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ECONOMIC GROWTH AND LIFE EXPECTANCY: THE CASE OF IRAN

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Abstract:

Regarding the link between economic growth and it`s public outcomes, this paper studies the effect of economic growth on life expectancy in Iran during 1966-2013. To achieve the research objectives, annually data collected from World Bank Database and I used the life expectancy at birth and annually GDP growth rate to measure the research variables. Then I applied Vector Error Correction Model to estimate the proposed model. The results on this study show that economic growth has a positively significant effect on life expectancy in Iran during the observation period.

Key words: *Economic Growth, Life Expectancy, Iran, Vector Error Correction Model (VECM).*

1. Introduction

The relationship between life expectancy and annually GDP rate is one the most attractive subjects in public health. The rise of life expectancy in the late 20th century led to many positive economic consequences around the world so that many researches shown a positive link between life expectancy and economic development at national level. For example Aghion et al (2010) developed a theoretical model which showed that the development of many economies depends upon both the level and the growth rate of life expectancy. In another look, the relationship between health and economic growth is briefly explained in the human capital theory which predicts that the higher life expectancy promotes investment in earning skills and leads to better performance by labor force (Oster et al, 2013). Also low health usually leads to less life expectancy and it is expected that poor health labor force being less productive and more incapable to learn or adapt to technological innovations (Madsen, 2012). This could indicate the existence of a relationship between life expectancy and economic growth. It is widely accepted that human capital plays a key role in growth process in any country (Barrow, 1996) and this reveals the importance of good health as one of the types of the capital. Although theories describing the relationship between

economic growth and life expectancy are limited, this relationship can be explained by a few viewpoints. One of these viewpoints emphasizes on the direct positive effect of health on economic growth through the endogenous growth models and the other viewpoint considers indirect negative effects of health on economic growth. The fans of positive effects of health on economic growth introduce health as a major source of income growth via its role in accumulating of human capital or as a central variable in growth models. (see for example Barro & Sala-i-Martin, 1992 or Acemoglu & Johnson, 2007). The indirect effect is considered by the neoclassical and Keynesian economists. This group emphasizes the negative effects of the public funding on growth via the rise in government levies and slowing down in economic activities. Some researchers believe that the debt crisis experienced by developing countries and panaceas implemented by donors as part of structural adjustment programs have led to withdraw from the social sectors such as health and education at 80th (Ngangue & Manfred, 2015). This process reduced essential funds for growing of human capital and improving the living conditions of the populations. The positive effect of economic growth on life expectancy can also be explained by some other items. Higher growth rates usually promotes investment incentives and provides more financial resources for individuals to do more health promotion activities like periodic medical check-ups, investment in life insurance or also improving their lifestyles. The other item is indirect effect of economic growth on life expectancy through the promoting of human capital as many studies showed that economic growth adds to the resources available in the economy for improvements in health and education (Olimpia, 2013). Obviously, the improvement of any of the items listed can be effective in improving life expectancy among the people.

Based on the above lines it is expected that economic growth has a significant effect on life expectancy and given to limited researches done in this field in Iran, I am going to examine this effect in Iran`s economy and compare the results with existing evidences in other countries.

2. Background

De la Croix & Licandro (1999) analyzed life expectancy and endogenous growth nexus in a theoretical framework and suggested that the effect of life expectancy on growth is positive for economies with a relatively low life expectancy, but could be negative in more advanced economies.

Acemoglu & Johnson (2006) studied the effect of increasing life expectancy on economic growth for 59 countries between 1940 and 1980 and presented no evidence that the large exogenous increase in life expectancy has led to a significant increase in economic growth.

Acemoglu & Johnson (2007) using data for 75 countries during 1940-1980 estimated the effect of life expectancy on economic performance and found out that life

expectancy has a much smaller effect on total GDP and there is no evidence that the large increase in life expectancy raised income per capita.

Azomahou et al (2009) provided a nonparametric inference of the relationship between life expectancy and economic growth on an historical data for 18 selected countries over the period 1820-2005 and showed that the generated relationship between life expectancy and economic growth is to be strictly increasing and concave.

Turan (2009) developed a model linking life expectancy to fertility, education, and labor supply for sub-Saharan Africa and showed that increases in life expectancy will have a positive impact on growth through fertility and education but the effect will be small.

Bowser (2010) analyzed the effect of life expectancy on economic growth for 51 states of USA over the period 1970-2000 and suggested that 1% increase in life expectancy over 10 years increases net earnings per capita by 1.9% at the county level and 6.0% at the state level.

Cervellati & Sunde (2011) using OLS estimate and 2SLS regressions emphasizing the role of the econometric specification , investigated the causal effect of life expectancy on economic growth for 47 selected countries during 1940-2000 and suggested that sufficiently high life expectancy is ultimately the trigger of the transition to sustained income growth.

Ecevit (2013) examined the impact of life expectancy at birth on economic growth for 21 OECD countries using panel data for the period of 1970-2010 and showed that life expectancy is a fundamental determinant of economic growth in the OECD countries and there is a unidirectional causality running from life expectancy to real per capita GDP.

Mahumud (2013) using multiple regression models studied the impact of life expectancy on changes of economic growth and health care expenditure for Bangladesh and observed the higher GDP per capita in a longer life expectancy.

Jafari Samimi et al (2014) using Smooth Transition Regression (STR) model discussed the impact of life expectancy on economic growth for Iran during 1965-2009 and concluded that there is a nonlinear threshold behavior in the relationship between life expectancy and economic growth in Iran in a two regime structures with a threshold level of 55.34 years.

Kunze (2014) investigated the relationship between life expectancy and economic growth in an overlapping generations model with family altruism and suggested that there is a non-linear pattern between life expectancy and economic growth.

Ebenstein et al (2015) using regression method examined the relationship between income, pollution, and mortality in China from 1991-2012 and documented a robust positive association between city-level GDP and life expectancy.

Hansen & Lønstrup (2015) examined the effect of life expectancy of economic growth for 35 countries during the period 1940-2000 and documented that the growth in life expectancy over the 20th century decreased per capita GDP growth and increased population growth.

Ngangue & Manfred (2015) using panel data studied the impact of life expectancy on the growth of Gross National Income (GNI) per capita for 141 developing country during 2000-2013 and showed that the improvement in life expectancy has a positive impact on economic growth.

3. Data and Methodology

Data

Life expectancy indicator usually rely on the number of years of life expectancy at birth. For example and among the past studies, Hansen & Lønstrup (2015) used life expectancy at birth and Ngangue & Manfred (2015) used the total number of years that an individual must live in a country to gauge life expectancy variable. In this paper I used the number of years of life expectancy at birth (total in men and women) to measure life expectancy in Iran. To obtain this measure and annually GDP growth rate, data collected from The World Bank Database (available on-line at http://data.worldbank.org/) over the period 1966 to 2013.

The Model

This paper employs a Vector Error Correction Model (VECM) to investigate the effect of economic growth on life expectancy in Iran during 1966-2013. The general assumption in the proposed model is that there is at least one long-run co-integration vector among the variables and the value of the dependant variable can be defined as a function of past values of the dependent variable, past values of the independent variable and error term as follow:

(1) $$LE = f\left(LE_{(-1)}, LE_{(-2)}, ..., LE_{(-n)}, GR_{(-1)}, GR_{(-2)}, ..., GR_{(-n)}, e\right)$$

Which *LE* and *GR* represent the life expectancy measure and annually GDP growth rate respectively and *e* is error term. To estimate such a model, the numbers of lags included, stationary of the time series and the results of the co-integration tests are of crucial importance. Thus using Schwarz (1978) Information Criterion (SIC), two optimal lags considered to specify the model as the following linear relation:

(2) $$LE = \alpha_1 LE_{(-1)} + \alpha_2 LE_{(-2)} + \alpha_3 GR_{(-1)} + \alpha_4 GR_{(-2)} + \alpha_5 e + c$$

Empirical Results

Using econometric methods in empirical studies is based on the stationary of the variables. Thus to test the stationary of the variables in level, I employed Phillips & Perron (1988) Unit Root Test using Eviews6, which the results are shown in Table 1.

Table 1. The results of Phillips & Perron (1988) Unit Root Test for variables in level.

Variable	Adj. t-Stat	Test Critical Value		
		In %1 Level	In %5 Level	In %10 Level
LE	-1.82	-4.17	-3.51	-3.18
GR	-3.49	-4.17	-3.51	-3.18

The results indicate that variable *LE* is unstable in level. Therefore Phillips & Perron (1988) Unit Root Test for variables in 1st difference applied which the results are shown in Table 2.

Table 2. The results of Phillips & Perron (1988) Unit Root Test for variables in 1st difference.

Variable	Adj. t-Stat	Test Critical Value		
		In %1 Level	In %5 Level	In %10 Level
D(LE)	-3.54	-4.17	-3.51	-3.18
D(GR)	-11.86	-4.17	-3.51	-3.18

The results indicate both variables are stable in 1st difference in 5% level. Stationary of the variables at the same level could indicate the existence of a long-run relationship between them (Hami, 2014). Examining the co-integration between times series variables is performed by different methods such as Engle & Granger (1987), Stock & Watson (1988) and Johansen (1988), which Johansen`s approach has clearly better properties than the other two estimators in situations where there is more than one co-integration vector (Gonzalo, 1994). Therefore in the next step I applied Johansen (1988) Co-integration Test using Eviews6 to examine the long-run relationship between economic growth and life expectancy which the results are shown in Table 3.

Table 3. The results of Johansen (1988) Co-integration Test for variables.

Hypothesized No. of CE(s)	Trace Statistic	0.04 Critical Value	Prob
None *	15.10	14.96	0.06

* Denotes rejection of the hypothesis at the 0.06 level

According to the Table 3, Johansen`s trace statistic is greater than critical value at the 0.06 level which indicates that there is at least one long-run co-integration vector among the variables with the certainty of more than 94%. This provides the basis of using estimation methods. As mentioned earlier, in this paper I employed Vector Error Correction Model (VECM) using Eviews6 to estimate the model which the results are shown in Table 4.

Table 4. The results of Vector Error Correction Estimates for variables.

Coefficient	Value	Standard Error	T-Statistics
α_1	1.84	0.04	49.06
α_2	-0.96	0.04	-25.28
α_3	0.01	0.01	1.91
α_4	0.01	0.01	1.91
α_5	-0.01	0.01	-1.83
c	0.06	0.01	6.31

Based on the estimated coefficients, the general linear relation can be described as follow:

$$D(LE) = 1.84D(LE_{(-1)}) - 0.96D(LE_{(-2)}) + 0.01D(GR_{(-1)}) + 0.01D(GR_{(-2)}) - 0.01e + 0.06 \quad (3)$$

4. Conclusion

This paper examined the effect of economic growth on life expectancy in Iran. To achieve the research objectives, measures of the variables introduced and the proposed model estimated via Vector Error Correction Model (VECM). Phillips and Perron (1988) Unit Root Test for variables showed that both variables have unit root and become stationary after first differencing (see Table 2). Based on the results of Johansen (1988) Co-integration Test for variables (shown in Table 3), there is at least one significant long-run relationship between the variables with the certainty of more than 94%. According to the results of Vector Error Correction Estimates for variables (shown in Table 4), coefficient of $\alpha_5 = -0.01$ which called error correction coefficient, appeared in the model with the negative sign and it`s significance approves in 1% level. Negative sign of error correction coefficient indicates the tendency for long-run equilibrium relationship among the research variables. Also the significance of $\alpha_3 = 0.01$ and $\alpha_4 = 0.01$ which indicate the impact of GDP growth rate on the number of years of life expectancy at birth approves in 1% level. This finding shows that economic growth has a positively significant impact on life expectancy in Iran during the observation period, so that 1% increase in GDP growth rate has led to approximately 0.01% rise in number of years of life expectancy in the next period and 0.01% rise in number of years of life expectancy in the next two period. The results of this paper are consistent with the result of the study of Mahumud (2013) for Bangladesh and suggest that economic growth has a negligible contribution in promoting of life expectancy in Iran.

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