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## The relationship between Life Expectancy and Economic Growth in selected countries

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### ABSTRACT

The question whether life expectancy rise would increase per capita income, had been the subject of many discussions. This research investigates the effect of life expectancy on the growth rate of GDP using a panel data set during the period of 1990 to 2009 for 36 countries among the developing and the developed countries. Life expectancy is one of the fundamental determinants of economic growth which is effective both quantitatively and qualitatively since it increases the efficiency of total production factor. Results show that life expectancy has a positive effect on economic growth. Furthermore population has a negative effect on economic growth. Thus if the life style improves, life expectancy would increase and through this, economic growth will boost.

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## INTRODUCTION

The increase in life expectancy will intensify the economic growth. The question whether life expectancy rise would increase per capita income, had been the subject of many discussions. Some economists believe the increase in life expectancy would boost the efficiency of total production factor and finally leads in economic growth (Bhargava *et al.* 2001).

The link between life expectancy and economic growth has been well established. There are many channels in which health influences economic growth. First healthier individuals increase their incomes by being more productive, physically more energetic and mentally more robust (Bloom and Canning 2000). A second mechanism for improved economic development is through increase in savings. As a population lives longer, they will want to invest more in their retirement. A 10 year increase in longevity has been shown to lead to a 4.5% rise in savings (Bloom, Canning and Sevilla 2004). Third, improved health can lead to increases in economic growth through increases in education levels. A healthier population will want to invest more in their skills in order to earn higher wages. A healthier child will be able to attend school, learn more and have higher cognition. This can lead to higher wages in the long term (Sachs and Malaney 2002).

To achieve a high and sustainable economic growth rate we should determine the effective factors of economic growth. The object of growth theories is to explain growth rate determinants in a country and the differences among growth rates among countries. Moreover these theories are going to answer this question that how growth rate is affected by different policies. Economic growth results in more employment and welfare which are the priorities of any government.

The people's evaluation of their quality of life has gained value in recent years. In view of some researchers of the University of Toronto (2005), the amount of joy and satisfaction that people have in their lives is the most crucial opportunity for experiencing a happy and healthy life. In this research we are trying to investigate the effect of life expectancy on economic growth.

### Population and economic growth:

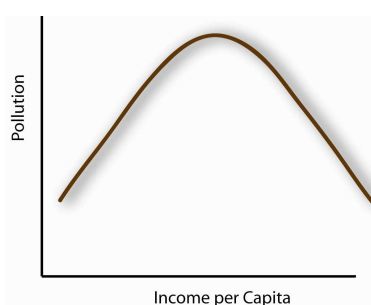
Population by its scope and nature is very extensive and important. Sattarifar (1996) argues high population growth makes problem in resource-rich countries, because it affect the creating of human capital and proficiency required to administering the development and extracting potential resources. For development on the use and utilization of these potential resources; infrastructure, public and education service are needed; however high population and its fast growth do not permit to investing. High population growth does not let the income distribution to be improved and necessary investing on human capital be performed and because of the lack of

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sufficient investment resources for achieving skills and public education, poor people cannot take advantage of equal opportunities and this makes the class differences acuter. It seems the only way is that the fertility rate be kept low. (Sattarifar, 1996 p187)

The relationship between economic growth and the environment

This relationship has been notified in growth studies from 1970 and highlighted growth constraints and the sustainability of economic development. In the decade of 1950, Simon Kuznets found an experimental U-shape relationship between historical income distribution and income growth which is similar to this argument that by increasing the per capita income growth, environmental effects due to economic activities initially raise and reach to a maximum value, and then it reduces. This U-shape relationship between economic growth and pollution is called the environmental Kuznets curve.



The following parts of paper are as below: The Second section is the literature review. Then in third section the specification and estimation of the model is presented and finally section four concludes.

#### Review of research:

A research performed by World Bank (1998) indicates the effect of life expectancy on increasing income per capita over 37 years in Sierra Leone is more than its effect on Costa Rica over 77 years equal to 12 times. Bhargava *et al.* (2001) found out life expectancy is an important variable in determining economic growth.

Ebert Chakh (2004) presents a theoretical model and surveys its experimental stability as a global parametric regression. He concludes life expectancy has a significant and positive effect on per capita savings.

Empirical evidence shows different conclusions on the effect of life expectancy on economic factors. Lorentzen, McMillan and Wacziarg (2008) using the data of countries around the world suggested high life expectancy leads to faster economic growth. In addition Acemoglu and Johnson (2007) found out improvement in life expectancy results in total income growth; however, cause rapid population growth and mainly has a negative effect on per capita income. Recent experimental have studied the effect of life expectancy by econometric indicators fundamentally. According to these theories effects on life expectancy may be negative before the transition; although, there is no reason to expect that after transition and reduced fertility, predictable and certain events happen. Empirical research on the effects of causal life expectancy on the economic growth focuses on the linear growth framework as the problem of understanding econometric model, thereby they left a possibility that the state of unchangeable effects which are affiliated with demographic transition. Crevellati and Sunde (2005) studied this issue.

Lorentzen *et al.* (2008) have used differences in climatic and geographic conditions of the countries to promote the research and showed more life expectancy cause economic growth faster. On the other hands Acemoglu and Johnson (2007) presented a new cognition strategy regarding differences within a country. This cognition tools applied a phenomenon known as "pervasive transition" which led to a reduction in deaths from infectious diseases after World War II. This research shows increased life expectancy has a very little impact on the aggregated revenues; however, has more effect on population increase, resulting in a considerable decrease in per capita income growth. These studies show the importance of economic growth and life expectancy as well as the fundamental causes of economic growth in the long term. Theoretical studies indicate that increasing life expectancy may have positive or negative effects on per capita income.

Mohamadian (2008) in his thesis entitled "the effect of human capital on economic growth", investigated the relationship between human capital and economic growth through an endogenous economic growth model according to Cobb-Douglas Production Function. In this study the variables such as investment on education sector, governmental funds in research and gross fixed investment without oil used as explanatory variables and the growth of gross domestic production is used as dependant variable. An OLS method applied for estimating this model over 1974 to 2004 and indicated human capital has a positive effect on economic growth.

Mohamad Hassan (2009) analyzed long-run relationship between population growth and per capita income in China. Population growth had a negative effect on per capita income in long-run using Cointegration and Granger Methods; however, the short-run results varied across the range. Neoclassical growth model stated the effect of population on the growth of per capita income is positive while endogenous economic growth model

shows a negative relationship between these two variables. Both models also indicate the effect of the growth of per capita income has a desire for lower population growth. Long-run relationship is consistent with Becker's view which by growing income, households tend to have children with higher quality specifications rather have more children.

Fumitaka Furuoka (2009) investigates the long-run effect of population growth on economic development of Thailand over the years 1961 to 2003 through Bond-Granger test. He concludes population growth has a positive effect on development and performance of economic factors of this country.

#### *The Model and Empirical Results:*

This research investigates the effect of life expectancy on the growth of GDP using a panel data set during the period of 1990 to 2009 for 36 countries among the developing and the developed countries. (از چه مقاله‌ای استفاده شده؟)

In this paper fixed effects method is applied due to the difference in intercepts resulting from Hausman test. The model is designed as following:

$$\text{LOG}(\text{GDP}_{it}) = \beta_0 + \beta_1 * \text{LOG}(\text{LEX}) + \beta_2 * \text{LOG}(\text{K}) + \beta_3 * \text{LOG}(\text{SCH}) + \beta_4 * \text{LOG}(\text{M}) + \beta_5 * \text{LOG}(\text{POP}) + U_{it}$$

GDP is gross domestic production in constant 2000 U.S. dollars. LEX represents life expectancy. K is gross fixed capital stock. SCH shows the share of education. M represents mortality and POP is for the population of studied countries.

Firstly to understand the presence or absence of intercept individually for each section, F-statistic is used which is the zero hypothesis for equality of intercepts for different sections. If the  $H_0$  hypothesis is rejected, there is no reason for uniform hypothesis of intercepts for each section. If the  $H_0$  hypothesis is rejected another question comes out that: Does the difference in intercepts of each section operate in a fixed way or random operators can better explain this difference? Usually these methods as applying Panel Data Method with Fixed or Random Effects are tested by Hausman Test which the rejection of zero hypotheses implies selection of fixed effects method and not rejection of zero hypotheses is the implication of choosing random effects method. According to the above, estimation of the model for each phase and different countries is performed as below:

**The First group estimation:** the countries of this group consist of:

Azerbaijan (AZE), Thailand (THA), Iran (IRN), China (CHN) Jordan (JOR), Tunisia (TUN), Algeria (DZA), Argentina (ARG), Chile (CHL), Colombia (COL), Lebanon (LBN), Lito (LTU), Malaysia (MYS), Mauritius (MUS), Mexico (MEX), Panama (PAN), Romania (ROM), Russia (RUS).

**Table 1:** Fixed against pooled effects in selecting developing countries

	Statistic	d.f.	Prob.
Effects Test			
Cross-section F	9.154562	(17,326)	0.0000
Cross-section Chi-square	136.595807	(17)	0.0000

Source: findings of research

**Table 2:** Fixed effects against random effects test in selected developing countries

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	46.590663	5	0.0000

Source: findings of research

Since F-statistic test and Hausman test are indicating the rejection of  $H_0$  hypothesis, selected method for estimation is fixed effects method and 2SLS will be applied.

Below table and equation are indicating the estimation results for first group of countries:

$$LGDP = 2 * LEX + 0.24 * LSCH + 0.51 * LM - 0.48 * LPOP + 0.34 * LK - 3.6 * DU12$$

**Table 3:** Estimation for the first group of countries (the developing countries)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-35255.39	8651.770	-4.074934	0.0001
LEX	304.4527	68.39237	4.451559	0.0000
LK	583.0768	190.4562	3.061475	0.0025
LSCH	30.69626	4.311900	7.118964	0.0000
LM	65.47001	22.49771	2.910074	0.0040
LPOP	-2.85E-06	1.32E-06	-2.152635	0.0324
DU3	-145.1917	22.05222	-6.583994	0.0000
DU14	276.9602	49.27527	5.620674	0.0000
R-squared	0.996617			
Durbin-Watson stat	1.949834			

Source: findings of research

In this model, besides the considered variables, two variables of CO2 emissions and employment are inserted as instruments and endogenous variables. These two variables can indirectly affect economic growth by influencing life expectancy. Other variables have an effect on economic growth directly.

Results indicate that there is a positive and significant effect between life expectancy and economic growth. Considering this fact that life expectancy is one of human development index, therefore its increase would raise the economic growth. Physical capital has a positive and significant effect on economic growth too. Education is also one of human development index and has a positive and significant effect on economic growth in these countries. The variable Mortality has a positive and significant effect on economic growth because by increased rate of mortality, per capita income would increase and then economic growth will boost. Population has a negative and significant effect on economic growth. By one percent increase in population, economic growth decreases 2.85 percentages. DU3 and DU4 are dummy variables. These variables are the proxies for social, political, religion and cultural situation of these countries. The effects of these variables for Azerbaijan and Panama are negative and positive respectively. For other countries they were eliminated because of not being significant. R<sup>2</sup> is about 0.99 and is suitable. It shows that economic growth is explained by these variables clearly in this particular model. Durbin-Watson statistics is 1.94 and indicates 2SLS was appropriate which removed autocorrelation.

**The Second group estimation:** the countries of this group consist of:

Australia (AUS), the Netherlands (NLD), France (FRA), Switzerland (CHE), Japan (JPN), Finland (FIN), United States (USA), Austria (AUT), Spain (ESP), Denmark (DNK), Italy (ITA), United Kingdom (GBR), South Korea (KOR), Iceland (ISL), Ireland (IRA), New Zealand (NZL), Norway (NOR), Portugal (PRT).

**Table 4:** Fixed against pooled effects in selecting developed countries

Effects Test	Statistic	d.f.	Prob.
Cross-section F	0.720099	(17,403)	0.7827
Cross-section Chi-square	12.747694	17	0.7529

Source: findings of research

Since F-statistic test is indicating not rejection of H<sub>0</sub> hypothesis, selected method for estimation is pooled effects method and 2SLS will be applied.

Below table and equation are indicating the estimation results for second group of countries:

$$LGDP = 2*LEX + 0.24*LSCH + 0.51*LM - 0.48*LPOP + 0.34*LK - 3.6*DU12$$

**Table 5:** Estimation for the second group of countries (the developed countries)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LEX	2.038123	0.341700	5.964656	0.0000
LSCH	0.248297	0.062546	3.969801	0.0001
LM	0.515723	0.146131	3.529176	0.0005
LPOP	-0.489331	0.085734	-5.707550	0.0000
LK	0.342799	0.089374	3.835561	0.0002
DU12	-3.629015	0.385743	-9.407847	0.0000
AR(1)	0.986118	0.003522	280.0209	0.0000

R-squared 0.998081

Durbin Watson stat. 763680

Source: findings of research

Also in this model, besides the considered variables, two variables of CO2 emissions and employment are inserted as instruments and endogenous variables.

Results indicate that both life expectancy and education have a positive and significant effect on economic growth of these countries. These two variables the basis of human development index and thus their increase would raise the economic growth. By one percentage of increases in life expectancy and education, economic growth would increase 2 and 0.24 percentages respectively. The coefficients of Mortality and Population are 0.5 and -0.48 respectively. By increased rate of mortality or reduction in population, per capita income would increase and then economic growth will boost. Physical capital by the coefficient of 0.3 has a positive and significant effect on economic growth. The dummy variable DU has a negative and significant effect on economic growth.  $R^2$  is about 0.99 and is suitable. It shows that economic growth is explained by these variables clearly in this particular model. Durbin-Watson statistics is 1.76 and indicates 2SLS was appropriate which removed autocorrelation.

#### Conclusion:

In this paper we attempted to study the relationship between life expectancy and economic growth through two groups of countries. Results show that life expectancy has a positive effect on economic growth both in the developing and the developed countries.

If the life style improves, life expectancy would increase and through this, economic growth will boost. In general, developed countries, people have higher life expectancy than in other countries. Economic circumstances, revenues commensurate with the costs, sanitation and clean air and totally achieving sustainable development are the affecting life style factors.

For lifestyle modification we should first reduce poverty and inequality in society, modify consumption patterns, with increases in GDP, employment, and the individual income. One of the variables that strongly affect the household's lifestyle is employment, or more specifically the type of jobs people occupy. The social status follows by the jobs, earnings, hours of work, leisure and grades of hard work all are important on their lifestyle. Investigating the index of unemployment and allocating people the kind of work which is commensurate with their education, can be effective in modifying the lifestyle of people society.

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