*Agnieszka Strzelecka**

GDP VS. HEALTH EXPENDITURES IN EUROPEAN COUNTRIES

Abstract. Analyses of public spending on health services require appropriate tools that will provide for capturing of changes over various periods. Identification of trends of the examined economic phenomenon plays a major role in taking decisions concerning health service management.

This paper is an attempt at identifying short- and long-term trends for selected EU countries, with view to various solutions in health services. A presentation is made also of a percentage share of health service spending in the Gross Domestic Product.

To this end, spatial and spatial and time data will be used for 16 countries: the old European Union and Poland. Those are annual data (covering 1990-2004) and derive from data bases: OECD Health Data 2004 and OECD Health Data 2006.

Key words: public expenditures on heath care (PEOHC), GDP, a space-time model, income elasticity of public expenditures on health care

1. INTRODUCTION

Financing of health services in many EU countries is becoming more complex with all kinds of financial analyses of health care becoming increasing important. The analyses are important from practical viewpoint and issues relating to comparing of financial expenditures grouped in health care are extremely difficult. Therefore, the analyses should be fully reliable and should contribute to proper functioning of Poland within the European Union. It is common knowledge that among countries with different level of economic development there are large differences in health service expenditures regardless of how they are calculated. In EU countries the differences are manifested primarily when the compared health service expenditures are expressed e.g. in dollar per capita with reference to the parity of purchasing power (PPP). The need to use such a solution is due to the differences in purchasing power of currencies in various countries. Thus it is necessary to convert nominal expenditures into so-called real term expenditures per capita (Kawiorska, Kozierkiewicz 2003, pp. 17–19).

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* Ph.D., Czestochowa University of Technology.

When assessing the level of expenditures for health care and the related interpretation based on international co-operation, one should also remember the existing differences of each system of statistical evidence and methodology applied in the analysis of the level of expenditures.

Recently it has become a necessity in EU Member States to conduct empirical studies on economy of health in order to confront the existing effectiveness of the health service system with the potential. Therefore, it is necessary to apply macroeconomic models whose chief task is to present and stress the role of government factors, acting on behalf of the society, in the process of provision and controlling the market of medical goods and services (Gerdtham, Jönsson 2000, pp. 27–48).

Due to the above, an econometric approach will be presented, applied to model health service issues. The interest that exists for a appropriate identification of values indirectly used to create health policies requires a more profound analysis of phenomena related to that area of economy.

Therefore, the key goal of this paper is to present the impact of GDP on public expenditures on health care as well as to identify short- and long-term trends for selected European Union member countries.

2. HEALTH CARE EXPENDITURES IN SELECTED EU COUNTRIES

Most frequently in EU countries there are two financial models applying to health care: insurance model (Bismarck's) with a majority of funds coming from health or social insurance (Austria, Belgium, France, Germany, Netherlands) and the budget model (Beveridge's) where health care are funded with taxes (Denmark, Finland, Ireland, Italy, Portugal, Spain, Sweden, United Kingdom) (Niżnik 2004, pp. 125–126).
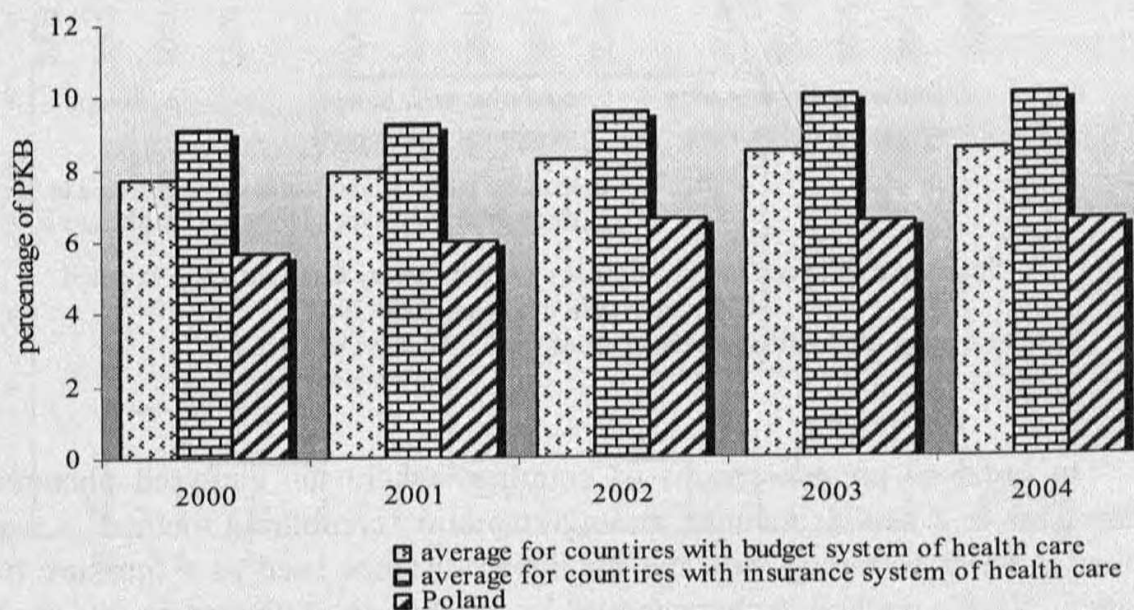
Recently, in effect of reforms, of this area of national economy, in several EU countries, systems have been created that would contain elements of both models. This is the health service system existing in Poland. It contains features of both systems and therefore it is frequently referred to as a budget-insurance system.

Apart from the system of health care in force in a given country, the health care expenditures are also affected by such factors as value of goods and services produced in the country or total private expenditures on health care.

The volume of spending in gross Domestic product on health services is an indication of measures taken in that sphere of economy resulting in allocation of funds for the examined non-material sphere.

Among the investigated EU countries, the largest amounts for health services are allocated by countries with the insurance model: France, Germany,

Austria. The lowest expenditures on health care are made by Portugal and Spain followed by Poland, which is on the very last position. The level of social development should be noted here. During the entire analysed period, the average share of health service expenditures in the final result of operations of all entities of Poland's national economy is lower in comparison with countries with the insurance health care model by about 3.3 percentage points while in relation to the countries with the budget health care system by about 1.91 percentage points (Graph 1).


average for countires with budget system of health care
average for countires with insurance system of health care
Poland

Graph 1. The share of GDP spent on expenditures on health care in some selected
UE countries in the years 2000–2004
S o u r c e: own calculations on the basis of OECD Health Data 2006.

In all the EU countries, throughout the studied period, there has been an upward trend in private expenditures measured as a percentage of GDP. Ireland and Austria are the only two exceptions. In the two countries, private expenditures on health care dropped in 2004 in relation to 2003 by about 0.1 percentage point. In Poland from 2000 to 2004 the share of private expenditures in GDP was growing on the average by 4.52% annually. However, the share remains the lowest. Changes in the financing and organisation of health services have changed the approach of Poles to the health service issues. Additionally, one should remember the impoverishment of the nation due to various transformations in our country.

However, regardless of the existing mechanisms to finance health services in all the countries, most of the funds are public (A. Strzelecka 2004, p. 64), although in Poland the proportion of the funds as a percentage of GDP was decreasing in 2003–2004 in favour of private spending (Graph 2).
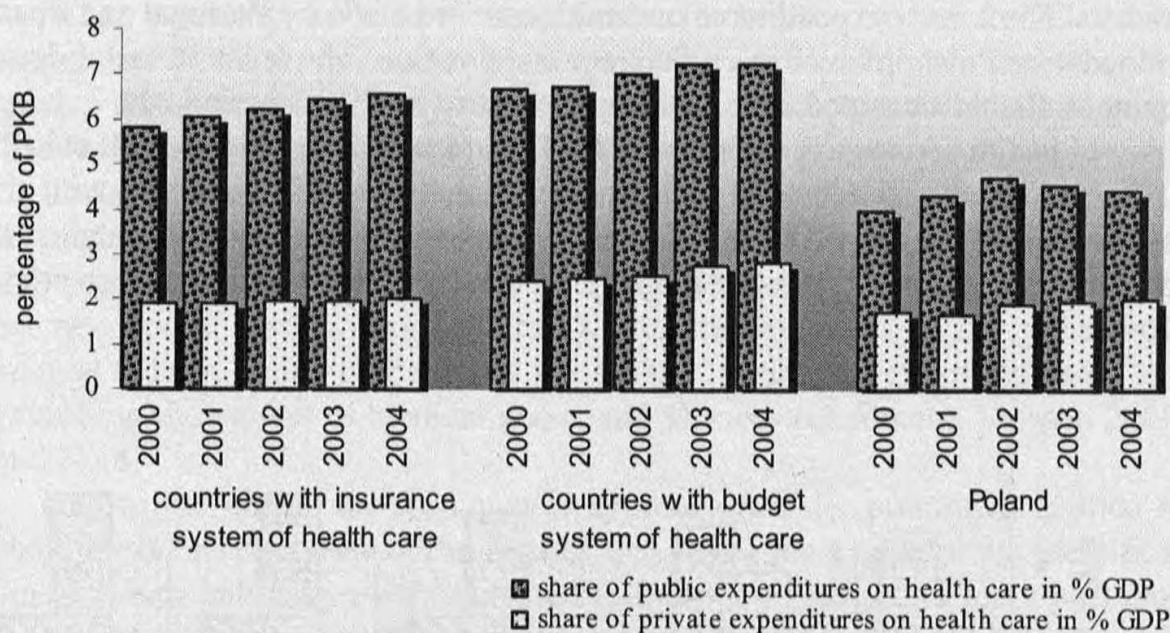
Graph 2. Public and private outlays on heath care by GDP shares in selected
UE countries in the years 2000-2004
S o u r c e: own calculations on the basis of OECD Health Data 2006.

In order to present groups of countries where the analysed phenomenon functions in a similar manner, an agglomeration combining method[1] – was applied – *Ward's method* with the Euclidean distance used as a measure of distance. Ward's method is characterised by combining of objects so that the intergroup variance describing the objects be possibly small in the resultant agglomeration (Strzelecka 2006, pp. 319–322).

In our case selected EU countries are agglomerated while the analysed public expenditures on health care can be characterised with:

• current Gross Domestic Product in USD per capita at the purchasing power parity;

• the proportion of the total number of doctors in the overall population (representing wage costs);

• number of hospital beds per capita (presents non-wage costs);

• proportion of persons aged above 65 in the overall population;

• proportion of persons below 14 in the overall population.

All the statistics used in the research refer to fourteen countries: Austria, Belgium, Denmark, Finland, France, Spain, Netherlands, Ireland, Germany,

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[1] Techniques of combinations are based determining a measure of distance used a base to start the first stage of the analysis, that is combing the closest objects into pairs, by searing in the distance matrix of the least distance between objects (groups), combining them into an agglomeration.

Poland, Portugal, Sweden, United Kingdom and Italy.[2] The classification was made on the basis of 2002 data.

Basing on a distance matrix, countries were grouped starting with a one-element agglomeration by such that combines most similar countries and ending with one combining all the examined objects. In result, it was possible to make a graphic presentation in the form of dendrogram of similarities and differences between the examined countries from the viewpoint of examined features (Graph 3).
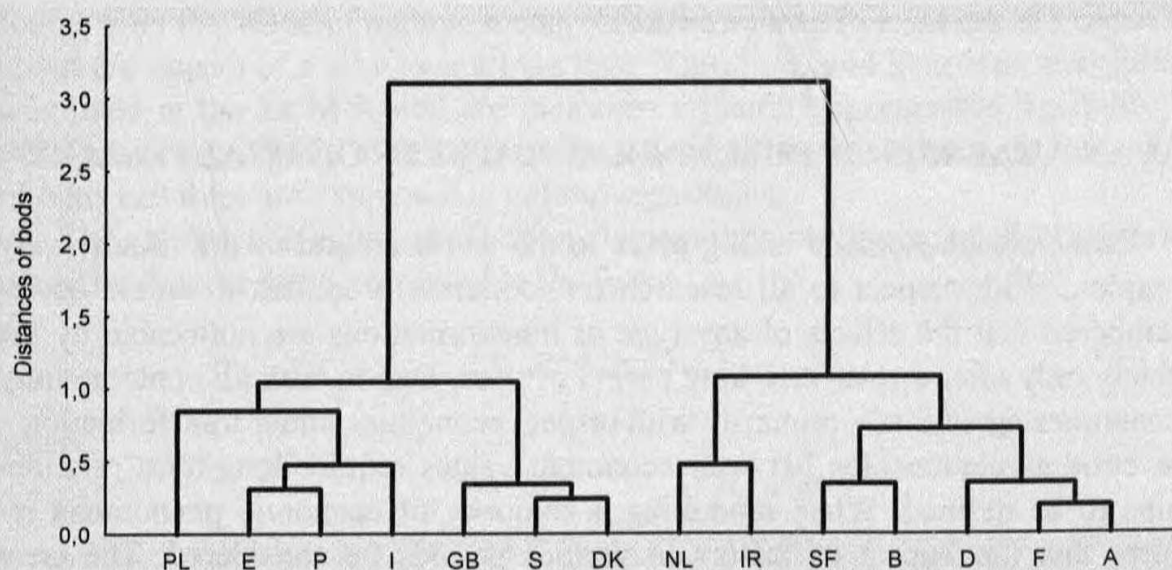
Austria – A, Belgium – B, Denmark – DK, Finland – SF, France – F, Spain – E, Netherlands – NL,
Ireland – IR, Germany – D, Poland – PL , Portugal – P, Sweden – S, United Kingdom – GB, Italy – I

Graph 3. Ward's dendrogram of selected UE countries in 2004
S o u r c e: own calculations with using Statistica 6.0.

Analysing the information in Graph 3 there are four groups of countries with a similar structure of public expenditures on health care:
1. Spain, Portugal, Italy and Poland;
2. Sweden, Denmark and United Kingdom;
3. Netherlands and Ireland;

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[2] The presented comparative analyses do not include Luxembourg and Greece since specific features of each health service system has to be considered in comparative analyses. Both countries can be treated as non-typical in the group of examined countries since in health services the share of public expenditures in total expenditures is primarily related to the functioning system of health care. In Luxembourg in over 91% health care are financed with public funds while in Greece about 40% of funds are fees contributed directly by patients.

4. France, Austria, Germany, Finland and Belgium.

Additionally, among all the examined countries, the least distances in functioning of the health care sector were in France and Austria and in Sweden and Denmark. The countries agglomerated in those two groups had closest similarities with respect to the examined features.

In Poland the health care sector creates an agglomeration with group one countries only at the last third stage of agglomerating. Thus a statement can be made that it requires primarily a verification of the level and type of provided health services. That will be a long lasting process and the results will definitely be subject to the level of economic development.

3. AN ANALYSIS OF PUBLIC EXPENDITURES ON HEALTH CARE

Economic phenomena taking place in the world around us are usually very complex. With respect to all research on economic processes it should be remembered that the effects of any type of transformations are noticeable by the society only after a relatively long period of time. Due to that, all contemporary economists agree that – primarily with respect economies under transformation – the current relationships between economic values require long-term relationships to be defined. When modelling, a majority of economic phenomena requires that the impact of factors in various periods be considered. The error made in the previous period allows to present both short-term and long-term relations. Thus, the measure of an "equilibrium error" is a deviation from the actual value of the dependent variable on the value of the variable resulting from long-term relations. (Welfe (ed.) 2000, p. 59). The difference is called an error correction term hat determines a long-term relation (equilibrium) between non-stationary variables. Models supplemented with that element are often called error correction models – ECM[3] and they permit to separate long- and short-term impact.

The ECM model comes from a model with an auto regressive distribution of ADL delays and is as follows:

$$\Delta y_t = \alpha_0 + \beta_0 \Delta x_t + (\alpha_1 - 1)(y_{t-1} - \delta x_{t-1}) + \varepsilon_t \qquad (1)$$

where:

Δy – growth of explained variable,

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[3] ECM models (*Error Correction Model*) were originally related to the London School of Economics. They were not originally related to an analysis of stationary type or a co-integration analysis. Its current interpretation and methods to estimate their parameters are due to development of issues related to time series modelling as well as research by Engele and Granger.

Δx – growth of explanatory variable,

y_{t-1} – lagged explained variable,

x_{t-1} – lagged explanatory variable,

δ – long-run multiplier,

β_0 – short-run multiplier,

α_0, α_1 –structural parameters.

Application of the error correction model in the analysis causes that we can speak of a reaction of the dependent variable in relation to the explanatory variables at different times. The force of immediate change y to change x may be found from the value of parameter β_0, while the value of parameter δ informs us about the impact of x on y over a long time. The short- and long-term multipliers contained in the ECM model are measures reflecting appropriate flexibility of the dependent variable in relation to the independent variable if only the values of both variables are expressed in natural logarithms.

The existence in equation (1) of an element representing an equilibrium error committed in the previous period in the form:

$$(y_{t-1} - \delta_0 - \delta x_{t-1}) \tag{2}$$

where:

$$\delta_0 = \frac{\alpha_0}{1 - \alpha_1}, \quad \delta = \frac{\beta_0 + \beta_1}{1 - \alpha_1}$$

makes the error not only corrected but also correcting. Another favourable feature of the ECM model is application of increments which eliminates the phenomenon of autocorrelation of the random term and limits the phenomenon of spurious regressions.

In view of the above, further below an analysis is made of public expenditures on health care with regard to Gross Domestic Product.

All the statistics used in the studies refer to sixteen countries: Austria, Belgium, Denmark, Finland, France, Greece, Spain, Netherlands, Ireland, Luxembourg, Germany, Poland, Portugal, Sweden, United Kingdom and Italy and derive from data base OECD Health Data 2004. Those are annual data and include the time period of 1990–2002.

The fact that the paper is based on time series coming from one source helps avoid differences in definitions and methods of information collection. However, not all the original time series considered in the paper are complete. Lack of specific individual pieces of information forces the use of methods that allow to estimate the missing data. The most frequently applied method to estimate date is extrapolation of the trend function.

Like a majority of economic series, also the time series of public expenditures on health care and gross domestic products are not stationary, i.e. key fea-

tures of the series (mean value, variance) change over time. It seems unjustified to identify relationships of the studied features on that basis as that may result in an apparent relationship between the variables.

All the analysed variables were made stationary after another differentiation. Due to the fact that the values of structural parameters are the same in the studied years, cross-sectional data and time series can be grouped. Further studies can be then made on the basis of cross-sectional and time data (Zeliaś 1991, pp. 152–156).

To facilitate comparison of data from various countries, there were presented in one currency (i.e. in USD) per capita in accordance with the parity of purchasing power.[4]

4. ELASTICITY OF PUBLIC EXPENDITURES ON HEALTH CARE IN SELECTED EU COUNTRIES

Transformations in the sector of health care are affected by the observed and manifested health needs as well as (or primarily) by estimates of the expenditures level on health care and the factors to be considered while determining the development of health policies. Knowledge of key economic indicators, or their values in specific periods, as well as of the perception of health services by the society facilitates management of the sector of the national economy.

The attempt at a comparison of long- and short-term trends in public expenditures on health care in Poland and 15 EU countries[5] is aimed at developing a tool supporting the transformations in the health care sector. The health service system in Poland requiring constant improvement makes us look at health care reforms through the solutions existing in other countries. Although the health care system in our country is modelled after those that exist in the other EU countries, like France, Germany or the UK, it may not be directly identified with any of them. In fact, it is a budget and insurance health care model. Therefore it seems necessary to follow both the insurance and budget model since further reforms in Poland in the sphere require a close look at the effects brought about by transformations of health care systems in individual countries.

In view of the impact of the system or organisation and financing of health care on cost generation in the existing health models, an estimation of individual equations was made with a view to different health service systems by the key funding source of goods and services in the sector.

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[4] Both variables are quoted in 1991 fixed prices. The total CPI was used as delaying agent for conversion.

[5] The EU countries discussed in the paper are those states that were members before the expansion of 1 May 2004.

Therefore, the conducted studies can be split as follows:
- studies of all EU countries and Poland,
- an analysis of the EU countries with the insurance health care system and Poland,
- an analysis of the EU countries with the budget health care system and Poland.

The space and time analyses present a model based on increments of logarithms.[6] This is a error correction model (ECM) allowing to read directly revenue flexibility in short- and long-term. Estimating the specific equations in the ECM model we are not exposed to the occurrence of spurious regression while using increments we avoid relationships between consecutive random terms.

Here below, there is a description of individual models while in the parentheses there are values of t-Student statistics.

4.1. Dynamic model for all the studied countries - PWKO[7]

The PWKO model contains dummy variables that was estimated with the method of ordinary last squares, using information on development of the examined economic factors over thirteen years: 1990-2002. The study covered 16 countries.

All the parameters proved significant statistically and there was no autocorrelation of the random term. The values of the explained variable was explained by the model in 72.25% while the random variation coefficient was 19.91%. Thus, the random factors (wages, materials) have an impact of about 18%.

$$\Delta \ln PE\hat{O}HC_t = \underset{(-2.017)}{-0.4601} - \underset{(-5.621)}{0.2262} \cdot (\ln PEOHC_{t-1} - \underset{(3.979)}{0.8374} \cdot \ln GDP_{t-1}) +$$

$$+ \underset{(9.376)}{0.7752} \Delta \ln GDP_t + \underset{(2.754)}{0.1757} \cdot Austria + \underset{(3.265)}{0.2066} \cdot Belgium + \underset{(3.499)}{0.2315} \cdot Denmark +$$

$$+ \underset{(2.801)}{0.1730} \cdot Finland + \underset{(3.656)}{0.2390} \cdot France + \underset{(4.266)}{0.2753} \cdot Germany + \underset{(2.868)}{0.1158} \cdot Greece +$$

$$+ \underset{(2.667)}{0.1624} \cdot Ireland + \underset{(3.047)}{0.1809} \cdot Italy + \underset{(2.531)}{0.1937} \cdot Luxembourg + \underset{(2,889)}{0.1816} \cdot Netherlands +$$

$$+ \underset{(3.572)}{0.1710} \cdot Portugal + \underset{(2.945)}{0.1557} \cdot Spain + \underset{(3.654)}{0.2358} \cdot Sweden + \underset{(3.252)}{0.1989} \cdot United\ Kingdom$$

$$\hat{R}^2 = 0.7225 \qquad r = 0.1050$$

(3)

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[6] Calculation of increments is a way to obtain a stationary series. Relations between GDP and spending on health care are not linear. Reducing the model to a linear form is possible here by applying logarithms.

[7] PWKO – Poland and All the Studied Countries: Systems of Health Care.

where:

$\Delta \ln PEOHC_t$ – increments of logarithm of public expenditures on health care in USD per capita by PPP in the period t (constant prices from the year 1991),

$\ln PEOHC_{t-1}$ – logarithm of public expenditures on health care in USD per capita by PPP in the period $t-1$ (constant prices from the year 1991),

$\Delta \ln GDP_t$ – increments of logarithm of Gross Domestic Product in USD per capita by PPP in the period t (constant prices from the year 1991),

$\ln GDP_{t-1}$ – logarithm of Gross Domestic Product in USD per capita by PPP in the period $t-1$ (constant prices from the year 1991),
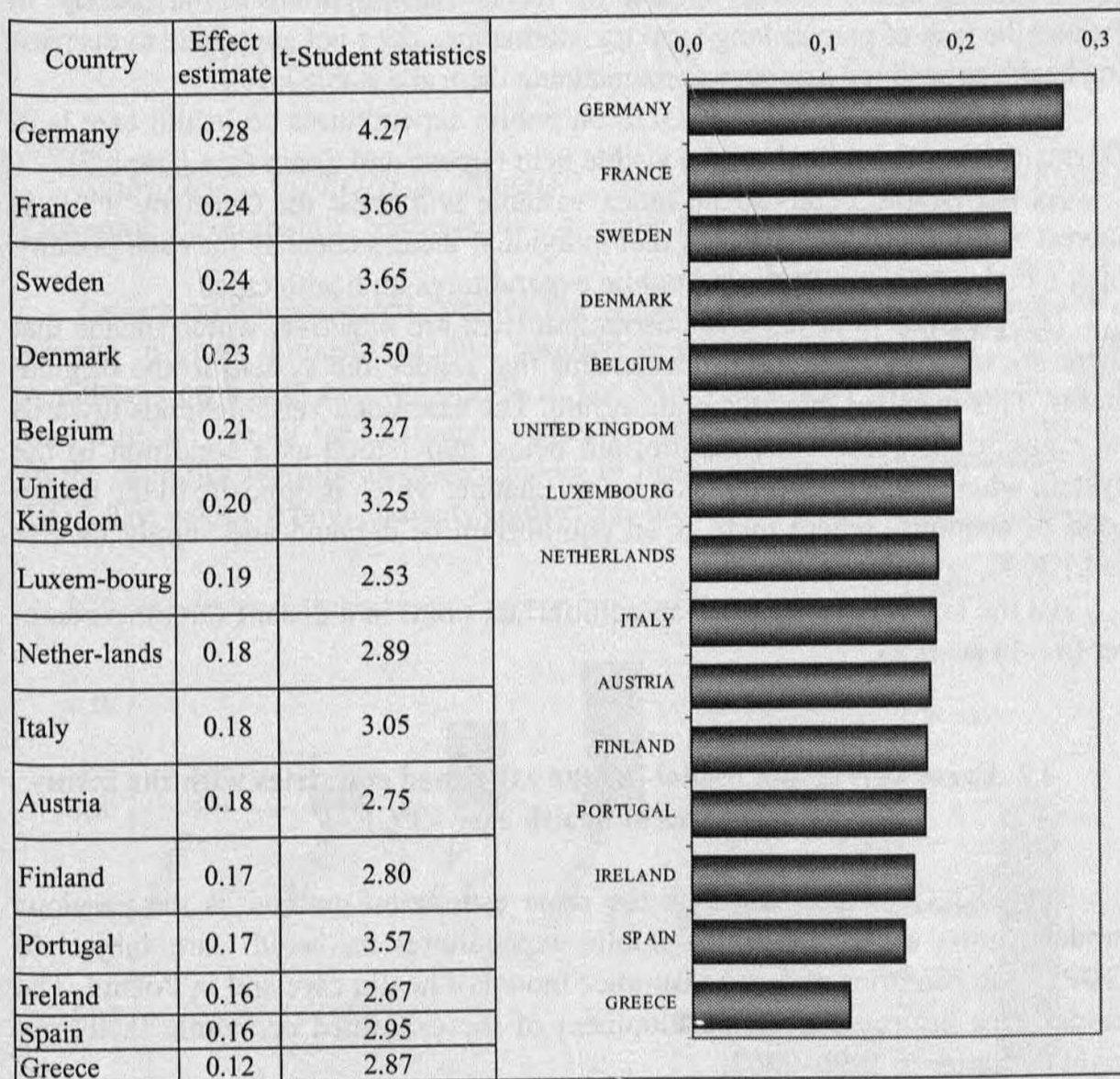
Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom – dummy variables for individual countries.

The above equation shows clearly a relationship of economic growth with the level of public expenditures on health care. A change in gross domestic product always affects the examined expenditures. Over a long period of time, a GDP growth by 1% resulted in an average growth of expenditures on health care by 0.84% while in the short-term the expenditures on health care were growing by an average of 0.78% relative to that factor. Thus, the effect of GDP is less than proportional. The conducted studies show that over a short period much less money was spent on health care than in longer run. The value of both elasticity coefficients have proven to be significant statistically.
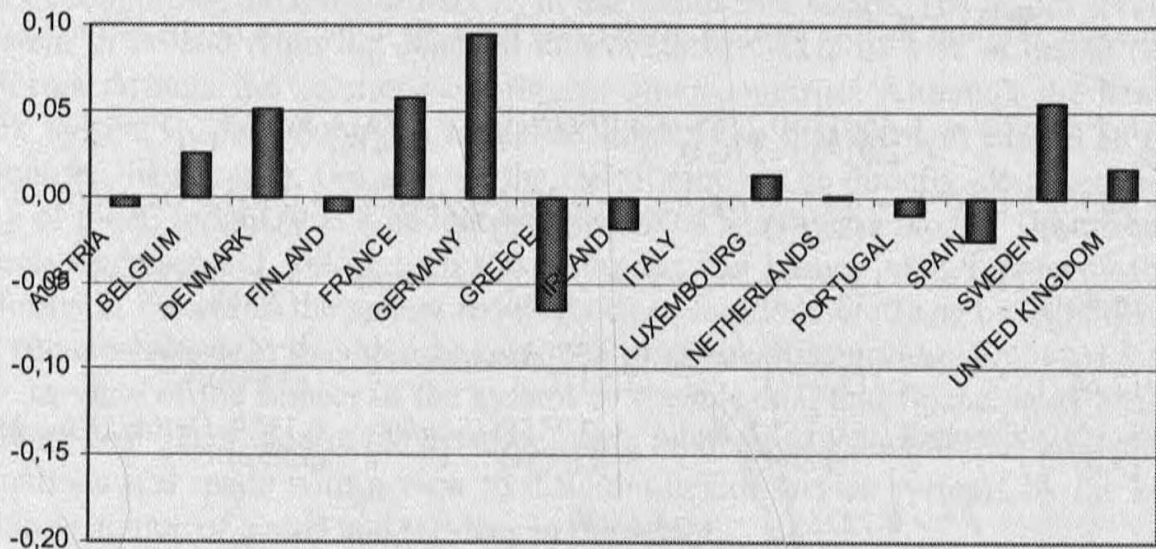
Graph 4. Deviations from the average level of constant terms for the PWKO model
S o u r c e: own calculations on the basis of OECD Health Data 2004.

Looking at the level of public expenditures on health care per capita, we can state that in eight countries: Austria, Finland, Greece, Ireland, Italy, Portugal, Spain and Poland these expenditures are below the average level for all the studied countries.

Country	Effect estimate	t-Student statistics
Germany	0.28	4.27
France	0.24	3.66
Sweden	0.24	3.65
Denmark	0.23	3.50
Belgium	0.21	3.27
United Kingdom	0.20	3.25
Luxem-bourg	0.19	2.53
Nether-lands	0.18	2.89
Italy	0.18	3.05
Austria	0.18	2.75
Finland	0.17	2.80
Portugal	0.17	3.57
Ireland	0.16	2.67
Spain	0.16	2.95
Greece	0.12	2.87

Graph 5. Spatial effects for individual countries

S o u r c e: own calculations on the basis of OECD Health Data 2004.

The expenditures are much above the average level of public expenditures for health care in the EU in Belgium, Germany, France, Denmark and Sweden. In the Netherlands and Italy the value is around the average while in Greece the expenditures are lowest as related to the average value. That is due not only to the level of affluence in the Greek society, expressed in the GDP value, but pri-

marily the existing health policies. In the existing funding system only about 60% of money comes from public sources.

On Poland health service expenditures are much below the average in the selected EU countries. The lowest public expenditures on health care in Poland is due to the existing health policies but also the recent transformations in our country. In Poland the lack of precise long-term transformations does not contribute to decreasing health expenditures or even to maintaining them at a stable level.

The most visible impact of GDP on public expenditures on health care is in Germany, France while the least visible is in Greece and Spain (see Graph 5).

As the Graph 5 shows, the index variable is highest for Germany while is lowest in Greece. This indicates that individual factors specific for each country play a major role in influencing public expenditures on health care.

The parameters at the error correction term are negative, which means that there are inherent regulating mechanisms that reduce the system to the original status. This is called dynamic equilibrium. The examined variable tends towards an equilibrium point – the equilibrium being understood as a condition of the system where there are no trends towards change, which is opposite to the notion used in economy where there is an equilibrium of demand and supply (Welfe (ed.) 2000, pp. 57–60).

All the countries will reach an equilibrium point in a distant future: parameter $(\alpha_1 - 1)$ is -0.23.

4.2. Error correction model for the examined countries with the insurance system of health care - PUKO[8]

The PUKO model, based on the same estimation method as the previous model, shows a relationship of public expenditures on health care subject to GDP in the countries with the insurance model of health care and in Poland. The model uses information on development of the examined economic factors in eight countries in 1990–2002.

All the variables have a major impact on the dependent variable and there is no autocorrelation of the random term. The explanatory variables explain the values of the studied expenditures in 86.41%, with the random variation coefficient of 19.92%. The random factors (wages, materials) have an average impact of 14% on public expenditures on health care.

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[8] PUKO - Poland and the Studied Countries with the Insurance System of Health Care.

$$\Delta \ln PE\hat{O}HC_t = \underset{(-2.285)}{-0.9068} \underset{(-5.343)}{-0.3855} \cdot (\ln PEOHC_{t-1} - \underset{(3.853)}{0.8867} \cdot \ln GDP_{t-1}) +$$

$$+ \underset{(6.447)}{0.7819} \cdot \Delta \ln GDP_t + \underset{(2.536)}{0.2291} \cdot \text{Austria} + \underset{(3.036)}{0.2700} \cdot \text{Belgium} + \underset{(3.657)}{0.3314} \cdot \text{France} + \quad (4)$$

$$+ \underset{(4.390)}{0.3890} \cdot \text{Germany} + \underset{(2.294)}{0.2515} \cdot \text{Luxembourg} + \underset{(2.720)}{0.2410} \cdot \text{Netherlands}$$

$$\hat{R}ZPORR^2 = 0.8641 \qquad r = -0.1112$$

where:

$\Delta\ln PEOHC_t$, $\ln PEOHC_{t-1}$, $\Delta\ln GDP_t$, $\ln GDP_{t-1}$, Austria, Belgium, France, Germany, Luxembourg, Netherlands – as same as in model (3).

Basing on the presented coefficients of income elasticity one can say that a growth of gross domestic product resulted in an average growth of public expenditures on health care by 0.89% in the long run and by 0.78% in the short run. Similarly to all the examined countries, public expenditures on health care in the countries with the insurance model of health care was growing slower than GDP. The values of both elasticity coefficients proved to be statistically material.
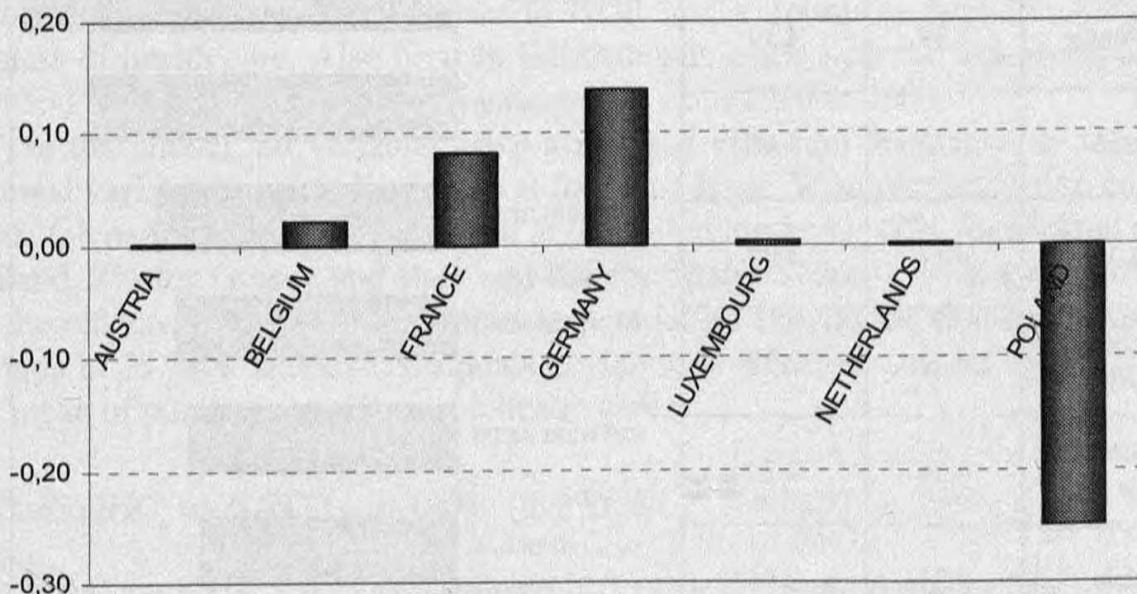
Graph 6. Levels of index variables in relation to the average value in the model PUKO

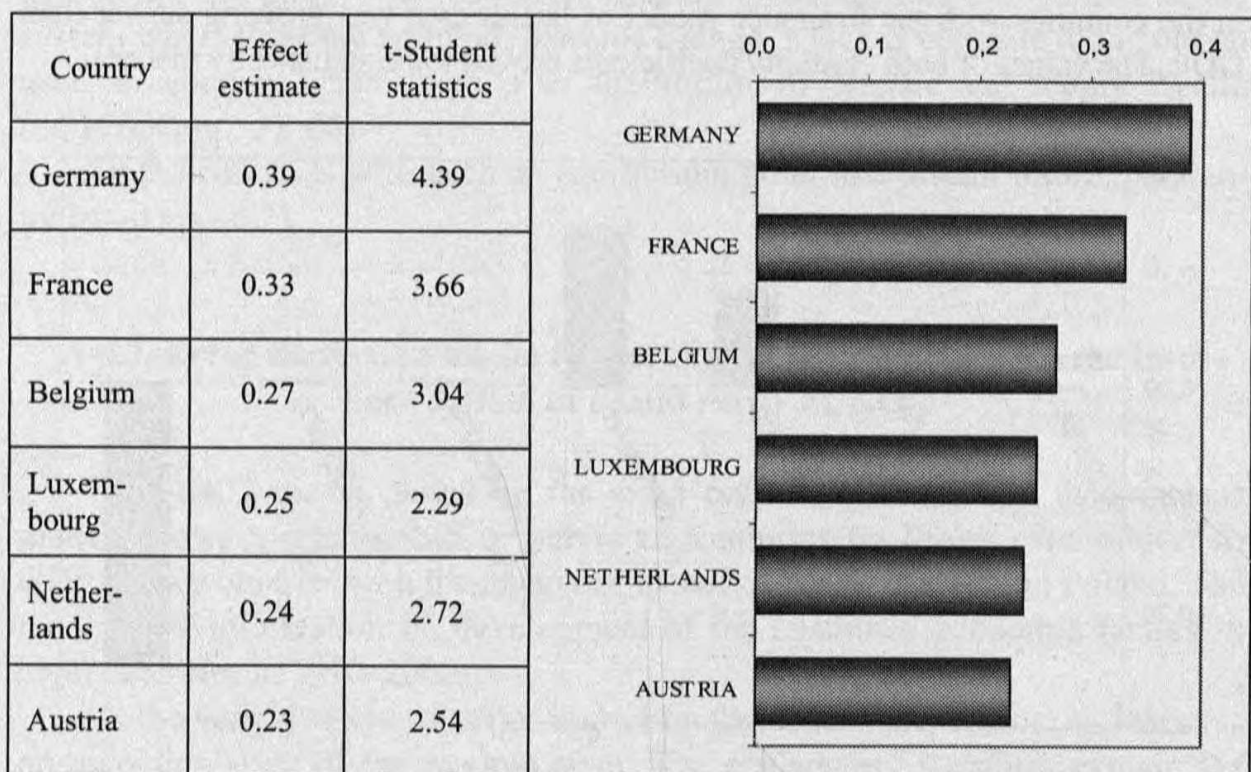S o u r c e: own calculations on the basis of OECD Health Data 2004.

In Poland, a country with a budget-insurance system of health care, expenditures on health care are below the average in the examined countries with the insurance model of health care.

The highest value of the constant term was noted for Germany. In Germany economic growth measured with GDP has the largest impact on public expendi-

tures on health care. The level of that expenditures is due e.g. to the health and social policies within the oldest health care system. In Germany, the vast financial expenditures on health care (It is USD 2.808 per capita, calculated in accordance with PPP) do not correspond to with the efficiency of the services. Stress on the appropriate training of the managerial staff in medicine directly affects cost escalation in the public sector.

In other country, in France[9] expenditures on health care administration and growing supply of health services are of major importance in determining expenditures on health services. Despite the fact that in France the funds are distributed carefully and precisely and management of health care is at a very high level, conflicts among system participants were not avoided or explosion of costs related to the provision of health services.

Gross Domestic Product has least impact on public expenditures on health care in the Netherlands and Austria (Graph 7).

Country	Effect estimate	t-Student statistics
Germany	0.39	4.39
France	0.33	3.66
Belgium	0.27	3.04
Luxembourg	0.25	2.29
Netherlands	0.24	2.72
Austria	0.23	2.54

Graph 7. Spatial effects for individual countries (model of Bismarck)

S o u r c e: own calculations on the basis of OECD Health Data 2004.

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[9] France is an excellent example of combination of funds available and organisation of the services.

In the sphere of health care, public expenditures are primarily composed of current expenditures for the provision of health services. In the countries with the insurance system more frequently citizens (particularly those with an improving social or financial status) use the services offered by private health protection institutions. Therefore, public expenditures for health care per one inhabitant of a country have been decreasing. Also reforms of the health service system are of major importance that are manifested e.g. in gradual transformations in the organisational systems of specific countries.

The explained variable tends towards a status at which the system is stable. The variable does not oscillate around the equilibrium trajectory or deviate increasingly from the long-term path. Countries with the insurance model of health care will return to the original status sooner than all the examined UE countries – Austria, Belgium, Denmark, Finland, France, Greece, Spain, Netherlands, Ireland, Luxembourg, Germany, Portugal, Sweden, United Kingdom and Italy.

4.3. ECM for the countries with the budget system of health care - PBKO[10]

Dynamic relationships are also shown in the model presenting the relation of public expenditures on health care to GDP in the countries with Beveridge's system of health care. Also here an estimate was made with the use of the OLS method, studying nine countries in the period from 1990 to 2002.

In this model, all variables have a material effect on the values of the explained variable but not all of them at the same level. With respect to five countries, the parameters proved material at the following level: 10% for Finland and Ireland, 7% for Greece and Italy and 8% for Spain. There is no autocorrelation of the random term while the explanatory variables explain the examined expenditures in 75.94%. Standard residuals deviation is less than 20% of the arithmetic mean of public expenditures on health care.

$$\Delta \ln PE\hat{O}HC_t = \underset{(-1.544)}{-0.4373} - \underset{(-3.813)}{0.1909} \cdot (\ln PEOHC_{t-1} - \underset{(2.833)}{0.8693} \cdot \ln GDP_{t-1}) +$$

$$+ \underset{(7.474)}{0.8094} \cdot \Delta \ln GDP_t + \underset{(2.134)}{0.1841} \cdot \text{Denmark} + \underset{(1.657)}{0.1331} \cdot \text{Finland} + \underset{(1.825)}{0.0941} \cdot \text{Greece} +$$

$$+ \underset{(1.638)}{0.1293} \cdot \text{Ireland} + \underset{(1.843)}{0.1420} \cdot \text{Italy} + \underset{(2.306)}{0.1426} \cdot \text{Portugal} + \underset{(1.792)}{0.1228} \cdot \text{Spain} \qquad (5)$$

$$+ \underset{(2.237)}{0.1882} \cdot \text{Sweden} + \underset{(2.014)}{0.1602} \cdot \text{United Kingdom}$$

$$\hat{R}^2 = 0.7594 \qquad r = 0.1558$$

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[10] PBKO - Poland and the Studied Countries with the Budget System of Health Care.

where:

$\Delta\ln PEOHC_t$, $\ln PEOHC_{t-1}$, $\Delta\ln GDP_t$, $\ln GDP_{t-1}$, Denmark, Finland, Greece, Ireland, Italy, Portugal, Spain, Sweden, United Kingdom – as same as in model (3).

In the countries, where health services are financed predominantly from the state budget where the funds are closely related to taxes collected, the chief determinant of public expenditures on health care is also gross domestic product. The values of both income elasticity items (short- and long-term) have proven statistically material and inform that public expenditures are less flexible than in countries with the other model of health care. They are 0.8693 and 0.8094 respectively.
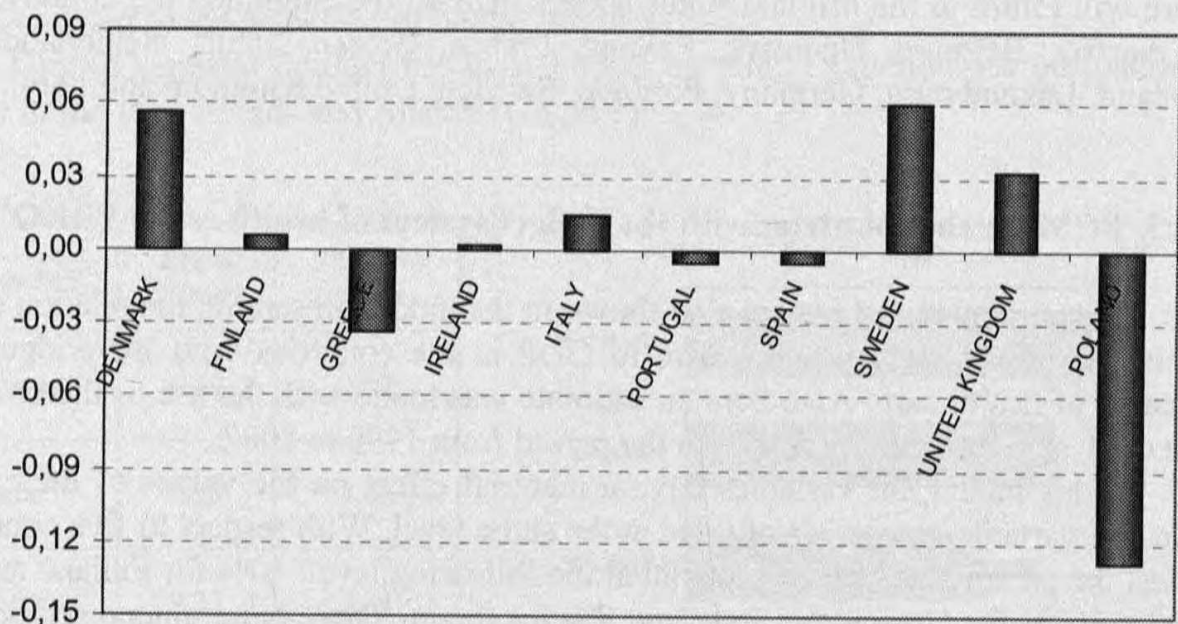
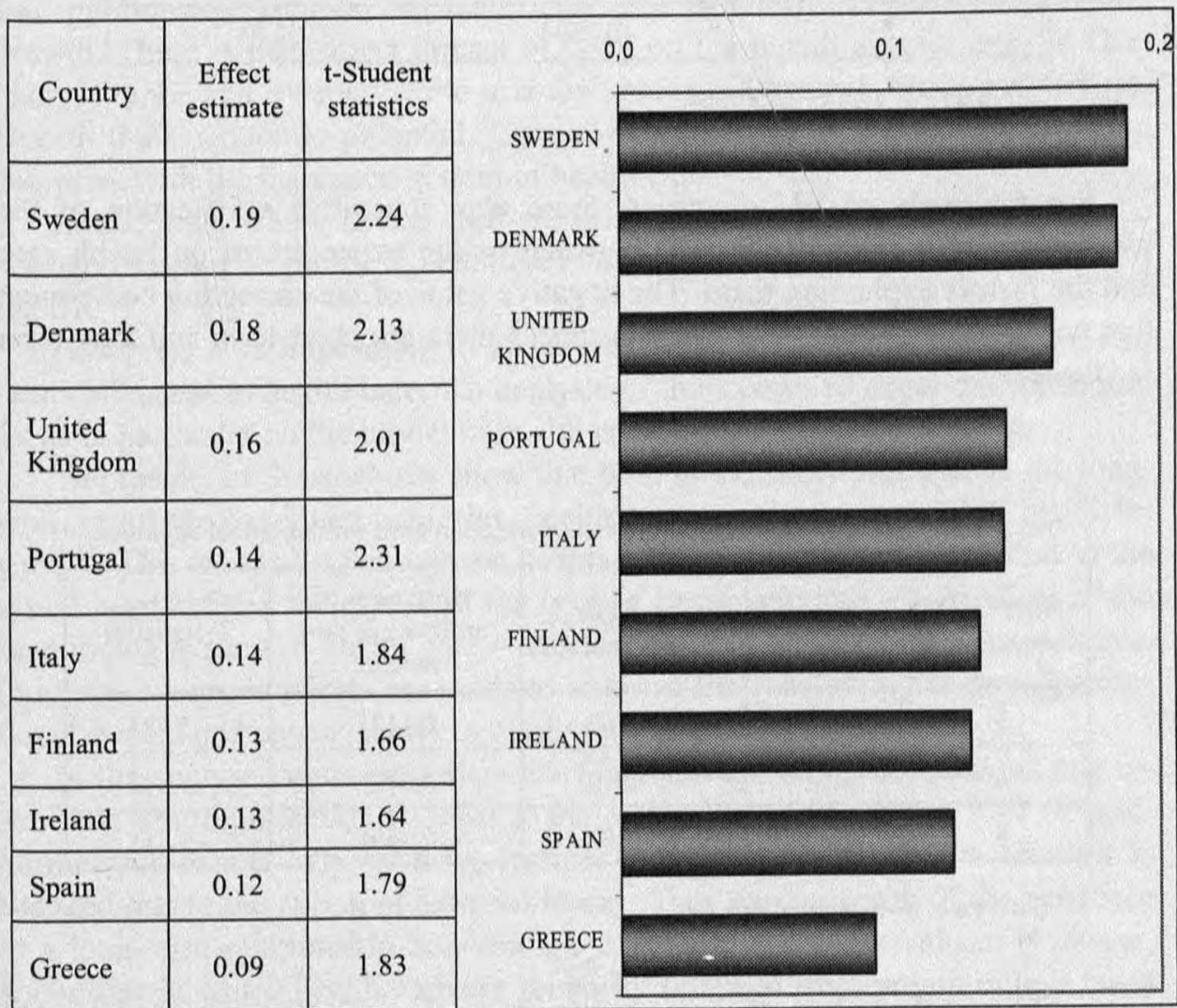Graph 8. Levels of index variables in relation to the average value in the model PBKO
S o u r c e: own calculations on the basis of OECD Health Data 2004.

In three countries, namely Greece, Portugal and Spain, expenditures on health care are below the average for the countries with Beveridge's model. In Spain the deviation from the average value is very small, hardly noticeable. In Poland the trend is similar to the one in Greece although in view of our economic potential public expenditures on health care are much lower. In Poland the examined expenditures on health care are also below the average and in Poland the difference is much larger than in Greece or Spain.

In the other countries, the expenditures on health care are in excess of the average value for countries with the budget model of health protection that had been members of the UE before the 2004 expansion. In Denmark and Sweden, public expenditures on health care are much above than the average in the examined EU countries. In those countries GDP has the strongest impact on the ex-

penditures. In Sweden this is primarily related to a fully democratic and decentralised system of health care. In this country co-payment has been reduced to a minimum while doctors have changed employment from job employment to contracts. In the UK there are no additional fees for health services which means that most of the health service costs are covered by the state.

GDP has a stronger impact on public expenditures on health care in Finland than in Ireland (Graph 9).

Country	Effect estimate	t-Student statistics
Sweden	0.19	2.24
Denmark	0.18	2.13
United Kingdom	0.16	2.01
Portugal	0.14	2.31
Italy	0.14	1.84
Finland	0.13	1.66
Ireland	0.13	1.64
Spain	0.12	1.79
Greece	0.09	1.83

Graph 9. Spatial effects for individual countries (model of Beveridge)
S o u r c e: own calculations on the basis of OECD Health Data 2004.

Countries with a budget system of health services will reach equilibrium point much later than countries from the groups described earlier.

The presented models described the development of public expenditures on health care in no less than 72% and no more than 86%. However, the applied test F confirms the materiality of the multiple correlation coefficient. Low adjustment of empirical data is due to consecutive transformation of variables (e.g. logarithm increments). The relevant information is provided in Table 1.

Determination coefficients (R^2) and test F values (F) in individual equations

Number of equation	R^2	F
3	0.7225	28.63
4	0.8641	59.66
5	0.7594	32.31

S o u r c e: own calculations.

For the analysed EU countries, there was a positive verification of the mechanism of correction by error between public expenditures on health care and the factors explaining them. The negative value of the correcting component that was obtained shows that in all instances there are short-term and long-term feedback.

Table 2

Estimates of parameters related to the error correction term for individual equations

Number of equation	Parameter	Parameter estimate	Mean error of estimate of parameter	T-statistics
3	α_1-1	−0.2262	0.1121	−5.621
4	α_1-1	−0.3855	0.0722	−5.343
5	α_1-1	−0.1909	0.0501	−3.813

S o u r c e: own calculations.

Looking at the values of the error correction term (ECT), it should be noted that that valuations of the estimates of parameters with the error correction term have the appropriate sign, i.e. $(\alpha_1 -1) < 0$. Low values of the estimates of thus parameters tell us that the examined countries will reach equilibrium in the near future. The countries with the insurance system of health care will reach equilibrium sooner than countries with budget model this sphere of national economy In other words, the examined systems are dynamically balanced ad the impact of disequilibrium in the previous period is weak (system inertia measured with the value of parameter α_1 is relatively strong).

5. CONCLUSION

The analyses of the examined issue presented in this chapter are to help select a best tool to model public expenditures on health care. The task is to present the trends existing in selected EU countries in their policies with respect to issues related to the examined non-material sphere of national economy.

On the basis of research conducted we can state that a thesis is confirmed that public expenditures on health care are primarily subject to economic growth. There is the largest impact of GDP on the health expenditures in Germany, France and Sweden while it is the lowest in Portugal, Spain and Greece. Due to their economic potential, Germany and France also are leaders among countries with the insurance system of health care.

In countries where health care are primarily based on taxes, GDP has the strongest impact on public expenditures on health care in Denmark, Sweden and the UK.

However, it is impossible to clearly split the countries by the amounts of funds allocated to health care. An analysis of the examined expenditures should focus in particular on the model of health care functioning in each country.

The results of the analyses show that both in the short-term and in the long-term, in all the examined countries, health services are perceived like necessity good [11]. This means that outlays on health care are determined in relation to the actual needs of the society. Also the type of health services – regardless of the functioning system of health care – exerts major impact on public expenditures. In all the countries efforts are made to improve the functioning of the organisational system and consequently to verify the financial system.

In the analysed countries, there are inherent regulating mechanisms that restore the health protection systems to the original condition (i.e. a state of equilibrium that results only from the features of the model) if only the situation is changed due to the action of external forces. Thus we can speak of the existence of a long-term relationship between the examined economic values. However, t countries in which health care are primarily financed from premium will reach the equilibrium sooner than others.

Summing up, we can conclude that the transformations that have taken place in our country prompt us to resort to solutions used in other countries with the insurance system of health care – although not all of them bring about the desired effects.

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[11] Revenue flexibility is higher than zero and below one. Public expenditures on health care is not flexible in relation to GDP.

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Agnieszka Strzelecka

PKB A WYDATKI ZDROWOTNE W KRAJACH EUROPEJSKICH

Analizy wydatków publicznych na ochronę zdrowia wymagają zastosowania odpowiednich narzędzi, które pozwolą na uchwycenie ich zmian w różnych okresach. Określenie tendencji badanego zjawiska ekonomicznego odgrywa niezwykle ważną rolę w podejmowaniu decyzji dotyczących zarządzania ochroną zdrowia.

Ze względu na różne rozwiązania w ochronie zdrowia w referacie podjęto próbę określenia tendencji krótko- i długookresowych dla wybranych krajów UE. Przedstawiono również udział procentowy wydatków zdrowotnych w Produkcie Krajowym Brutto.

Wykorzystane w tym celu zostaną zarówno dane przestrzenne jak i przestrzenno-czasowe dla 16 krajów: starej Unii Europejskiej i Polski. Są to dane roczne (obejmują lata 1990-2004) i pochodzą z baz danych: OECD Health Data 2004 oraz OECD Health Data 2006.

Słowa kluczowe: wydatki publiczne na ochronę zdrowia (PEOHC), PKB, model przestrzenno-czasowy, elastyczność dochodowa względem publicznych wydatków na ochronę zdrowia.