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OVPLYVŇUJÚ VÝDAVKY NA ZDRAVOTNÍCTVO HOSPODÁRSKY RAST? DÔKAZY Z VYBRANÝCH ÁZIJSKÝCH KRAJÍN

DOES HEALTH CARE EXPENDITURE AFFECT ECONOMIC GROWTH? EVIDENCE FROM SELECTED ASIAN COUNTRIES

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Výsledky výskumov dlhodobo poukazujú na fakt, že existuje silná pozitívna korelácia medzi výdavkami na zdravotníctvo a hrubým domácim produktom. Predkladaný článok skúma vzťah medzi hospodárskym rastom a výdavkami na zdravotníctvo v 23 vybraných ázijských štátoch. Používa panelovú analýzu dát za roky 1996-2009 a tvorí model metódou GLS. Výsledky výskumu potvrdzujú existenciu silnej pozitívnej korelácie medzi hospodárskym rastom a výdavkami na zdravotníctvo. Grangerov test kauzality ukazuje, že z krátkodobého hľadiska je vzťah obojsmerný, kým z dlhodobého hľadiska prebieha kauzalita jednosmerne od výdavkov na zdravotníctvo k hospodárskemu rastu.
Kľúčové slová: výdavky na zdravotníctvo, hospodársky rast, GLS, panelový ECM model.

A strong and positive correlation between health care expenditure and GDP has been the consistent finding of research. Based on this concept about the role of health in the economy, this paper aims to investigate the relationship between economic growth and health care expenditure. We use panel data analysis of 23 selected Asian countries over the period of 1996-2009. We develop a framework by employing a series of respective tests and estimate the model using GLS approach. The results confirm presence of a positive

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and significant relationship between economic growth and health care expenditure. The Granger causality test also indicates the existence of bidirectional causality between health care expenditure and economic growth in the short-run and unidirectional causality from health care expenditure to GDP in the long-run.
Key words: health care expenditure, economic growth; GLS, panel-type ECM model.
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1 INTRODUCTION

From the early 1990s up to now the relationship between health care expenditure and GDP has become an interesting subject of research in the field of health economy. This is attributed to a rapid rise in the share of health care expenditures in GDP which has been a source of concern for developed countries (Mehrara et al. 2010). For instance, this ratio accounted for 4% of US GDP in the 1930s, later it increased to 13.1% during 1990s and reached 14.5% during 2000s (Tang and Zhang 2007, Warshawsky 1999). However, far less attention has been paid to this subject in developing countries. For policy makers, it is crucial to know the effect of health care expenditure on national income – this helps them to plan health reforms and efficiently allocate resources (Sulku and Caner 2011). Consequently, the necessity of investigating this relationship becomes obvious.

Human capital as a source of growth warrants a closer look at how change in population´s state of health influences economic growth and thus total welfare (Zon and Muysken 2001). The concept of human capital as an important component of development is usually defined broadly by including education, health, training, migration and other investments that enhance an individual's productivity in the equation (Akram et al. 2008). Literature mostly focuses on health as the key element which directly influences economic growth. This paper pays attention to analyzing the relationship between health care expenditure and GDP, while ignoring the role of other factors.

The state of health in a country affects its economic growth. Health is an engine of economic growth (Barro 1996). Wang (2011) found that when health of general population improves, the country can produce more output with any given combination of skills, physical capital and technological knowledge; consequently, improved health status of a nation creates an outward shift in the labor supply and increases productivity of labor (Rahman 2011); thus, a rise in GDP is obvious. Looking at the topic from a slightly different perspective, healthier workforce are less susceptible to disease, more alert, more energetic and are likely to be able to work longer and more productively (Mehrara and Musai 2011, Bukenya, 2009). In addition, higher curative and preventive health care expenditures improve labor participation in

production activity (Erdil and Yetkiner 2009) as the employees are less likely to be absent from work because of illness (Bloom et al. 2004). As a result, the GDP rises.

This paper aims to investigate the relationship between health care expenditure and economic growth in selected Asian countries during the period of 1996-2009. By using econometric regression techniques, this paper analyzes the effect of health expenditure on economic growth. In addition, in order to explore the long and short-run causal relationships between increases in health care expenditure and economic growth, the study employs Granger causality test to find the direction of mutual causality of these two variables.

The organization of this paper is as follows: the next section explains the purpose of the study, in section 3 we offer literature review, section 4 provides an overview of the data set, section 5 describes the model and empirical results, and finally, the last section presents conclusions.

2 OBJECTIVE OF THE STUDY

The existence of a positive relationship between health care expenditure and economic growth has been well established. However, the extent of this relationship remains debatable. Hence, it is essential to determine whether this link exists in the developing countries and how strong it is. This study intends to shed light on this question and demonstrate the positive effect of health care expenditure on economic growth.

3 LITERATURE REVIEW

The relationship between health care expenditure and economic growth is well recognized in the literature. Most studies find a positive relationship between health care expenditure and the GDP. A strong interest in this research area was initiated by the findings of Kleiman (1974). In his pioneering study, he stated that there is not only a strong positive correlation between health care expenditure and GDP, but also that fluctuations in the GDP can be explained by fluctuations in health care expenditure. This subject became the focus of research for the following three decades. In the following text, we categorize literature on this topic by methods used.

The first group is made up of those analyses that use quantile regression methods. Among them we can highlight the paper by Wang (2011) who reports that in countries with low level of growth, the influence of health care expenditure on economic growth is small. In countries with medium and high levels of economic growth, the influence of health care expenditure on economic growth is positive. As found by Chen (2009) conditional distribution of per capita health care expenditure on GDP is asymmetric. For lower GDP countries, the conditional distribution is skewed to the right which means less health care tends to be consumed, but in high GDP countries the conditional distribution is skewed to the left which means higher expenditure on health.

The second branch of literature consists of unit root and cointegration tests Dreger and Reimers (2005) focused on evidence of cointegration relationship between health care expenditure and GDP for a sample of 21 OECD countries. Also Sulku and Caner (2011) performed a cointegration analysis in Turkey and found evidence of multivariate cointegration relationship between health care expenditure and GDP.

The third branch of literature involves those studies that consider structural breaks. When examining the relationship between these two variables, it is important to determine whether or not this relationship is stable or it exhibits a structural break. Sharma and Srivastava (2011) allowed for a structural break and found a significant long-run relationship between subcomponents of aggregate health expenditure and GDP in Australia. Gerdtham and Lothgren (2000) examined stationary of health expenditure and GDP for OECD countries. Unit root and stationary trend results for their sample indicate both health expenditure and GDP are non-stationary.

Studies on the relationship between health care expenditure and GDP are not limited to the above mentioned findings only. Amiri and Ventelou (2010) used a modified version of the Granger causality test to evaluate relationship between GDP per capita and health care expenditure per capita in the United States for the period of 1965-1984. Their results show that there exists a bilateral relationship between these two variables. Erdil and Yetkiner (2009) inspected the Granger causality relationship between real per capita GDP and real per capita health care expenditure. Their findings show that for low and middle income countries there is one-way causality from income to health, whereas the reverse holds for high income countries. As can be seen, many studies – no matter what method they used – point to the positive relationship between economic growth and health care expenditure.

4 DATA

Analyses of inter-relationship between health care expenditure and economic growth can be conducted at individual level, at regional level within a country, and for aggregate country data **(**Bhargava et al. 2001). A growing amount of literature focuses on the latter, including McCoskey and Selden (1998), Nancy and Paul (2001), Jewell et al. (2003), Carrion-i-Silvestre (2005), Narayan (2009), Baltagi and Moscone (2010). We follow their method and use country level data as well. However, most of the empirical studies are restricted to OECD countries (Chen et al. 2009). In this paper, our sample consists of 23 Asian countries: Armenia, Azerbaijan, Bahrain, Egypt, Georgia, Iran, Iraq, Israel, Jordan, Kazakhstan, Kuwait, Kyrgyzstan, Lebanon, Oman, Pakistan, Saudi Arabia, Syrian Arab Republic, Tajikistan, Turkey, Turkmenistan, United Arab Emirates, Uzbekistan and Yemen.

The relationship between health care expenditure and GDP can be investigated by using comprehensive data sets and performing either cross-section, time-series or panel-data analysis. Table 1 reports various data sets and methods used in previous research.

Table 1: Previous research and regression methods used

Author	Method
Newhouse (1977)	Cross section
Parkin et al. (1987)	Cross section
Hansen and King (1996)	Time series
Bukenya (2009)	Time series
Hitiris and Posnett (1992)	Panel
Hansen and King (1998)	Panel
McCoskey and Selden (1998)	Panel
Bhargava et al. (2001)	Panel
Jewell et al. (2003)	Panel
Baltagi and Moscone (2010)	Panel
Magazzino and Mele (2012)	Panel

Source: Own elaboration.

Regression analysis based on time series neglects the influence of economic integration, thereby resulting in inefficient testing power. On the other hand, cross-section analysis may overlook the influence of time. Current literature on international economic integration tends to be based on the analysis of panel data, which aims to avoid the inefficient testing power of traditional time-series and cross-section approaches (Wang 2011). Hence, to obtain more powerful results and to avoid the issue of small sample, our results are derived from panel data on 23 countries obtained from the World Health Organization (WHO) database.

5 THE MODEL AND EMPIRICAL RESULTS

5.1 Description of the model

As was already mentioned, this paper aims to supply evidence on the relationship between economic growth and health care expenditure. The empirical pattern is as follows:

$$Y = f\,(HCE) \tag{1}$$

Economic growth is a function of health care expenditure. The construction of the relationship between economic growth and health care expenditure can be specified as:

$$LogY_{it} = \alpha_i + \beta_i LogPHCE_{it} + \varepsilon_{i,t} \tag{2}$$

where Y_{it} indicates GDP growth of country *i* at time *t*, PHCE stands for private expenditure on health as a percentage of total expenditure on health of country *i* at time

t, α_i is the fixed effect of each country, β_i displays the coefficient of explanatory variable and $\varepsilon_{i,t}$ is the error term of each country at time *t*.[1]

To investigate the relationship between economic growth and health care expenditure we employ standard econometric tests. The process of empirical analysis consists of the following five steps: We start by performing Leamer and Hausman tests to understand whether the regression is panel or not and to choose between fixed or random effect. Second, we use three unit root tests to verify that the data series are stationary. In the third step, likelihood ratio test is implemented to determine whether heteroscedasticity exists. In step four the model is estimated via generalized least squares (GLS). Finally, Granger causality test is applied to uncover the direction of causality both in the short and long term.

5.2 Leamer and Hausman tests

Mixing cross-section dimension (N) and time dimension (T) into panel data leads to reliable results, which is the main advantage of this method (Breitung and Pesaran 2008). However, before estimating the model, we must determine the type of data used. For this purpose, we employ Leamer test. Table 2 shows the results for Leamer test at 5% significance level. As can be seen, since the probability of the test statistic is less than 5 per cent, the null hypothesis of pool data is rejected and panel data method is adequate.

The next step is to choose between fixed effects model (FEM) or random effects model (REM). Baltagi (2001) emphasized that the choice between the fixed and random effects models should be solely based on theoretical consideration. In this study, in order to validate the choice of fixed effects, the Hausman specification test with an asymptotic chi-square distribution is performed. The statements of hypotheses are as follows:

H_0: existence of random effects model

H_1: existence of fixed effects model

The result shows that the null hypothesis of a random effects model should be rejected. This confirms that fixed effects model should be used (table 2).

[1] In search for the correct model, we used six other variables as proxies for health care expenditure: social security expenditure on health as a percentage of general government expenditure on health, total (private plus public) expenditures on health as a percentage of gross domestic product, general government expenditure on health as a percentage of total expenditure on health, per capita total expenditure on health (PPP int. $), per capita government expenditure on health (PPP int. $) and general government expenditure on health as a percentage of total government expenditure. However, only the variable of private expenditure on health as a percentage of total expenditure on health turned out to be statistically significant, therefore, the other variables were excluded from further analyses.

Table 2: Results of Leamer and Hausman tests

Test	Distribution	Stat.	Prob.
Leamer	F	3.740	0.0000
Hausman	Chi2	0.029	0.5926

Source: Own elaboration.

5.3 Panel unit root tests

Another important test in this perspective is the panel unit root test. Jewell et al. (2003) pointed out that ignoring this test will lead to a spurious regression. Carrion-i-Silvestre (2005) described various types of panel unit root tests in great detail. Levin et al. (2002) applied panel unit root with heterogeneous dynamics, fixed effects and determinant trend. Also, Im et al. (2003) proposed unit root tests for dynamic heterogeneous panels based on the mean of individual unit root statistics. Moreover, Maddala and Wu (1999) and Choi (2001) used Fisher statistic as a type of unit root. While a great deal of research has been devoted to the use of unit root tests, the most popular seem to be the approaches by Levin et al. (2002) and Im et al. (2003) – LLC and IPS unit root tests. Augmented Dickey-Fuller (ADF) test is also used often (Maddala and Wu 1999). Hence, we use these three tests in our research.

In these tests, the null hypothesis assumes existence of unit root in series. Table 3 presents results of these tests. The results provide evidence that null hypothesis should be rejected at 5% significance level. The variables are stationary and there is no need to use cointegration test.

Table 3: Results of unit root tests

H_0: Unit root	LogY		LogPHCE	
	Stat.	Prob.	Stat.	Prob.
LLC	-5.8805	0.0000	-5.4127	0.0000
IPS	-3.4892	0.0002	-3.2841	0.0005
ADF	90.2449	0.0001	83.6668	0.0006

Source: Own elaboration.

5.4 Likelihood ratio tests

For avoiding heteroscedasticity in the model, the Likelihood ratio test has been employed. The result (shown in table 4) indicates that the hypothesis based on the existence of homoscedasticity in variances should be rejected and thus, the model has heteroscedasticity. In this case, the best way to estimate the model is the method of Generalized Least Squares (GLS). By doing this, autocorrelation in error terms will also be removed.

Table 4: Results of Likelihood ratio test

LR Chi2	Prob.
109.37	0.0000

Source: Own elaboration.

For simplicity, we briefly summarize the process of testing in table 5.

Table 5: Summary of the testing process

Leamer	Panel/Pool	Panel
Hausman	Fixed/Random	Fixed
Unit root	Stationary/Non-Stationary	Stationary
Likelihood	Heteroscedasticity/Homoscedasticity	Heteroscedasticity

Source: Own elaboration.

5.5 GLS estimation

Having specified the process of estimation of the model, in order to overcome the problem of heteroscedasticity, the so-called GLS regression method is employed. The result is shown in table below. As mentioned previously, the variables in the model are in the form of natural logarithms.

Table 6: Results of GLS regression

Variable	Coef.	Std. error	Z	P> Z
Log HCE	0.3190205	0.1069261	2.93	0.003
Cons	0.3879284	0.4193765	0.93	0.355
Prob. = 0.0034		$\chi^2 = 8.57$		

Source: Own elaboration.

As can be seen, the probability of χ^2 statistics is significant, which indicates that model estimation is well organized. The results give evidence of positive relationship between economic growth and health care expenditure. In other words, the coefficient points out that with a one-per-cent increase in health care expenditure (measured as private expenditure on health as a percentage of total expenditure on health), the GDP will rise by 0.319 %.

5.6 Causality

In investigating the relationship between economic growth and health care expenditure an important question is whether this relationship is unidirectional or bidirectional. It is therefore necessary to determine the direction of causality between economic growth and health care expenditure. To do this, we use the Granger causality test. To undertake this test between GDP and PHCE variables, the following error correction models are established:

$$\Delta LogY_{it} = \alpha_{1j} + \sum_{k=0}^{q} \theta_{11ik} \Delta LogY_{it-k} + \sum_{k=0}^{q} \theta_{12ik} \Delta LogPHCE_{2it-k} + \sigma_{1i} EC_{it-k} + \mu_{1it} \quad (3)$$

$$\Delta LogPHCE_{it} = \alpha_{2j} + \sum_{k=0}^{q} \theta_{21ik} \Delta LogPHCE_{2it-k} + \sum_{k=0}^{q} \theta_{22ik} \Delta LogY_{2it-k} + \sigma_{2i} EC_{it-k} + \mu_{2it} \quad (4)$$

Table 7: Results of causality tests

Variable	**Short-run causality**		**Long-run causality**
	$\Delta LogY_{it}$	**$\Delta LogPHCE_{it}$**	**EC**
$\Delta LogY_{it}$	-	5.07 (0.079)	0.0034 {-5.57}
$\Delta LogPHCE_{it}$	9.01 (0.011)	-	-0.0027 {2.015}

Source: Own elaboration.

As can be seen from table 7, there is a bi-directional causality between economic growth and health care expenditure in the short run. With a negative and significant EC coefficient (-0.0027, t-statistics = 2.015), there is a one-way causality from private health care expenditure (PHCE) to economic growth (GDP) in the long run.

6 CONCLUSION

Health is one of the essential determinants of any country's economic development and therefore plays an important role in economic activities. Analysing the impact of health care expenditure as a key element of economic growth has got a lot of attention in recent decades. The main objective of this study was to find the evidence of relationship between health care expenditure and economic growth. To fulfil this aim we used panel data analysis on 23 selected Asian countries for the period of 1996-2009. To confirm the validity of our results, we applied a series of standard econometric tests consisting of Leamer, Hausman, unit root and likelihood tests. The last test showed that there was a problem with heteroscedasticity. We tackled this problem by using GLS method. Our results provide evidence that a positive and significant relationship between health care expenditure and economic growth exists. Also, with regard to the Granger causality test, the study found bi-directional causality between the variables of health care expenditure and economic growth in the short run and unidirectional causality from health care expenditure to economic growth in the long run.

The policy implication of this study is that health expenditure has direct impact on economic growth. This leads us to the conclusion that countries that desire to have a thriving society must pay more attention to health care expenditures and their structure.

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