THE ROLE OF MORTALITY IN ECONOMIC GROWTH

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Abstract:
Can mortality affect the economic growth of a country? From this question, I have developed a study in the member countries of the European Union for a period contained between the years 1990-2012, using as a human health measure the mortality rate. In order to proof the effect of mortality on the economic growth, the study has begun from the function of health production described by Grossman in 1972, which uses as explanatory variables, the environmentally socialist economic factors as health determinants. The econometric analysis has been performed using the statistical program Stata 12, and the results have been interpreted from a sign and coefficient measure point of view.

Key words: mortality, health, economic growth, investment.

JED Classification: O01

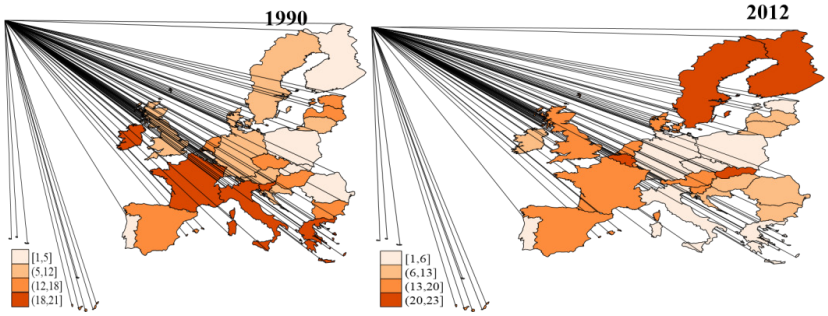
Introduction

The theoretic and empiric researches on the impact of social, economic and environmental factors on health, by the particular potential implications on individuals and on the human society, on the whole, are registered in the concerns of the experts from various domains, as well as in the ones of the political deciders.

"The Zero growth theory became a social phenomenon, people becoming more conscientious about the limits of a growth which obviously brings waste, over consumption, routine. Especially the young generation seems to be more concerned about its future, eager to skip the routine, to tend for more ideals, to do more about the best way of living, than their genitors. A negative economic growth for the future generations could mean less consumption per capita, more distribution problems of the economic results, in order to avoid the blockages and for the stability, for the continuity of an efficient market mechanism."(Sarbovan, M., 2011).

Baseline surveys, known for their contribution on the effect of the potential factors on mortality, as a health measure, stresses evident effect in most of the situations, but also ambiguous or even contradictory results, sometimes. An important issue in the appraisal of a production function of health is the measurement of the health results. A great part of the empiric studies uses the mortality rate as a health measurement guide, because it is considered to be precise, measured objectively and sufficiently available in terms of data; however, there are some limitations in its measurement.

Image No. 1*: The mortality rates in the EU countries*



Source: own processing according to World Bank, 2014

Image No. 1 represents the cartographic distribution of the mortality rate in the member countries of the EU. The countries with a mortality rate over 10% in the final year of our study are: Bulgaria, Hungary, Latvia, Lithuania, Croatia, Estonia, Romania, Germany, Greece, Italy, Portugal and Czech Republic. Also, the mortality rate below 10% is encountered in Austria, Belgium, Denmark, Finland, France, Luxembourg, Malta, Great Britain, Ireland and Cyprus.

Material and Methods

This study focused on EU countries and analyzed the indicators that show a link between health measured by mortality rates and economic performance. Data were taken from the Eurostat database, World Bank and thus I have created the database.

In this paper we developed a panel of EU countries observed during the period 19902012.

The program used was Stata 12 and were processed data from database, 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 this study, I have aimed to evaluate the impact of some determinant factors on the decline of the mortality rate, as a health degree expression manner. The study is accomplished on the case of the EU (EU-28), in the period of 1990-2012. To this purpose, the econometric analysis undertaken utilizes the various models that combine economic growth variables with variables referring to the environment, the educational level, the lifestyle and so on. In all these appraisals, we have utilized static examples, as well as dynamic econometric examples (with disparities). All these models are doubly logarithmic, the estimation method being GLS (generalized least squares) for the results obtained with the method of the random effects and respectively, OLS (ordinary least squares) in the case of fixed effects estimation.

The role of the main modeler factors at the EU-28 level

The results from Table No. 4.7 are attained behind the development of the specifications (during 1990-2012) through static models (Models 1-12) and dynamic models (Models 12-24), with the dependent variable having a 1st degree disparity.

Table No. 4.7

The results of the regression model with panel data, respectively through dynamic models with 1st degree disparity variables, the dependent variable *The mortality rate, 1990-2012.*

LOG 1990-2012	m1	m2	m3	m4	m5	m6	m7	m8	m9	m10	m11	m12
	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se	
PIB_cap	-0.034***	-0.001	-0.021***		-0.039***	-0.036*	-0.025	-0.045*	-0.038**	-0.066**	-0.050*	-0.048
	(0.00)	(0.01)	(0.01)		(0.01)	(0.02)	(0.02)	(0.02)	(0.01)	(0.02)	(0.02)	(0.02)
Exp%_PIB		-0.163***		-0.095***	-0.089**	-0.145*	-0.134*	-0.157**	-0.096**	-0.172***	-0.156**	-0.283***
		(0.02)		(0.03)	(0.03)	(0.05)	(0.05)	(0.05)	(0.03)	(0.05)	(0.05)	(0.06)
Edu_sec			0.113***	0.143***	0.140***	0.110	0.074		0.175***	0.105	0.073	0.158*
			(0.03)	(0.03)	(0.04)	(0.06)	(0.06)		(0.05)	(0.06)	(0.06)	(0.07)
Edu_tert				-0.046**				0.069	0.001	0.089*	0.070	0.039
				(0.02)				(0.04)	(0.02)	(0.04)	(0.04)	(0.05)
Urban					-0.163	0.170	0.144	0.102	-0.106	0.134	0.122	0.230
					(0.11)	(0.15)	(0.15)	(0.15)	(0.12)	(0.15)	(0.15)	(0.14)
Alcohol					0.104***	0.016	0.038	0.060	0.103***	0.055	0.066	-0.006
					(0.03)	(0.04)	(0.04)	(0.04)	(0.03)	(0.04)	(0.04)	(0.05)
Tobacco						0.060	0.064	0.052		0.031	0.040	0.038
						(0.05)	(0.05)	(0.05)		(0.05)	(0.05)	(0.06)
Food_index							-0.176**	-0.169**			-0.153*	0.047
	(0.06)	(0.06)		(0.06)	(0.09)							
No beds												-0.011
												(0.07)
Constanta	2.640***	2.653***	2.073***	2.079***	2.763***	1.613*	2.467**	2.932***	2.382***	1.862**	2.546***	1.424
	(0.05)	(0.05)	(0.11)	(0.11)	(0.49)	(0.71)	(0.76)	(0.71)	(0.57)	(0.72)	(0.77)	(0.95)
N obs.	644.000	504.000	358.000	345.000	254.000	93.000	93.000	93.000	243.000	93.000	93.000	59.000

LAG 1990-2012	m13	m14	m15	m16	m17	m18	m19	m20	m21	m22	m23	m24
	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se	
PIB_cap	-0.033***	-0.009	-0.042***	-0.035*	-0.043*	-0.066*	-0.042**	-0.058**	-0.050*	-0.059*	-0.042**	-0.070**
	(0.00)	(0.01)	(0.01)	(0.02)	(0.02)	(0.03)	(0.01)	(0.02)	(0.02)	(0.03)	(0.01)	(0.03)
Exp%_PIB		-0.138***	-0.099**	-0.162**	-0.267***	-0.223**	-0.096**	-0.185***	-0.177***	-0.260***	-0.104**	-0.279***
		(0.02)	(0.03)	(0.05)	(0.06)	(0.07)	(0.04)	(0.05)	(0.05)	(0.06)	(0.04)	(0.07)
Edu_sec			0.094*	0.057	0.099	0.052					0.113*	0.159*
			(0.04)	(0.06)	(0.08)	(0.08)					(0.05)	(0.06)
Edu_tert							-0.002	0.075	0.066	0.071	0.002	0.061
							(0.03)	(0.04)	(0.04)	(0.05)	(0.03)	(0.05)
Urban			-0.224	0.096	0.215	0.157	-0.242	0.039	0.035	0.080	-0.188	0.235
			(0.12)	(0.14)	(0.17)	(0.18)	(0.13)	(0.15)	(0.15)	(0.16)	(0.12)	(0.14)
Alcohol			0.126***	0.013	-0.046	-0.047	0.126***	0.040	0.046	-0.014	0.127**	-0.010
			(0.03)	(0.04)	(0.05)	(0.05)	(0.03)	(0.04)	(0.04)	(0.06)	(0.03)	(0.06)
Tobacco				0.091	0.074	0.047		0.074	0.076	0.051		0.061
				(0.05)	(0.06)	(0.06)		(0.05)	(0.05)	(0.06)		(0.07)
Food_index				0.165	0.170				-0.070	0.132		0.199
				(0.10)	(0.10)				(0.06)	(0.10)		(0.11)
No beds					0.048	0.078				0.057		0.059
					(0.08)	(0.08)				(0.07)		(0.08)
Employ						0.248						
						(0.19)						
Constanta	2.628***	2.681***	3.202***	2.084**	0.951	0.396	3.638***	2.586***	2.843***	1.948*	2.977***	0.497
	(0.05)	(0.06)	(0.50)	(0.71)	(1.11)	(1.26)	(0.55)	(0.66)	(0.71)	(0.93)	(0.59)	(0.97)
N obser	616.000	504.000	254.000	93.000	59.000	59.000	243.000	93.000	93.000	59.000	243.000	59.000

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

Source: own processing in Stata 12

In the 1st model (the 1st column from Table No. 4.7) is presented as a regressor of the economic factors, *the gross domestic product per resident*, which seems to have a positive role in the sense of reducing the mortality rate, the minus sign of the coeficient being the one expected and significantly statistical. The estimated elasticity of the mortality rate in relation to the GDP would indicate a reduction of mortality of 0,021% (Model No.3) – 0,045% (Model No. 8), to a 1% increase of the independent variable. We have found similar results in Vongsaroj (2004, page 228), which analyzed the determinant factors of the mortality rate for 3 different models: a national model (19502000), a

regional model (4 regions, between 1970 and 2000) and a provincial model (75 provinces, between 1994 and 2000).

The drop of the mortality rate at income increase is, on average, 0, 41% for the regional model (Vongsaroj, 2004, page 228).

The inclusion of the GDP expenditures allocated to health has the same effect in the sense of reducing the mortality rate, the elasticity of the coefficients concerning the 2 variables also being statistically significant and economically important. The results show that the elasticity of the mortality rate concerning *the expenses allocated to health* is negative and statistically significant, this indicating that a 1% increase of the health expenses could lead to a drop in the mortality rate with approximately 0,238% (Model No. 12). This statistically significant result is maintained in all the models, thereby, we can say that the allocation of the funds for health presents a positive influence on the mortality rate. We have found similar results in Zeynep (2000), which has analyzed the determinant factors of health, measured through the mortality rate, depending on the health expenses, from his estimation resulting that a 1% increase of the expenses allocated for health influences the decline of the mortality rate with 0,18 % for women, respectively 0,04% for men. The study was effectuated on 21 OECD (Organization for Economic Co-operation and Development) member countries, in the period between 1970 and 1992 (Zeynep, 2000, page 64). The models No. 3, 4, 5, 9 and 12 introduce variables that measure the educational level, more specifically, the graduation rate of the secondary education (ages between 15 and 64).

The calculated elasticity is statistically significant, but the signs of the estimated coefficients are positive, contrary to expectations, appreciating that a lower level of education can have a negative impact on the mortality rate, more specifically a 1% increase of the secondary education level influences the increase of the mortality rate with at least 0,113%.

Similar results are also presented by Vongsaroj 92004, page No. 230), the elasticity of the mortality rate depending on the secondary education level is positive: a 1% growth of the secondary education level leads to a 0, 02% mortality rate growth. Augmenting the specification with *the tertiary education* (Model No. 4), we can notice the statistically significant and positive influence in the sense of diminishing the mortality rate, the coefficient sign being the one expected (minus) and indicating that a 1% growth of the tertiary education level leads to a mortality rate decline with 0, 046 %. Behind the results in terms of the education level, we can say that a superior educational level can influence the reduction of the mortality rate, while an inferior educational level doesn't have the same effect on the mortality rate. By widening the specification with new variables, the tertiary education loses its statistical signification, including the sign that becomes positive, the less stable results having to be examined or empirically invalidated in other models, with other variables. The population from the urban environment, an environment determinant factor, doesn't present a statistical significance, even though the sign is the one expected (Models No. 5 and 9), thereby, the influence of the variable elasticity is negative on the mortality rate. In the Models from No 16 to 24, surprisingly, the level of the urban population records the modification of the coefficient sign, becoming positive, but still remaining without a statistical signification. In literature, this effect is ascribed to the negative externalities induced by the agglomeration effect (elevated levels of pollution, increased life expenses). We have found a similar result in the empiric literature of Zeynep Or (2000), who, by analyzing the determinant factors of mortality for 21 countries, members of OECD between 1970 and 1992, has estimated a minus sign elasticity (a positive effect) of the Co2 emissions on mortality, on average, 0, 05 % in women, respectively 0, 16 % in men (Zeynep Or, 2000, page 64). Correlated with this,

the mortality elasticity depending on *tobacco consumption* has the expected positive sign, but its values aren't statistically significant, probably because of the data insufficiency for all the countries of the specimen, this being established from the lessening of the observation amount. Another determinant factor found in the empirical literature is *the alimentary index,* which presents a positive influence on the reduction of the mortality rate. In the No. 7,8 and 11 models, the estimated coefficients indicate the fact that the mortality elasticity depending on the *alimentary index* is negative and statistically significant: an 1% index growth can lead to a drop in the mortality rate with maximum 0, 176% (Model No. 7). Also, the occupancy rate of the hospital beds, as a population morbidity measure, has, surprisingly, an unexpected, but without any statistical significance, negative sign. The results obtained in the models with the staggered mortality rate consolidate the conclusions made so far in the sense that, in the simple relationship between health and GDP, the elasticity calculated in relation to the economic growth signifies a drop in the mortality rate with 0, 070 % (Model No. 24). Also, the same positive and statistically significant effect is presented by the *health expenses* variable, *as a percentage of GDP*, the 1% growth of this explanatory variable could lead to the drop of the mortality rate with maximum 0, 267 % (Model No. 5).

The negative effect of an inferior education level is reconfirmed, as the growth of the population percentage that has, utmost, a high school education, comes as a powerful factor that acts towards the mortality rate growth. The 1% growth of the *secondary education level* could influence the growth of the mortality rate with 0, 094% (Model No. 15). Also, *the tertiary education* keeps its expected sign (Minus, Model No. 19), but loses its statistical significance.

The elasticity of the mortality rate depending on the population from the *urban environment* doesn't have a statistical significance, but the sign is the one expected (minus, Models No. 15 and 23). In the models No. 16 to 24, surprisingly, the level of the urban population records the alteration of the coefficient sign, becoming positive, but still remaining without any statistical signification. The alcohol and tobacco consumption is proven to have the same influential relationship on the mortality rate drop, the *alcohol* variable keeping its statistical significance and the expected sign, while the *tobacco* consumption, even though it presents a negative effect, namely of mortality rate increase, doesn't have a statistical significance. The elasticity of the mortality rate depending on the *alcohol* consumption is positive (as a sign) and significant, indicating that a 1% growth of the *alcohol* variable would influence the growth of the mortality rate with 0,126% (Model No. 15). The influences of the alimentary index variables, as well as the hospital beds occupancy rate are statistically insignificant; thereby, an effect in time of these variables on the dependent variable could not be proven.

In terms of the *labor force occupancy*, the effect obtained for all the effectuated estimations didn't lead to a direct and relevant influential relationship.

Conclusion

It is extremely clear that a higher GDP leads to the mortality rate reduction, in all the EU countries, regardless of the inclusion or alternative exclusion of some influential variables. In terms of alcohol consumption, a consumption growth of it has, as a noticeable effect, the mortality rate growth at the EU level – 28.

Concretely, *the obtained results consolidate the conclusion made so far, in the sense that the relationship between health, measured through the mortality rate, and GDP/capital is a negative one, significant in the approach of health as a growth factor.*

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.

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