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KEY DRIVERS OF CHANGES IN HEALTH EXPENDITURE

The main goal of this paper is to analyze the factors of health expenditure in European countries. The paper analyzes health expenditures in 34 European countries, including EU members as well as Montenegro, Macedonia, Iceland, Turkey, Serbia and Bosnia and Herzegovina. The paper identifies 9 independent variables which we divide in 5 groups of factors that affect health expenditures as GDP share. After we made the regression model with all the analyzed variables, we came to the conclusion that by using 9 independent variables (in combination), we can explain 29.4% of health expenditure variability expressed as GDP %.

Keywords: *health expenditure; GDP percentage; European countries.*
JEL: H51; I10.

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ОСНОВНІ ФАКТОРИ ЗМІНИ ВИТРАТ НА ОХОРОНУ ЗДОРОВ'Я

У статті проаналізовано фактори і витрати на охорону здоров'я в 34 країнах Європи, в тому числі членів ЄС, а також Чорногорії, Македонії, Ісландії, Туреччини, Сербії та Боснії і Герцеговини. Визначено 9 незалежних змінних, які розділено на 5 груп факторів, що впливають на витрати на охорону здоров'я у відсотках від ВВП. Після побудови регресійної моделі з усіма проаналізованими змінними, дійшли висновку, що 9 незалежних змінних (у поєднанні) пояснюють 29,4% мінливості витрат на охорону здоров'я у % до ВВП.

Ключові слова: витрати на охорону здоров'я; доля у ВВП; європейські країни.
Форм. 4. Табл. 10. Літ. 23.

Вельма Пиялович

ОСНОВНЫЕ ФАКТОРЫ ИЗМЕНЕНИЯ РАСХОДОВ НА ЗДРАВООХРАНЕНИЕ

В статье проанализированы факторы расходов на здравоохранение в 34 странах Европы, включая членов ЕС, а также Черногорию, Македонию, Исландию, Турцию, Сербию и Боснию и Герцеговину. Определены 9 независимых переменных, разделённые на 5 групп факторов, влияющих на расходы на здравоохранение в % к ВВП. После построения регрессионной модели со всеми проанализированными переменными мы пришли к выводу, что 9 независимых переменных (в сочетании) объясняют 29,4% изменений в расходах на здравоохранение в % от ВВП.

Ключевые слова: *расходы на здравоохранение; доля в ВВП; европейские страны.*

Introduction. Increased interest in studying healthcare within economic science has been caused by the growth of expenses in this sector. According to the World Health Organization, 10.1% of the total world GDP was spent in this sector in 2012, which makes this sector one of the leading industries in the global economy. However, regardless these facts, there are very few countries which are not facing problems with healthcare financing. Therefore, health sector has been an important economic and political issue in developed countries in recent years (we remember, for example, the healthcare reform in USA). According to the latest World Health Organization report, direct or out-of-pocket payments make up 17.6% of the total world health expenditures. As a consequence of the growth of direct payments in health sector, 150 mln people face serious financial troubles every year, and additional 100 mln have

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been pushed below the poverty line because of health expenses. On the other hand, countries where governments have taken the responsibility for healthcare, health expenses are becoming one of the main and constantly growing components of public finance. Therefore, in times of recession and growing fiscal pressure, the growth of health expenses is becoming an increasingly important problem, and identification of the factors which determine health expenditures is becoming a vital necessity.

Literature review. The first paper attempting to explain differences in the levels of health expenditures and define the determinants of health expenditure was (Newhouse, 1977) where he uses the example of 13 OECD countries to prove that 90% of variations in per capita health expenditure can be explained by *differences in amounts of GDP per capita*. 20 years after Newhouse, there was little progress since the discovery of the fact that variations in per capita GDP are closely related to variations in per capita health expenditure. Research in this period has been mainly based on examining OECD states in different periods of time. We can provide the following examples: T. Getzen and J. Poullier (1991), as well as T. Hitris and J. Posnett (1992). More recent studies (such as Fuchs, 2013) also analyze the impact of GDP on health expenditure. Another factor used in literature to explain the growth of health expenditure is *age structure of population*. Many studies (Hitris and Posnett, 1992, for example) proved significant and positive link between health expenditure and the share of persons above 65 years in total population. Besides the analysis of the impact of aging population, there are also studies analyzing the impact of share of persons under 15 years in total population number. E. Kleiman (1974) mentions the correlation between these two variables. This result is explained by low unit prices for products consumed by younger population, such as vaccines. On the other hand, a number of studies indicate that population aging itself does not lead to an increased health expenditures. Already in 1999, P. Zweifel, S. Felder and M. Meier (2004) used the famous model (ZFM) to analyze health expenditures related to deceased persons in years prior to their death, and they established that the number of persons above 65 years does not have significant influence on health expenditure per se. A repeated research in 2004 (Zweifel at al., 2004) confirmed that probability of death occurrence and not aging itself causes the increase of health expenditures. D. Johnson and J. Yong (2006) confirmed this hypothesis in their paper, but they proved that there are differences caused by different age groups when it comes to impact of death probability on health expenditure. Additional argument for the claim that aging has a limited effect on growth of health expenditure is provided by M. Chawla (2006) who claims that parallel to the aging process, there is also the process of health improvement, which is why it can be expected that 65-year olds in 2025 will be healthier than their peers today.

The next factor explaining health expenditure is *technology*. Technologic innovation in medicine does not include only capital and equipment, but also new surgery methods, medication, treatments, as well as new procedures based on the combination of all of the above. Economic theory still does not have a clearly defined model which would explain how technologic innovation influences health expenditure. On the other hand, many studies produced different results. Already in 1995, Cutler claimed that application of modern technology is the basic factor leading to health expenditure growth. A. Carter (1997), and later E. Tosetti and F. Moscone (2007) also proved that health expenditure growth is, to a great extent, caused by changes in tech-

nology and treatment. T. Bodenheimer (2005) concludes that although there is a decrease of unit expenses at early stages, technologic innovation leads to growth of total health expenditures. As an example, T. Bodenheimer refers to laparoscopic gallbladder removal which costs 25% less than a classical surgery, but this led to an increase in number of the procedures by 60%. Therefore, T. Bodenheimer concluded that the growing use of modern technology annuls the cost reduction caused by the usage of modern technology, which results in increased health expenditure. J. Newhouse (1992) and D. Wanless (2002) also explained that technical progress causes the reduction of relative price of health products and services, but it is also the main driving force for expenditures. However, unlike the analysis of the impact of socioeconomic factors such as per capita GDP or aging, analysis of technological impact is mostly reduced to descriptive analysis. This is probably due to scantiness of relevant data. Studies on macrolevel generally establish the effect of technological changes as "existing" increase of expenses which is not explained by interaction of demographic changes and GDP growth. However, some authors who include data on technological development in quantitative analysis use different proxy variables. Some use the number of medical devices, for example, the number of MRI scanners per 100,000 inhabitants (Baker and Wheeler, 2000) or the number of surgical procedures (Weil, 1995), or R&D expenditures (Okunade at al., 2001). Under the assumption that technological progress develops its influence linearly with time, some studies represent technological changes as linearly time trend (Blomqvist and Carter, 1997; Zweifel et al., 1999). A recent study analyzing determinants of health expenditure in OECD countries (Pammolli et al., 2009) uses the number of published medical scientific papers as proxy variables for influence of technology, as well as the number of deaths related to pathologies treated by high-tech devices. E. Ford et al. (2007) showed that around 47% of total improvements in medical treatments refer to coronary diseases. Mortality rate decreases with spread of high-tech devices. The next determinant of health expenditure identified in literature is *public funding share*. R. Leu (1986) argues that public funding share increases health expenditure. However, this argument has not been confirmed in recent empirical studies. U. Gerdtham et al. (1992), and more recently E. Tosetti and F. Moscone (2007) discovered a negative link between proportion of health expenditure financed through public funds and total expenditures. Although there is no doubt in medical literature regarding the impact of lifestyle on health of population and thus health expenditure, as far as we are aware, only two studies include lifestyle as determinant of health expenditure – T. Christiansen et al. (2006) and F. Pammolli et al. (2009).

Data and methods. Data used in the following section of this paper were collected from World Health Organization's Health for All Database and Eurostat's data. The analysis was conducted for 34 countries including EU members as well as Montenegro, Macedonia, Iceland, Turkey, Serbia and Bosnia and Herzegovina. The paper uses different models to identify and compare the key drivers of changes in the dependent variable: health expenditures as GDP percentage. Basing on the research of literature and previous studies on factors which have impact on health expenditure, we came to the conclusion that basic factors can be divided in 3 groups:

- Economic factors (we will use the variables of GDP per capita in PPP dollars and % of public expenditure in total health expenditures).

- Demographic factors (we include the share of persons above 65 in total population and fertility rate).
- Technology factors (we include the number of death cases caused by coronary diseases per 100,000 inhabitants and life expectancy at the age of 65 as predictors).

Only a few studies examine lifestyle as the factor determining health expenditure. On the other hand, although we failed to find empirical research examining the impact of efficiency of healthcare systems in order to test theoretical claims that efficiency of secondary healthcare influences the level of health expenditure, we decided to include this indicator as well. So, in addition to previous factors, our analysis also includes:

- lifestyle-related factors;
- efficiency of healthcare systems.

We find justification for such classification of health expenditure determinants in the fact that World Health Organization uses a similar set of determinants.

Lifestyle as factor which explains health expenditure has been rarely used so far. One of the reasons is the limited ability to collect relevant data. Standard predictors indicating impact of lifestyle on health expenditure are cigarette and alcohol consumption. However we decided to use the indicator of alcohol consumption in liters per capita for persons above 15 and the indicator of sugar consumption per capita in kilograms. Although we do not dispute the significance of cigarette consumption for health of smokers and thus for health expenditures, we decided to use sugar consumption as an indicator related to the entire population of a country. Basic argument for the selection of this indicator is data availability and the fact that sugar consumption (along with salt and white flour) is the most frequently cited cause for many diseases. These three items are often referred to as "white death" in medical literature. Of course, sugar is an important energy source and this variable should be used cautiously in countries where malnutrition of children is one of the most significant health problems. However, this paper analyses European countries which mainly face the problem of obesity.

The final variable which will help us show whether the efficiency of secondary healthcare influences health expenditure is the average duration of hospitalization in days.

Before creating the model of health expenditure, we conducted the Kolmogorov-Smirnov test and analyzed the Pearson's coefficient of correlation between earlier specified dependent and independent variables.

Basing on SI and KI values, we can conclude that the values for almost all variables are distributed normally. Exceptions are the values of real GDP PPP$ per capita and mortality rates where SI indicates mild positive asymmetry. On the other hand, all K-S Z-values are statistically insignificant, which means there is no significant deviation from normality, and that it is permissible to continue with parametric correlation analysis.

Basing on the data in Table 2, we can make the following conclusion: the variable of expenditure expressed as % of GDP has significant correlation to the following variables: deaths caused by cardiovascular diseases, life expectancy at 65 or older and alcohol consumption per capita. Out of all these variables, the number of deaths caused by cardiovascular diseases is the only one with negative correlation.

Table 1. **Skewness and kurtosis index, value and significance of Kolmogorov-Smirnov Z-value for individual variables,** *author's*

Variable	SI	Statistical error SI	KI	Statistical error KI	Kolmogorov-Smirnov Z-value	Significance level p
Health expenditure, % GDP	-0.144	0.403	-0.584	0.788	0.558	0.914
Public health expenditure, % of total expenditure	-0.659	0.403	0.021	0.788	0.763	0.605
Real GDP PPP$	1.208	0.403	2.966	0.788	0.721	0.676
Fertility rate	0.767	0.403	0.550	0.788	1.103	0.176
Population over 65 years	-1.408	0.403	3.539	0.788	0.851	0.464
Deaths caused by cardiovascular diseases	1.208	0.403	1.575	0.788	1.043	0.227
Life expectancy at 65 years or older	0.205	0.403	0.297	0.788	0.990	0.281
Sugar consumption in kg per capita	-0.366	0.403	0.527	0.788	0.395	0.998
Alcohol consumption in liter per capita	0.762	0.403	8.667	0.788	1.502	0.22
Duration of hospitalization in days	-0.935	0.403	1.143	0.788	0.608	0.854

SI – Skewness Index; KI – Kurtosis Index.

Table 2. **Values and significance level for Pearson coefficient of correlation between dependent and independent variables,** *author's*

Predictor variable	Health expenditure as % of GDP	
	Pearson correlation coefficient	Level of significance p
Public health expenditure, % of total expenditure	0.191	0.279
Real GDP PPP$	0.161	0.363
Fertility rate	0.133	0.454
Population over 65 years	0.275	0.115
Deaths caused by cardiovascular diseases	-0.466	0.006**
Life expectancy at 65 or older	0.361	0.036*
Sugar consumption	0.053	0.765
Alcohol consumption	-0.356	0.039*
Duration of hospitalization	0.083	0.642

* $p < 0.05$; ** $p < 0.01$.

Models of Health Expenditure with All Variables Included. In order to create the health expenditure model, the previously mentioned independent variables were included into regression analysis. We used the enter method of regression analysis in the first phase of model design, meaning that all independent variables were included in the analysis, regardless whether they significantly correlate to other criteria, or not.

As Table 3 shows, the coefficient of multiple correlation are significant. 9 independent variables (their combination) share 29.4% of variability with the variable of health expenditure as GDP %.

Table 3. **Value and level of significance of multiple correlation coefficient in the prediction of health expenditure value as share of GDP,** *author's*

Criteria variable	R	R^2	Corrected R^2	Standard error of estimate	Statistical significance change				
					Change in R^2	Change in F	Freedom lvl 1	Freedom lvl 1	Significance of change of F-value
Health expenditure as % of GDP	0.698	0.487	0.294	1.45368	0.487	2.528	9	24	0.034*

* $p < 0.05$.

Table 4. **F-values in the test of significance of the overall model (all predictors included),** *author's*

Criterion variable	Model	Variability	Sum of squares	Freedom level	Variation	F	Significance p
Health expenditure as % of GDP	1	Regression	48.079	9	5.342	2.528	0.034*
		Residual	50.716	24	2.113		
		Total	98.795	33			

* $p < 0.05$.

We can conclude that F-values are statistically significant for criterion variable, which means that the model significantly contributes to the predictability of the dependent variable values as compared to pure guessing or baseline prediction.

Table 5. **Values and levels of significance for regression coefficients of individual predictors for health expenditure as GDP %,** *author's*

Unstandardized regression coefficients	Unstandardized coefficients		Standardized coefficients	t	p	95% interval of reliability for B	
	B	Std. error	Beta			Lower endpoint	Upper endpoint
(Constant value)	3.374	6.049		0.558	0.582	-9.111	15.858
Public health expenditure (% of total expenditure)	0.032	0.030	0.196	1.048	0.305	-0.031	0.095
Real GDP PPP$	0	0.000	-0.270	-1.203	0.241	0.000	0.000
Fertility rate	1.441	1.285	0.218	1.121	0.273	-1.212	4.094
Population over 65	0.239	0.130	0.373	1.839	0.078	-0.029	0.508
Deaths caused by cardiovascular diseases	-0.012	0.006	-0.437	-2.114	0.045*	-0.023	0.000
Life expectancy at 65 years or older	0.116	0.209	0.123	0.555	0.584	-0.316	0.548
Sugar consumption per capita	0.020	0.042	0.092	0.470	0.643	-0.067	0.106
Alcohol consumption	-0.437	0.279	-0.278	-1.565	0.131	-1.012	0.139
Duration of hospitalization	0.135	0.224	0.113	0.603	0.552	-0.328	0.599

When it comes to health expenditure expressed as GDP %, significant contribution to the prediction of this variable is provided by the predictor of the number of deaths caused by cardiovascular diseases. Other independent variables do not contribute significantly to the predictive abilities of the model.

Table 6 shows the correlation coefficients before and after partialization of other predictors infact. After partialization, the number of deaths caused by cardiovascular diseases still shows the greatest (but negative) link to the variable of health expenditure expressed as GDP %.

Table 6. **Values of impartial and partial coefficients of correlation of individual predictors with criterion variable of health expenditure as GDP %,** *author's*

Predictor	Correlation			Collinearity	
	Correlation	Partial	Part correlation	Tolerance	Variance inflation factor
Public health expenditure (% of the total expenditure)	0.191	0.209	0.153	0.614	1.630
Real GDP PPP$	0.161	-0.239	-0.176	0.424	2.359
Fertility rate	0.133	0.223	0.164	0.564	1.772
Population over 65	0.275	0.351	0.269	0.520	1.922
Deaths caused by cardiovascular diseases	-0.466	-0.396	-0.309	0.499	2.003
Life expectancy at 65 or older	0.361	0.112	0.081	0.436	2.295
Sugar consumption per capita	0.053	0.095	0.069	0.562	1.780
Alcohol consumption per capita	-0.356	-0.304	-0.229	0.678	1.475
Duration of hospitalization	0.083	0.122	0.088	0.611	1.635

Basing on the regression analyses, the value of health expenditure expressed as GDP % (HEGDP) can be expressed by two equations.

The equation includes the following variables:

1. Health expenditures volume expressed as GDP % (*HEGDP%*) (dependent variable).
2. Public health expenditure (% of total expenditures) (*PE*) (independent variable).
3. Real GDP PPP$ (*RGDP*) (independent variable).
4. Fertility rate (*FR*) (independent variable).
5. Population over 65 (*POP65*) (independent variable).
6. Deaths caused by cardiovascular diseases (*DCVD*) (independent variable).
7. Life expectancy at 65 or older (*LE*) (independent variable).
8. Sugar consumption per capita (*SCPC*) (independent variable).
9. Alcohol consumption per capita (*AC*) (independent variable).
10. Duration of hospitalization (*HD*) (independent variable).

The unstandardized form of equation

$$HEGDP\% = 0.032PE + 1.441FR + 0.239POP65 - 0.0125DCVD + \\ + 0.116LE + 0.020SCPC + 0.437AC + 0.135HD + 3.374. \quad (1)$$

The standardized form:

$$HEGDP\% = 0.196PE - 0.270RGDP + 0.218FR + 0.373POP65 - \\ - 0.0437DCVD + 0.123LE + 0.092SCPC - 0.278AC + 0.113HD. \quad (2)$$

Models of Health Expenditure with Variables Which Significantly Contribute to the Prediction Ability of the Model. Basing on the results of regression analyses of prediction models for values in criterion variables, we decided to take into account only the predictor variables which had significant impact on the improvement of prediction abilities of the model. This is depicted in the following tables.

Table 7. **Values of standardized and unstandardized regression coefficient predictors significantly contributing to the prediction of values of dependable variables with criterion variables of health expenditure expressed as GDP%,** *author's*

Criterion variable	Predictors	Unstandardized coefficients		Standardized coefficients	t	p	95% interval of reliability for B	
		B	Std. error	Beta			Lower endpoint	Upper endpoint
Health expenditure as GDP %	Deaths caused by cardiovascular diseases	-0.012	0.006	-0.437	-2.114	0.045*	-0.023	0.000

As Table 7 shows, the unstandardized regression coefficient is -0.012 and the standardized regression coefficient is -0.437, both are significant at $p < 0.05$ level.

Table 8. **Value and level of significance of multiple correlation coefficient in the prediction of health expenditure values as GDP% (predictors which proved to be statistically significant in previous analyses),** *author's*

Criterion variable	R	R^2		Corrected R^2	Std. error of estimate		Statistical significance change		
					Change in R^2	Change in F	Freedom level 1	Freedom lovel 1	Significance of change of F-value
Health expenditure as GDP %	0.466[a)]	0.217	0.192	1.55509	0.217	8.853	1	32	0.006**

[a)] predicator: constant value, deaths caused by cardiovascular diseases.
** $p < 0.01$.

When it comes to the prediction model for the criterion variable of health expenditure expressed as GDP %, prediction model with constant value and number of deaths caused by cardiovascular diseases can explain 19.2% of this criterion variable's variability.

Table 9 shows that F-values are statistically significant at $p < .01$ levels, which means that the selected prediction models predict the described dependable variables significantly better than the baseline prediction.

Table 9. **F-values in the test of significance of the overall model (all predictors included, which proved to be statistically significant in previous analyses),** *author's*

Criterion variable	Model	Variability	Sum of squares	Freedom level	Variance	F	Significance p
Health expenditure as GDP%	1 (constant value, deaths caused by cardiovascular diseases)	Regression	21.410	1	21.410	8.853	0.006**
		Residual	77.386	32	2.418		
		Total	98.795	33			

** p < .01.

Table 10. **Values of standardized and unstandardized predictor regression coefficients which proved to make significant contribution to values prediction of dependent variables with criterion variables of health expenditure expressed as GDP %,** *author's*

Criterion variable	Predictors	Unstandardized coefficients		Standardized coefficients	t	p	95% interval of reliability for B	
		B	Std. error	Beta			Lower endpoint	Upper endpoint
Health expenditure as GDP %	Constant value	9.841	0.579		16.994	0.000**	8.662	11.021
	Deaths caused by cardiovascular diseases	-0.012	0.004	-0.466	-2.975	0.006**	-0.021	-0.004

** p < 0.01.

Basing on the repeated regression analyses, we can formulate the following regression equations:

For health expenditure expressed as GDP %, the unstandardized form of equation is:

$$HEGDP\% = -0.012DCVD + 9841. \quad (3)$$

The standardized form of equation is

$$HEGDP\% = -0.466DCVD. \quad (4)$$

Conclusion. Basing on the detailed analysis of the most significant and recent studies on the factors which have impact on health expenditure, we included in our analysis a set of variables referring to: economic, demographic, and technology factors, lifestyle factor and factor of efficiency of secondary healthcare. The analysis was conducted for the last year for which all data were available, and we included 34 countries divided in 3 groups.

Basing on SI and KI values, we concluded that values of almost all variables are distributed normally. Exceptions are the values of real GDP PPP$ per capita and mortality rates where SI indicated mild positive asymmetry. On the other hand, all K-S Z values are statistically insignificant, which means there is no significant deviation from normality.

Testing of correlation between the dependent and independent variables shows that the following variables have a significant correlation to the variable of health

expenditure expressed as GDP %: the number of deaths caused by cardiovascular diseases, life expectancy at 65 or older and alcohol consumption per capita.

After we included all analyzed variables in the regression model, we came to the conclusion that by using 9 independent variables (their combination), we can explain 29.4% of variability of health expenditure expressed as GDP% and as much as 79% of health expenditure variability in per capita PPP$.

In order to get results as precise as possible, we included only variables with significant contribution to the improvement of prediction abilities of the model in the next set of regression models. Basing on all the described analyses, we concluded that technological changes and constant value explain 19.2% of health expenditure variability expressed as GDP%.

References:

Baker, L.C., Wheeler, S.K. (2000). Managed care and technology diffusion the case of MRI. Health Affairs, 17: 195–207.

Blomqvist, G.R., Carter, A.L. (1997). Is health care really a luxury? Journal of Health Economics, 16: 207–222.

Bodenheimer, T. (2005). High and Rising Health Care Costs. Part 2: Technologic Innovation. Ann International Medicine, 142: 932–937.

Chawla, M. (2006). The Third Transition From Red To Gray: Impact of Ageing and Changing Demographics in Countries of Europe and Central Asia. Fiscal Sustainability in the Health Sector: Issues, Lessons, Tools and Best Practices, Ljubljana, 29–30 Juni.

Christiansen, T., Bech, M., Lauridsen, J., Nielsen, N. (2006). Demographic changes and aggregate health-care expenditure in Europe. ENEPRI Research Report No. 32.

Cutler, D.M. (1995). Technology, Health Costs, and NHI. Harvard University and National Bureau of Economic Research.

Ford, E.S., Ajani, A.U. et al. (2007). Explaining the Decrease in U.S. Deaths from Coronary Disease, 1980–2000. N Engl J Med, 356: 357–941.

Fuch, R.V. (2013). The Gross Domestic Product and Health Care Spending. N Engl J Med, 369: 107–109.

Gerdtham, U.G., Sogaard, J., Andersson, F., Jonsson, B. (1992). An econometric analysis of health care expenditure: A cross-section study of the OECD countries. Journal of Health Economics, 11(1): 63–84.

Getzen, T.E., Poullier, J.P. (1991). An income-weighted international average for comparative analysis of health expenditures. Int J Health Plann Manage, 6(1): 3–22.

Hitiris, T, Posnett, J. (1992). The determinants and effects of health expenditure in developed countries. Journal of Health Economics, 11(2): 173–181.

Hoffmeyer, U.K., Thomas, R. (1994). Financing Health Care. Vol. 1. Dordrecht: Kluwer Academic Publishers.

Johnson, D., Yong, J. (2006). Costly ageing or costly deaths: Understanding health care expenditure using Australian Medicare payments data. Australian economics papers, Blackwell Publishing Ltd/University of Adelaide and Flinders University.

Kleiman, E. (1974). The determinants of national outlay on health. In: The Economics of Health and Medical Care. Ed. M. Perlman. Macmillan, London and Basingstoke.

Leu, R.R. (1986). Public and private health services: Complementarities and con.icts, Chapter The public-private mix and international health care cost. Basil Blackwell, Oxford.

Newhouse, J.P. (1977). Medical care expenditure: a cross-national survey. Journal of Human Resources, 12(1): 115–125.

Okunade, A.A., Murthy, V.N.R. (2002). Technology as a .major driver of health care costs: a cointegration analysis of the Newhouse conjecture. Journal of Health Economics, 21: 147–159.

Pammolli, F., Riccaboni, M., Magazzini, L. (2009). Sustainability of European Health Care Systems Beyond Income and Ageing, Munich Personal RePEc Archive.

Tosetti, E., Moscone, F. (2007). Health expenditure and income in United States. University of Leicester, Working Paper No 07/14.

Wanless, D. (2002). Securing Our Future Health: Taking a Long-term view. Final report. London: HM Treasury.

Weil, T.P. (1995). Comparisons of medical technology in Canadian, German, and US hospitals. Hospital & Health Services Administration, 40.

Zweifel, P., Felder, S., Meiers, M. (1999). Ageing of population and health care expenditure. Health Econ, 8: 485–496.

Zweifel, P., Felder, S., Werblow, A. (2004). Population aging and health care expenditure: New evidence on the "Red Herring". The Geneva papers on risk and insurance, 29(4): 652–666.

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