has a larger impact on economic growth than education expenditure. My inclusion of the interactive term is not found in the existing literature and further demonstrates the interdependence of these two public expenditures.

Contrary to evidence proposed Blankenau, Simpson, and Tomljanovich (2008), the regression run in OECD countries was non-significant for education and healthcare expenditure. Education and healthcare levels are very similar in these developed countries, and thus there is little variation that can explain differences in GDP. That is not to say that education and healthcare expenditure does not influence growth in these countries; rather, the impact of the expenditure is not observable with the data used in this paper. Furthermore, there is the possibility that because Blankenau, Simpson, and Tomljanovich did not include healthcare expenditures in their regression, their results are influenced by some omitted variable that distorted the findings upwards.

In developing countries, the findings for the variables in question are negative. This corroborates the results from Eggoh, Houeninvo, and Sossou (2015) and Conrad (2011), but contradicts the hypothesis proposed by Musila and Belassi (2004) which suggests that education expenditure would be beneficial in all developing countries. These results are likely due to the prominence of corruption, inefficient allocation of funding, an absence of physical capital to supplement human capital accumulation, and a lack of complementary public goods that facilitate quality education.

Finally, the regression run in countries where oil production is not the chief output is positive and statistically significant for all variables except for year on year population growth rate. This is consistent with the earlier assumptions proposed by Mankiw, Romer, and Weil (1990), which state that these countries are often outliers due to their high GDP and corrupt governments, and with Al-Yousif's (2008) study on oil production countries in the Gulf Cooperation Council, which found that their effect is ambiguous and bidirectional. By eliminating these indistinct samples, the regression provides results that are more robust than the aggregate sample.

Improvements in market productivity through education expenditure are subject to the institutional and economic environment in which governments fund these services. This paper suggests that increasing education funding is more beneficial in countries with institutions that are transparent with their government expenditure. Furthermore, these governments can supplement education funding that contributes to economic growth by simultaneously increasing healthcare funding. Future research would benefit from using data that are more specific to real school spending rather than ministry funding. It is my view that if these data were available, they would demonstrate that education expenditure in developing countries produces a positive and statistically significant effect on economic growth.

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