RELATIONSHIP AND CAUSALITY BETWEEN ECONOMIC GROWTH RATE AND CERTAIN DISEASES IN THE EUROPEAN UNION

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The objective of this paper is to further research the already established relationship between economic growth and health by using the results of some previous works and applying them on the recent data, in order to find out if the economic growth rate in the current European Union member countries is connected to the growth rates of various diseases. In this respect, based on the existing economic theories, this paper examines if the results found out in the above refereed scientific works apply when regressing different types of variables in the EU member states for the period of 1995-2007. The results turn out a positive relationship between the health of population and the GDP, and that the causality in the relation between the real GDP and the economic growth is directed from the economic growth to the diseases growth rates.

Key words: Health Policy, European Union, Economic Development, Human Resources, GDP, Economic Growth, diseases

JEL Classification code: I10, I11, I18, I19, O15, F02.

1. Introduction

Basic books on economics offer a simple view to the relation of the GDP and human well-being. For example: "Large differences in income are reflected in large differences in the quality of life. Richer countries have more automobiles, more telephones, more televisions, better nutrition, safer housing, better health care, and longer life expectancy." (Mankiw 2004, p. 537)
Easterlin and Angelescu (2007) studied the quality of life, and show that the material well-being has objectively increased, but phones and TV have not made people subjectively better off. Furthermore, Frey and Stutzer (2002, p. 56) discovered a connection between self-reported health and happiness rates and in this respect, the quality of life can somehow be explained by life expectancy or any other health related indicator. As there is a connection between health and economic growth, it must be admitted that Mankiw has a point even in the subjective sense.
The purpose of this paperwork is to further research the relationship between economic growth and health by testing if the results of some previous works hold with new data. The main interest is to find out, if the rate of economic growth in the current EU member states is related with the growth rates of different diseases, because the interpretation of the theories makes us to expect a negative relationship between the variables studied (Järvi, 2007).
Since there is not yet any distinct theory or model that would explaining these relationships, the issues of growth and health are of interest not only to economists, but they are also topics in general discussion, newspapers, politics etc.

2. Theoretical Background

"A Contribution to the Empirics of Economic Growth" by Mankiw, Romer and Weil (1992) is an article often referred to economic growth, especially because they incorporated the human capital into the Solow growth model, which was a really important improvement. Kendrick (1976) estimated also already in 1969 that a big part of the total capital stock is human capital: "over half of the total U.S. capital stock was in the human capital". The augmented Solow model reflected by the Y = K1/3 x H1/3 x L1/3 equation, shows us that the output is produced with a combination of physical capital (K), human capital (H) and labour (L). We will test further on how the growth rates of diseases and GDP are related.

Health of the human capital in economic theories

Mankiw, Romer and Weil (MRW) described human capital as gain of education, but now, the human capital is considered to be a complex input with much more sources than only knowledge capital. For this reason, Knowles and Owen (1995) incorporated health capital into the Solow model by using life expectancy as a proxy for health capital. One may use also the health care expenditure per capita (HCE), as it was done in an extension of the MRW model by Heshmati (2001), whose results were analogous with the ones in the MRW model. He also notes that HCE has significant and positive effects on economic growth and the speed of convergence. On the other hand, when the HCE is included in the growth model as a variable of health, the coefficient of human capital variable becomes insignificant (Heshmati 2001).

The results by Knowles and Owen suggest that the relationship between income per capita and health capital is stronger than the one between income per capita and education level of the human capital. However, Weil (2006) argues that health is less important as an explanator of the income differences between countries than both human capital acquired by education and physical capital. Kaldaru et al. (2004) suggested that not all the changes in GDP and in health are directly related via human capital contribution.

Health and income – positive or negative relationship? If we agree that health determines the quality of human capital, it is normal to assume that health has a positive influence on productivity and economic growth. Going forward on this idea, health also affects GDP through higher wages and less absence from work. Besides the direct effects on growth, according to Weil (Weil 2006), there are numerous indirect effects, such of: higher incentive to acquire education and the raising of investment and physical capital per worker, if people who live longer start saving for retirement.

Figure 1 illustrates the relationship between life expectancy at birth and the national income per head of Samuel H. Preston (1975). The curve is based on scatter-diagram and shows a clear logically correlation between health and GDP.

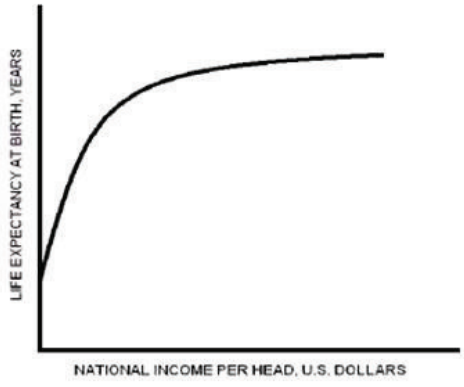

Figure 1

Bloom et al. (2001) indicate that health, measured as life expectancy, has a positive and statistically significant effect on economic growth, suggesting that one year improvement in life expectancy contributes to four percent increase in output, and this way, the result is only slightly stronger than the effect found in most other studies.

A study by Weil (2006) shows that if there were not health differences between the countries: the income ratio between them would reduce by 12.7 percent, when the adult survival rate (ASR) for men is used as a health measure. The largest part of reduction came from the lower part of the distribution, meaning that the effect of health on GDP is

strongest among the poor countries. The importance of health was fairly larger when using the age of menarche for women as a measure.

Other authors showed significant effects of ASR on the economic growth rates for low income countries. Bhargava et al. (2001) show that for the poorest countries, a 1% increase in ASR was associated with an approximate 0.05% increase in the growth rate. For sure, health has an economically important effect in determining income differences among countries, but it worth remembering that this effect is far from the dominant source of the cross-country income variation: "A world in which health was equalized among countries would still have 90 percent of the cross-country income variance left intact" (Weil 2006).

Against the approach of Weil, Acemoglu et al. (2006) did not hold population constant when investigating the effect of the life expectancy at birth on economic growth, and therefore, their method is better to use when trying to estimate the effects of health changes on economic growth per capita, both changes in health and population growth caused by increased life expectancy being included in the model. Unfortunately, the results did not give evidence that the large exogenous increase in life expectancy would lead to a significant increase in per capita economic growth. According to Acemoglu the capital-to-labour and land-to-labour ratios are reduced, which then diminishes the labour productivity and reduces the income per capita. The authors further argued that "this initial decline is later compensated by higher output as more people enter the labor force. This compensation can be complete and may even exceed the initial level of income per capita if there are significant productivity benefits from longer life expectancy". Acemoglu et al. (2006) also noted that when the accumulation of the capital is slow, the direct effect of an increase in population may reduce income per capita even in the steady state and that the benefits from health can be limited if some factors of production, for example land, are supplied inelastically. An interesting result is that life expectancy is higher in countries with income distributed more equally. Clarke and Islam (2003) found that "Equity is important in increasing social welfare and in particular health", and that "health status is unlikely to be strictly proportional to income, and relatively small transfers to the poor from the rich can be expected to improve overall health levels". Resuming, the existence of the relationship between health and economic growth can be explained in three ways (Järvi, 2007), as follows: increased income causes better health; reverse causation: healthier workers are more productive and thereby income increases as well; some external factor causes the changes in health and in wealth.

Kaldaru et al. (2004) stipulate that economic development and growth have traditionally been considered as a precondition for improvements in health. However, this view changed recently when *The Commission on Macroeconomics and Health* pointed out that the improvements in health are important for economic growth and it is more difficult to achieve sustainable growth in countries where people have poor health and low level of education. Pritchett et al. (1996) have used such variables, knowing the direction of the relationship: "The fact that using different, nearly orthogonal, components of income to estimate the elasticity produces generally higher (and tolerably similar) results provides strong evidence in favour of a causal and structural relationship running from income to mortality". Using structural microeconomic, Weil (2006) estimates on the direct effect of health on individual income, and shows a relation going to the other direction. The effects of health on GDP growth rates, when measured as adult survival rates (ASR), are depending on the level of GDP. The effects on economic growth aren't remarkable at high levels of GDP, being difficult to attain increases in ASR and those will mainly increase the proportion of the elderly in the economy. On the other hand, it can be expected to see significant effects of ASR on economic growth because its contribution to the labour in the first years in the countries with lower levels of GDP. The ASR has significant positive effects on growth rates, until a given level of GDP is reached. Once the level is crossed, the net effect of ASR approaches zero. For a few countries with high GDP levels there was even a negative and statistically significant net effect (Bhargava et al. 2001). Corresponding results for other health indicators

were also found by Barro and Sala-i-Martin (1999). In the developing countries where the starting point in health is lower, the gradual improvements can have significant benefits, for example, the life expectancy and infant mortality. For the developed countries, it's impossible to improve health dramatically, because the health levels are already high and probably at limits (Järvi, 2007). Against all above mentioned theories, Clarke and Islam (2003) explained the possibility of the relation between health and economic growth turning to negative because of the biological limits of human beings (improving health outcomes becomes increasingly difficult when the starting points are already high), environmental externalities of growth (pollution associated with the increasing economic growth) and less healthy diets (especially in the developing countries, where wealth is a new phenomenon reflected in the consumption of fatty or high cholesterol foods and increased rates of smoking and alcohol use).

3. Testing the European Union data

This empirical part will test if the relationships discussed above prove for the mental and heart related diseases in European Union (Järvi, 2007), because these diseases were revealed by the ECHI[315] project, carried out in the framework of the Health Monitoring Programme and the Community Public Health Programme 2003-2008, as being the main causes of death in the EU. We will test how the average growth rates for examined health indicators are related to growth rates of real GDP per capita, between 1995 and 2006. As earlier discussed, the direction of the causality is not clearly reflected and the regression could have been done therefore on the opposite way as well. Then the changes in the GDP growth rate per capita would have been exogenous, and the changes in the growth rate of diseases endogenous variables. As the results of regression later indicate, this might have been the correct direction of the causality and therefore it could have been a better approach for the research. On the other hand, changing axes does not change the relations and exactly the same conclusions can be construed, no matter which way the regression is done. The data used comes from the *WHO Health for All database* 2008 (Järvi, 2007) and from the European Commission, *Dissemination of health information and data*[316], and includes the following four variables: real gross domestic product per capita measured in PPP$ (code 0270), mental disorders incidence per 100000 inhabitants (code 2390), hospital discharges due to circulatory system disease per 100000 inhabitants (code 2450) and Hospital discharges due to ischemic heart disease per 100000 inhabitants (code 2460). The codes above refer to the organizing system of the variables in the database. The growth rate of incidence and hospital discharges of the diseases are used instead of mortality rates because those are direct indicators of the changes in current health (Järvi, 2007). Had mortality been used, it would have been important to notice that the time of diagnose is unknown, as is the proportion in which the disease has been related to the growth rate of GDP per capita since that year. Even if the year and proportions could have been estimated from the medical information of the disease, the changes in health that caused the death in the period in question might have happened before year 1995, which is the first year in the sample. The sample cannot even be expanded much, as there is not enough data available. Due to the limitations on data availability, not all the countries were presented on the period in question, because only 22 out of 27 EU member states had enough data for regression. Cyprus, France, Luxembourg, Malta and United Kingdom were those excluded. For testing the variable "mental", there was data only from 11 countries, which already makes it really hard to get significant results. Drawing conclusions from these limited data should be done therefore with consideration.

315 Please, see the The ECHI (European Community Health Indicators), on http://ec.europa.eu/health/ph_information/dissemination/echi/echi_en.htm, last visited on 15.04.2009.
316 Idem.

The relationships founded between the average annual growth rates of GDP and the three health indicators are used as a base when analyzing the deeper meaning of the results (Järvi, 2007). All the values used further on are logarithmic, and each indicator is presented in its own scatter plot and a line of best fit is drawn to each graph. *Mental disorders* are between the few measurable indicators of how healthy people are psychologically, and it is appropriate to study this variable here.

The study of relationship in *Figure 2,* between growth rate of GDP per capita and incidence of mental disorders, shows a negative linear relationship meaning that better mental health is related to faster economic growth (Järvi, 2007). Unfortunately, there was data available only from 11 countries and therefore the result rests ambiguous. A closer look exposes that the negative slope of the line of best fit is only caused by two extreme points at the top left corner on the scatter plot. If these points were removed, the relationship would turn positive. The relationship would still be positive even if the third point at the top right corner of the scatter plot was removed. The three points above all the others represent the Baltic countries, in order from left to right: Lithuania, Latvia and Estonia. The P-value 0.16 of the relation (extreme points included) indicates that the result is not significant statistically (Järvi, 2007).

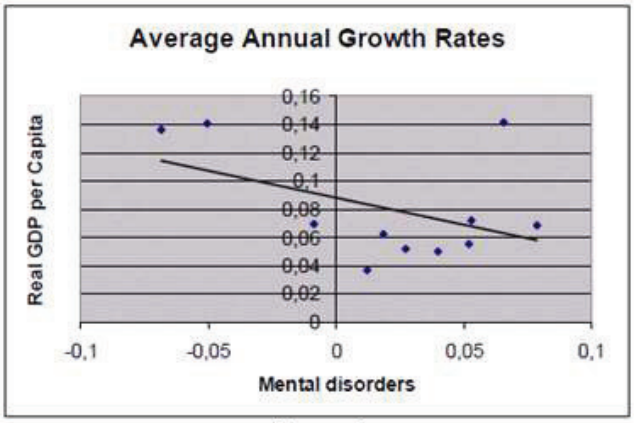

Figure 2

The different kinds of heart diseases are common in the whole developed world, and therefore it was appropriate to have them represented as well. First variable of this type in this study are the circulatory system diseases.

Figure 3 shows a better fitting line for hospital discharges after a circulatory system disease, than the one for mental health. The amount of data has also been doubled. The data are available from 22 countries and so, the results are more reliable. Also here it is possible to discuss if the three points at the 0.14 line of the GDP per capita growth are such extreme points that the positive slope of the trend line was caused by them. In this case, if the points were removed the trend line would still have a positive growth coefficient. The result for this regression (extreme points included) is also significantly different from zero at 95% confidence level. The P-value of X variable is 0,049.

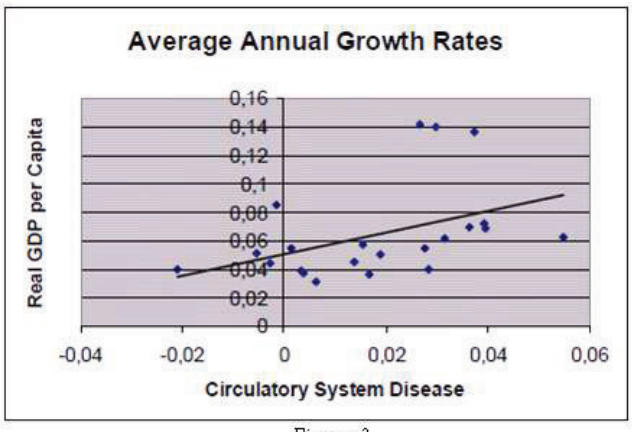

Figure 3

Ischemic Heart Disease is another consequence of the general term *heart disease*, and shows us another outcome, giving more weight to these types of diseases, and being also interesting to see if the two types of heart disease have the same kind of relation in economic growth.

Figure 4 shows us that there is no relationship between the growth of GDP and the hospital discharges after an ischemic heart disease. The P-value for this regression is 0.98. The data comes from the same 22 countries observed for the Circulatory System Disease and conduct to

the conclusion that it does not have the same kind of effect on economic growth as the Circulatory System Diseases had (Järvi, 2007).

Concluding remarks

There are three different patterns of observations and three regressions of which only one has statistical significance. Therefore, it is natural to analyse mainly the results of economic growth related to the growth of hospital discharges due to circulatory system disease. The interesting thing in this relationship is its positive slope, i.e. as the number of the discharges grows faster, so does the growth of GDP accelerate, which can be also interpreted as that countries with higher growth rates are offering hospital services more often than the ones with lower growth rates, even if the need would be the same (Järvi, 2007). This is opposite to the hypothesis that economic growth and better health would vary towards the same direction, and so, the relationship between health and economic growth can turn out to be negative, as it was found also in the study made by Barro and Sala-i-Martin (1999, p. 454).

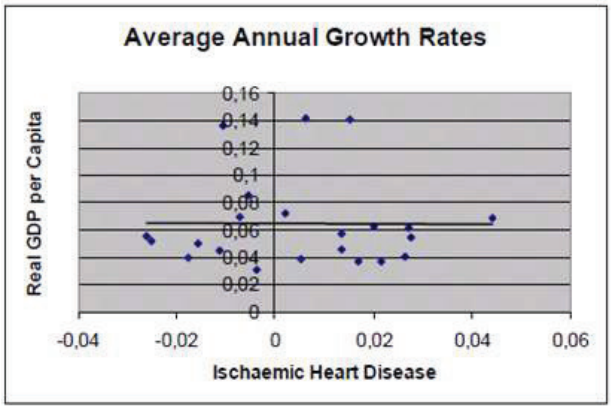

Figure 4

In conclusion, the relationship between health and economic growth is at least two-ways, and there is a positive one, as the results of this paperwork indicate us, even if the study suffers from the lack of data (Järvi, 2007). The direction of causality in the relationship is likely to go from the economic growth to the growth rates of the diseases, or we can express it as follows: the higher the economic growth, the higher the usage of hospital services and thereby discharges, while the incidence of the diseases remains unchanged. The result can also be seen as supporting evidence to the theory according to which in wealthier countries the relationship between health and economic growth can even turn out to be negative, but this relationship must be studied more before drawing any general conclusions.

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