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Testing The Effect of Human Capital Investment on Economic Growth

Antonio Goncalves de Andrade, Yang Qing

***Abstract*—** This paper conducts a study on effect that education and health has on economic growth, a case study of Cabo Verde. A considerable number of studies have been carried out in attempt to prove the existing relationship between human capital with economic growth. We used secondary times series data of the following variables, public expenditure on education, public expenditure on health and gross domestic product for the period of 1990 - 2012. We attempt to find the short run and log run relationship associated with the variables in this study. For this purpose unit root tests such as: ADF, PP tests are utilized to check the stochastic properties of the variables, Johansen co integration tests and vector error correction model are applied to find relationship among variables. The results show that there is a long run relationship between economic growth with education and heath and there is a short run relationship between economic growth and heath, which runs from heath to economic growth. This study brings new insights of gross domestic product long and short run relationship with human capital and provides empirical evidence of exceptional case of Cabo Verde.

***Keywords*—**Education, health, economic growth, long run relationship.

I. INTRODUCTION

One of the most notable macroeconomic objectives of any country is sustainable economic growth complemented with social development in which human capital is believed to be a very important component to this end. Backs to early 1950s we denote with the initial theory of human capital consider being the pioneer studies such as: Mincer (1958), Schultz (1961) and Becker (1962). They believed that economic growth can be achieved by investing in human capital as just like as physical capital by means of education, health and training. Latters studies suggest that the difference in growth performance of any country is explained by human capital formation, considered being the proponents of endogenous growth theory (in details see, Romer, 1986, 1990; Lucas, 1988; Rebelo, 1991). The existing literature on human capital shows that while admitting the role of human capital in economic growth macroeconomists express human capital exclusively in the form of education however micro economists consider health as another significant component of human capital beside education. It's widely accepted that education and health is a very important factor for promoting economic growth. For Cabo Verde, where growth is essential if the country wants to climb out of poverty, education and health are deemed as an anchor to achieve sustainable development.

The economy of Cabo Verde performed quite well in the past fifteen years. With average growth of 4.5 % a year, education and health has shown significant improvement. High GDP growth rates have been led by growth in the tourism sector and aided by concessional lending, which helped fund capital investment including public investment in infrastructure. In fact, public investment in Cape Verde has averaged a very high 13% of GDP, while education and health has 5.9 % and 4.7% respectively.

With ascension of Cabo Verde to the developing country, concessional lending at very low interest rates will be reduced, with lending taking place at higher interest rates, so Cabo Verde should relocate the expenditure in infrastructure to education and health financed by taxes rather borrowing in order to experience better growth.

The main purpose of this research is to explore and examine the role of human capital in clarifying the economic growth Cabo Verde. The data used in the study covered the period from 1990 to 2012. Investment in education and health will boost human capital and this will promote the growth of a country. This paper is organized into five sections. Following this introduction is section two which presents the review of empirical literature; third section presents data description and methods; Section four focuses on the results and analysis and at last we present our final conclusion.

II. LITERATURE REVIEW

The key to promote the human capital remains into government decisions to invest on it. In order to achieve this purpose the government must invest on education and health. Becker (1964) argued that a man would definitely invest in education, as it will give him a promising return in the future. He assumed that, this rational decision will lead the individual to assure that the investment in education is efficient in terms of the cost, profits and opportunities cost that the person incurred while pursuing his education.

Antonio Goncalves de Andrade: School of Management, Wuhan University of Technology, Wuhan, China, Email: antoniocv@live.com, phone: +8618827415580

Yang Qing: School of Management, Wuhan University of Technology, Wuhan, China, email: yangq@whut.edu.cn.

During the past century, the attention of researchers remained on the impact of human capital on economic growth by increasing the facilities of education and health. A huge number of empirical studies have been carried out and have emphasized a strong and positive relationship between human capital and economic growth. Nevertheless, this relationship between the variables remained vague.

Schultz (1971) and Becker (1962) find significant positive association between economic growth and human capital formation. According to Pritchett (1996), empirical results of cross-country macro studies are controversial and inconsistent whereas results of micro studies are consistent and both have shown positive impact of education and health (proxies for human capital) on individual's productivity and income. Ejiogu et al. (2013) discovered that Nigeria's current year education expenditure increases due to the previous year's GDP but it is negatively related with the gross capital formation for the period 1981 to 2011. They also found that there exists causality from GDP to education expenditure.

Anwar (2008) show that advanced education training and increased spending on R&D will not only increase the supply of human capital but also attract foreign investment to Singapore. Foreign investment and human capital play a vital role in the growth of Singapore's manufacturing sector. Pradhan (2009) proved that education has high economic value and must be considered as a national capital. He suggested that this capital must be invested, and India, must capitalize this human capital development besides the physical capital that contributes to country's economic growth.

Agiomirgianakis et al. (2002) conduct panel study (consisting of 93 countries) on subject matter and find significant positive long-run impact of education (primary, secondary and tertiary) on economic growth. Weil (2001) findings related to health-growth nexus further strengthen the importance of health for economic growth. The study concludes that 17-20% of variations in income across countries is due to differences in health status. According to Taniguchi and Wang (2003), education and health both cause each other and thus contribute in economic growth.

Bloom et al. (2004) try to investigate the impact of human capital on economic growth. By utilizing, 2SLS approach they find that schooling and life expectancy both positively contribute to economic growth. Improvements in health standards are associated with increase in output due to increased labor productivity and capital accumulation.

Baldwin and Borreli (2008) revealed that the growth of per capita income is positively associated with higher education but has a negative association with junior college pupil-teacher ratios during 1988-2005 in the US. Spending on higher education and college attainment are negatively related and this creates a negative indirect relationship with income growth.

We have shown some previous studies that reveal important relationship between economic growth with and health and education. However some studies have researchers does not believe that investing on education would bring economic growth. Blaug (1970) and Sheehan (1971) stated that investment in education is just merely consumption. This is due to the fact that investment in acquiring knowledge or skills is for the individual interests only and does not contribute into the economic growth. To support this argument, empirical study by Devarajan et al., (1996) on 43 developing countries showed that excessive government expenditure in education negatively correlated with the countries' economic growth. Moreover, Bils and Klenow (2000) argued that it was too weak to conclude that the education or school achievement significantly contributed the economic growth. This finding is based on their study among the 52 countries between 1960 and1990.

According to the previous discussion we can say that the effect of education and health on economic growth is debatable. Some suggest that exists relationship among these variables while others suggest otherwise. In the research we will investigate long-term relationship and casual relationship between education and health with economic growth.

III. METHODOLOGY

A. Data set and model specification

In this study we used secondary times series data of the following variables, public expenditure on education, public expenditure on health and GDP for the period of 1995 - 2014 in order to access the long run relationship. Most of the following data was collected at websites of World Bank, Bank of Cabo Verde and National Institute of statistics of Cabo Verde.

In order to investigate the associationship between human capital and economic growth the following model is specified.

$$\ln \mathrm{GDP} = \beta_0 + \beta_1 \ln \mathrm{PHE}_{\mathrm{Exp}} + \beta_2 \ln \mathrm{PED}_{\mathrm{Exp}} + \varepsilon \quad (1)$$

Where, $\ln \mathrm{GDP}$ is natural log of Economic growth measure by Gross Domestic Product, β_0 is a constant term, β_1 represents the coefficient associated to Public health expenditure, $\ln \mathrm{PHE}_{\mathrm{Exp}}$ is natural log of public health expenditure, β_2 represents the coefficient associated with Public education expenditure, $\ln \mathrm{PED}_{\mathrm{Exp}}$ is natural log of public education expenditure and finally ε represents the error term.

B. Econometric methods

- Unit root tests - It has been established in literature that most of time series in economics are non-stationary at level. In statistics, a unit root test tests whether a time series variable is non-stationary using an autoregressive model. A well-known test that is valid in large samples is the augmented Dickey–Fuller test. The optimal finite sample test for a unit root in autoregressive models was developed by Denis Sargan and Alok Bhargava. Another test also well known is the Phillips–Perron test. These tests use the existence of a unit root as the null hypothesis. Some authors suggest that in small samples ADF and PP are not reliable and Ng-Perron test has the superiority over them.

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- Cointegration test - After testing the time series weather there are non stationary or stationary and have the same order of integration we proceed with the cointegration in order to find if the variables are cointegrated or not. To achieve it we will run Johansen cointegration test to investigate long-run relationship among non-stationary variables in this especial case Public Education Expenditure and Public health Expenditure with the economic growth.
- Vector Error Correction Model (VECM)- In this paper we use vector error correction model to capture the Short-run and long-run dynamics among variables (education and health with economic growth). It is a special case of restricted VAR for the variables that are integrated of order one as well as having long-run relationship. Vector error correction model can only takes places only if after applying Johansen cointegration tests the results prove that the variables are cointegrated and to apply the Johansen cointegration tests the variables also becomes stationary at same level after applying unit root test.

IV. Empirical results and discussion

The following table presents the statistical summary of variables that we use in this research.

TABLE I. STATISTICAL SUMMARY OF VARIABLES

	GDP	PEDExp	PHEExp
Mean	20.423	17.102	17.542
Median	20.200	16.908	17.407
Maximum	21.346	17.853	18.408
Minimum	19.542	16.151	16.766
Std. Dev.	0.601	0.542	0.608
Skewness	0.307	0.042	0.126
Kurtosis	1.730	1.807	1.421
Jarque-Bera	1.906	1.372	2.450
Probability	0.386	0.504	0.294
Sum	469.729	393.350	403.474
Sum Sq. Dev.	7.959	6.458	8.121
Observations	23	23	23

From the above table we can see that mean of Gross Domestic Product (GDP) is 20.423, Public Education Expenditure on (PEDExp) is 17.102 and finally Public Health Expenditure (PHEExp). The results of Jarque-Bera and the probability associated reveals that all the series are normal distributed.

A. Unit root Test

ADF t-tests and PP tests were performed on each of the time series to examine the stationary properties. The results are given in the table 2. The results show that at level all variables are non stationary since their associated P-value are more than 95% and after first difference the probability of T- statistics are less than 5% which means that after first difference they become stationary data. Both ADF and PP test support that all the series GDP, PEDExp and PHEExp are stationary at its level I (0).

B. Cointegration test

The unit root test has proven that the variables are stationary therefore we can apply Johansen cointegration test. At this test we should first select the order of Vector Auto Regressive (VAR). All the test results of LR test statistic, final prediction error, Akaike information criterion, Schawarz information criterion and Hannan-Quinn information criterion has suggested use of lag 1. After selection of lags then we run the Johansen's co integration procedure to test the presence of number of co integrating Vector. For this purpose Trace tests and Maximal Eigen Value were used and results are presented in table 3.

From the results we can see that both test has denied the existence of none co integrating vector since their associated p-value is less than 5% thus, we accept the null hypothesis, consequently the acceptance of at most 1 cointegrating vector existence, since the p-value is 0.415 for trace statistic and 0.419 for Max-Eigen statistic, that is more than 5% which the null hypothesis must be rejected. The results have proven the existence of long run relationship between Gross Domestic Product with public education expenditure and public health expenditure. The results are consistent with Agiomirgianakis et al. (2002) and Weil (2001).

Since both tests indicate the existence of at most 1 cointegrating vector, therefore this is appropriate for further

TABLE II. RESULTS OF ADF AND PP

Variables	ADF				PP			
	At level		1st Difference		At Level		1st difference	
	T-stat.	P-Value	T-stat.	P-value	T-stat.	P-Value	T-stat.	P-value
GDP	-0.534	0.866	-4.958	0.000	-0.474	0.879	-4.976	0.000
PEDExp	-1.306	0.608	-5.149	0.000	-1.338	0.593	-5.147	0.001
PHEExp	-0.500	0.874	-4.432	0.003	-0.498	0.874	-3.891	0.008

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TABLE III. RESULTS OF JOHANSEN COINTEGRATION PROCEDURE

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	Critical Value	Probability
None	0.667	31.571	29.797	0.031
At most 1	0.304	8.486	15.495	0.415
At most 2	0.040	0.866	3.841	0.352
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	Critical Value	Probability
None	0.667	23.085	21.132	0.026
At most 1	0.304	7.620	14.265	0.419
At most 2	0.040	0.866	3.841	0.352

analysis. If variables are co-integrated, then dynamic ECM framework is an ideal basis for estimation of growth response because it provides information about the speed of adjustment to long-run equilibrium and avoids the spurious regression problem between the variables (Engle and Granger, 1987).

C. VECM

The error correction model is further employed to expose the short relationship between Gross Domestic Product with public heath expenditure and public education expenditure. The result of error correction model is present on the table 4. The results reveal that only public education expenditure has short run relationship with gross domestic product, since its probability associated with t-statistic is 0.09, which means it is significant at 10%level. However public expenditure on education does not has short run relationship with gross domestic product. To the light of the results is seems there is need to apply granger causality test to ensure the variables causality.

TABLE IV. RESULTS OF ERROR CORRECTION MODEL

Error Correction	**Coefficient**	**Std. Error**	**T-Statistic**	**Prob.**
CointEq1	-0.003	0.008	-0.458	0.653
D(GDP(-1))	-0.831	0.406	-2.048	*0.057
D(PEDExp(-1))	0.656	0.379	1.732	0.102
D(PHEExp(-1))	0.381	0.218	1.747	*0.090
Constant	0.072	0.033	2.212	**0.042

The results on table 5 express that there is unidirectional causality between Public health expenditure and economic growth, which runs from public health expenditure to economic growth. In the other hand the result shows that the probability associated with F-statistic to support that public education expenditure does granger cause gross domestic product is equal to 10%. We can affirm that the statistical significance is low and it does not strong support that exist unidirectional causality between public education expenditure with economic growth.

TABLE V. RESULTS OF GRANGER CAUSALITY

Null Hypothesis:	**F-Statistic**	**Probability**
PEDExp does not Granger Cause GDP	2.979	0.100
GDP does not Granger Cause PEDExp	0.080	0.779
PHEExp does not Granger Cause GDP	6.199	0.022**
GDP does not Granger Cause PHEExp	0.0002	0.987

V. CONCLUSION

This paper examines the long and short run relationship between Gross domestic product with by using cointegration test, vector error correction model and granger causality test. After applying these tests to find out the relationship between the variables on this study, we conclude that there is a long run relationship between gross domestic product with public health expenditure and public education expenditure. However the results of VECM express that only public health expenditure has short run relationship and granger causality test confirm that it is unidirectional causality, which runs from public health expenditure to economic growth. The study failed to provide evidences that in short term public education expenditure can affect economic growth. Thus, for Cabo Verde to experience higher economic growth rate the government should give more priority to these to components since they are imperative to bust economic growth.

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Antonio Goncalves de Andrade was born in Fogo, Cabo Verde on 26th February 1985. He is currently doing his Doctor Degree in Management Science and Engineering from Wuhan University of Technology, Wuhan, China. He has completed his master degree in applied economics from Wuhan University of Technology in 2013. On July 2011 He has completed his BA in Economics and Management from Jean Piaget University of Cabo Verde. His special interests include: financial economics, international finance, and management.