

EFFICIENCY OF GOVERNMENT EXPENDITURE ON HEALTH AND EDUCATION IN BULGARIA

Konstantin Kolev¹, Maya Tsoklinova²
e-mail: konstantinklv@yahoo.com
e-mail: maya.koleva@unwe.bg

Abstract

The Covid-19 pandemic has faced countries worldwide with major challenges in securing additional funds for health and education services. Due to this the goal of present paper is to estimate the efficiency of government expenditure on health and education. This is done through application of Data Envelopment Analysis (DEA) for the period 2005 – 2021. The research hypothesis, which is defended is: the expenditure are not used quite efficiently and during the studied period with their amount higher final results in health and education should be received. In this regard should be pointed out that the final results connected with health (the number of beds in hospital facilities and the number of doctors in medical and health facilities per 10,000 people of the population) and education (the number of students in public general schools and the number of students enrolled in educational qualification degree “professional bachelor”, “bachelor” and “master” in public higher schools) should be achieved respectively with 5.78% less expenditure on health of the General Government Sector and with 13.35% less expenditure on education of the General Government Sector than the incurred expenditure during the analysed period.

Keywords: efficiency, Data Envelopment Analysis (DEA), public goods, health, education

JEL: H51, H52, C67

Introduction

The modern development of state intervention in the economy is in a stage that describes the transformation of the purely social state (the “welfare state”) into the effective state, with an emphasis on the control of state expenditure and their impact on economic growth and public welfare. The concept of the efficient state appears as a counterbalance to the ever-increasing government expenditure on the one hand and the production of an increasingly expensive public product on

¹ Assoc. prof., PhD, Department of “Forest management”, Faculty of Forestry, University of Forestry, ORCID ID: 0000-0002-7060-9087

² Assist. Prof., PhD, Department of “Economics”, Faculty of General Economics, University of National and World Economy, ORCID ID: 0000-0001-5388-8056

the other. The latter necessitates the need to evaluate the efficiency of government expenditure in the context of the concept of the effective state. The redistributive function of the state is related to its intervention in the economy and, in particular, for spending general budget funds and generating a socially fair result in terms of increasing the level of public welfare. The topic of government expenditure programs is always relevant, as it is related to the amount of expenditure generated and public goods produced. The latter raises the question of the size of the public sector in the economy and the efficiency of the functions performed by the state. During the different historical periods, the state intervention in the socio-economic life of the society was different. The Covid-19 pandemic has faced countries worldwide with major challenges in securing additional funds for health and education services. This determines the goal of the article and namely to evaluate the efficiency of government expenditure on education and health. The usefulness of such studies is related to the possibility to make a strict calculation of the government expenditure policies and the goods created in the process of redistribution of budget funds, as well as to analyse the macroeconomic effects of the implemented fiscal policy. In addition to the above, in the specialized literature on state intervention in the economy, there are authors' views that government expenditure is constantly increasing, but the final result obtained is not related to the improvement of public welfare, and that high opportunity costs are generated, reflecting in the formation of large budget deficits, increasing the amount of the tax burden and loss of utility for individuals.

Theoretical framework of the research

The topic of the efficiency of government expenditure is of extremely great importance, as it is related to the redistribution of income in society and is ultimately the embodiment of the correct implementation of the state's distributive function in the economy (Цоклинова, 2022; Беев, 2015). The study of the efficiency of government expenditure is a subject of great research interest. A large part of the specialized literature focuses precisely on the evaluation of the efficiency of government expenditure on the production of public goods, which aims to establish how efficiently the public sector functions and whether budget funds are spent rationally in relation to the final product created (Yun, 2020, pp. 27-38; Ouertani, Naifar and Haddad, 2018. p. 16; Solihin, Mursinto and Sugiharti, 2017, pp. 91-102; Cincera, Czarnitzki and Thorwarth, 2011, pp. 131-139; Atmant, 2016 pp. 101-106; Hsu and Lee, 2014 pp. 136-159; Dutu and Sicari, 2016; Stefanova and Velichkov, 2019, pp. 490-497; Асенова, 2015). Researching and analysing the functioning of the public sector, the main issue here boils down to the fact that its effective functioning is not always related to the generation of large govern-

ment expenditure. Rather, the thesis that a number of authors defend is that the public sector is efficient when the amount of government expenditure is small (Lekë and Elshani, 2022, pp. 92–108; Pitlik and Schratzenstaller, 2011; Afonso, Schuknecht and Tanzi, 2005, pp. 321-347; Kimaro, Keong and Sea, 2017, pp. 34-54; Brini and Jemmali, 2016, pp. 24-34; Javaid, 2017, pp. 275-297; Herrera and Pang, 2005, p. 69; Moreno-Enguix and Bayona, 2017, pp. 105-143). The literature survey on the efficiency of government expenditure shows that research interest is focused on evaluating the efficiency of several types of government expenditure by function, among which are: social protection expenditure, education expenditure and health expenditure.

In this regard, the effective use of social protection expenditure, education expenditure and health expenditure is related to several effects important for the national economy: *first*, their effective spending ensures an increase in the level of public welfare; *secondly*, the effective absorption of the general financial resources is related to the implementation of a conscientious fiscal policy; *thirdly*, the efficiency in the implementation of redistributive state policies ensures macroeconomic stability; *fourth*, the evaluation of the efficiency of the expenditure in the field of social protection, education and health allows to apply adequate policies corresponding to the current state of the economic conjuncture and the social system; *fifth*, the effective spending of this type of expenditure is related to the creation of services important for the socio-economic system with a collective nature of consumption, including: social protection services; educational and health services. These are “merit goods”, the provision of which is a guarantee for the rational functioning of the public sector and a testimonial for the correct performance of state functions in the economy.

The education and health systems are basic social pillars, extremely important for society and for economic prosperity. Their proper management, especially with regard to the spending of budget funds, is key to achieving sustainability and growth of the economy. The latter is related to constant research and analysis of the two systems, with an emphasis on evaluating the efficiency resulting from their functioning. Based on the strategic document for the national economy – the National Development Program Bulgaria 2030, one of the main priorities is related to ensuring quality education, equal access to all levels of the education system, reducing the percentage of dropouts from the education system, investments in material infrastructure, digitization of the educational process, as well as the implementation of educational innovations, improving the health level of the population, prevention and early diagnosis of a number of diseases, as well as reducing the negative impact of risk factors that stimulate the appearance of diseases (Министерство на финансите, 2020, с. 126). The latter is related to providing additional financial resources, a large part of which is provided by the state

and/or municipal budgets. The expenditure of the general budget funds requires to periodically assessing the efficiency of the functioning of the two systems – the educational and health systems as components of the state administration and poses the question of optimizing the incurred costs.

Therefore, the research interest in the present article is related to the evaluation of the efficiency of education and health expenditure related to the „production” of socially significant goods with a collective nature of consumption. For example, R. F. Lavado and G. A. Domingo (2015) evaluate the efficiency and equity in the provision of public services in the field of health, education and social protection on the example of the economic development of countries that are members of the Asian Development Bank (ADB) (Lavado and Domingo, 2015, p. 57). The authors emphasize the technical efficiency that is generated as a consequence for spending the public financial resources collected through the tax system on health and education expenditure. R. F. Lavado and G. A. Domingo (2015) evaluate the technical efficiency of the supplied health and educational services through the DEA approach. The variables that are used in the two models are: in the first model, “health expenditure per capita” is used as an input variable and as output variable are used: “life expectancy (years)”; “DPT immunization rate” (combined vaccine against three infectious diseases in humans) and “measles immunization rate”. The second model uses the input variable “educational expenditure per capita” and the output variables: “percentage of completed primary education” and “percentage of completed secondary education” (Lavado and Domingo, 2015, p. 21). In addition, N. Van De Sijpe and G. Rayp (2004), using the DEA approach, evaluate the inefficiency of government expenditure in 52 developing countries. As a result, various factors affecting the generated inefficiency in the spending of government expenditure are identified (Van De Sijpe and Rayp, 2004, pp. 1-35). The authors use the DEA approach as the main method, in which government expenditure per capita is used as an input variable, and as output variables – “child mortality”; “measles immunization”; “rate of youth illiteracy”; “secondary education enrolment rate”; “government efficiency”.

The use of the DEA approach is a preferred method for evaluating the efficiency of the public sector functioning on the example of OECD countries by the authors A. Afonso and M. St. Aubyn (2005) (Afonso and Aubyn, 2005, pp. 227-246). The authors’ attention is directed to the efficiency of public services for education and health, posing a serious question, namely, that a specific country can be efficient in terms of the obtained technical efficiency, but at the same time generate an extremely expensive result (product) for society (Afonso and Aubyn, 2005, pp. 227-246). This is a problem for many countries, especially when public funds are spent. In the process of transformation of general public resources into public goods satisfying collective public needs, the redistributive mechanism of

the implemented economic policy is very clearly visible. The latter is related to the efficiency of the functioning of the public sector, and from there the efficiency of performing the functions of the state in the economic life of society can be evaluated. In the first model concerning the efficiency of education expenditure, A. Afonso and M. St. Aubyn use as input variables “expected teaching time in public institutions in hours of the year for students aged 12 to 14” and “the number of teachers per student in secondary education in public and private institutions” (Afonso and Aubyn, 2005, pp. 234-235). In addition to the variables that can be used as inputs, the authors list other possibilities, including: “cost per student”; “average class size”; “ratio of students to teaching staff”; “the number of study hours” as well as “the use and availability of computers”. As output variables, the authors suggest using “graduation rate”; “mathematical, reading and scientific literacy indicators of students” (Afonso and Aubyn, 2005, p. 234). Regarding the evaluation of the efficiency of health expenditure, A. Afonso and M. St. Aubyn use the following input variables: “number of hospital beds”; “medical technology indicators” as well as “healthcare employment”. As output variables are applied: “life expectancy”, “child and maternal mortality”, “number of doctors, nurses and hospital beds per thousand inhabitants”, which aim to evaluate the result of the transformation of input resources into a final public product (Afonso and Aubyn, 2005, p. 238).

In addition to the problem of the effectiveness of government expenditure on education and health is the article by the authors S. Herrera and G. Pang (2005) (Herrera and Pang, 2005, p. 69). The authors argue that even a small improvement in the efficiency of government expenditure is associated with a large impact on GDP. It is the measurement of the efficiency of government expenditure and its quantitative expression that is the problem that is solved by the above-mentioned article (Herrera and Pang, 2005, p. 69). For this purpose, the DEA approach is used, through which it is proven that countries differ not only in terms of input resources (in most cases in the form of cash flows), but also in output ones, and the quantitative relationship between input and output resources determines the degree of the achieved efficiency of the distribution function of the state.

The Covid-19 pandemic has focused public attention on the resilience and efficiency of various systems in the national economy, especially healthcare systems (Илоратов, 2023). A number of countries experienced serious difficulties with regard to the services supplied. As a result, the pressure on the health sector and governments has been severe. To meet the challenges of the progressively increasing number of infected, governments have increased the amount of health expenditure. To the latter were added the government expenditure for the purchase of vaccines. Therefore, the health sector and the efficiency of its functioning is always a matter of great responsibility and directly correlates

with the level of public welfare and is considered one of the main social pillars along with education. In this context is the article by Guo X, Zhang J, Xu Z, Cong X, and Zhu Z. (2021), in which the authors estimate health expenditure in 31 Chinese provinces in the context of health reform (Guo et al., 2021, p. 16). Accordingly, the input variable is “health expenditure over a period of 21 years”, and the output variables are: “number of medical facilities”; “number of beds in medical facilities” and “number of health workers” (Guo et al., 2021, p. 6). With the realized evaluation of the efficiency of the government expenditure on health, the authors bring out a number of recommendations of a purely political nature, which are relevant to the rationalization of the health sector in China. Such studies are a testament to the usefulness of evaluating the efficiency of government expenditure, regardless of the functional characteristics they possess. The state of the health sector and the efficiency generated by its operation is the subject of interest by authors S. Jung, J. Son, Ch. Kim and K. Chung (2023), who conduct an in-depth literature review on public health efficiency and the current state of health systems (Jung et al., 2023, p. 17). The authors highlight recent studies evaluating the efficiency of the health sector using the DEA approach and, on this basis, systematize various variables that may be involved in the quality of input and output quantities. (Jung et al., 2023, p. 7). S. Jung, J. Son, Ch. Kim and K. Chung (2023) indicate the following input variables that can be used to evaluate the efficiency of health sector: “number of medical personnel”; “number of beds in hospitals”; “number of non-medical workers”; “educational expenditure”; “number of population”; “investments made in the healthcare sector”; “number of health and treatment facilities”, as well as indicators related to the Covid-19 pandemic (Jung et al., 2023, p. 7). Accordingly, based on the studied literature, in the above-mentioned article, the authors propose to use as output variables: “number of patients”; “number of patients treated in hospitals”; “duration of hospitalization”; “number of operations performed”; “bed occupancy rate in hospitals”; “number of medical consultations performed” as well as variables directly related to the Covid-19 pandemic. (Jung et al., 2023, p. 7). The purpose of the aforementioned research is to analyse the current state of the health sector, especially after 2020, when serious budgetary resources have been invested and the pressure on health systems has inevitably had an impact on the quality of supplied services. The latter has a direct relationship with the efficiency generated in the functioning of the health sector as part of the public infrastructure.

The efficiency of the education system in Rio de Janeiro is the subject of interest by T. Mota and L. Meza (2020), who evaluate the efficiency of municipal education expenditure, aiming to systematize the factors influencing their inefficient management (Mota and Meza, 2020, p. 13). For the purposes of the study, the authors use the DEA approach. The following output variables

are used in the construction of the model: “municipal expenditure on primary education”; “number of teachers employed in primary education” and “number of students enrolled in primary education”, and as input variables – “number of students who achieved a good level of knowledge in mathematics” and “number of students who achieved a good level of knowledge in Portuguese” (Mota and Meza, 2020, p. 5). L-Ch. Liu, Ch. Lee and Gwo-Hsh. Tzeng (2004) conducted an evaluation of professional education in Taiwan using the DEA approach using 38 institutes of technology (Liu, Lee and Tzeng, 2004, pp. 353-374). The aim is to evaluate the management of educational organizations, especially comparing the level of achieved management efficiency especially between private and state educational institutes. The following input variables are used: “area of the building infrastructure of the educational institution”; “the amount of annual expenditure”; “size of the library fund, as well as the number of periodicals”. The output variables in the model include: “the number of graduates”, “research expenditure and revenue from cooperation between educational institutions and business” (Liu, Lee and Tzeng, 2004, pp. 353-374).

Evaluating the efficiency of tertiary education is an extremely important problem concerning the state policy in the field of education. The number of tertiary education graduates per capita is one of the important determinant guaranteeing economic prosperity of the countries. In this line of thought, a large part of the available articles is related to the evaluation of the effectiveness of education focus specifically on tertiary education. M. M. Kosor, M. L. Perovic and S. Golem (2019) assess the efficiency of the functioning of tertiary education on the example of the EU-28 (Kosor, Perovic and Golem, 2019, pp. 396-409). The authors focus attention on the correlation between properly implemented educational policies and the quality of the educational services created. Using the DEA approach, M. M. Kosor, M. L. Perovic and S. Golem estimate the technical efficiency generated by the functioning of tertiary education. When constructing the model, the following variables are used: as an input variable – “government expenditure on education (% of GDP)” is entered and as output variables are: “graduates of tertiary education (per 1000 people)” and “employment rates (%)” (Kosor, Perovic and Golem, 2019, pp. 396-409). The usefulness of the research is reflected in the ranking of the EU countries that show great efficiency in terms of the final created product “tertiary education” and others that lag behind in this indicator. At the same time, the obtained results allow to derive good practices regarding the effectively functioning educational market in the face of countries characterized by high efficiency on the one hand and on the other hand, to change the educational model of those countries generating less efficiency in terms of relation to the final educational product. Such research has a positive impact on the educational market, in which the product is not priced in the traditional way

and also stimulates the creation of policies, strategies and normative documents that increase its quality. The authors L. Chen, Y. Yu, A. K. Addis and X. Guo (2022) make an assessment of the efficiency of the education sector among the most economically developed countries, placing emphasis on the education sector, since its effective functioning is related to increasing the competitiveness of the national economy and is a factor stimulating the development and improvement of human capital (Chen et al., 2022, p. 17). The assessment of the efficiency of the educational product is realized through the DEA approach based on a group of variables – “total government expenditure on education”; “total government expenditure on education per capita” and “share of government expenditure on education (% GDP)” as input variables, and as output variables are used: “graduation rate of primary education”; “achievements in tertiary education” and “results of the conducted PISA test” (Chen et al., 2022, pp. 6-7). Evaluation of the efficiency of public expenditure on secondary education is the subject of research interest by B. Gavurova, K. Kocisova, L. Belas and V. Krajcik, V. (2017) (Gavurova et al., 2017, pp. 329-343). The authors use the DEA approach, constructing the model with one input variable and three output variables. For the purposes of the study, the following are used: as an input variable - “state education expenditure (% of GDP)” and as output variables are used the three main dimensions of the PISA indicator – “PISA mathematics”, “PISA reading” and “PISA science” (Gavurova et al., 2017, p. 341). The authors use the PISA indicator to show the performance of the education sector. The usefulness of the research is expressed in the grouping of EU countries according to the indicators used with a low or high efficiency rating of public expenditure on secondary education in relation to the final result, as well as the ranking of EU Member States in relation to the EU average rating of efficiency of public education expenditure.

Research methodology

The efficiency of the public goods “health” and “education” is assessed by applying input-oriented Data Envelopment Analysis (DEA) under variable returns to scale (VRS) model. The assessment has to be made on the relative efficiency of the so-called Decision making units (DMUs). For this purpose, data on input resources and the results achieved by DMUs are used. Effectively functioning DMUs receive a score equal to 1, and ineffective ones receive a score of less than 1. The analytical expression of the VRS model is presented as follows (Banker, Charnes and Cooper, 1984, pp. 1078-1092):

$\min \theta,$

with restrictive conditions:

$$\begin{aligned} \sum_{j=1}^n \lambda_j x_{ij} &\leq \theta x_{i0} & i = 1, 2, \dots, m \\ \sum_{j=1}^n \lambda_j y_{rj} &\geq y_{r0} & r = 1, 2, \dots, s \\ \sum \lambda_j &= 1; \lambda_j \geq 0, & j = 1, 2, \dots, n \end{aligned} \quad (1)$$

where θ is the efficiency of DMU₀ (one of the DMUs to be evaluated).

n – the number of DMUs subject to evaluation (in this particular case, 17 years during the studied period 2005 - 2021);

x_{i0} – the i^{th} input resource of DMU₀;

y_{r0} – the r^{th} output result of DMU₀;

λ_j – the weight of DMU_j from the studied multitude.

The choice of the model described above is justified by the fact that the goal of the optimization task is to minimize input resources. In the specific study, these are the expenditure of producing public goods. At the same time, the preferred model is characterized by variable returns to scale, since in the public sector large expenditure do not always generate significant, positive results. The reverse is also true, i.e. it is possible for small public expenditure to generate substantial positive results (Sawulski and Kutwa, 2022, pp. 64-83).

Discussion and results

Based on the literature review, two input-oriented models with variable returns to scale are constructed to estimate the efficiency of the provision of the public goods “health” and “education”. A logical positive correlation should exist between the input and output variables, the measurement of which is not the object of the present study (Hu et al., 2020, pp. 1-12). In the first model, as an input resource, the health expenditure of the General Government Sector in Bulgaria are used at prices for 2015. At the same time, the number of beds in hospitals as of December 31st and the number of doctors in medical and health care facilities are used as results per 10,000 of the population. In relation to the second model, the input variable uses the education expenditure on the General Government Sector in Bulgaria with prices for 2015, and as the output variables are used the number of students in public schools and the number of students enrolled in educational qualification degree “professional bachelor”, “bachelor” and “master’s degree” in public higher schools. For the input and output variables described above, data from the National Statistical Institute (NSI) for the period 2005-2021 are

used. In such a case, as a DMU, whose efficiency in relation to the production of the public goods “health” and “education” subject to assessment are the years of the analysed period. Table 1 presents the efficiency coefficient of health and education expenditure on the General Government Sector. In parentheses after the value of the efficiency coefficient is the ranking of the corresponding year (DMU) according to the level of efficiency of the input resource during the studied period.

Table 1: Efficiency of health and education expenditure on the General Government Sector in the period 2005 – 2021

Years (DMUs)	Efficiency Coefficient of Health Expenditure on the General Government Sector	Efficiency Coefficient of Education Expenditure on the General Government Sector
2005	0.9224 (9)	1.0000 (1)
2006	1.0000 (1)	1.0000 (1)
2007	0.9352 (8)	0.9460 (3)
2008	0.8417 (12)	0.8211 (8)
2009	1.0000 (1)	0.8364 (7)
2010	0.8519 (11)	0.9445 (4)
2011	0.9798 (3)	0.9888 (2)
2012	0.9689 (4)	1.0000 (1)
2013	0.9833 (2)	1.0000 (1)
2014	0.8324 (13)	0.8431 (6)
2015	0.8607 (10)	0.8047 (10)
2016	0.9396 (7)	0.8801 (5)
2017	1.0000 (1)	0.8146 (9)
2018	0.9471 (6)	0.7939 (11)
2019	1.0000 (1)	0.7069 (13)
2020	0.9561 (5)	0.7138 (12)
2021	1.0000 (1)	0.6065 (14)

Source: NSI and own calculations

From the values obtained of the efficiency coefficient of health expenditure on the General Government Sector it is clear that the input resources were used effectively in 2006, 2009, 2017, 2019 and 2021. At the same time, the most significant inefficiency of public expenditure was found in 2014, when the output results should be achieved with 16.76% less expenditure than used. The average value of the efficiency coefficient of health expenditure on the General

Government Sector for the period 2005 – 2021 is 0.9422, which means that the final results related to the number of beds in hospital facilities as of December 31st and the number of doctors in medical and health facilities per 10,000 people of the population should be provided with 5.78% less costs than used.

Regarding the expenditure on education of the General Government Sector, it should be noted that the effective years are 2005, 2006, 2012 and 2013. The lowest values of the efficiency coefficient are found in the last four years of the studied period, and in 2021 the value of the coefficient is 0.6065, which means that the final results should be provided with 39.35% less costs than those used. At the same time, the average value of the efficiency coefficient of the expenditure on education of the General Government Sector for the period 2005 – 2021 amounts to 0.8647 and gives reason to conclude that the final result in the field of education should be achieved with 13.35% less expenses than incurred during the analysed period.

The high inefficiency of expenditure on education of the General Government Sector, requires a deeper study of the efficiency of the education system. Consequently, the focus is on the expenditure associated with secondary schools and the expenditure associated with tertiary education. In accordance with the standard statistical data, to which NSI provides unrestricted access, two models are built. In the case of the first, public and private expenditure on general schools at prices from 2015 are considered as an input resource and as output variables the number of students in public and private schools and the number of secondary school graduates. In the second model, the public and private expenditure on tertiary education at 2015 prices are used as an input resource, and the number of students enrolled in educational qualification degree “professional bachelor”, “bachelor” and “master’s” and “doctor” as output variables and the number of students who graduated in educational qualification degree “professional bachelor”, “bachelor” and “master’s”. The data related to general schools (the first model) refer to the period 2005 – 2020 and the data related to tertiary education (the second model) refer to the period 2008 – 2020. The calculated efficiency coefficients are presented in Table 2. From their values, it is clear that public and private expenditure on general schools are used efficiently only in 2005, 2007 and 2012 and in the last three years of the studied period, the efficiency coefficients reach their lowest values. The average value of the efficiency coefficient of public and private expenditure on general schools in the period 2005 – 2020 is 0.8992, which means that the achieved results should be provided with 10.08% less public and private expenditure on general schools. Regarding the second model, evaluating the efficiency of public and private expenditure on higher schools, it should be noted that the effective years are seven, namely 2010, 2011, 2012, 2013, 2015, 2016, 2018 and 2019. The average value of the efficiency coefficient

of public and private expenditure on tertiary education for the period 2008 – 2020 is 0.9390, which means that the final results in tertiary education should be achieved with 6.1% fewer inputs.

Table 2: Efficiency of public and private expenditure on general schools and higher schools

Years (DMUs)	Efficiency Coefficient of Public and Private Expenditure on General Schools	Efficiency Coefficient of Public and Private Expenditure on Higher Schools
2005	1.0000 (1)	-
2006	0.9944 (3)	-
2007	1.0000 (1)	-
2008	0.8524 (11)	0.8398 (4)
2009	0.9167 (7)	0.7986 (5)
2010	0.9359 (4)	1.0000 (1)
2011	0.9954 (2)	1.0000 (1)
2012	1.0000 (1)	1.0000 (1)
2013	0.9358 (5)	1.0000 (1)
2014	0.8902 (9)	0.8942 (3)
2015	0.9243 (6)	1.0000 (1)
2016	0.9009 (8)	1.0000 (1)
2017	0.8580 (10)	0.9312 (2)
2018	0.7980 (12)	1.0000 (1)
2019	0.7196 (13)	1.0000 (1)
2020	0.6668 (14)	0.7437 (6)

Source: NSI and own calculations

Conclusion

Research on the production efficiency of the public goods “health” and “education” through the application of input-oriented Data Envelopment Analysis (DEA) under variable returns to scale gives rise to the following conclusions:

First, the average value of the efficiency coefficient of health expenditure on the General Government Sector during the period 2005 – 2021 is 0.9422, which means that the final results related to the number of beds in hospital facilities as

of December 31st and the number of doctors in medical and health facilities per 10,000 people of the population should be achieved with 5.78% less expenses than the ones incurred.

Second, the average value of the efficiency coefficient of education expenditure on the General Government Sector, for the period 2005 – 2021 is 0.8647 and gives reason to conclude that the final result in the field of education should be achieved with 13,35% less expenses than incurred during the analysed period.

Third, the average value of the efficiency coefficient of public and private expenditure on general schools for the period 2005 – 2020 is 0.8992 and on higher schools for the period 2008 – 2020 is 0.9390. The values of the efficiency coefficients mean that the achieved results should be achieved with 10.08% less public and private expenditure on general schools and 6.10% less public and private expenditure on higher schools, respectively.

Fourth, in the last four years of the analysed period, the lowest values of the efficiency coefficient of public and private expenditure on general schools were found, which can be interpreted as increasing inefficiency in the system of primary, lower secondary and upper secondary education.

References

- Асенова, К. (2015). Ефективност на публичните разходи в Централна и Източна Европа, Научни трудове на Русенски университет, 54(5.1). (Asenova, K., 2015, Efektivnost na publichnite razhodi v Tsentralna i Iztochna Evropa, Nauchni trudove na Rusenski universitet, 54(5.1).).
- Беев, И. (2015). За моделирането в икономиката, сборник доклади от научна конференция – Свищов, „Развитието на българската икономика – 25 години между очакванията и реалностите“, СА “Д. Ценов”. (Beev, I., 2015, Za modeliraneto v ikonomikata, sbornik s dokladi ot nauchna konferentsiya – Svishtov, “Razvitie na balgarskata ikonomika – 25 godini mezhdu ochakvaniyata i realnostite, SA “D. Tsenov”).
- Министерство на финансите. (2020). Национална програма за развитие България 2030, Детайлизирана стратегия. (Ministerstvo na finansite, 2020, Natsionalna programa za razvitie Bulgaria 2030, Detaylizirana strategija).
- Национален статистически институт. (2023). Статистически данни, (Nationalen statisticheski institut, 2023, Statisticheski dannii), available at: <https://www.nsi.bg/bg/content/766/статистически-данни> (accessed 01.07.2023)
- Цоклинова, М. (2022). Държавни преразпределителни политики в страните членки на ЕС: сравнителни характеристики, Диалог, 4, с. 32-51. (Tsoklinova, M., 2022, Darzhavni prerazpredelitelni politiki v stranite chlenki na ES: sravnitelni harakteristiki, Dialog, 4, s. 32-51).

- Шотаров, Ан. (2023). Иновационна активност на Р България по време на пандемия, *Икономически и социални алтернативи*, 29(1), с. 149-156. (Shotarov, An., 2023, *Inovatsionna aktivnost na R Balgariya po vreme na pandemiya, Ikonomicheski i sotsialni alternativni*, 29(1), s. 149-156). DOI: <https://doi.org/10.37075/ISA.2023.1.12>.
- Afonso, A., Aubyn, St. M. (2005). Non-Parametric Approaches to Education and Health Expenditure Efficiency in OECD Countries', *Journal of Applied Economics VIII*, pp. 227-246, DOI: 10.2139/ssrn.498383
- Afonso, A., Schuknecht, L., Tanzi, V. (2005). Public sector Efficiency; An international comparison', *Public Choice*, 123, pp. 321-347, <https://doi.org/10.1007/s11127-005-7165-2>
- Atmant, D. H. (2016). Efficiency of Government Spending For Human Development Some Districts in Central Java During 2008 – 2012, *JDE (Journal of Developing Economies)*, 1(2), pp. 101-106, DOI: <http://dx.doi.org/10.20473/jde.v1i2.3695>
- Banker, P., Charnes, A., Cooper, W. (1984). Some models for estimating technical and scale inefficiencies in data envelopment analysis, *Management Science*, 30(9), pp. 1078-1092.
- Brini, R., Jemmali, H. (2016). Public spending efficiency, governance, political and economic policies: Is there a substantial causal relation? Evidence from selected MENA countries', *International Journal of Economics and Financial Management*, 1(1), pp. 24-34.
- Cincera, M., Czarnitzki, D., Thorwarth, S. (2011). Efficiency of public spending in support of R&D activities,. *Reflats et perspectives de la vie économique*, 2011/1-2 (Tome L), pp. 131-139, <https://doi.org/10.3917/rpve.501.0131>
- Chen, L., Yu, Y., Addis, A. K., Guo, X. (2022). Empirical Assessment and Comparison of Educational Efficiency between Major Countries across the World, *Sustainability*, 14, 4009, p. 17, <https://doi.org/10.3390/su14074009>
- Dutu, R., Sicari, P. (2016). Public Spending Efficiency in the OECD: Benchmarking Health Care, Education and General Administration', *OECD Economics Department Working Papers*, No. 1278, OECD Publishing, Paris, <https://doi.org/10.1787/5jm3st732jmq-en>
- Gavurova, B., Kocisova, K., Belas, L., Krajcik, V. (2017). Relative efficiency of government expenditure on secondary education, *Journal of International Studies*, 10(2), pp. 329-343, doi:10.14254/2071-8330.2017/10-2/23
- Guo, X, Zhang, J, Xu, Z, Cong, X, Zhu, Z. (2021). The efficiency of provincial government health care expenditure after China's new health care reform, *PLoS One*. 16(10):e0258274, doi: 10.1371/journal.pone.0258274, PMID: 34644313, PMCID: PMC8513862, p. 16.

- Herrera, S. H., Pang, G. (2005). Efficiency of public spending in developing countries: an efficiency frontier approach, Policy Research Working Paper Series 3645, The World Bank, p. 69.
- Hsu, Y.-Ch., Lee, Ch.-Ch. (2014). Performance Measurement in Public Spending: Evidence from a Non-Parametric Approach, Romanian Journal of Economic Forecasting, XVII (3), pp. 136-159.
- Hu, Y., Wu, Y., Zhou, W., Li, T., Li, L. (2020). A three-stage DEA-based efficiency evaluation of social security expenditure in China, PLoS ONE 15(2): e0226046, pp. 1-12, <https://doi.org/10.1371/journal.pone.0226046>
- Javaid, M. F. (2017). Expenditure Efficiency and Fiscal Size: an Empirical Evidence from Developing Asian Countries, Pakistan Economic and Social Review, 55(1), pp. 275-297.
- Jung, S. Son, J. Kim, C. Chung, K. (2023). Efficiency Measurement Using Data Envelopment Analysis (DEA) in Public Healthcare: Research Trends from 2017 to 2022, Processes, 11, 811, p. 17, <https://doi.org/10.3390/pr11030811>
- Lavado, F. R., Domingo G. A. (2015). Public Service Spending: Efficiency and Distributional Impact – Lessons from Asia, Asian Development Bank, p. 57.
- Kimaro, E. L., Keong, C. C. Sea, L. L. (2017). Government expenditure, efficiency and economic growth: a panel analysis of Sub Saharan African low income countries, African Journal of Economic Review, 5(2), pp. 34-54.
- Kosor, M. M., Perovic, L. M., Golem, S. (2019). Efficiency of Public Spending on Higher Education: a Data Envelopment Analysis for EU-28, Problems of Education in the 21st Century, 77(3), pp. 396-409, doi:10.33225/pec/19.77.396
- Lekë, P., Elshani, A. (2022). The Efficiency of Educational and Healthcare public expenditures in Kosovo: A Data Envelopment Analysis Technique, Ekonomika, 101(2), pp. 92-108, DOI: <https://doi.org/10.15388/Ekon.2022.101.2.6>
- Liu, Li-Ch., Lee, Ch., Tzeng, Gwo-Hsh. (2004). DEA Approach for the Current and Cross Period Efficiency for Evaluating the Vocational Education, International Journal of Information Technology & Decision Making, 03(02), pp. 353-374, <https://doi.org/10.1142/S0219622004001069>
- Mota, R. A. T., Meza, A. L. (2020). The use of DEA as a tool to evaluate public expenditure on education: an analysis of the cities of the state of Rio de Janeiro, Engineering Sciences, Annals of the Brazilian Academy of Sciences 92 (2), p. 13, <https://doi.org/10.1590/0001-3765202020190187>
- Moreno-Enguix, M. Del R., Bayona, L. V. L. (2017). Factors Affecting Public Expenditure Efficiency in Developed Countries, Politics & Policy, 45(1), pp. 105-143, <https://doi.org/10.1111/polp.12194>.
- Ouertani, N. M., Naifar, N., Haddad, H. B. (2018). Assessing government spending efficiency and explaining inefficiency scores: DEA-bootstrap analysis in the

- case of Saudi Arabia, *Cogent Economics and Finance* 6: 1493666 p. 16, <https://doi.org/10.1080/23322039.2018.1493666>
- Pitlik, H., Schratzenstaller, M. (2011). Growth implications of structure and Size of Public Sector, No.404 WIFO, Working papers.
- Sawulski, J., Kutwa, K. (2022). Does spending on social-welfare policies reduce poverty? An assessment of the European Union countries using impulse-response and efficiency methods, *Optimum, Economic Studies* NR 1(107), pp. 64-83, DOI: 10.15290/oes.2022.01.107.05
- Stefanova, K., Velichkov, N. (2019). Comparative Analysis of Higher Education Expenditures in European Union Member States from Central and Eastern Europe, *Proceedings of the 15th International Conference of ASECU, Sustainable Development Goals 2030: Challenges for South and Eastern European Countries and the Black Sea Region, organized on the Occasion of 100th Anniversary of the University of National and World Economy, UNWE Publishing Complex*, pp. 490-497.
- Solihin, A., Mursinto, D., Sugiharti, L. (2017). Efficiency and Effectiveness of Government Expenditure on Education at Districts/Cities Level in East Java Indonesia, *Asian Social Science*; 13(8), pp. 91-102, <https://doi.org/10.5539/ass.v13n8p91>
- Van De Sijpe, N., Rayp, G. (2004). Measuring and Explaining Government Inefficiency in Developing Countries, *Working Papers of Faculty of Economics and Business Administration, Ghent University, Belgium* 04/266, Ghent University, Faculty of Economics and Business Administration, pp. 1-35.
- Yun, W. S. (2020). Assessment of Public Expenditure Efficiency: a Review, *Journal of Economics and Sustainability (JES)*, 2(2), pp. 27-38.