EXPENDITURES OF THE NATIONAL HEALTH FUND ON HOSPITAL SERVICES AND THE EFFICIENCY OF HOSPITALS IN POLISH VOIVODESHIPS

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Abstract

Effective use of public funds for health services is essential for functioning medical entities. The main aim of this paper is to carry out regional statistical analysis of the National Health Fund outlays for hospital services in Poland. The study attempts to determine the short-term trend for the voivodeships and dependence of expenses of the National Health Fund on the technical efficiency of hospitals or its determinants such as the number of bed-days or the number of inpatients in hospitals. The study was conducted for the Polish voivodeships on annual data for the years 2004-2012. Data come from the National Health Fund and the Central Statistical Office. The cross-section-time data were used to show trend and dependence.

Key words: *medical entities, the National Health Fund outlays for hospital services, short-term trend, technical efficiency of hospitals, space-time analysis*

1. INTRODUCTION

One of the very important issues in every country is the financing of health care which is closely connected with the existing national system of this non-material sphere. In Europe there are two basic health care models: Beveridge model and Bismarck model (André & Hermann n.d.) which functions in Poland. Each of them assumes a specific health services financing source, but according to the World Health Organization all health care systems aim at improving population health and promoting social welfare, ensuring accessibility to medical services to all citizens on equal footing and improving services quality and patients' satisfaction (The World Health Report 2000).

Although providing medical services is the prime activity of medical units, they must not overlook the financial and managerial aspects. It is all the more so important as these entities are part of health care system which cannot be discussed without paying attention to economic aspects because the system is not hermetic but dependent on economic changes. For this reason, medical units increasingly use market economy elements in their operation which above all contributes to the increase in the effective exploitation of public resources transferred to health care which is followed by a greater diligence in financial resources management. It is monitored in particular by the National Health Fund (*NHF*) which as a public payer is obliged to provide health care services for the insured through contracting service providers.

Polish health care model has undergone numerous transformations and now has the character of an insurance model, although in fact it can be thought of as a budget-insurance health care system. It is financed predominantly by health insurance contributions administered by the NHF which is supervised by the Ministry of Health (Wendt, Agartan & Kaminska 2013). Financial resources also come from the state budget and the budgets of local governments. Other entities also play an important role here: patients themselves who participate in health care costs, health insurance companies, companies offering their workers individual or group medical packets by means of which money is transfered to the health care system, and EU resources.

Each of these institutions/organizations finances health care to a different extent and performs different activities, e.g.

1. the National Health Fund finances basic health care, specialized services, in-patient and out-patient care;

2. the state budget covers the costs of highly specialized health policy programs, public blood donation, rescue services (Dobska & Rogoziński 2008);
3. local government units allocate resources from their budgets to health care, social care and public health;
4. patients' own resources, private health insurances, business and charity entities funds covering (partially or completely) the costs of treatment are used by patients who want to avoid long waiting for public health services or use a medical service not covered by public resources.

NHF - the primary payer, processes financial resources for health care services retrospectively or prospectively using capitation (primary care doctor receives fixed remuneration for every enlisted patient), global budgets (Hospitals get financial means on the basis of estimation of services provided), fixed remuneration paid out to service providers in budget systems, mixed case fee (on the basis of the system of Diagnosis Related Groups - hospitals receive financial resources for patients with similar illnesses and treatment methods and costs), service or consultation fee (service provider receives payment for his actual work), fee for a bed-days or hospitalization (the fee depends on the length of stay or illness type).

The imperfection of the medical services market results in public authorities taking at least part of the responsibility for the health care system functioning (Bem 2014), and the decreasing quality of public health services and limited access to them contribute to the bigger interest in private health care (in the EU countries private health insurance has become a standard) (Rodzinka & Paszkowska 2013). When choosing treatment in private health care units patients are aware of the indispensability and level of treatment costs. The situation is different in public health care units which struggle with organizational and financial problems. These problems increase the patients participation in treatment costs - co-payment is connected with payments for medicines and medical materials in the first place, but also the so called "informal payments" which are hard to estimate must be included here (Strzelecka 2013).

The limitation of financial resources allocated to health care and the assessment of health care entities performance, especially hospitals, is inseparable from the idea of efficiency, measuring of which plays an important role in the decision making processes of entities wanting effectiveness maximization.

The transformation of financing and organization of health care systems placed an emphasis in many countries on the size of resources (or actually their limitation) and effectiveness of activities in medical entities. This makes considering economic effects necessary in their operation. As long as such approach is easy in producing enterprises, it is not so in the case of health care entities because hospital managers must remember that the main goal of a medical unit is providing health care services and promoting health. Nowadays, however, in trying to meet market requirements this is often forgotten and "[...] instead of concentrating on the value for the patient, the interest is shifted towards hospital profitability, cost reduction and treatment outlays effectiveness." (Dart 2011). These words are true in relation to all units providing health care services, regardless of the system they operate under.

In the evaluation of a medical unit performance according to the principles of rational management, one must take into consideration the relation between the outlays and effects in a health care provision unit. This relationship is the effectiveness yardstick, and as a multidimensional concept can be discussed from the standpoint of (Suchecka & Owczarek 2011):

1. the assessing party (society, health service provider, consumer and intermediaries);
2. the product (a singular service, service bundles, e.g. in hospitals, related services bundles provided by a few entities);
3. the outlays: physical (e.g. medical personnel work) and financial (e.g. drugs costs, wages, dues).

And so the effectiveness of a health care unit can be discussed with consideration of both efficiency (effectiveness, rationality) and the cost - effect relationship. It is this relation that allows to assess the performance of these units (especially public hospitals) in economic terms. Consequently, analyzing the effectiveness in this way, we can speak of two categories of economic efficiency**:**

1. allocative efficiency – the so called Pareto efficiency; it assumes the limitation of resources and determines their allocation so that they yield best health results for the society, which means its goal is to maximize health benefits for the whole population and not just a selected group; it is measured by the life expectancy or the length of healthy life;
2. technical efficiency which refers to the verification of performance of individual health care entities and to the assessment of the unit's resources management. It is usually measured through rates such as the use of hospital beds, the number of doctors and nurses per 10 thousand people, the number of hospital beds.

Thus, every medical unit should carry out analyses which allow to determine the direction of change in health care.[1] It is crucial especially now in the times of economic crisis because looking at the problem from an economic standpoint enables an appropriate assessment of medical units activity. According to Skrodzka (2012), the basis of this assessment is the correct identification of risk in health care facility and the adequate management of this risk. This should draw the attention of public hospitals which need to address the needs of patients and meet the demands of the market at the same time. The evaluation of their performance is, therefore, necessary and requires measuring their management effectiveness and looking for more effective methods in this respect.

Considering the above, the main goal of the article is to present regional analyses of financial resources for hospital services allocated by the main Polish payer - the National Health Fund, and to describe the relationship between the NHF outlays on hospital services and the technical efficiency of hospitals, i.e. its determinants such as the number of bed-days or the number of inpatients in hospitals.

Furthermore, the article attempts a space-time analysis of the NHF outlays on hospital services in Polish voivodeships which will allow determining what kind of necessity (goods) hospital care is.

2. DATA AND METHODOLOGY

The analyses use yearly data coming from reports on the performance of the NHF and the publications of the Central Statistical Office such as: "Basic Data on Health Care in…." (the years 2004-2009) and "Health and Health Care in…" (the years 2010-2012). The analysis period covers the years 2004-2012. The comparisons are based on the population number of individual voivodeships.

An effective management of such a unit is inextricably connected with the health care services financing mechanism which is dependent on the size of health care funding. Examining its structure, we can see that although it is decreasing, the share of public outlays in the total expenditure on health care still outweighs the private sources. It can be due to the low quality of services provided by the public health care or long waiting times.

The Polish health care sector is characterized by a significant participation of public resources in health care financing and the money collected by the National Health Fund is fundamental here. For this reason the NHF outlays are presented.

The space-time analysis uses the econometric model with cross-section-time data applied. The results were obtained through the panel data model where (i) objects are the Polish voivodeships, (t) time for the 2004-2012 period. The time span selection was based on the availability of data.

[1] In the article, the authors use the terms "protection of the health" and "health care" as synonyms.

Considering the character of the present work, the concentration is placed on the economic performance. The technical efficiency of hospitals is assumed as the effectiveness measure. In order to calculate it, the non-parametric DEA method (*Data Envelopment Analysis)* was used. It does not require determining the functional relationship between outlays and effects, but information about the expenditure and effects (Hollingsworth & Peacock 2008). It allows to assess the relationship between outlays and expected effects and thus compare medical units in individual voivodeships. Furthermore**,** using DEA it is possible to measure factors expressed in different units (Mesjasz-Lech 2012).

Considering the above, in order to measure the technical efficiency of hospitals, the following indexes influencing it were proposed (Nieszporska 2010):

1. the number of inpatients in general hospitals (in person);
2. the number of bed-days in general hospitals (in days);
3. the number of beds in general hospitals (in items);
4. the number of doctors in general hospitals (in person);
5. the number of nurses in general hospitals (in person).

Considering the character of the study and the fact that the technical efficiency of hospitals is used instrumentally to determine the expenditure of the National Health Fund on hospital services, the theoretical discussion of the efficiency estimation method is skipped. And it has already been reviewed in detail in the paper Coopera, Seiforda & Zhu (2011).

One must keep in mind, though, that the consideration of quantitative measures does not paint a complete picture of the qualitative diversification or the efficiency of medical intervencies (Jacobs, Smith & Street 2013), and the presented study should be seen as only part of a comprehensive hospital effectiveness analysis.

The research examines the variables referring to the technical effectiveness of general hospitals, its determinants and the Gross Domestic Product, i.e.

1. outlays on the NHF hospital services - *WNSZ* (zl per capita, fixed prices from 2004),

2. technical efficiency of general hospitals – *EFE*,

3. Gross Domestic Product in a voivodeship - *PKB* (zl per capita, fixed prices from 2004),

4. bad-days in general hospitals – *OSOB* (days per 1000 voivodeship residents),

5. number of beds in general hospitals – *BED* (items per 1000 voivodeship residents),

6. number of inpatients in general hospitals - *LEC* (person per 1000 voivodeship residents).

After the initial analysis exponential models forms were chosen:

$$WNSZ_{it} = \alpha \cdot EFE_{it}^{\alpha_1} \cdot PKB_{it}^{\alpha_2} \cdot e^{\varepsilon_{it}} \qquad (1)$$

$$WNSZ_{it} = \beta \cdot OSOB_{it}^{\beta_1} \cdot LEC_{it}^{\beta_2} \cdot PKB_{it}^{\beta_3} \cdot n^{\eta_{it}} \qquad (2)$$

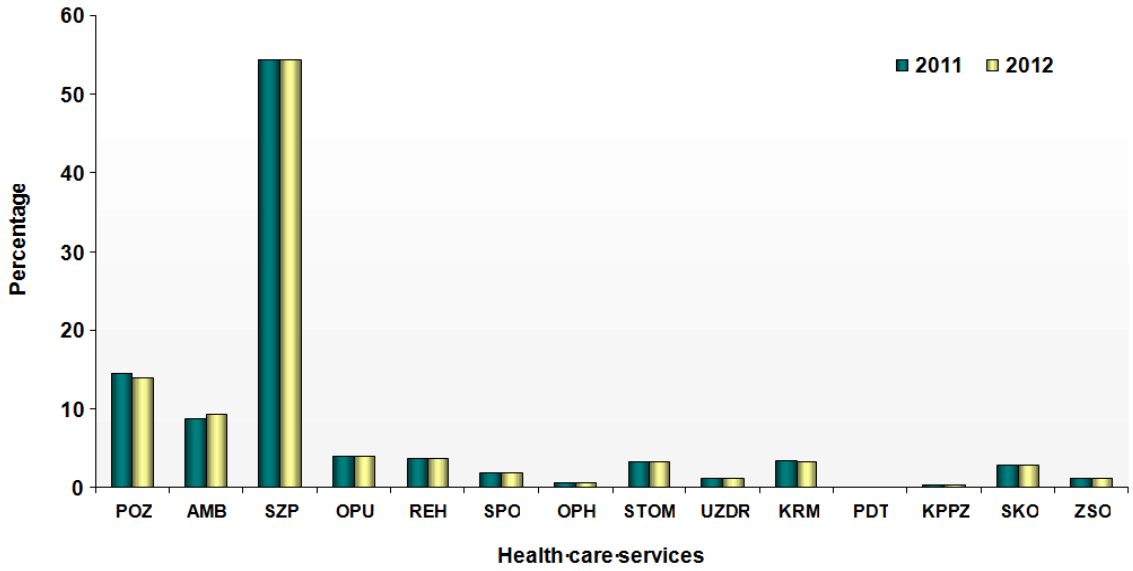
The elasticity coefficients calculated on their basis allow to make right decisions concerning the financing of health care and draw conclusions in relation to the effectiveness of medical entities and their proper management.

In the discussion of the technical efficiency of hospitals influence and GDP in individual voivodeships on the NHF hospital services the dummy variables were used because a model with artificial variables, when applied to a collection of specific objects, yields reliable results in the factual and statistical sense.

3. RESULTS

3.1 Expenditures of National Health Fund in Poland

While analyzing non-public outlays on health care, one needs to take into account the economic development which is particularly important in the current economic crisis because the market conditions have a large impact on the revenues of public entities responsible for health services provision (Bialyncki-Birula 2014). The increasing unemployment can be an example. It translates into lower health contributions which results in the dwindling of National Health Fund resources, the main institution responsible for health services financing. Figure 1 presents the type of services and their share in NHF outlays in the two last years of the discussed period.



POZ – Primary health care, AMB – Outpatient specialistic care, SZP – In-patient curative care, OPU – Psychiatric care and addiction treatment, REH - Rehabilitative care, SPO – Long-term care, OPH – Palliative and hospice care, STOM – Outpatient dental care,

UZDR – Health resort treatment, KRM – The costs of emergency medical services, PDT – First aid and sanitary transport, KPPZ – The costs of preventive health programs, health policy programs financed from the Fund's own sources, SKO- Health services contracted separately, ZSO – The supply of orthopedic equipment, medical aids and technical measures. In 2012 the costs of preventive health programs financed by the Fund include programs realized by the primary health care and out-patient care. Resort medical care, on the other hand, includes the value of services realized in a given voivodeship and an additional fee determined by the Act of 27 August 2004 on Health Services Financed from Public Funds.

Figure 1. The share of individual health services expenses in the total NHF expenses in the years 2011-2012 (in percentages)

Source: Own calculations on the basis of the NHF: 2012-2013.

In 2011 out of all services financed by it, the NHF allocated most of its resources to hospitals (27552056.83 thous. zl) whereas the smallest sum was directed to emergency aid and sanitary transportation (36158.29 thous. zl). One year later the expenses grew by 6.84% and 20.80% respectively. In all examined years (2004-2012) the NHF outlays on hospitals increased year to year by 10.50% on average, which is 1.36 percentage point less than in the case of expenses on rehabilitation and 1.53 percentage point less than on out-patient and specialized care.

Because the NHF outlays are the main public source of health care financing, in looking at their share in public outlays on health care, National of Health Accounts (NHA) information was used as it can

contribute to an efficient health care management and allow for an international comparison of expenses in this sector (Organization for Economic Co-operation and Development 2000). It turns out that in the years 2004-2012 the NHF outlays constituted between 79% and 88.4% of total current expenditure on health care (Table 1).

Table 1. Expenditure and income of the National Health Fund in the years 2004-2012 (current prices)

Years	Total current public expenditures in mln zl	Expenditures of the NFZ		Revenues of the NFZ from contributions to health insurance		Expenditures of the NFZ on hospitals in mln zl
		in mln zl	% total current public expenditures	Total in mln zl	Current period in mln zl	
2004	37071.4	29286.4	79.0	31468.0	31263.1	13241.2
2005	39515.6	31217.3	79.0	34004.1	33792.1	14569.6
2006	42968.0	36522.8	85.0	37300.2	37071.6	15688.1
2007	49960.0	42446.0	85.0	42427.2	42223.7	18623.1
2008	60170.0	51686.0	85.9	50684.1	50459.6	23802.1
2009	66764.0	57483.8	86.1	53856.3	53732.0	25775.4
2010	66505.0	58790.4	88.4	55237.6	55153.1	26905.7
2011	69223.7	60640.0	87.6	58378.7	58238.3	27552.1
2012	70770.5	61995.0	87.6	60312.3	60085.3	29437.1

Source: Own calculations on the basis of the NHF: 2005-2013 and the CSO: 2006-2014.

In the discussed period, the National Health Fund allocated to hospitals averagely 45.79% of the gross insurance contributions. It also spent about 2833.17 zl per patient treated in a hospital per annum.

Apart from insurance contributions, the NHF also collects financial resources through donations, incomes based on laws on the coordination of social security systems concerning medical benefits in kind provided for EU-EFTA citizens on the Polish territory, direct budget grants for e.g. realization of medical rescue tasks and financial incomes. From the point of view of services financing, only the mentioned contributions matter, the other incomes are marginal.

The analysis of the NHF outlays on hospital services in the years 2004-2012 by regions and per capita shows that on average they grew most year by year in the following Voivodships: Opolskie (12.21%), Kujawsko-Pomorskie (11.75%), Lubuskie (11.62%) and Łódzkie (11.51%), and least in the Śląskie (8.87%), Mazowieckie (9.39%), Wielkopolskie (9.96%) and Małopolskie (10.10%) voivodships (Figure 2).

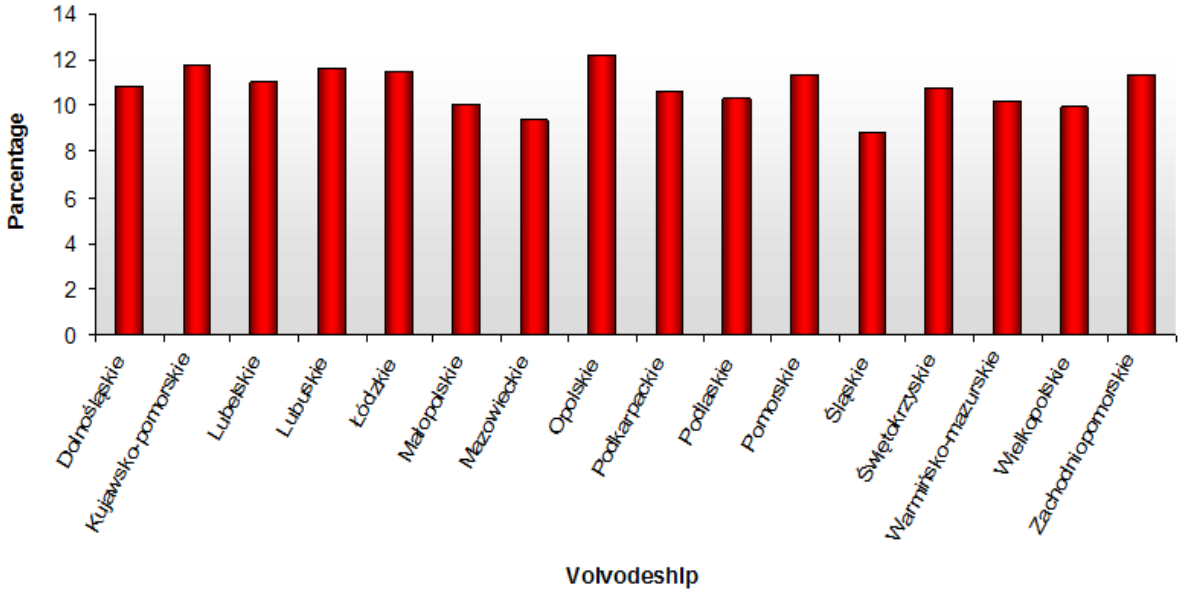


Figure 2. Medium-term tempo of NHF outlays increase on hospital services in Polish voivodeships in the years 2004-2012 (in percentages)

Source: Own calculations on the basis of the NHF: 2005-2013.

All voivodeships saw an increase in the discussed outlays and the empirical variability area was 3.34 percentage point.

In 2012, the NHF spent most on hospital services in the Mazowieckie Voivodeship (856.43 zl per capita) and least in the Podkarpackie Voivodeship (699.33 zl per capita).

The analysis of the average increase tempo of these outlays in individual voivodeships in comparison to the average increase tempo for all Polish voivodeships shows that the voivodeships differing the most are Śląskie (1.88 percentage point below the average) and Opolskie (1.47 percentage point above the average) (Figure 3)

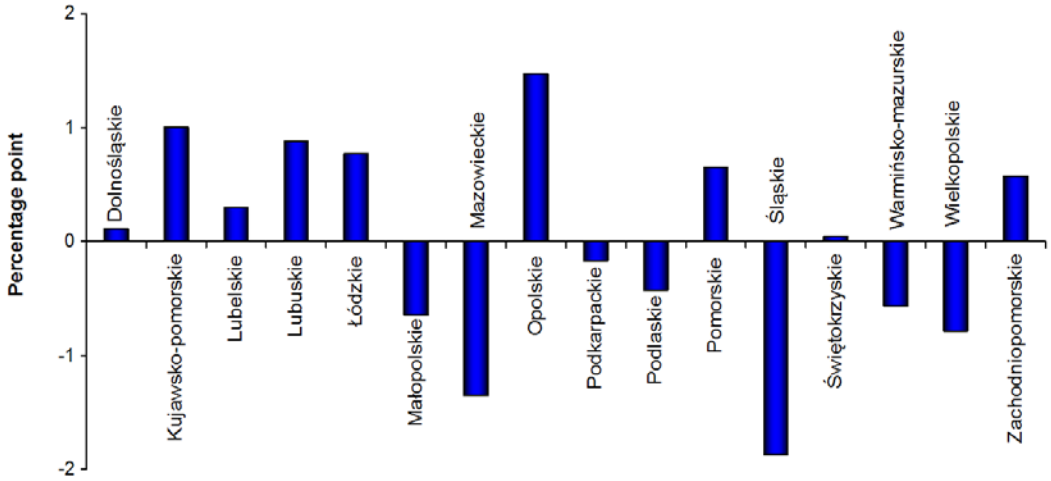


Figure 3. Deviations in the average tempo of changes in the NHF outlays on hospitals by individual voivodeships from the average tempo of these changes in all Polish voivodeships in the years 2004-2012 (in percentage point)

Source: Own calculations on the basis of the NHF: 2005-2013.

The smallest differences form the average level are observed in Świętokrzyskie, Dolnośląskie and Podkarpackie voivodships. The differences are bigger in the first and second voivodeships by about 0.03% and 0.10% respectively and the difference in Podkarpackie voivodship is smaller by about 0.15%.

3.2 A space-time analysis

All changes in the health care sector are considerably influenced by financial resources allocated to health care from public sources. The limited size of the financial means is indirectly connected with the low quality of health care and long waiting lists for medical services. Keeping that in mind, this part of the article focuses on the estimation of the National Health Fund outlays on hospital services. The fact the NHF revenue is mainly dependent on consumers contributions, and inflation, which is exceptionally high in health care (Jones 2002), is one of the reasons of high medical services costs. The determination of short-term expenditure trends is based on the Gross Domestic Product of voivodships. Furthermore, the NHF expenditure on hospital services was estimated according to:

1. technical efficiency of general hospitals,
2. hospital bed-days, the inpatient number and the number of beds.

Such a differentiation was intended to indicate how the NHF outlays on hospital services respond to the efficiency and what is their reaction to its determinants. The reason for the discussion of these outlays is the fact that the NHF incurs highest expenditure on hospital treatment.

Once the equations were processed logarithmically and the variables logarithms increases were deducted,[2] the least squares method was used to estimate the models which yielded the following results:

$$\Delta \ln \hat{WNSZ}_{it} = \underset{(5,438)}{0,036} + \underset{(2,149)}{0,742}\,\Delta \ln EFE_{it} + \underset{(14,334)}{0,997}\,\Delta \ln PKB_{it} \qquad (3)$$

R^2=62,07% F (2,125)=104,91 n=128

$$\Delta \ln \hat{WNSZ}_{it} = \underset{(3.516)}{0,024} + \underset{(2,242)}{0,547}\,\Delta \ln OSOB_{it} + \underset{(3,645)}{0,695}\,\Delta \ln LEC_{it} + \underset{(19,573)}{1,228}\,\Delta \ln PKB_{it} \qquad (4)$$

R^2=79,26% F (3,124)=162,78 n=128

The estimation of the model (4) does not consider BED because this variable turned out statistically insignificant. In the equation (3) the elasticity in relation to GDP is slightly smaller than 1 which means that the influence of GDP on the NHF hospitals outlays is less than z proportional - the GDP increase by 1% results in the growth in the discussed expenditures by 0.997%. We can therefore say that in consideration of a technical efficiency medical care is in short time perceived as a necessity good in all voivodeships. This changes, though, if the outlays depend on GDP and the efficiency determinants. In this case the elasticity in relation to GDP is bigger than 1 which means that the NHF outlays on hospitals grow faster than the Gross Domestic Product. Such index value prompts us to state that in short term hospital health care is perceived as a luxurious good in all voivodeships. The situation here, however, is somewhat out of ordinary as income elasticity coefficients point to other goods. Nevertheless, the differences between them are not huge which makes the statement that for the society hospital health care is a superior good perfectly valid.[3] It means that the demand for services in this respect is growing faster than consumers' income, and the rich spend a bigger part of their resources on health care than poorer people. The increase in health services demand is fostered by the change in the approach to health among Polish people, shorter waiting times for services, difficult material condition of the elderly who increasingly use medical services (which is also due to society aging) and the increase in the number of seriously and chronically ill people. The increase in outlays

[2] The calculation of processes increases (logarithms increases) helped eliminate the non-stationarity of variables in the average and variance.

[3] This statement is justified because people who are well-off consume health care services in hospitals more often and to a greater extent than people with lower income.

faster than the GDP growth is also caused by the fact that the beneficiaries need time to adjust the demand and outlays on medical services to the changes in their income (Lago-Penas, Cantarero-Prieto & Blazquez-Fernandez 2013).

Looking at the influence of the technical efficiency of hospitals, bed-days and the number of in-patients on the hospital services outlays, we see that the level of these variables is growing faster than the level of the explained value.

In the model (3) the NHF outlays are explained in 62% and in (4) in about 79%. This lets us assume that the models describe the value sufficiently - the F test confirms the significance of the multiple correlation coefficient ($p<0$), and the poor matching with empirical data is caused by consecutive data transformation.

Like before, also here the equation was processed logarithmically, processes increases were deducted, and then the least square method was used to estimate them which resulted in the following:

$$\Delta \ln \hat{WNSZ}_{it} = \underset{(1,974)}{0,730}\,\Delta \ln EFE_{it} + \underset{(13,651)}{1,004}\,\Delta \ln PKB_{it} + \underset{(0,946)}{0,027}\,D + \underset{(1,800)}{0,050}\,KP + \underset{(1,175)}{0,033}\,LE + \tag{5}$$

$$+ \underset{(1,732)}{0,048}\,LU + \underset{(1,389)}{0,039}\,L + \underset{(0,932)}{0,026}\,M + \underset{(0,528)}{0,015}\,MZ + \underset{(1,942)}{0,054}\,O + \underset{(1,218)}{0,034}\,PK +$$

$$+ \underset{(1,155)}{0,032}\,PL + \underset{(1,366)}{0,038}\,PM + \underset{(0,851)}{0,024}\,SL + \underset{(1,344)}{0,037}\,SW + \underset{(1,363)}{0,038}\,WM + \underset{(0,990)}{0,028}\,W + \underset{(1,994)}{0,056}\,Z$$

$$R^2=63,51\% \quad F(17,110)=11,26 \quad n=128$$

where: D – Dolnośląskie, KP – Kujawsko-pomorskie, LE – Lubelskie, LU – Lubuskie, L – Łódzkie,

M – Małopolskie, MZ – Mazowieckie, O – Opolskie, PK – Podkarpackie, PL – Podlaskie, PM – Pomorskie,

SL – Śląskie, SW – Świętokrzyskie, WM – Warmińsko-mazurskie, W – Wielkopolskie, Z – Zachodniopomorskie

In the above model only a small percent of the NHF outlays is explained but it can be attributed to the use of natural logarithms and variables increases. Besides, test F, whose p-value is 0, confirms the sufficient matching of the model.

Like in the model of (4) the influence of GDP on the NHF hospital outlays is more than proportional. However, the income elasticity coefficient value suggests a very small demand elasticity or even a proportional demand. Moreover, analyzing the model performance in regions, we can observe a statistically significant influence in only 8 voivodeships (Kujawsko-Pomorskie, Lubuskie, Łódzkie, Opolskie, Pomorskie, Świętokrzyskie, Warmińsko-Mazurskie, Zachodniopomorskie). It seems, therefore, that only in these voivodeships the NHF is oriented on hospital effectiveness and the level of GDP in allocating financial resources. It is visible thanks to the decomposition of constant into 16 parts (which is the number of the analyzed voivodeships) which allowed to identify effects characteristic of individual regions. And so through the diversification of the constant it is possible to examine the way a given model works in a specific voivodeships. It is connected with the fact that the analyzed variable initial level can differ across regions and it is not possible to determine regional differences with a single constant interpreted on the level of the whole country.

Also, the differences between voivodeships (in a multiplicative view) can be determined through the analysis of non-logarithmic values of decomposed constants (Table 2). While interpreting the parameters evaluations we have a chance to see that the elasticities in the "significant" voivodeships are bigger than 1.

Table 2 The value of the parameter estimates in model (5)

Variable	**Parameter estimate (elasticity)**
Technical efficiency of hospitals	0.730
Gross Domestic Product in voivodeships	1.004
Kujawsko-pomorskie	1.051
Lubuskie	1.049
Łódzkie	1.040
Opolskie	1.055
Pomorskie	1.039
Świętokrzyskie	1.038
Warmińsko-mazurskie	1.039
Zachodniopomorskie	1.058

Source: Own calculations

Out of the 8 voivodeships mentioned above, the weakest influence power on the NHF outlays on hospital treatment is visible in the Świętokrzyskie, Pomorskie and Warmińsko-Mazurskie regions. The reaction is strongest in Zachodniopomorskie, Opolskie and Kujawsko-Pomorskie voivodeship. It is hard to explicitly account for this phenomenon. Perhaps the above results are connected with the public resources management in regional NHF branches. Nonetheless, the verification of that would call for a more in-depth analysis.

4. CONCLUSION

Public health insurance contributions are the principal source of health care financing and make for around 95% of NHF income. NHF is the main payer and its task is to finance health services or health programs which it also develops, implements and realizes. The costs are chiefly connected with hospital treatment.

The fact that hospitals face financial difficulties and problems resulting from the changing environment makes it necessary to evaluate their performance which helps them verify their activities and find their way in the changing economic reality. The problems of hospitals are closely connected with the size of health care funding which unfortunately is not sufficient. An increasingly mentioned solution is the bigger participation of patients in treatment costs. But the sole increase of the co-payment level will not repair the standard of health care or the budgets of local medical entities which consume almost all their public financing on covering treatment costs.

The carried out space-time analysis of the National Health Fund outlays on hospital services brings us to the conclusion that apart from the GDP, the examined expenditures are influenced by the technical efficiency of hospitals or its two determinants: hospital bed-days and the number of inpatients. However, on the basis of income elasticity coefficients, it is difficult to clearly determine what kind of good hospital health care is because the coefficients value point to two kinds of goods depending on the set of explanatory values. On one occasion we are dealing with an elastic demand, and on the other with non-elastic or proportional. Hospital care is a superior good only if we consider treatment bed-days, the number of patients and the GDP.

On the other hand, if we use technical efficiency and the GDP as the explanatory variables, hospital services are perceived as a necessity good. In spite of this, though, we can conclude that the analysis of these indexes can be helpful in the examination of these entities management and improving their

effectiveness. A future study, then, should concentrate on the proper set of explanatory variables.

REFERENCES

André, Ch & Hermann, Ch n.d., *Privatisation of health care in Europe*, viewed 16 February 2015, <http://www.raumplanung.tu-dortmund.de/irpud/presom/fileadmin/docs/presom/external/Publications/WP5.pdf>.

Bialynicki-Birula, P 2014, 'Impact of global financial crisis on healthcare expenditures in developed countries', *Proceedings of the second of the Economic & Financial Conference,* International Institute of Social and Economic Sciences**,** Vienna, Austria, pp. 102-120, viewed 18 February 2015, <http://www.iises.net/proceedings/2nd-economics-finance-conference-vienna/table-of-content/detail?article=impact-of-global-financial-crisis-on-healthcare-expenditures-in-developed-countries>.

Bem, A 2014, 'Public financing of healthcare services' in T Skica & J Rodzinka (eds.) *Financing of health care system in Poland*, The Institute for Financial Research and Analyses and Department of Finance, University of Information Technology and Management in Rzeszow, Rzeszow, pp. 2-24.

CSO 2006, *Basic Data on Health Care in 2005* (Polish), Central Statistical Office, viewed 6 March 2015, <http://stat.gov.pl/obszary-tematyczne/zdrowie/zdrowie/podstawowe-dane-z-zakresu-ochrony-zdrowia-w-2009-r,3,5.html>.

CSO 2007, *Basic Data on Health Care in 2006* (Polish), Central Statistical Office, viewed 6 March 2015, <http://stat.gov.pl/obszary-tematyczne/zdrowie/zdrowie/podstawowe-dane-z-zakresu-ochrony-zdrowia-w-2009-r,3,5.html>.

CSO 2008, *Basic Data on Health Care in 2007* (Polish), Central Statistical Office, viewed 6 March 2015, <http://stat.gov.pl/obszary-tematyczne/zdrowie/zdrowie/podstawowe-dane-z-zakresu-ochrony-zdrowia-w-2009-r,3,5.html>.

CSO 2009, *Basic Data on Health Care in 2008* (Polish), Central Statistical Office, viewed 6 March 2015, <http://stat.gov.pl/obszary-tematyczne/zdrowie/zdrowie/podstawowe-dane-z-zakresu-ochrony-zdrowia-w-2009-r,3,5.html>.

CSO 2010, *Health and Health Care in 2009* (Polish), Central Statistical Office, viewed 6 March 2015, <http://stat.gov.pl/obszary-tematyczne/zdrowie/zdrowie/podstawowe-dane-z-zakresu-ochrony-zdrowia-w-2009-r,3,5.html>.

CSO 2012, *Health and Health Care in 2010* (Polish), Central Statistical Office, viewed 6 March 2015, <http://stat.gov.pl/obszary-tematyczne/zdrowie/zdrowie/zdrowie-i-ochrona-zdrowia-w-2013-r-,1,4.html>.

CSO 2012, *Health and Health Care in 2011* (Polish), Central Statistical Office, viewed 6 March 2015, <http://stat.gov.pl/obszary-tematyczne/zdrowie/zdrowie/zdrowie-i-ochrona-zdrowia-w-2013-r-,1,4.html>.

CSO 2013, *Health and Health Care in 2012* (Polish), Central Statistical Office, viewed 6 March 2015, <http://stat.gov.pl/obszary-tematyczne/zdrowie/zdrowie/zdrowie-i-ochrona-zdrowia-w-2013-r-,1,4.html>.

CSO 2014, *Health and Health Care in 2013* (Polish), Central Statistical Office, viewed 6 March 2015, <http://stat.gov.pl/obszary-tematyczne/zdrowie/zdrowie/zdrowie-i-ochrona-zdrowia-w-2013-r-,1,4.html>.

Cooper, WW, Seiford, LM & Zhu, J 2011, 'Data Envelopment Analysis: History, Models and Interpretation', in WW Cooper, LM Seiford & J Zhu (eds), *Handbook on Data Envelopment Analysis*, 2nd edn, International Series in Operations Research & Management Science 164, Springer Science & Business Media LLc, New York, pp. 1-39.

Dart RC 2011, 'Can Lean Thinking Transform American Health Care?', *Annals of Emergency Medicine*, vol. 57, no. 3, pp. 279-281.

Dobska, M & Rogoziński, K (eds) 2008, *Basics of management of health care facility* (Polish), Wydawnictwo Naukowe PWN, Warsaw.

Hollingsworth, B & Peacock SJ 2008, *Efficiency Measurement in Health and Health Care*, Routledge, New York, NY.

Jacobs, R, Smith, PC, & Street, A 2013, *Measuring Efficiency in Health Care* (Polish), ABC a Wolters Kluwer business, Warsaw.

Jones, CI 2002, *Why Have Health Expenditures as a Share of GDP Risen So Much?*, NBER Working Paper No. 9325, National Bureau of Economic Research, viewed 23 February 2015, <http://www.nber.org/papers/w9325>.

Lago-Penas, S, Cantarero-Prieto, D & Blazquez-Fernandez, C 2013, 'On the relationship between GDP and health care expenditure: a new look', *Economic Modelling*, vol. 32, May 2013, pp. 124-129.

Mesjasz-Lech, A 2012, *Economic effectiveness and ecological efficiency of reverse logistics* (Polish), Wydawnictwo Politechniki Częstochowskiej, Czestochowa.

NHF 2005, *Reports on the performance of the NHF in 2004* (Polish), National Health Fund 2005, viewed 30 January 2015, <http://www.nfz.gov.pl/new/index.php?katnr=3&dzialnr=11&artnr=3778>.

NHF 2006, *Reports on the performance of the NHF in 2005* (Polish), National Health Fund 2006, viewed 30 January 2015, <http://www.nfz.gov.pl/new/art/2041/sprawozdanie_dzial_NFZ_2005.pdf>.

NHF 2007, *Reports on the performance of the NHF in 2006* (Polish), National Health Fund, viewed 30 January 2015, <http://www.nfz.gov.pl/new/art/2700/013_2007_I_zal.pdf>.

NHF 2008, *Reports on the performance of the NHF in 2007* (Polish), National Health Fund, viewed 30 January 2015, <http://www.nfz.gov.pl/new/index.php?katnr=3&dzialnr=11&artnr=3777>.

NHF 2010, *Reports on the performance of the NHF in 2009* (Polish), National Health Fund, viewed 30 January 2015, <http://www.nfz.gov.pl/new/art/4137/011_2010_II_zal.pdf>.

NHF 2011, *Reports on the performance of the NHF in 2010* (Polish), National Health Fund, viewed 30 January 2015, <http://www.nfz.gov.pl/new/index.php?katnr=3&dzialnr=11&artnr=4501>.

NHF 2012, *Reports on the performance of the NHF in 2011* (Polish), National Health Fund, viewed 30 January 2015, <http://www.nfz.gov.pl/new/index.php?katnr=3&dzialnr=11&artnr=4999>.

NHF 2013, *Reports on the performance of the NHF in 2012* (Polish), National Health Fund, viewed 30 January 2015, <http://www.nfz.gov.pl/new/index.php?katnr=3&dzialnr=11&artnr=5502>.

Nieszporska, S 2009, 'The evaluation of hospital technical efficiency in Poland' (Polish), in R Holly, J Suchecka (eds), *The public hospital in the Polish health care system. Management and financial economy*. (Polish), Krajowy Instytut Ubezpieczeń, Agencja Wydawnicza Sowa, Warsaw.

Organization for Economic Co-operation and Development 2000, *A System of Health Accounts, Version 1.0*, OECD, Paris.

Rodzinka, J & Paszkowska, M 2013, **'**Private health insurance as a source of financing the healthcare system in Poland', *Financial Internet Quarterly „e-Finanse"*, vol. 9, no. 1, pp. 60-73, viewed 30 January 2015, <http://www.e-finanse.com/artykuly_eng/242.pdf >.

Skrodzka, W 2012, 'Risk management in health care facilities' (Polish), in S Nieszporska (ed.) *Risk management in health care system* (Polish), Sekcja Wydawnictw Wydziału Zarządzania Politechniki Częstochowskiej, Czestochowa.

Strzelecka A 2013, **'**Allocation of financial resources from public sources on medical entities – regional analysis' (Polish), *Przedsiębiorczość i Zarządzanie*, vol. XIV, no. 10, section I, pp. 385-396.

Suchecka, J & Owczarek, K 2011, 'Measures of effectiveness of medical services in the American health care system' (Polish), *Problemy Zarządzania*, vol. 9, no 3, pp. 79-92.

The World Health Report 2000, *Health systems: improving performance*, World Health Organization, viewed 25 March 2015, <http://www.who.int/whr/2000/en/whr00_en.pdf?ua=1>.

Wendt, C, Agartan, TI, & Kaminska, ME 2013, 'Social health insurance without corporate actors: Changes in self-regulation in Germany, Poland and Turkey', *Social Science & Medicine*, vol. 86, June 2013, pp. 88-95.