Analysis of the Relationship between the Size and Structure of Public Expenditure and Socio-economic Development[1]

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Abstract

The relation between the levels of public expenditure and their impact on economic growth and socio-economic development is long-term issue investigated by the public finance theory. Relevant answers to it are also of great importance for economic practice. The aim of the present study is to analyse the relation between the levels and structures of public expenditures and the Human Development Index. The study uses the Data Envelopment Analysis (DEA) to identify countries that effectively use public spending to achieve the highest socio-economic development of society. The findings indicate that the total amount of public expenditure does not have significant impact on the socio-economic development; however public expenditures in "productive" sectors of public services (especially education, health and social services) have the potential of positive impact on the socio-economic development.

Keywords: *public expenditure, socio-economic development, DEA, health, education and welfare, Human Development Index*

JEL Classification: H51, H52, H53, I15, I25

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Introduction

The question about the scope and structure of public expenditure and their impact on economic growth and socio-economic development has been the subject of theoretical discussion of economic science since its inception and has not become obsolete even today. The majority of the works inspired by the fundamental models of growth in public spending, like (Peacock and Wiseman, 1961; Musgrave, 1969; Rostow, 1971; Meltzer and Richard, 1983) indicate that there should be a relation between the level of public spending and GDP growth (also Afonso, Schuknecht and Tanzi, 2005; Kuhry, 2004; Mandl, Adriaan and Ilzkovitz, 2008; Landau, 1983; Ram, 1986; Fölster and Henrekson, 2001; Haque and Kim, 2003; Mitchell, 2005; Bose, Haque and Osborn, 2007; Sutherland et al., 2009; Schaltegger and Torgler, 2006, Ivančík, 2017 and many others). However, almost all results of the above-mentioned studies are inconclusive.

As regards the structure of public expenditure, studies devoted to the efficiency of public spending in certain sectors of public services (especially education and health) point to the importance of these expenses in relation to socio-economic development (Verhoeven, Gunnarsson and Carcillo, 2007; Grigoli, 2012; Doménech and Garcia, 2008; Clements, 1999; Hauner, 2007).

Some authors stress that GDP may not be the best indicator to evaluate the real wealth of a country. Many authors suggest that the Human Development Index (published in 1990) should be considered as more comprehensive indicator of socio-economic development than GDP or GDP per capita (Kelley, 1991, or Zelenický, Stehlíková and Tirpáková, 2009; Verner, 2011 in our conditions), because it provides much more comprehensive situation and includes also the results of education or health care services. The Human Development Index (HDI) combines information about economic growth (expressed by per capita GDP), achieved education level (expressed by indicators of literacy of the adult population) and achieved health status (expressed by indicators of life expectancy).

The importance of the switch from GDP as main indicator of wealth of nations to more complex approaches is very visible in theory and practice. The socio-economic development of a country is based on systematic targeting of society's activities in the relevant country, and, following their accomplishment, society (country) moves to a higher stage of development, and thus increases its social and economic development. "The ABCD model – Achieving Better Community Development is a planned process of changes based on the inputs, processes, outputs and outcomes" (Ledwith, 2011). During implementation of the process, society advances which provides personal development of members

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of society and the right conditions for their disposition within society and social justice, but also to obtain power or influence in the relevant territory. The outcome of the implementation process is to strengthen the society that is taking concrete steps associated with social, economic, environmental or political areas (Srebalová, 2014). In this stage of development, development of public services, health care and public scrutiny can occur (Pekár, 2012). In the results phase, society is characterized by acquiring new knowledge and skills, which society acquired by the process but also by an increase in the quality of life in society (Pierson and Skocpol, 2002). Cary (1970) talks about the development of the stages through which any economy or company achieve its set objectives. Rostow (1971), in his development model, says that a country has to go through certain stages of development and when development reaches a level of maturity a certain proportion of public spending will then shift from supporting infrastructure to supporting education, health and social welfare in the country. "Quality of life" – is related to the stages of economic growth; after the fifth stage of "high mass consumption" there then follows the stage of the search for ways to improve the living conditions of man, i. e. "the stage of looking for a new quality of life" (Stanek et al., 2008, p. 183). Search for the interdependencies between volume, structure of public expenditure and the level of socio-economic development of quantified indices of human development can contribute to answering the currently discussed question of productive public investment (Semmler et al., 2007; Agénor and Neanidis, 2011; Constatini and Martini, 2008; Rao, 1998).

One might expect that countries with higher GDP can afford a better quality of education and health care than poorer countries ("the rich countries have better education systems, simply because they can" – Mankiw, 2000, p. 479) and with this they automatically achieve also better results from delivering educational and health care services (higher HDI). Our paper tries to test, if this kind of assumption is also a reality.

Human Development Index

Today many authors suggest that HDI captures the socio-economic development of a country more accurately than the increase or decrease of the gross domestic product, as it is creating an environment in which individuals can develop their full potential and lead productive lives in accordance with their needs and interests (for example Mehrotra and Peltonen, 2005).

The Human Development Index takes into account human health, literacy levels and material standard of living (Noorbakhsh, 1998). Human health is

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currently expressed as the average life expectancy at birth (LEB – life expectancy at birth). Level of education (ALR – adult literacy rate) is determined as a proportion of literate population (CGE – combined gross enrolment), as well as a combined market share of the population of the relevant age group attending school at first, second and third levels (EDU – Education). Material standard of living is expressed as Gross National Income per capita (GNIPC) in USD, calculated in purchasing power parity (PPP) between nations. The method of calculating the HDI is as follows (http://hdr.undp.org/en/composite/HDI):

$$\text{LEB index} = (\text{LEB} - 25)/(85 - 25) = (\text{LEB}/60) - 0.416666 = 0.01667^{*} \text{LEB} - 0.41666 \quad (1)$$

$$\text{ALR index} = (\text{ALR} - 0) / (100 - 0) = \text{ALR}/100 \quad (2)$$

$$\text{CGE index} = (\text{CGE} - 0) / (100 - 0) = \text{CGE}/100 \quad (3)$$

$$\text{EDU index} = 2/3 * (\text{ALR}/100) + 1/3 * (\text{CGE}/100) = 2/300 * \text{ALR} + 1/300 * \text{CGE} = 0.00667 * \text{ALR} + 0.00333 * \text{CGE} \quad (4)$$

$$\text{GNIPC index} = (\ln \text{GNIPC} - \ln 100) / (\ln 40000 - \ln 100) = (\ln \text{GNIPC} - 4.60517) / (10.59663 - 4.60517) = 0.16690 \ln \text{GNIPC} - 0.76802 \quad (5)$$

$$\text{HDI} = 1/3^{*}(\text{LEB index} + \text{EDU index} + \text{GDPPC index}) \quad (6)$$

Values of the HDI indicator can range from 0 to 1, where 0 is the lowest state and 1 the highest possible state of development of a country or region. Based on the calculated value of HDI, countries can be divided into three main groups (UNDP, 2016).

- countries with very high levels of human development (HDI > = 0.8),
- countries with high levels of human development (HDI > = 0.790.75),
- countries with medium levels of human development (HDI = 0.74 – 0.53),
- countries with low levels of human development (HDI < 0.53).

The evaluation of the wealth of a country by GDP per capita (GDPPC) and by HDI may differ significantly as presented by the data published by UNDP, calculating HDI (<http://hdr.undp.org/en/composite/HDI>) see Table 1.

The fact that HDI is a composite indicator and all its constituent parts are fed by specific categories of public spending may generate the assumption that higher total public expenditures (GDP per capita calculations include public expenditures) and higher sectoral public expenditures for education and health automatically increase also HDI.

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Taking this into the account the investigation of the reality of this assumption is really important both for economic theory and practice. Our aim is to add a bit to this kind of discussion.

Table 1

Human Development Index and its Components

		HDI	Life expectancy at birth	Expected years of schooling	Mean years of schooling	GNIPC	GNIPC rank minus HDI rank
HDI rank	Country	Value	(years)	(years)	(years)	(2011 PPP USD)	
		2014	**2014**	**2014**	**2014**	**2014**	**2014**
1	Norway	0.944	81.6	17.5	12.6	64,992	5
2	Australia	0.935	82.4	20.2	13.0	42,261	17
3	Switzerland	0.930	83.0	15.8	12.8	56,431	6
4	Denmark	0.923	80.2	18.7	12.7	44,025	11
5	Netherlands	0.922	81.6	17.9	11.9	45,435	9
6	Germany	0.916	80.9	16.5	13.1	43,919	11
6	Ireland	0.916	80.9	18.6	12.2	39,568	16
8	United States	0.915	79.1	16.5	12.9	52,947	3
9	Canada	0.913	82.0	15.9	13.0	42,155	11
9	New Zealand	0.913	81.8	19.2	12.5	32,689	23
11	Singapore	0.912	83.0	15.4	10.6	76,628	–7
25	Slovenia	0.880	80.4	16.8	11.9	27,852	12
26	Spain	0.876	82.6	17.3	9.6	32,045	7
27	Italy	0.873	83.1	16.0	10.1	33,030	4
28	Czech Republic	0.870	78.6	16.4	12.3	26,660	10
29	Greece	0.865	80.9	17.6	10.3	24,524	14
30	Estonia	0.861	76.8	16.5	12.5	25,214	12
35	Slovakia	0.844	76.3	15.1	12.2	25,845	5
36	Poland	0.843	77.4	15.5	11.8	23,177	10
37	Lithuania	0.839	73.3	16.4	12.4	24,500	7

Source: UNDP (2016).

Methodology

The goal of this study is the empirical testing of interdependencies between volume and structure of public expenditures and the HDI. The results of this testing should indicate possible answers to following important questions:

1. What is the relationship between the amount of public expenditure and the HDI? Do increased public expenditures automatically increase HDI, or is this relation non-linear?

2. What is the relationship between the structure of public expenditure and the HDI? Are public educational and health care expenditures of any level "productive" from the point of HDI increase?

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Analysis of the efficiency of public spending is realized with the use of Data Envelopment Analysis (DEA) method. DEA represent the set of nonparametric methods of linear programming abstracted from random errors. DEA is expected to allow the identification of countries that are efficient from the point of the relation between the level and structure of public spending and the socio-economic development of society measured by the HDI. We build for example on the methodology of the study "Public sector efficiency: evidence for new EU member states and emerging markets" (Afonso, Schuknecht and Tanzi, 2008), however we modify their approach by changing the indicator of gross domestic product GDP indicator to the HDI.

DEA models were designed as a specialized modelling tool for assessing the efficiency, effectiveness, and productivity of homogeneous production units. The aim of DEA methods is division of the investigated objects (in our case countries) into efficient and inefficient according to the size of consumed resources (in our case, public spending) and the quantity of manufactured products (in our case, socio-economic development of the society). The seminal studies about DEA are connected with names like Charnes, Cooper and Rhodes (CCR) and Banker, Charnes and Cooper (BCC). In our conditions we can mention Vintrová (2005), Majorová (2007) or Friebelová and Klicnarova, 2007. In addition to basic CCR and BCC models, there are also some certain modifications. The authors of one of them, referred to as model SBM are Cooper, Seiford, Tone (2007) – their model is the basis for the definition of super efficiency.

Our study uses also the Malmquist Index (MI), which evaluates changes in productivity of DMU (decisive unit) between two periods of time (Coelli et al., 2005). MI has the capacity to distinguish between impacts of technical efficiency (TE) improvements and technical (technological) change (TC), however our data allow us to sue only composite MI.

The study used current data on public expenditure and the human development index (Eurostat and United Nations databases). Public expenditure is broken down by function, based on the international standard COFOG (Classification of the Functions of Government). The most current available data from the databases was entered into the analysis. Changes in the development of efficiency were observed from 2010 to 2013 (last available year). All outputs are processed in the program DEA Solver Pro Version 13.0 and in PASW Statistics, version 18.0.0.

The used output and input indicators for DEA are characterised in the Table 2 and Table 3. The object of analysis is European Union 27 countries and two extra countries with very close links to the EU (Norway and Switzerland).

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Table 2

Input Indicators (Public Spending on Welfare, Health and Education) and Output Indicators (HDI) for DEA, Years 2010 and 2011

Country/DMU	(I)Health	(I)Education	(I)Welfare	(O)HDI	(I)Health	(I)Education	(I)Welfare	(O)HDI
	2010				2011			
Belgium	0.002571130	0.002057952	0.006228182	0.882948	0.002643974	0.002160420	0.006404038	0.886295
Bulgaria	0.000227682	0.000184296	0.000653685	0.772813	0.000232582	0.000189418	0.000673770	0.775303
Cyprus	0.000703421	0.001583490	0.002483824	0.848341	0.000722952	0.001529263	0.002578860	0.852421
Czech Republic	0.001118343	0.000758032	0.001946600	0.862667	0.001158025	0.000801365	0.002028087	0.866084
Denmark	0.003756420	0.003133211	0.010965162	0.908388	0.003766643	0.003039711	0.011007426	0.920488
Estonia	0.000587119	0.000731049	0.001568001	0.837598	0.000621587	0.000776439	0.001572357	0.849472
Finland	0.002749360	0.002300508	0.007969650	0.878046	0.002868876	0.002367320	0.008285342	0.880921
France	0.002456369	0.001741324	0.007305171	0.880909	0.002515700	0.001735984	0.007506842	0.884196
Greece	0.001384351	0.000810034	0.003858880	0.866494	0.001196937	0.000823849	0.003813765	0.863849
Netherlands	0.002989082	0.002149383	0.006306611	0.909236	0.003057013	0.002133251	0.006375077	0.919071
Croatia	0.000657867	0.000535924	0.001534519	0.807277	0.000671980	0.000512371	0.001560961	0.814140
Ireland	0.002846028	0.001790137	0.006118198	0.908000	0.002694535	0.001752004	0.006033695	0.908905
Iceland	0.000619928	0.000572729	0.001261881	0.826808	0.000680537	0.000621931	0.001273280	0.830676
Lithuania	0.000355482	0.000530346	0.001169722	0.810715	0.000400751	0.000577508	0.001182538	0.812219
Latvia	0.003989914	0.004109619	0.015048619	0.885995	0.004010238	0.004193107	0.015396999	0.888370
Luxembourg	0.000495311	0.000546128	0.001706935	0.821484	0.000518661	0.000515436	0.001708770	0.822832
Hungary	0.000837627	0.000897043	0.002188505	0.824161	0.000892554	0.000944844	0.002275241	0.822286
Malta	0.002195013	0.001376515	0.006280890	0.906467	0.002236874	0.001425293	0.006228661	0.910604
Germany	0.004949674	0.003506094	0.011597960	0.939844	0.005277844	0.003654469	0.012520138	0.940697
Norway	0.000473368	0.000527396	0.001580244	0.829136	0.000466338	0.000542179	0.001565805	0.833472
Poland	0.001242354	0.001315423	0.002907577	0.819367	0.001136453	0.001208450	0.002952967	0.825132
Portugal	0.002789619	0.001810350	0.007570534	0.879002	0.002864278	0.001844059	0.007659360	0.881273
Austria	0.000206108	0.000208054	0.000909618	0.784498	0.000271354	0.000271126	0.000846010	0.785841
Romania	0.000946477	0.000614443	0.001606260	0.827445	0.000939110	0.000596983	0.001570679	0.831645
Slovakia	0.001205681	0.001175979	0.003210834	0.875823	0.001246909	0.001182818	0.003352179	0.877255
Slovenia	0.002269219	0.001904604	0.005029656	0.906006	0.002236618	0.001779637	0.005056860	0.901455
United Kingdom	0.001529042	0.001043139	0.003854399	0.866617	0.001483698	0.001010068	0.003859329	0.870483
Spain	0.001076754	0.003306440	0.007217609	0.924370	0.001260296	0.003743062	0.007994591	0.924559
Switzerland	0.002670662	0.002576525	0.008318632	0.901034	0.002934809	0.002778833	0.008773149	0.902599
Sweden	0.002012599	0.001184876	0.005383126	0.868561	0.001970936	0.001126276	0.005455600	0.872746
Italy	0.002571130	0.002057952	0.006228182	0.882948	0.002643974	0.002160420	0.006404038	0.886295

Source: Own processing based on Eurostat (Eurostat Yearbook 2014) and United Nations (Human Development Index Trend 2012 – 2013) Databases.

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Table 3

Input Indicators (Public Spending on Welfare, Health and Education) and Output Indicators (HDI) for DEA, Years 2012 and 2013

Country/DMU	(I)Health	(I)Education	(I)Welfare	(O)HDI	(I)Health	(I)Education	(I)Welfare	(O)HDI
	2012				2013			
Belgium	0.002778740	0.002214198	0.006704029	0.888567	0.002809166	0.002265464	0.006965382	0.888117
Bulgaria	0.000250941	0.000190823	0.000698423	0.778056	0.000260455	0.000212051	0.000770150	0.779238
Cyprus	0.000670989	0.001374344	0.002555884	0.851546	0.000639351	0.001360931	0.002480834	0.849723
Czech Republic	0.001139228	0.000768744	0.002006026	0.866594	0.001093654	0.000771415	0.001992930	0.868058
Denmark	0.003947914	0.003183218	0.011198498	0.921084	0.003937224	0.003169281	0.011320455	0.922809
Estonia	0.000679285	0.000838806	0.001655125	0.854625	0.000719148	0.000852463	0.001697276	0.858618
Finland	0.003032066	0.002382959	0.008788494	0.881737	0.003108165	0.002409579	0.009275847	0.882038
France	0.002567674	0.001752930	0.007725847	0.885878	0.002606759	0.001776552	0.007907006	0.887026
Greece	0.000999332	0.000776356	0.003589892	0.864588	0.000840542	0.000744210	0.003180500	0.863427
Netherlands	0.003206150	0.002132353	0.006479363	0.920454	0.003189056	0.002106490	0.006610954	0.920442
Croatia	0.000689572	0.000494600	0.001559781	0.816563	0.000696575	0.000519364	0.001470529	0.817146
Ireland	0.002643547	0.001662009	0.006155554	0.909851	0.002690539	0.001572264	0.005970394	0.912306
Iceland	0.000653607	0.000645350	0.001327789	0.832975	0.000663009	0.000655539	0.001336146	0.837134
Lithuania	0.000419598	0.000618101	0.001220503	0.812857	0.000412733	0.000651242	0.001295023	0.815756
Latvia	0.004187268	0.004477444	0.016002195	0.888447	0.004439529	0.004723121	0.016556898	0.890070
Luxembourg	0.000513798	0.000468610	0.001667290	0.823268	0.000522687	0.000478797	0.001680396	0.825371
Hungary	0.000946004	0.001001327	0.002406202	0.829676	0.001029751	0.001052534	0.002501638	0.837045
Malta	0.002329365	0.001456991	0.006430431	0.914763	0.002443987	0.001500042	0.006591981	0.915162
Germany	0.005774699	0.003887727	0.013578854	0.942293	0.005811265	0.003816442	0.013602328	0.942322
Norway	0.000472252	0.000549530	0.001615351	0.837545	0.000480197	0.000547089	0.001680548	0.839926
Poland	0.001048794	0.001042040	0.002934664	0.826513	0.001086439	0.001105805	0.003092448	0.828075
Portugal	0.002942941	0.001893479	0.007922329	0.883921	0.002983473	0.001928605	0.008167788	0.884234
Austria	0.000255349	0.000200139	0.000818885	0.787848	0.000289594	0.000204360	0.000826940	0.790759
Romania	0.000992132	0.000594062	0.001659764	0.835893	0.001023631	0.000679599	0.001679463	0.839492
Slovakia	0.001216008	0.001118659	0.003236299	0.877625	0.001211713	0.001139147	0.003290330	0.878008
Slovenia	0.002426581	0.001860412	0.005604389	0.901390	0.002400713	0.001723184	0.005347746	0.902098
United Kingdom	0.001377220	0.000924790	0.003900298	0.873709	0.001348360	0.000907231	0.003947086	0.874257
Spain	0.001386910	0.003933517	0.008316607	0.926960	0.001398460	0.003832662	0.008314828	0.928312
Switzerland	0.003085126	0.002923392	0.009431579	0.903746	0.003182947	0.003004701	0.009871877	0.905172
Sweden	0.001954517	0.001105546	0.005563034	0.871708	0.001931667	0.001098480	0.005661803	0.873189
Italy	0.002778740	0.002214198	0.006704029	0.888567	0.002809166	0.002265464	0.006965382	0.888117

Source: Own processing based on Eurostat (Eurostat Yearbook 2014) and United Nations (Human Development Index Trend 2012 – 2013) Databases.

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Results and Discussion

The BCC core model results for the whole period are shown in the Table 4 (showing the global relations).

T a b l e 4

Results of BCC Model

Country	2010		2011		2012		2013	
	Result	Ranking	Result	Ranking	Result	Ranking	Result	Ranking
Belgium	0.9258	22	0.8990	25	0.9163	26	0.8825	26
Bulgaria	1.0000	1	1.0000	1	1.0000	1	1.0000	1
Cyprus	0.9231	23	0.8890	26	1.0000	1	0.9771	23
Czech Republic	0.9999	10	1.0000	1	1.0000	1	1.0000	1
Denmark	0.9999	10	0.9999	10	0.9999	14	0.9999	12
Estonia	1.0000	1	1.0000	1	0.9999	14	1.0000	1
Finland	0.9347	21	0.9138	24	0.9999	14	0.9999	12
France	0.7102	28	0.6983	28	0.8050	29	0.6887	30
Greece	1.0000	1	1.0000	1	1.0000	1	1.0000	1
Netherlands	0.9572	20	0.9999	10	0.9999	14	0.9999	12
Croatia	0.9999	10	0.9999	10	1.0000	1	1.0000	1
Ireland	1.0000	1	1.0000	1	1.0000	1	1.0000	1
Iceland	–	–	–	–	–	–	1.0000	1
Lithuania	1.0000	1	1.0000	1	1.0000	1	1.0000	1
Latvia	1.0000	1	0.9999	10	0.9809	22	0.9998	22
Luxembourg	0.5493	30	0.5078	30	0.4869	30	0.4708	31
Hungary	1.0000	1	0.9999	10	1.0000	1	1.0000	1
Malta	0.8339	25	0.8149	27	0.8116	28	0.8035	28
Germany	0.9999	10	0.9999	10	1.0000	1	0.9999	12
Norway	0.9999	10	0.9999	10	0.9999	14	0.9999	12
Poland	0.9999	10	1.0000	1	1.0000	1	1.0000	1
Portugal	0.5928	29	0.6630	29	0.9387	23	0.7833	29
Austria	0.9791	19	0.9152	22	0.9134	27	0.8421	27
Romania	1.0000	1	1.0000	1	1.0000	1	1.0000	1
Slovakia	0.9186	24	0.9563	21	0.9380	24	0.9512	24
Slovenia	0.9999	10	0.9999	10	0.9999	14	0.9999	12
United Kingdom	0.9999	10	0.9999	10	0.9336	25	0.9999	12
Spain	0.8134	27	0.9142	23	0.9983	21	0.9999	12
Switzerland	1.0000	1	1.0000	1	1.0000	1	0.9999	12
Sweden	0.9999	10	0.9999	10	0.9999	14	0.9999	12
Italy	0.8278	26	0.9999	10	1.0000	1	0.8938	25

Source: Author's own (2016).

The results from DEA indicate that the relation between public expenditures and HDI is non-linear. In the study group, we observed that 79.51% of economies of scale were identified as decreasing over the monitored group. This tells us that if public spending increases, there is only a small increase in socio-economic development of society. At constant returns (the remaining 20.49%) socio-economic development of society grows at the same rate as public expenditure. When there is increasing returns to scale, there is only a minimal change in public expenditure capable of supporting the growth of socio-economic development of society. The case of increasing returns to scale, however, throughout the entire monitored group and time period was not recorded. This fact indicates that the use of other DEA models, like CCR and SBM (Slacks Based Measure) – would not be possible.

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From the point of country comparisons in each particular year, at least nine countries were absolutely efficient. These countries may serve as reference points for the remaining countries. Interesting finding is the fact that the higher efficiency is achieved by small open economies (for example Switzerland, Estonia, Hungary, Latvia, Lithuania, Greece, Estonia, Romania and Bulgaria in 2010) and also the fact that the positions of some countries change very rapidly (indicating possible bottlenecks of used DEA methodology or limited reliability of data about HDI or may be even the scale and structure of public expenditures). Rather interesting is also the fact that the most visible inefficient countries are Luxembourg and France (small but very rich country and large country with relatively high level of public expenditures per capita). Concerning the countries of authors the Czech Republic performs very well, but Slovakia is positioned among the less efficient countries. Slovakia oscillates around twenty-fourth place and has not recorded any significant fluctuations.

The Malmquist Index shows our results in the form of the intertemporal evaluation of efficiency see Table 5.

T a b l e 5

Intertemporal DEA Efficiency Evaluation Method (Malmquist Index 2010 – 2013)

Country	Malmquist Index
Belgium	1.080979292
Bulgaria	0.909213772
Cyprus	1.100985722
Czech Republic	1.209756014
Denmark	1.379694375
Estonia	1.05657319
Finland	1.05225819
France	1.070047839
Greece	0.943722872
Netherlands	1.260688096
Croatia	0.899728819
Ireland	1.460934701
Lithuania	1.07365445
Latvia	0.777883043
Luxembourg	1.214891094
Hungary	1.39953895
Malta	1.056820838
Germany	1.240278879
Norway	0.931651556
Poland	1.204860289
Portugal	1.528056803
Austria	1.073456293
Romania	1.082583495
Slovakia	1.156818717
Slovenia	1.086679549
United Kingdom	0.989579622
Spain	1.393933586
Switzerland	1.128009778
Sweden	0.97870036
Italy	1.111125257

Source: Author's own (2016).

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Interesting are also the results of DEA from the point of the geography (Figure 1). We grouped countries into following geographical groups:

A: Central Europe (Czech Republic, Hungary, Poland, Romania, Slovakia, Slovenia)

B: Eastern Europe (Estonia, Lithuania, Latvia)

C: Northern Europe (Denmark, Finland, Ireland, Sweden, United Kingdom, Norway, Iceland)

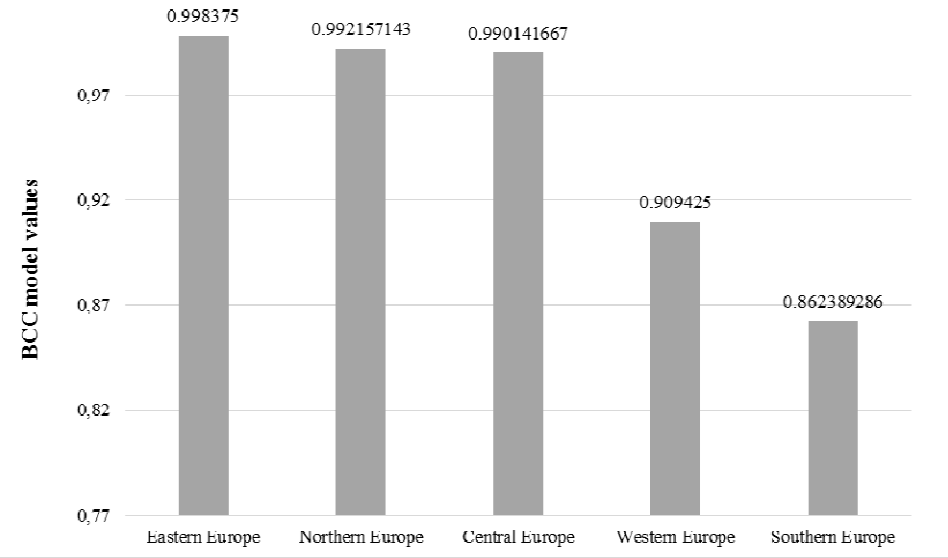
D: Southern Europe (Bulgaria, Cyprus, Greece, Croatia, Malta, Portugal, Spain, Italy)

E: Western Europe (Belgium, France, Netherlands, Luxembourg, Germany, Austria, Switzerland).

The results can be very surprising, especially for less informed readers. The DEA model suggests that Western European countries are the least effective group – supporting the above-mentioned statements that increased public expenditures may not directly produce HDI growth.

F i g u r e 1

Geographical Distribution of Results from DEA Model



Source: Author construction.

The fact that Eastern European countries are rated as most efficient from the global picture can be related to our second research question. In these countries, "productive" expenditures for health and education accounted 60.5% of total public expenditure (average for the period 2010 – 2013). In the same group of less wealthy countries (measured by GDP per capita) Central Europe spending

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on education and health were 58.4% and Southern Europe 58.1% from total public expenditures. These results may indicate that with lower total and relative expenditures per capita and per sector, educational and health care expenditures may represent important factor of HDI growth. Existing studies *Health Systems Observatory* (Milsteina and Schreyoegga, 2016) support such assumption – technical efficiency of health care spending in best performing countries is very high (but relatively low for example in Slovakia).

With increasing absolute and relative public spending the trends change. Although the countries of Northern and Western Europe allocate more public expenditure (15 350.79 EUR per capita) to "productive" sectors of public services, they do not achieve adequate changes of HDI (especially Western Europe).

These findings above provide important response to our research question about the relation between the structure of public expenditures and HDI growth and are in line with results of many other studies on the topic (like Verhoeven, Gunnarsson and Carcillo, 2007; Grigoli, 2012; Clements, 1999; 2002; Hauner, 2007). According to our calculations, public expenditures for health, education and social expenditures showed the most important positive impact on HDI growth (from all COFOG expenditure categories). However, such trend was not absolute, similarly to the findings of above-mentioned studies the data propose that expenditures in health and education can be really "productive" public investment only if they are spent efficiently.

Conclusions

The goal of this study was to test the relation between the scope and structure of public expenditures and HDI by DEA tools (BCC DEA model and the Malmquist Index). Our findings on the sample of 30 developed European countries (results for developing countries outside of Europe may be, but must not be the same) indicate that the total amount of public expenditure has no significant impact on the level of HDI. Small, open economies with a lower share of public spending to GDP show a higher efficiency. As regards the structure of public spending, the investments in certain sectors of public services, especially education, health and social issues, have a positive impact on HDI, but only if the technical efficiency of this spending is assured. The total picture, both for the total amount and the structure of public expenditures, suggest that their link to HDI growth is non-linear and this situation should be the result of allocative inefficiencies (expenditures over a certain level do not produce automatic HDI increases) and especially of technical inefficiency of spending (only well-spent resources deliver needed educational and health results).

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