European Journal of Accounting, Finance & Business
Volume **2**/2014 ISSN 2344-102X
Issue (2)/ June 2014 ISSN-L 2344-102X

ANALYSIS OF HEALTH DETERMINANTS ON ECONOMIC GROWTH

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Abstract

This paper aims to analyze health and its role in economic growth. Starting from these things we wonder if health can explain the difference in levels between countries and the growth rate of revenues? This question is of primary importance especially in the current debate regarding the cost and benefits of new health programs.

Health is the result of complex interactions between our genetic, the environment in which we live in, the society to which belong and our lifestyle. Thus, health systems are not at the origin of our health, but they play a fundamental role: they help people maintain and improve their own health.

Primarily, people with higher life expectancy are likely to save more and these savings turn into accumulated capital and therefore into GDP growth (Zhang and Lee 2008).

Secondly, people with higher life expectancy are likely to invest more in education which in turn should facilitate economic growth.

Keyword: growth, investment, health, indicator.

JEL Classification: O1

I. Introduction

Health, according to the World Health Organization, is a state of complete physical, mental and social well and does not consist only in the absence of disease or

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infirmity (Preamble to the Constitution of the World Health Organization, International Health Conference, New York, 19 June - 22 July 1946).

Introducing the concept of human capital by Beker (1964) in the scope of economics has opened another way that health expenditure to be effective in GDP. In this new way, health expenditures have led to increased human capital and as a result a growth in GDP by improving health indicators. Therefore, health expenditures and real GDP in each country have a mutual relationship based on theoretical principles and experimental observations.

Since 1960 researchers in economics have paid special attention to the part of health expenditures in GDP in most industrial economies. Numerous studies had as subject the efficient improvement of these expenditures. Depending on the results obtained in most studies GDP is the most important factor of health expenditures in that country.

On the other hand, health expenditures could affect that country's gross domestic product.

According to studies, health expenditures reduce the level of gross domestic product due to the deflection of resources from generative investments. (Beheshti and Sajoudi, 2005, p 116).

Economic growth does not need only healthy people but also education and other additional investments, part of the labor force in private and public sectors, active and reasonable market, adequate sovereignty and institutional mechanisms of the society are major factors of technical progress. The resulting increase in the private commercial sector must be complemented by the active role of the government in different areas, such as provision of investment in health and education, ensuring enforcement of rules, regulations and ensuring security and cooperation with the private sector for technical and scientific progress. This does not mean that investments in the health sector can solve development problems, rather that the investments in this sector should be in central development section and the strategy to eliminate (reduce) poverty. (Saches, 2001).

Bloom and Malaney (1998) in a study performed for the period 1965-1990 in 78 countries, perceived as a crisis of mortality in the first half of 1990 in Russia has led to a reduction of life expectancy from 70 years to 65 years, thereby causing a reduction in GDP by 1.8-2.7% in 1990 and the income per capita was reduced to a third (Ghanbari, 2009, p 196). In this study, life expectancy was considered the main variable

representative of health and education (years spent in school) and the abundance of natural resources, government saving, institutional quality and geographic conditions were considered as other variables.

Currais Rivera (1999) showed that countries that have more health expenditures had higher economic growth. They estimated the relationship between health and growth of OECD countries during 1960-1990 using health expenditures as a descriptive variable and an index for health in the growth regression. They also consider investments in health as a descriptive variable for output. The analysis of the role of health investments in human capital accumulation was noted in their study and they showed that education is not the only effective factor in workforce performance and its productivity.

Dixon et al (2001) studied the impact of life expectancy and epidemic diseases, such as HIV, along with the inventory of physical capital and workforce productivity concerning economic growth in 104 countries over the period 1980-1992. The result reveals the existence of positive relationships in life expectancy as well as the negative relationship of epidemic diseases with economic growth.

Bloom and Canning (2000) estimated based on various studies conducted on developing countries. The overall conclusion is that, in countries where life expectancy is higher than five years, the growth rate of real income per capita is higher by 0.3% up to 0.5%. They examined the impact of health on productivity in four ways:

A healthier workforce produces more since it has greater mental and physical capacity and is less absent from his workplace because of his illness or his family.

People with higher life expectancy have more reasons to invest in education and obtain higher revenues for investments.

The amount of savings (for the retirement period) is increased by rising the age of people due to improved health and facilitating a resulted investment process.

Improving health in the form of increasing the period of life and health of children may be motivation to increase the birth rate; therefore, individuals participate more in the labor market and obtain a higher income per capita.

Bloom and Canning consider national production as a function of inputs that is physical capital, workforce and human capital, with three elements, namely: education, work experience and health. This model studied the relationship between efficiency and effectiveness of these inputs with total factor productivity. The major result is that health has a significant impact on economic growth. This means that one year increase in life

expectancy has led to a 4% increase in national production and shows that an increase in costs for health improvement is warranted by virtue of the impact it has on workforce productivity.

Heshmati (2001) studied the relationship between health expenditures and GDP in a research through the Solow model. He introduced health expenditures as a representative variable of the health status in the growth function. Then he came to the conclusion that health expenditures have a positive and significant impact on GDP growth.

The result of the research performed by Bloom et al (2004) regarding the impact of life expectancy along with other variables such as labor experience, inventory physical capital, workforce and average years of schooling on economic growth confirmed this relationship. The main result of the study is that health has a significant impact on economic growth, so that a one year increase in life expectancy of the society has led to an increase in national production by 4%. The positive and high impact of health on productivity and economic growth may justify an increase of health expenditures and an improvement of the health status in society.

Cole and Neumayer (2005) considered as health variables the impact of malnutrition, malaria and accessibility to healthy water. Other variables of this research included: commercial opening, inflation rate and the agricultural sector's share in GDP. This study was conducted for 152 countries over the period 1965-1995. The results highlighted the negative impact of these three variables on economic growth.

Acemoglu (2006) in a study entitled "The impact of life expectancy on economic growth", states that the recent agreement between science and policy development demonstrates that the disease environment and the health status currently created differences in revenues between countries. The discussions about improving health are not only to improve life, but rather to stimulate faster economic growth. He studies this problem by estimating the impact of life expectancy on economic growth.

The findings illustrate that the increase in life expectancy has led to a considerable increase of the population. The birth rate growth does not control the compensation of the increase in life expectancy. He understood that the impact of life expectancy on total GDP is reduced; therefore an increase of revenues is not sufficient for to population growth.

European Journal of Accounting, Finance & Business
Volume **2**/2014 ISSN 2344-102X
Issue (2)/ June 2014 ISSN-L 2344-102X

II. Materials and methods

General model. Econometric methods and tests

In order to analyze the impact of health on economic growth we have built a panel type database, which includes the 28 member states of the European Union for a period of 12 years, during 1990-2012.

Most data were collected from the Eurostat database. Other indicators used were from the Penn World Tables and Barro and Lee database.

The purpose of the analysis was to demonstrate that health, which we measured through life expectancy, has a positive impact on economic growth.

In this analysis, we used the linear regression model, which is also the most commonly used in empirical analyzes, because it estimates a regression between two variables, the dependent variable being influenced by the independent ones.

The research methodology is based on macroeconomic data and uses a panel type general research macro-econometric model, as well as testing the proposed hypotheses. The models included in regressions, which are explained in the analysis, use the methodology of fixed effects models and with random effects.

The general forms of these models are:

$$Y_i = \beta_1 + \beta_2 X_{2it} + \beta_{3it} + \cdots + \beta_k X_{kit} + \mu_i$$

Fixed effects models

A fixed effects model is that model which is assumed to be measured without error. Most often suggested in the specialized literature is the use of models with fixed effects when the analysis studies the impact of some variables that vary over time. Thus, each data set has its own characteristics which may, or may not influence the dependent variable.

Example *Fixed effects:*

```
Fixed-effects (within) regression               Number of obs      =       109
Group variable: country                         Number of groups   =        19

R-sq:  within  = 0.8636                         Obs per group: min =         2
       between = 0.9579                                        avg =       5.7
       overall = 0.9535                                        max =         8

                                                F(4,86)            =    136.14
corr(u_i, Xb)  = 0.1308                         Prob > F           =    0.0000
```

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```
           log_GDP_EURO_CAP |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
----------------------------+----------------------------------------------------------------
              log_LE_birth_F |   .0723566   .0269374     2.69   0.009     .0188068    .1259065
         log_H_CARE_EXP_euro |   .7112364   .0548544    12.97   0.000     .6021895    .8202833
     log_fertility_rates_tot |  -.2855655   .1242868    -2.30   0.024    -.5326395   -.0384915
log_second_edu_attainment_f |    .202252   .1348424     1.50   0.137    -.0658058    .4703097
                      _cons |   3.676212   .6591995     5.58   0.000     2.365766    4.986657
----------------------------+----------------------------------------------------------------
                    sigma_u |  .16052773
                    sigma_e |  .04608387
                        rho |  .92386143   (fraction of variance due to u_i)
------------------------------------------------------------------------------------------
F test that all u_i=0:     F(18, 86) =    27.35              Prob > F = 0.0000
```

Random effects models

Unlike fixed effects models, the variation from the data sets is presumed to be random and uncorrelated with the independent or dependent variables included in the model. These models, in the specialized literature, are recommended to be used when there are grounds for suspicion regarding the differences across data sets and their influence on the dependent variables.

The measurement of these models include error terms, variables are intended for the generalization of a much larger population of values and the number of values is relatively small compared to the number of values of all variables of a population.

Example *Random effects:*

```
Random-effects GLS regression                   Number of obs      =       581
Group variable: country                         Number of groups   =        29

R-sq:  within  = 0.0041                         Obs per group: min =        17
       between = 0.0084                                        avg =      20.0
       overall = 0.0085                                        max =        23

                                                Wald chi2(1)       =      2.47
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.1162

------------------------------------------------------------------------------
    log_GDP_EURO_CAP |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
---------------------+--------------------------------------------------------
log_infant_mortality |  -.0355119   .0226053    -1.57   0.116    -.0798175    .0087937
               _cons |    9.67063   .2116149    45.70   0.000     9.255872    10.08539
---------------------+--------------------------------------------------------
             sigma_u |  .85121508
             sigma_e |  .44035181
                 rho |  .78887903   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```

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However, the chosen model is based on Hausman test by testing the null hypothesis that the extra orthogonally conditions imposed by the model are valid variable effects. Otherwise, if the test results show a low, under 95% probability level, then is maintained the null hypothesis that specifies the absence of systematic differences between coefficients.

Example *Hausman test:*

```
. Hausman fe re

                 ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |       fe           re         Difference          S.E.
-------------+------------------------------------------------------------
log_LE_bir~F |    .0723566     .0692095        .0031471        .0121903
log_H_CARE~o |    .7112364     .7208528       -.0096164        .0408595
log_fertil~t |   -.2855655    -.2277381       -.0578274        .0567998
log_second~f |     .202252      .020549         .181703        .1048435
------------------------------------------------------------------------------
                           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(4) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =        9.16
                Prob>chi2 =      0.0571
```

Variables and databases used in the models applied

Variables used

Dependent variables and especially the independent ones raise major problems regarding the measures used, the validation of the models and robustness of the estimated coefficients depend on these. Some of the indicators used in econometric models are those resulting from the databases, but often they are the result of an expression composed of several primary indicators, given quantification as relevant as possible of influence variables.

Dependent variables

The reference empirical analyzes commonly use life expectancy and mortality as dependent variables for measuring health.

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GDP/ capita (GDP_EURO_CAP) is calculated as the ratio of real GDP and average population of a given year.

GDP growth rate (gdp_growth) represents the GDP evaluated in the price of the previous year calculated at the level of a reference year.

Independent variables

The explanatory variables are multiple and very diverse. They are selected from different considerations, both in terms of the most common measures found in the empirical literature and in terms of data availability.

The explanatory variables used are:

Life expectancy (LE_tot) represents the average life expectancy of an individual or the average number of life years remaining at a certain age.

Health expenditure (H_CARE_EXP) measures the economic resources used by a country for services and health care products, including administration and insurance.

Causes of death (all_death_cause) represent the disease or injury which initiated the succession of morbid events leading directly to death or the circumstances of the accident, violence which produced the fatal injury.

Corruption control (contr_coruption_guvern) reflects the perception of people on public power, if it is exercised for personal gain, including both petty and grand forms of corruption, as well as "the capture" of the state by elites and private interests.

Education is measured by variables (second_edu_atteinment, tertiary_edu_atteinment) and represents the number of pupils/ students enrolled in a country.

Results and discussion

In Table 1, are presented the results of models 1-5. These are estimated on panel data for the period 1990-2012.

The models differ by the explanatory variables added sequentially. The dependent variable used is GDP/ capita. The results obtained from the processing of the 5 models highlight the high level of statistical significance specific for the estimated coefficients, most of them at the threshold of 0.1%, respectively with a probability of 99.9%.

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Issue (2)/ June 2014 ISSN-L 2344-102X

Table 1 - Health's influence on the growth of GDP/ capita

	Model 1 b/se	Model 2 b/se	Model 3 b/se	Model 4 b/se	Model 5 b/se
log_LE_birth_F	0.316***	0.030	0.027	0.072**	0.079**
	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)
log_H_CARE_EXP_euro		0.749***	0.742***	0.711***	0.733***
		(0.03)	(0.03)	(0.05)	(0.06)
log_fertility_rate~t			-0.023	-0.286*	-0.250
			(0.06)	(0.12)	(0.13)
log_second_edu_att~f				0.202	0.194
				(0.13)	(0.14)
log_tertiary_edu_a~t					-0.076
					(0.10)
Constanta	8.640***	4.216***	4.280***	3.676***	3.738***
	(0.07)	(0.16)	(0.17)	(0.66)	(0.67)
R-squared	0.542			0.864	0.865
F	267.138			136.141	108.470
N observations	256.000	159.000	142.000	109.000	109.000

* p<0.05, ** p<0.01, *** p<0.001

Source: own processing in Stata 12

The interpretation of the results for models 1-5, in terms of theoretical criteria involves an analysis of the sign and size of the estimated coefficients.

A higher level of life expectancy is an indication of a positive influence on economic growth, the GDP growth rate based on life expectancy is approximately 0.3%.

Also, health expenditures introduced in model 2 have a significant statistical significance and at the same time maintain almost at the same level the result of the first model.

Education level specialized studies confirmed that the there is a positive correlation with economic growth. A higher level of education of individuals requires more efficient use of health care resources, thus a healthy individual produces more and automatically influences GDP growth.

Table 2 - The relationship between GDP, education and health

	Model 1 b/se	Model 2 b/se	Model 3 b/se	Model 4 b/se	Model 5 b/se
log_infant_mortality	-0.036	-0.058*	-0.011	-0.049**	-0.049**
	(0.02)	(0.02)	(0.01)	(0.02)	(0.02)
log_LE_TOTAL		-1.855**	-0.448	-1.503**	-1.311*
		(0.65)	(0.24)	(0.57)	(0.58)
log_H_CARE_EXP_euro			0.814***	0.820***	0.817***
			(0.02)	(0.03)	(0.03)
log_tertiary_edu_a~t				0.108	0.104
				(0.06)	(0.07)
contr_coruption_gu~a					-0.002
					(0.02)
Constanta	9.671***	17.878***	5.854***	10.292***	9.492***
	(0.21)	(2.88)	(1.05)	(2.35)	(2.41)

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Issue (2)/ June 2014 ISSN-L 2344-102X

R-squared		0.019			
F		5.212			
N observations	581.000	581.000	172.000	122.000	113.000

* p<0.05, ** p<0.01, *** p<0.001

Source: own processing in Stata 12

Table 2, presents the results of models 1-5, in the relationship between GDP as the dependent variable and education, health as explanatory variables. The models differ through the explanatory variables added sequentially.

In *model 1*, the infant mortality level has a statistically significant influence on GDP, resulting that a 1% increases in infant mortality decreases the GDP level by about 0.04%.

Another variable with positive influence, statistically significant on GDP is health expenditure is introduced in *model 3*, the GDP growth coefficient depending on health expenditures is approximately 0.8%.

In *model 4*, we observe a positive relationship between GDP and education, our result confirms the outcomes of specialized studies, namely that education significantly influences statistically GDP and therefore economic growth.

Table 3 - GDP growth rate and health

	Model 1 b/se	Model 2 b/se	Model 3 b/se	Model 4 b/se	Model 5 b/se
log_LE_TOTAL	-10.080***	-10.069***	10.138	-14.140	-8.675
	(1.48)	(1.43)	(12.14)	(20.33)	(21.76)
log_infant_mortality		-0.108*	-2.133*	-2.207*	-2.279*
		(0.04)	(1.02)	(1.01)	(1.02)
log_H_CARE_EXP_euro			-2.619***	-2.824***	-2.533**
			(0.67)	(0.69)	(0.77)
tertiary_edu_attai~t				0.141	0.127
				(0.11)	(0.12)
log_contr_coruptio~a					0.533
					(0.38)
Constanta	44.834***	45.420***	-11.445	93.199	67.813
	(6.43)	(6.24)	(53.05)	(88.39)	(94.88)
R-squared			0.204	0.230	0.215
F			5.991	5.091	3.443
N observations	239.000	239.000	92.000	91.000	86.000

* p<0.05, ** p<0.01, *** p<0.001

Source: own processing in Stata 12

Table 3 presents the results obtained for models 1-5.

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Issue (2)/ June 2014 ISSN-L 2344-102X

The interpretation of the results for models 1-5, in terms of theoretical criteria involves an analysis of the sign and size of the estimated coefficients.

The dependent variable used is the growth rate of GDP. This model has a combination of negative effects. Life expectancy influences negatively the growth rate of GDP.

Another negative effect occurs in model 3 with the introduction of health expenditures variable. This is statistically significant since it has a negative impact on our dependent variable.

Following the analysis of health on economic growth, in the models run above, we can say that the results confirm the outcomes of empirical studies, according to which there is a relationship of influence of health on economic growth.

III. Conclusions

Starting from the question whether it health can explain the difference in levels between countries and the growth rate of revenues, we tested several models using as dependent variables both GDP and GDP growth rate in order to find an answer.

Thus, we can say that our results confirm the results of specialized studies according to which health has a role in economic growth.

The empirical literature describes the complex links between health and various influence factors and shows some results likely to confirm the major influence of determinants on the growth of life expectancy.

One of the most important determinants found in the literature is related to the educational component (expressed through measures such as the rate of enrollment/ graduation in primary, secondary, tertiary education, and others), which has a significant role in increasing life expectancy, by the fact that a person with a higher life expectancy is likely to invest more in education, which in turn should favor economic growth.

In most studies, life expectancy has a direct relationship with economic growth.

As a result of the analysis of health on economic growth, we can say that the outcomes confirm the results of empirical studies, and there is a relationship of influence of health on economic growth.

Acknowledgement:

European Journal of Accounting, Finance & Business
Volume **2**/2014 ISSN 2344-102X
Issue (2)/ June 2014 ISSN-L 2344-102X

This work was supported from the European Social Fund through Sectorial Operational Programme Human Resources Development 2007 – 2013, project number POSDRU/159/1.5/S/142115 , project title "Performance and Excellence in Postdoctoral Research in Romanian Economics Science Domain"

References

1. Acemoglu, D., Johnson, S. (2007), *Disease and development: The effect of life expectancy on economic growth*. Journal of Political Economy, 925-984.
2. Beheshti, M. B. Sojoudi, S. (2008), *Experimental analysis of the relationship between health expenditures and gross domestic product in Iran*. Economic Studies Quarterly, 4, 95-115
3. Bloom, D.E., Canning D., (2004). *The Effect of Health on Economic Growth: A Production Function Approach.* World Development vol. 32, No.1, pp. 1-13.
4. Bloom, D.E., Canning, D., (2005), *Health and Economic Growth: Reconciling the Micro and Macro Evidence*. CDDRL, Stanford Working Paper No. 42.
5. Bloom, D., Canning D., Fink, G., and Finlay, E. J., (2007). *Fertility, Female Labour Force Participation and the Demographic Dividend*. Working paper, Harvard School of public Health.
6. Bloom, D., Canning D., (2008). *Population Health and Economic Growth*. The World Bank.
7. Deaton, Angus,(2003*). Health, Inequality and Economic Development*. J.Econ. Literature 41, 113-58.
8. Ghanbari, A., Baskha, M. (2009). *Effects of Changes In The Cost of Health on Economic Growth in Iran*. Journal of Tahghighat Eghtesadi, 83,187-224.
9. Hassan, G., Cooray, A. (2012). *The Effect of Female and Male Health on Economic Growth: Cross-Country Evidence within a Production Function Framework.* MPRA paper no. 40083.
10. Kalemli – Ozcan, Sebnem, (2002). *Does the Mortality Decline Promote Economic Growth?* J. Econ. Growth 7, 411-39.
11. Rivera, B., Currais, L. (1999a). *Economic Growth and Health. Direct Impact or Reverse Causation?* Applied Economics Letters 6, 761-764.
12. Rivera, B., Currais, L. (1999b). *Income Variation and Health Expenditure: Evidence for OECD Countries*. Review of Development Economics3, 3, 258-767.
13. Weil, D. N., (2007*). Accounting for the Effect of Health on Economic Growth*. Q.J.E.122, 1265–1306.
14. WHO (2004), *World Health Report 2004: Changing History*, *World Health Organization*, Geneva.
15. World Bank (1993), *World Development Report: Investing in Health*, Washington, D.C.
16. http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home/
17. www.who.int

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Issue (2)/ June 2014 ISSN-L 2344-102X

18. http/www.worldbank.org/healthreform/index.htm