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Khobai, Hlalefang and Mbeki, Zizipho Mihlali

Nelson Mandela University

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## **Health and economic growth in Vista countries: An ARDL bounds test approach**

Hlalefang Khobai

Nelson Mandela University, South Africa

Email: [hlalefangk@gmail.com](mailto:hlalefangk@gmail.com)

Nwabisa Kolisi

Nelson Mandela University, South Africa

Email: [Kolisi.nwabisa@gmail.com](mailto:Kolisi.nwabisa@gmail.com)

Zizipho Mhlabi Mbeki

Nelson Mandela University, South Africa

Email: [ziziphombeki@yahoo.co.za](mailto:ziziphombeki@yahoo.co.za)

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### **ABSTRACT**

The present study examined the relationship between health and economic growth in the VISTA countries (Vietnam, Indonesia, South Africa, Turkey and Argentina). The study employed time series data covering the period between 1990 and 2016. Labor and capital were incorporated in the model to form a multivariate framework. The ARDL bounds test approach was used to determine the presence of the long run relationship among the variables. The findings posited that there is long run relationship between economic growth, health, capital and labour in all the countries except for Argentina. There were mix results in terms of the long run and short estimates. It was established that in Vietnam, Indonesia and South Africa, there is evidence of a long run positive and significant relationship between economic growth and health while in Turkey a negative relationship was established. Therefore, the findings of the study have different implications for the different countries.

**Keywords: Health; Economic growth; ARDL model; Vista countries**

**JEL codes: C1; C01; I10; I15; I18**

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## 1. INTRODUCTION

Increasing health development raises a number of important issues in developed, emerging and developing countries. Particularly, health is believed to increase the standard of living in a country. Improved health is considered to play a major role in promoting economic growth and development in many economies. There is a general consensus that healthier workers are more mentally and physically energetic and strong to be productive and earn higher wages. Ogunleye (2014) argue that health and nutrition play a substantial role in economic growth. As a form of human capital, it enhances workers' productivity, whether skilled or unskilled, by improving general physical and mental capacities.

Several studies in the literature established a positive relationship between health and economic growth (Bloom and Canning (2000), Schultz (2005), Mayer (2001), Halıcı-Tülüce, Doğan and Dumrul (2016), Gong, Li and Wang (2012) and Rico et al. (2005). However, there are studies that failed to find the relationship between these variables Malik (2005) and Hartwig (2010). The main reason for the difference in the results of these studies lies with different study periods explored, different methodologies and country specifics. According to our knowledge there are no studies have been done to investigate the relationship between health and economic growth for Vista countries. More significantly, no study has been done on the Vista countries to examine the causal relationship between these five countries simultaneously using the Non-linear ARDL model. Therefore, this study serves to fill the gap.

The aim of the study is to examine the relationship between health and economic growth in Vista countries namely: South Africa, Turkey, Indonesia, Vietnam and Argentina over the period 1990-2016. The study utilizes the Non-linear ARDL estimation technique proposed by Shin, Yu and Greenwood-Nimmo (2014). The rest of the study is structured as follows: section two provides an overview of health and economic growth of Vista countries and section three provides literature review. Section four provides data and methodology, while section five discusses the results. Lastly, section seven concludes the study.

## **2. OVERVIEW OF HEALTH AND ECONOMIC GROWTH IN VISTA COUNTRIES**

The importance of health on economic growth has received a lot of attention presently in developed, emerging and developing countries. Health is believed to have a positive impact on economic growth. Coovadia; Jewkes, Barron, Sanders and McIntyre (2009) argue that the history of South Africa has had effect on the health of its people and the health policy and services of the present day. Before 1994, political, economic, and land restriction policies structured society according to race, gender, and age-based hierarchies, which greatly influenced the organisation of social life, access to basic resources for health, and health services. South Africa is considered a middle-income country in terms of its economy. However, it has health outcomes that are worse than many lower income countries.

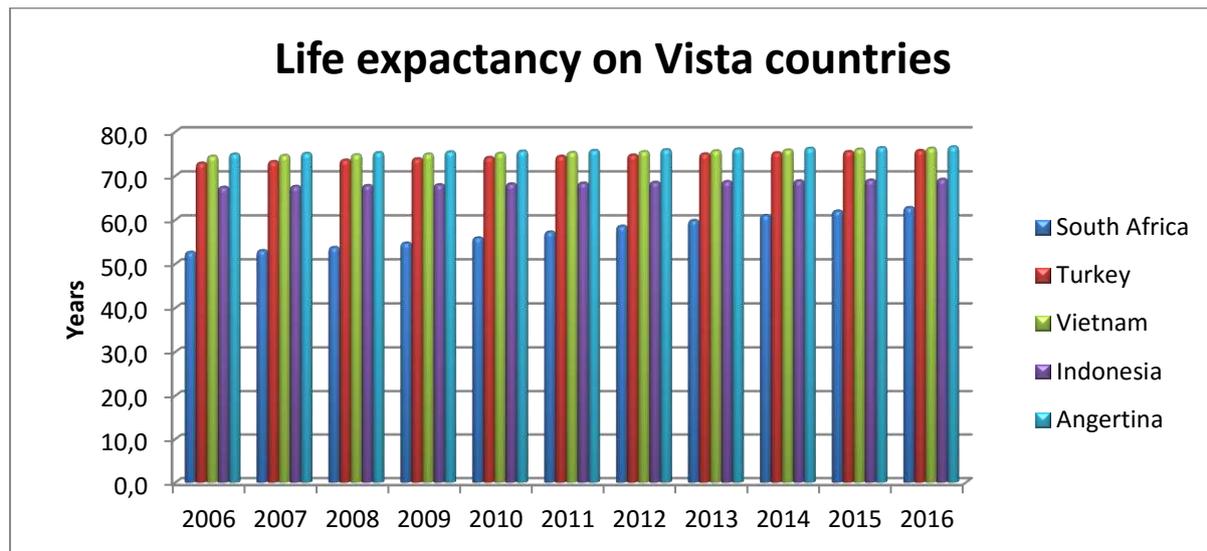
Thoa (2011) argue that in 1986 the Vietnam government introduced a new economic policy that led to an increase of the out-of-pocket health expenditures as a proportion of private health expenditures from 59% in 1989 to 84% in 1998 and it increased to 90.2% in 2007. Wagstaff et al. (2010) reported that Vietnam health care expenses have become a financial burden and influenced health care service seeking behavior, especially among the poor. Total health expenditure in 2008 was 7.3% of Gross Domestic Product (GDP), with government expenditure accounting for only 38.5% of total health budget. Economic growth in Vietnam saw an improvement following economic reforms in 1986. Economic growth in real GDP recorded in the past 10 years approximately 6%. According to World Health Organization (WHO) Statistics, the GDP per capita of Vietnam increased from US\$610 in 1990 to US\$2,700 in 2008 and Vietnam became one of the most potent markets in the Southeast Asia.

Indonesia's economy has expanded strongly over recent decades. The strong pace of growth has been seen as becoming an increasingly important part of the global economy (Elias and Noone, 2011). The country of Indonesia is recognized as the fourth largest economy in East Asia, following China, Japan and South Korea. Historically, the Indonesia's economy has been heavily geared towards the agriculture sector. Over the time there was a gradual change in the structure of the economy towards industrialization and urbanization in the late 1960s.

Since 2003 there have been ongoing reforms to the Turkey health care system. These reforms led to increases on the demand and the expenditure of health care services. The country removed constraints of access to health services by merging different health insurance schemes

and by providing access to all types of health care, as the results the total number of physician consultations has increased to 643 million in 2014 from 209 million in 2002. It was evident that the per-capita health expenditure s increased from \$187 in 2002 to \$624 in 2008 whereas the share of health expenditure of GDP increased from 5.4 % in 2002 to 6.1 % in 2008 (Atilgan, Kilic and Ertugrul, 2016).

**Figure 1: Life expectancy of Vista countries**



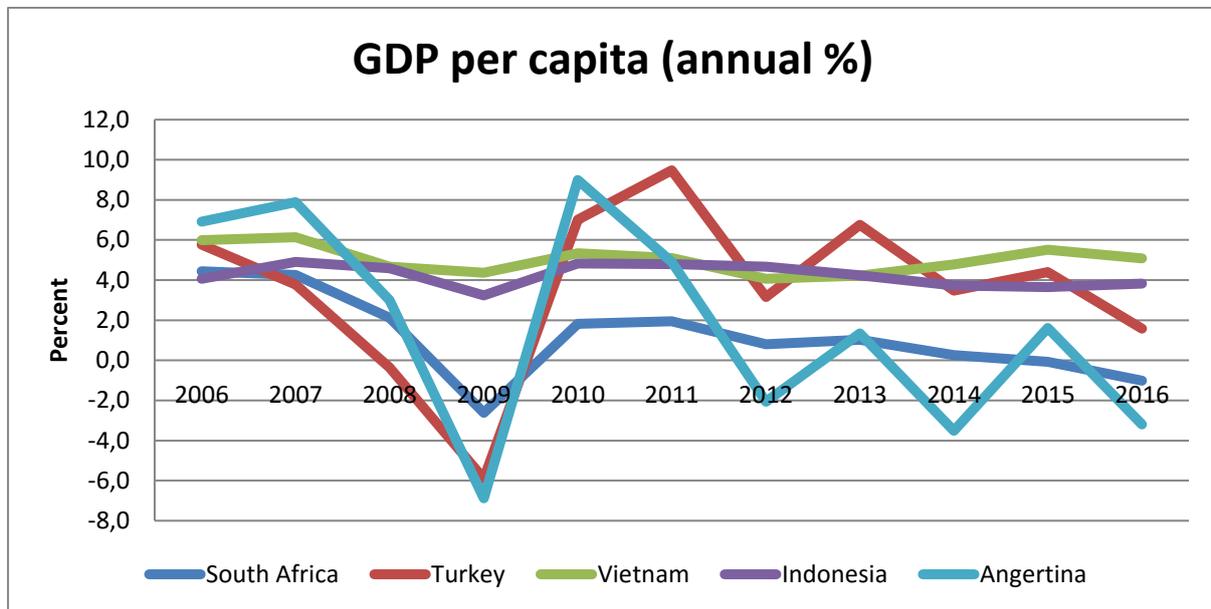
**Source: World Bank (2017)**

The economy of Argentina has been characterized by ups and down over the past 50 years, attributable by several severe economic crises. Argentina lost extensive ground in incomes and wellbeing in relation to Latin American and other countries over time (OECD, 2017). It was recognised that Argentina’s per capita income were amongst the top ten in the world a century ago, when they were 92% of the average of the 26 richest economies (Bolt and van Zanden, 2014). At present, per capita incomes are 43% of those same 16 rich economies. Exporting of food were the primarily basis for Argentina’s high income, nonetheless foreign demand plummeted during the Great Depression and the economy became more inward-focused as of 1930 (OECD, 2017).

The trends in life expectancy and GDP per capita on Vista countries over the period 2006 and 2016 are shown on figure 1 and 2 respectively. When looking very close on life expectancy, Argentina recorded the highest life expectancy of 76 years on average over the period of the analysis. South Africa recorded the lowest life expectancy of 57 years on average over the period 2006 and 2016. When comparing the GDP per capita of the Vista countries over the

study period of 2006 and 2016. Vietnam recorded the highest rate of GDP per capita, an overall of 5 on average and South Africa again recorded the lowest GDP per capita of 1.2 percent on average for the full period of the analysis under review.

**Figure 2: GDP per capita (annual %)**



**Source: World Bank (2017)**

### 3 LITERATURE REVIEW

The relationship between health and economic growth has raised interest amongst various researchers resulting in an increase in the number of studies investigating this relationship. According to the World Health Organisation (2003), health is generally linked to a state of complete physical, mental and social well-being as opposed to just being the absence of sickness. Furthermore, Bloom and Canning (2000) indicate that individual that are educated and of good health achieve higher levels of productivity that inevitably contributes positively towards economic development. This section covers the findings of some recent studies that have conducted research on the effect of health on economic growth.

Akram (2006) investigated the effect of different health indicators on economic growth in Pakistan for the period 1972-2006. The Co-integration, Error Correction and Granger causality techniques were employed in order to yield the desired results. The study indicates that in the long run a significant relationship exists between health and economic growth. However, in the short run no relationship is evident. The results show that population per bed, age dependency and mortality has a negative effect on economic growth. On the other hand, health

expenditure, life expediency and trade openness has a positive effect on per capita. Furthermore, the study recommends an increase and improvement in the stock of health and human capital in order to yield higher levels of per capital income.

Schultz (2005) investigated the impact of health on total factor productivity. The study indicates that improved health human capital has a positive and significant impact on the wages and labourer's level of productivity. Furthermore, the study indicates that developing countries experience a lack of resources needed for health investment which thus leads to poor health status and slow levels of economic growth. This vicious cycle results in continuous underdevelopment.

Rico et al. (2005) examined the effect of health on economic growth. The study employed the Ordinary Least Squares technique, with panel data that included the growth rates of physical capital, labour, education and health indices. The study time period ranged from 1970-1980 and 1980-1990 with a sample size of 52 to 72 countries. With the use of the Generalised Least Square, the results indicated that health has a significant impact on economic growth. Furthermore, the study recommends further investment in health as means of combating the vicious cycle of poverty.

Mayer (2001) made use of the probability of adult survival by gender and age group as a measure of health status. The study employed the Granger causality test which indicated that health status causes economic growth in Brazil, Mexico and Latin America. Improved levels of health in adults are linked with 0.8-1.5 percent increase in annual income. Furthermore, growth impact is higher for improvements in female health as compared to improvements in the health of males.

Malik (2005) conducted a study that indicated that the use of the OLS model finds that a significant relationship between health status and economic growth does not exist. However, when 2SLS is used the study indicates a highly significant effect of health indicators on economic growth.

Bhargava et al. (2001) investigated the effect of health on the growth rates of GDP per capita, using a panel estimation of 92 countries from the period 1965-1990. The results of the study showed that the growth rates of GDP per capita only yielded positive results for low income countries. Jamison et al. (2005) study also indicated similar findings, with a panel estimation of 53 countries from the period 1965-1990. The study reported a decline in the positive effects

of health on GDP per capita as the levels of life expectancy increased, the effects were thus larger for low income countries with lower levels of life expectancy.

Bloom et al. (2004) examined the effects of health indicators on economic growth and made use of an economic growth model that included two variables that have been recognised as basic components of human capital, work experience and health. The study used panel data from various countries with a study period ranging from 1960-1990. The results indicate that good health has a positive and statistically significant effect on aggregate output. Furthermore, improvements in the education system may result in a rise in output through labour productivity as well as capital stock.

#### 4 DATA AND METHODOLOGY

Following from the literature, the investigation of health – growth nexus for Vista countries was conducted in a neo-classical aggregate production model where labour, capital and health are treated as separate factors of production:

$$Y_t = f(H_t, K_t, L_t) \quad (1)$$

Where, Y is economic growth represented by real GDP per capita; H is life expectancy as an indicator for Health, K is the capital stock; L is the employment level and the subscript  $t$  represent the time period. Taking the log linear form of equation 1, the following equation is derived

$$LY_t = \alpha_0 + \beta_1 LH_t + \beta_2 LK_t + \beta_3 LL_t + \varepsilon_t \quad (2)$$

Where, LY is the logarithm form of economic growth; LH is the logarithm of health, LK is the logarithm of capital stock; LL is the logarithm of the level of employment. The coefficients  $\beta_i, i = 1,2,3$  denotes the elasticity of output with respect to health, capital stock and employment level, respectively.

##### **Data description**

We examine the long run relationship between economic growth and health for Vista countries (Vietnam, Indonesia, South Africa, Turkey and Argentina) covering the period between 1990 and 2016. Our empirical study incorporated labour and capital as the additional variables to form a multivariate framework. The data on economic growth, Health, labour and capital series is sourced from the World Development Indicators (WDI) database. Real GDP per capita was used as a proxy for economic growth while life expectancy was used as a proxy for health.

Gross capital formation (constant 2010 US\$) was employed as a proxy for capital and total labour force was used as a proxy for labour.

### **Data Analysis**

Unit root tests are required to determine the maximal integration order before conducting the ARDL bounds test. To examine the existence of unit roots and determine the order of integration of the four variables, we apply the Augmented Dickey-Fuller (ADF), Phillips and Perron (PP) and Dickey-Fuller Generalised Least Squares (DF-GLS). According to the literature, PP and ADF unit root tests have low power of rejecting the null hypothesis. To complement for this, DF-GLS is also employed in order to have robust results. The results of the unit root tests are illustrated in Table 1.

According to Table 1, the ADF results indicate that all the variables are stationary at first difference for all the countries. The ADF results also posit that the health variable in Vietnam, Indonesia and Turkey is stationary at  $I(0)$ . The findings from the PP test evidence that all the variables are stationary at first difference for all the countries while the health variable is also stationary at levels for Indonesia and Turkey. Finally, the DF-GLS test shows that all the variables are stationary at first difference for all the countries.

According to Johansen (1991), Johansen's cointegration technique requires that the variables should be non-stationary at their respective levels, but their linear combination must be stationary and they should be integrated of the same order. However, the ARDL bounds test of cointegration is independent of the order of integration of the variables. From the results in Table 1, it has been realised that some of the variables are integrated  $I(0)$  while others are integrated  $I(1)$ . This leads to the current study adopting the ARDL bounds test in determining the existence of the long run among the variables.

Table 1: Unit root tests

	ADF		PP		DF-GLS	
	Levels	1 <sup>st</sup> Diff	Levels	1 <sup>st</sup> Diff	Levels	1 <sup>st</sup> Diff
<b>Vietnam</b>						
GPD	-2.87	-4.99**	-1.14	-3.69**	-2.88	-3.65**
Health	-10.45*	-3.57***	-2.86	2.94***	-1.41	-4.77*
Capital	-1.26	-5.11*	-1.36	-5.10*	-1.41	-5.31*
Labour	3.00	-4.51**	2.06	-3.51**	0.00	-3.26**
<b>Indonesia</b>						
GDP	-1.29	-5.81*	-1.52	-3.62**	-1.41	-3.78*
Health	-4.60*	-3.49**	-4.95*	-4.06**	-3.12	-3.00***
Capital	-2.40	-4.13**	-3.60	-3.28**	-2.54	-4.31*
Labour	-2.07	-3.71**	-2.07	-3.64**	-1.25	-3.90*
<b>South Africa</b>						
GDP	-2.50	-3.46***	-3.11	-4.11**	-2.17	-3.46**
Health	-1.39	-3.48***	0.30	-3.97**	-2.54	-3.48**
Capital	-2.41	-3.87**	-2.53	-3.81**	-2.59	-2.84***
Labour	-2.46	-4.43**	-2.14	-3.59***	-2.46	-4.43**
<b>Turkey</b>						
GDP	0.40	-5.08*	0.45	-5.08*	0.77	-4.84***
Health	-8.07*	-4.28*	-5.54*	3.00**	0.33	-2.62**
Capital	-2.55	-5.46*	-2.59	-5.46*	-2.62	-5.70***
Labour	-0.43	-5.99*	-0.18	-5.99*	-2.18	-6.14*
<b>Argentina</b>						
GDP	-1.77	-4.67*	-1.87	-4.67*	-1.83	-4.72*
Health	-1.79	-2.46***	-1.45	-2.49***	-0.23	-3.28**
Capital	-2.41	-4.08*	-2.55	-4.02**	-2.29	-4.16***
Labour	-1.67	-7.54*	-1.65	-8.00	-1.38	-7.85
Note: *, **, ***, represent significance at 1%, 5% and 10%, levels, respectively						

An ARDL bounds test is a general dynamic specification, which employs the lags of the dependent variable and the lagged and contemporaneous values of the independent variables, through which the long run equilibrium relationship can be indirectly estimated and the short

run effect can be directly estimated. The ARDL model used in this study can be modelled as follows:

$$\Delta LGDP_t = \alpha_0 + \delta_{1i}LH_{t-1} + \delta_{2i}LK_{t-1} + \delta_{3i}LL_{t-1} + \sum_{i=1}^p \gamma_{1i}\Delta LGDP_{t-1} + \sum_{i=0}^p \gamma_{2i}\Delta LH_{t-1} + \sum_{i=0}^p \gamma_{3i}\Delta LK_{t-1} + \sum_{i=0}^p \gamma_{4i}\Delta LL_{t-1} + \varepsilon_t \quad (3)$$

Where  $\Delta$  is the first difference operator; LGDP is the log of real GDP per capita; LH is the log of life expectancy, used as a proxy for health; LK is the log of capital stock and LL is the log of employment level.

The ARDL bounds testing approach is based on the joint F-statistic (Wald statistics) for cointegration analysis. The null hypothesis of no cointegration among the variables in eq. (3) is  $H_0: \gamma_1 = \gamma_2 = \gamma_3 = \gamma_4 = 0$  is tested against the alternative hypothesis  $H_1: \gamma_1 \neq \gamma_2 \neq \gamma_3 \neq \gamma_4 \neq 0$ . The F-test has a nonstandard distribution which relies on; firstly, whether the variables included in the ARDL model are I(0), or I(1), secondly, the number of regressors and lastly, whether the ARDL model contains an intercept and/or a trend. Pesaran and Pesaran (1997) and Pesaran et.al (2001) reported two sets of critical values for a given significance level. The results conclude in favour of co-integration, if the calculated F-statistics exceeds the upper critical bound value, this means that the  $H_0$  is rejected. On the contrary,  $H_0$  cannot be rejected if the F-statistics falls below the lower critical bound value. Finally, if the F-statistics falls within the two bounds, then the co-integration test becomes inconclusive.

Table 2 illustrates the findings of the ARDL bounds technique. The results evidence that there is a long run relationship between economic growth and health in Vietnam, Indonesia, South Africa and Turkey. This is on account that the F-statistics for these countries is greater than the upper bound critical value (4.35) at the 5 percent level of significance. But the ARDL test indicates no long run relationship between economic growth and health in Argentina because the F-statistics is for Argentina (2.42) is less than the lower bound critical value (3.23) at 5 percent level of significance.

**Table 2: The ARDL bounds test results**

Country		F-statistic			
Vietnam		16.6*			
Indonesia		24.9*			
South Africa		5.48**			
Turkey		6.88*			
Argentina		2.42			
Critical values					
<b>10%</b>		<b>5%</b>		<b>1%</b>	
I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
2.72	3.77	3.23	4.35	4.29	5.61

The diagnostic tests results are illustrated in Table 3. It was evidenced that the error terms of the short run models are free of heteroscedasticity, have no serial correlation and are normally distributed. Therefore, this leads to the discussion of both the long run and short run estimates.

**Table 3: Diagnostic test results**

Country	Normality	Serial Correlation	Heteroscedasticity
Vietnam	0.84	0.67	0.43
Indonesia	0.90	2.59	0.44
South Africa	0.77	6.33	2.79
Turkey	0.46	0.28	1.30
Argentina	0.59	2.63	2.29

The results of the long run and short run estimates are illustrated in Table 4. Commencing with long run results, it is evident from Table 4 that there is a positive and significant relationship between economic growth and health in Vietnam, Indonesia and South Africa at 1 percent level of significance. More specifically, the results imply that increasing life expectancy by one year boosts the productivity of workers and increases economic growth by 0.43%, 0.57% and 0.001%, respectively. This consistent to economic theory that healthy people provide sustained labour and can invest in their education which will in turn boosts productivity. These results

are similar to the ones found by Bloom et al. (2004) and Rico et al. (2005). The results further validated that there is a negative and significant relationship between health and economic growth in Argentina, while a negative relationship was also realised in Turkey but it was not significant. Akram (2006), also found that in the long run a significant relationship exists between health and economic growth in Pakistan. However, in the short run no relationship is evident.

**Table 4: The long run and short run estimates**

Variable	Vietnam	Indonesia	South Africa	Turkey	Argentina
<b>Long-run</b>					
Constant	-1.86 (-8.71)*	1.58 (1.29)	-1.31 (-2.33)***	3.61 (1.26)	-1.31 (0.77)
Health	0.43 (4.05)*	0.57 (14.07)*	0.001 (3.97)**	-1.00 (-1.09)	-2.17 (-6.25)*
Capital	0.19 (3.27)*	0.65 (3.38)**	-0.03 (-2.83)**	-0.75 (-5.07)*	0.13 (1.16)
Labour	8.08 (12.78)*	6.36 (11.63)*	4.08 (6.51)*	14.83 (4.07)*	18.32 (9.03)*
<b>Short-run</b>					
D(Labour)	-0.53 (-1.44)	0.55 (1.29)	-0.40 (-2.15)	1.48 (3.60)*	0.12 (0.74)
D(Health)	0.08 (2.56)**	0.11 (4.71)*	-0.002 (-1.43)	0.16 (3.48)*	-0.01 (1.56)
D(Capital)	-0.29 (-2.65)**	-0.06 (-0.63)	0.001 (3.19)**	0.88 (3.13)**	-0.17 (-1.53)
ECM <sub>t-1</sub>	-0.69 (-3.84)*	-0.35 (-4.53)*	-0.42 (-3.38)**	-0.22 (-5.45)*	-0.12 (-4.21)*

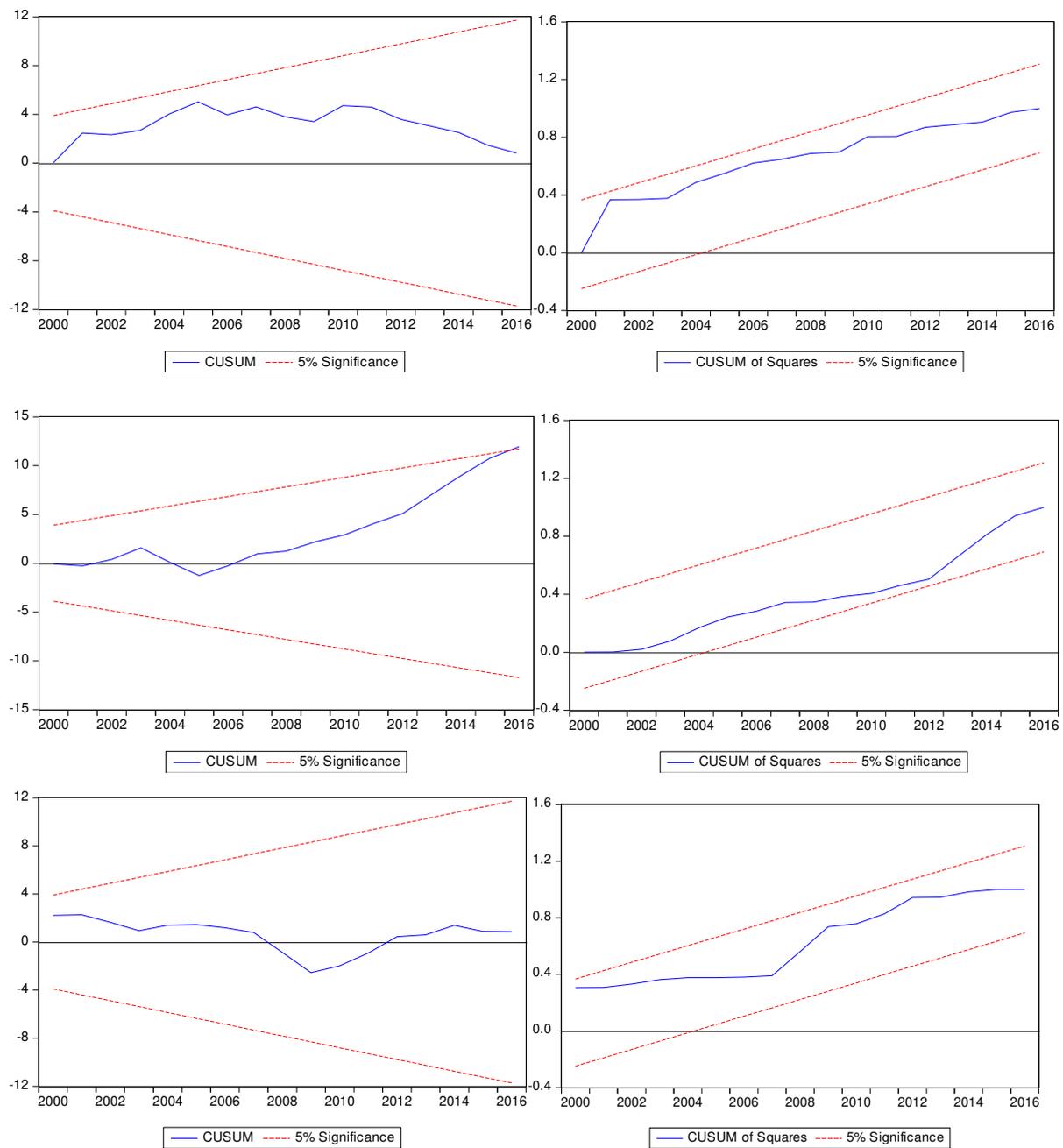
Capital was found to have a negative and a significant effect on economic growth in South Africa and Turkey contrary to a priori expectations. In Vietnam and Indonesia, it was discovered that capital has a positive and a significant effect on economic growth. This is consistent to economic theory and is supported by the findings of Bloom et al. (2004). In

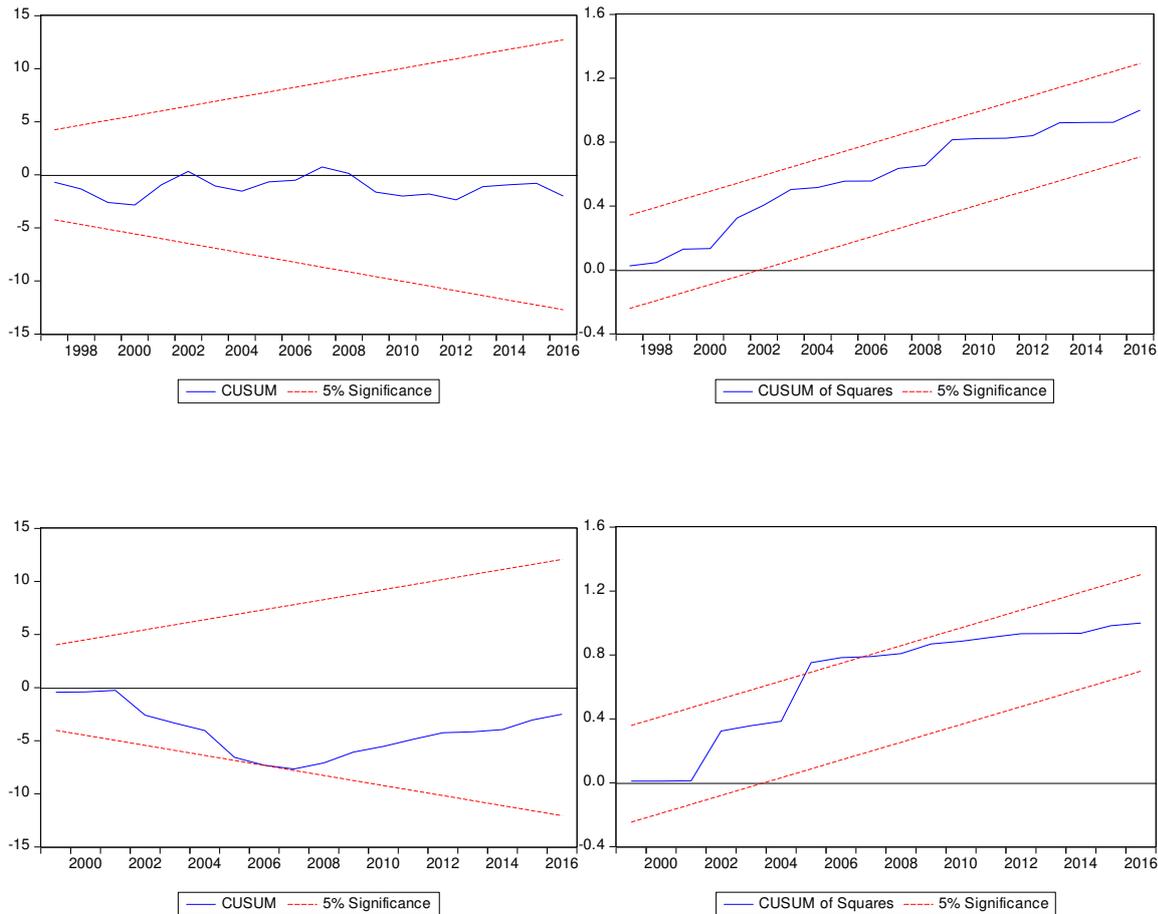
Argentina, capital and economic growth have a positive but insignificant relationship. Finally, labour and economic growth were found to have a positive and a significant effect on economic growth for all the countries.

The short run results indicate that in Vietnam, Indonesia and Turkey, there is evidence of a positive and a significant relationship between health and economic growth. A negative but insignificant relationship between health and economic growth was established in South Africa and Argentina. Capital was found to have a positive and a significant effect on economic growth in South Africa and Turkey while in Vietnam, it had a negative and a significant effect on economic growth. Furthermore, capital had no significant effect on economic growth in Indonesia and Argentina. Labour evidenced a positive and significant effect on economic growth in Turkey but it had no significant effect on economic growth for all the other countries.

The stability of the long run parameters were tested using the cumulative sum of recursive residuals (CUSUM) and CUSUM of recursive squares (CUSUMSQ). The results are presented in Figure 1. The results fail to reject the null hypothesis at 5 percent level of significance because the plot of the tests fall within the critical limits. Therefore, this indicate that our selected ARDL model is stable.

**Figure 1: CUSUM and CUSUMsq**





## 5 CONCLUSION

The study investigated the relationship between health and economic growth in the VISTA countries covering the period 1990 to 2016. The ARDL bounds test was employed to examine the presence of the long run relationship among the variables. The study incorporated labour and capital in the analysis to form a multivariate framework. The ARDL bounds test results posited that there is a long run relationship between economic growth and health in all the countries except for Argentina.

The results suggest that there is a positive and significant relationship between health and economic growth both in the long run and short run in Vietnam and Indonesia. In South Africa, it was evidenced that health has a positive and a significant effect on economic growth only in the long run but in the short it suggest a negative and insignificant effect. The results further posited that in Tukey a positive and significant effect of health on economic growth is only realised in the short but in the long run, no significant effect found was found. Lastly, in

Argentina, there was an evidence of a negative and significant effect in the long while no significant effect was established in the short run.

These findings have some policy implications. For the countries that established a positive and a significant effect between economic growth and health, it can be realised that improvement in health doesn't not only boost welfare but it also enhances output. Therefore, there is a need for increasing investment in health in Vietnam, Indonesia and South Africa as this will boost economic growth. To achieve this goal, it is important that these countries invests in the construction of new health facilities, improve medical supplies in the hospitals as well as ensuring that proper training of healthcare personnel. Therefore, to improve life expectancy of the population, the policy makers and government should engage in strengthening the healthcare systems of these countries.

Furthermore, policies geared towards improving labour productivity will assist in propelling Vista countries' long term growth. It is important that proper training for staff should be provided and also investment in education should be taken into consideration as it will enhance the skills of the labour force and enhance economic growth.

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