THE RELATIONSHIP BETWEEN LIFE EXPECTANCY AND GDP

DOGAN MIHAELA SIMONA
WEST UNIVERSITY OF TIMISOARA, FACULTY OF ECONOMICS AND BUSINESS ADMINISTRATION
TIBISCUS UNIVERSITY OF TIMIŞOARA, FACULTY OF ECONOMIC SCIENCES
mihaela.dogan@yahoo.com

Abstract: *Improving health is an important worldwide social goal whose purpose is a longer and better life for many citizens. Literature on 1940 is significantly to demonstrate the improvement of major international health and to estimate the effect of life expectancy on economic performance due to three factors that influenced this. This paper intends to demonstrate the effect of life expectancy on economic performance in European Union countries during the period 1990-2012.*

Key words: *life expectancy, performance, heath*

JED Classification: O01

INTRODUCTION

Basic economic intuition supported by partial empirical evidence, suggests that health should somehow matter for growth. Individuals with higher life expectancy are likely to save more and saving in turn feed back into capital accumulation and therefore into GDP growth. This has been demonstrated by Zhang and Lee (2003).

Jayachandran and Lleras – Muney (2009) showed that individuals with higher life expectancy are likely to invest more in education, which in turn should be growth-enhancing. In an environment marked by reduced child mortality, parents are likely to choose a low level of fertility, which limits the growth in total population and supports per capita GDP growth.

Healthier individuals are typically more productive, better at adapting to new technologies and more generally to changing situations.

In the recent literature on health and growth, two papers exemplify this approach.

First, Acemoglu and Jonson (2008) exploit the wave of health innovations that occurred as of the 1950s and affected all countries worldwide.

Second, Lorentzen, McMillan and Wacziarg (2008) adopt a Nelson –Phelps approach and regresses per capita GDP growth on the average child and adult mortality rates.

Relationships between health and economic prosperity are difficult to assess. For some authors, diseases or poor health had contributed to poor growth performances especially in low-income countries. For other authors, the effect of health on growth is relatively small, even if one considers that human capital accumulation needs also health investments.

Health measurement is a hard task since, contrary to economic indicators; health is multidimensional and measured with errors. Moreover, researchers have developed a wide array of health indicators, among which few however are satisfactorily measured (Murray and Frenk, 2008).

The most commonly used indicators of health conditions at the macroeconomic level are life expectancy at birth and infant mortality rates. Those indicators are considered reflecting the general health conditions and supposed to be positively associated with economic growth. It is true that life expectancy is higher and infant mortality lower in richer countries than in poorer countries.

Researchers generally conclude that population health remains an important predictor of economic outcomes. Life expectancy at birth positively impact economic performances (Barro & Lee, 1994; Acemoglu & Johnson, 2007, 2009).

MATERIAL AND METHODS

This study focused on EU countries and analyzed the indicators that show a link between health and GDP. Data were taken from the Eurostat database and thus we created a database.

For this paper was developed a panel database of EU countries observed during the period 1990-2012.

The program used was Stata 12 and were processed data from the new database created, compiled to demonstrate the effect of health on economic performance. Several models were run and the most significant of these is shown in this paper. To verify the results, the Hausman test was run for each model.

RESULTS AND DISCUSSION

In the following table is presented the relationship between life expectancy and its influence on GDP. The result is significant, namely life expectancy influences in a significantly positive way the GDP. In this model the dependent variable used is GDP/ capita and the independent variables are:

- in model 1 is Life expectancy birth females
- in model 2 is Life expectancy birth males
- in model 3 is Life expectancy 65 years females
- in model 4 is Life expectancy 65 years males.

Table no.1

Impact of Life Expectancy on per capita GDP 1990-2012

	Model 1 b/se	Model 2 b/se	Model 3 b/se	Model 4 b/se
log_LE_birth_F	0.316*** (0.02)			
log_LE_birth_M		6.916*** (0.57)		
log_LE_65_F			3.288*** (0.25)	
log_LE_65_M				2.653*** (0.22)
Constanta	8.640*** (0.07)	-20.043*** (2.47)	-0.011 (0.75)	2.427*** (0.62)
R-squared	0.542	0.393	0.433	0.383
F	267.138	145.851	171.687	139.701

(Source: own processing in Stata 12)

NOTE: The dependent variable in this model is log GDP per capita. Robust standard errors are reported in parentheses.

In model 1 the independent variable is life expectancy at birth for females and the result shows a positive relationship between life expectancy at birth for females and GDP/ capita.

For example in model 1 we can state that a growth of 1 percent in life expectancy is associated with a growth of 0.3 percent in GDP.

In model 2 the independent variable used id life expectancy at birth for males, the result being a positive one, statistically significant that allows us to say that 1 percent increase in life expectancy for males can influence a growth in GDP by 6.9 percent.

In model 3 was used as an independent variable life expectancy at 65 years for females and the result is significant and has a positive impact on GDP.

In model 4 the independent variable used is life expectancy at 65 years for males. The result is positive, meaning we can say that a growth of 1 percent in life expectancy for males influences a growth of GDP by 2.6 percent.

Thus we can say that the relationship between life expectancy and total revenues is positive and statistically significant.

The verification of the results was performed using the Hausman test which was run for each model as shown below.

Hausman fe re (Model 1)

```
            ---- Coefficients ----
             |     (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |      fe           re         Difference          S.E.
-------------+----------------------------------------------------------------
log_LE_bir~F |   .3155111     .3314771        -.015966               .
------------------------------------------------------------------------------
                   b = consistent under Ho and Ha; obtained from
xtreg
         B = inconsistent under Ha, efficient under Ho; obtained from xtreg

   Test:  Ho:  difference in coefficients not systematic
              chi2(1) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                    =   -15.42    chi2<0 ==> model fitted on these
                                 data fails to meet the asymptotic
                                 assumptions of the Hausman test;
                                 see suest for a generalized test


xtreg  log_GDP_EURO_CAP log_LE_birth_F, fe


Fixed-effects (within) regression              Number of obs      =       256
Group variable: country                        Number of groups   =        29

R-sq:  within  = 0.5417                        Obs per group: min =         7
       between = 0.6850                                       avg =       8.8
       overall = 0.6363                                       max =         9

                                               F(1,226)           =    267.14
corr(u_i, Xb)  = 0.6078                        Prob > F           =    0.0000


------------------------------------------------------------------------------
log_GDP_EURO~P |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
---------------+--------------------------------------------------------------
log_LE_birth_F |   .3155111    .019304    16.34   0.000     .2774723    .3535499
         _cons |   8.639584   .0709797   121.72   0.000     8.499717    8.779451
---------------+--------------------------------------------------------------
       sigma_u |  .52382319
       sigma_e |  .09876318
           rho |  .96567186   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(28, 226) =   158.93            Prob > F = 0.0000
```

Hausman fe re (Model 2)

```
            ---- Coefficients ----
             |     (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |      fe           re         Difference          S.E.
-------------+----------------------------------------------------------------
log_LE_bir~M |   6.915764     7.455292       -.5395281        .1964766
------------------------------------------------------------------------------
                   b = consistent under Ho and Ha; obtained from xtreg
         B = inconsistent under Ha, efficient under Ho; obtained from xtreg

   Test:  Ho:  difference in coefficients not systematic
```

```
chi2(1) = (b-B)'[(V_b-V_B)^(-1)](b-B)
        =        7.54
Prob>chi2 =      0.0060
```

Hausman fe re (Model 3)

```
                ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |       fe           re         Difference          S.E.
-------------+----------------------------------------------------------------
 log_LE_65_F |    3.288175     3.544986       -.2568114        .0294377
------------------------------------------------------------------------------
                 b = consistent under Ho and Ha; obtained from xtreg
      B = inconsistent under Ha, efficient under Ho; obtained from xtreg

   Test:  Ho:  difference in coefficients not systematic

            chi2(1) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                    =       76.11
          Prob>chi2 =      0.0000
```

Hausman fe re (Model 4)

```
                ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |       fe           re         Difference          S.E.
-------------+----------------------------------------------------------------
 log_LE_65_M |    2.653182     2.927518        -.274336        .0567903
------------------------------------------------------------------------------
                 b = consistent under Ho and Ha; obtained from xtreg
      B = inconsistent under Ha, efficient under Ho; obtained from xtreg

   Test:  Ho:  difference in coefficients not systematic

            chi2(1) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                    =       23.34
          Prob>chi2 =      0.0000
```

Example fixed effects:

```
. xtreg  log_GDP_EURO_CAP log_LE_birth_F, fe

Fixed-effects (within) regression               Number of obs      =       256
Group variable: country                         Number of groups   =        29

R-sq:  within  = 0.5417                         Obs per group: min =         7
       between = 0.6850                                        avg =       8.8
       overall = 0.6363                                        max =         9

                                                F(1,226)           =    267.14
corr(u_i, Xb)  = 0.6078                         Prob > F           =    0.0000

------------------------------------------------------------------------------
log_GDP_EURO~P |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
---------------+----------------------------------------------------------------
log_LE_birth_F |   .3155111    .019304    16.34   0.000     .2774723    .3535499
         _cons |   8.639584   .0709797   121.72   0.000     8.499717    8.779451
---------------+----------------------------------------------------------------
       sigma_u |  .52382319
       sigma_e |  .09876318
           rho |  .96567186   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(28, 226) =   158.93            Prob > F = 0.0000
```

Table 2 shows descriptive statistics of the model.

TABEL NO 2

Descriptive statistics of the model

Variable		Mean	Std. Dev.	Min	Max	Observations
LE_bir~F	overall	47.39453	21.58641	1	84	N = 256
	between		20.6331	8.333333	76.625	n = 29
	within		7.207226	29.39453	95.17231	T = 8.82759
LE_bir~M	overall	74.9098	3.919749	64.8	80.1	N = 255
	between		3.848487	66.66667	79.18889	n = 29
	within		.907113	72.38758	77.48758	T-bar = 8.7931
LE_65_F	overall	19.8149	1.63474	16.1	23.8	N = 255
	between		1.573603	16.7	22.9	n = 29
	within		.5376736	18.67046	21.17046	T-bar = 8.7931
LE_65_M	overall	16.19059	1.810509	12.5	19.3	N = 255
	between		1.759348	13.03333	18.425	n = 29
	within		.5165891	15.02392	17.61281	T-bar = 8.7931

(**Source:** own processing in Stata 12)

CONCLUSION

This article investigated the effect of life expectancy on economic growth. The results indicate that the increase in life expectancy led to a significant increase on GDP.

This model is a simple one, whose results coincide with the microeconomic results from specialized studies.

Thus, we can state that there is a direct connection between life expectancy and GDP's growth if we look at the model above. An increase of 1 percent in life expectancy can influence GDP's growth by up to 6.911 percent depending on the indicator used (life expectancy birth for males - being the most significant in our model).

Even if the results are significant it is difficult to demonstrate only by using these indicators just how much does life expectancy influence a country's economic growth.

This is the first step in the analysis of the impact of health on GDP growth.

AUTHORS' CONTRIBUTIONS

As part of the authors' contribution we can mention the study of the specialized literature and of the studies in this field.

Also a database was drawn up, comprising EU countries and the indicators used in this paper to run representative models in order to demonstrate the connection between health and economic performance.

The program used for processing the indicators used was Stata 12.

REFERENCES

1. Acemoglu, D. and S. Johnson (2008). “Disease and development: the effect of life expectancy on economic growth”. Journal of political economy, vol. 113(5), p. 949-995.
2. Bloom, D. et all (2004). “The effect of health on economic growth: a production function approach”. World development, vol. 32, p. 1-13.
3. Jayachandran, S., and A. Lleras-Muney (2009). “Longevity and human capital investments: evidence from maternal mortality declines in Sri Lanka”. Quarterly Journal of Economics, vol. 124(1), p. 349-397.
4. Lorentzen, P.,et all (2007).“Death and development”. Journal of economic growth, vol.13(2), 81-124.
5. http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home.