ʾARTICLES

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MEASUREMENT OF CAMPAIGN EFFICIENCY IN THE 2020 ELECTIONS USING DATA ENVELOPMENT ANALYSIS

Abstract
Data envelopment analysis (DEA) is used to analyze the efficiency of political parties campaign spending. DEA is a method to estimate a relative efficiency of decision making units (DMUs) performing similar tasks in the production system that consumes multiple inputs to produce multiple outputs. In this research paper DMUs represent 24 political parties and the production system represents the election campaign 2020. The input variable selected for the study is the cost for the political campaign. The output variables are the number of votes that the political party received in the election, number of points for the election program and the third output is the number of members of the government. For the efficiency analysis was used the BCC output oriented model which assumes variable returns to scale. The aim of the paper is twofold. The first task is to analyze input and output variables of individual political parties. The second aim is to point out and interpret the results of DEA analysis.

Key words: Elections, Data Envelopment Analysis (DEA), Efficiency, Political Campaign

1 INTRODUCTION

There are many aspects that come into play in the successful run of a campaign (budget for campaign, advertising, platform, targeting, audience, personalities in the political party, the way the campaign is run, etc.). Each piece plays an important role in not just a performance of the campaign, but the overall campaign efficiency as well. The beginning of 21st century marked the

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use of technologies in elections. With the rise of the internet, many political parties recognized the potential of cost-effective online advertisements with great reach, see Hoferer et al. 2020, Böttcher et al., 2017 and Melo et al., 2018.

Data Envelopment Analysis (DEA) is a non-parametric technique for evaluating the efficiency of organizations in terms of inputs and outputs. DEA is a mathematical programming technique originally developed by operations research workers studying business firms and not-for-profit organizations to identify best-practise efficiency frontiers and to measure shortfalls from the frontiers. The basic goal of DEA models is to evaluate on a comparative basis the efficiency of homogeneous decision-making units (DMUs), which use inputs for their activities and transform them into desirable, or undesirable outputs. The beginnings of the ideas leading to the current form of this non-parametric method can be found in the study of Farell (1957), which was significantly followed by the work of Charnes et al. (1978) and Banker et al. (1984). Authors formulated exactly radial DEA models under the assumption of constant returns to scale (CCR model), or taking into account the variability of returns to scale (BCC model). The pioneers in the formulation and application of non-radial DEA models are the studies of Charnes et al. (1985) and Tone (2001).

DEA is proposed as a method for measuring the efficiency of political campaigns. Election campaigns are finite and time dependent venues for incumbents and hopefuls alike to express their platforms for the purpose of achieving electoral success (Downs, 1957). Berry, Chen (1999) ranked the efficiency of incumbent party reelection campaigns between 1948 and 1996 by comparing two election inputs, presidential popularity and the growth in employment, to the percent of the popular vote garnered by the party occupying the White house, their ,,output". The authors Tankersley, Cuzán (2011) followed up on Berry and Chen's study (1999). They estimate and rank the relative efficiency of presidents at converting fiscal, economic, and political variables at the end-of-term election into votes for themselves or their party's candidate for the period 1880-2000. Coates (1997) has used DEA to evaluate the efficiency with which congressional candidates use their spending to produce vote share. Efficiency scores were then examined using regression analysis to determine the influence of district and candidate characteristics on candidate efficiency. The results of study suggest that both district and candidate characteristics matter. Farvaque et al. (2019) use DEA method to measure candidates resource management abilities. The paper uses a database detailing the different sources of campaign funding for French Members of Parliament to analyze their relative performance. They also reveal an important role of constituencies characteristics and of politicians experience

in explaining differences between politicians' efforts. Sexton, Lewis (2011) developed a new DEA model that measures organizational efficiency in the presence of head-to-head competition. The traditional DEA model does not incorporate the head-to-head nature of political campaigns in which a candidate spends money not only to increase the number of votes that he or she receives but also to reduce the number of votes that his or her opponents receive. Their new model assumes that organizations deploy inputs for the explicit purpose of increasing its own outputs while reducing the outputs of competitors. Authors apply this new DEA model to the political campaigns in New York.

The first goal of this study is to analyze the input and output variables of the political parties in the campaign in the elections to the National Council of the Slovak Republic. The second goal is to describe the results of the DEA analysis and make recommendations to political parties how to be efficiency.

The remainder of the paper is organized as follows. Section 1 focus on the description of the political campaign in the 2020 parliamentary elections. Section 2 discusses the materials and methods, where DEA technique of the efficiency scores is explained. Section 3 describes the results of the DEA model. Section 4 summarizes the main findings of the paper.

2 POLITICAL CAMPAIGN IN THE 2020 PARLIAMENTARY ELECTIONS

Parliamentary elections took place on the 29th of February 2020. 24 political entities ran in the elections and the total turnout reached 65,80%. The movement OĽANO received the largest number of votes (25,02%). The following parties also reached the parliament: SMER-SD (18,29%), Sme rodina (8,24%), Kotlebovci-ĽSNS (7,97%), SaS (6,22%) and Za ľudí (5,77%).

The coalition was formed by the parties OĽANO, Sme rodina, SaS and Za ľudí. The parties in opposition are SMER-SD and Kotlebovci-ĽSNS. These parties divided 150 seats within the Slovak parliament.

The main topics in the election campaign were: joining of opposition parties in connection with the arrival of new political parties on Slovakia (PS, SPOLU, Za ľudí), economic policy, power engineering, health and social policy, foreign and European policy, corruption and the power of oligarchs and other.

An election campaign is any activity of a political party (movement) for which a fee is paid to promote their activities, goals and program in order to obtain a position (§ 2, Act n. 181/2014 Coll.). Political parties are required to have functional special bank accounts, so-called transparent accounts, through which they transfer all income and expenses related to their campaign

(to these accounts also apply regulations § 22 to § 24 act n. 85/2005 Coll.). The Act no. 181/2014 Coll. provides that political parties may spend a maximum of 3 million EUR on campaign expenses, including VAT, incurred in the 180 days before the elections. Each political party is obliged to prepare a final report on the costs of the election campaign and deliver it to the Ministry of the Interior of the Slovak Republic, which will then publish it on its website .

The transparency of election campaigns is assessed by a non-governmental organization called „Transparency International Slovensko". This organization also regularly drew attention to the non-transparency of the bank accounts of some political parties. The organization monitors the income and expenditure of the political parties.

Political parties have used various forms of marketing tools to promote themselves. The primary sources of information are still television, the press and billboards. In addition to these tools, social media (online media, Facebook, YouTube, Instagram,...) have an increasing influence on the voters. The right combination of the marketing tools and the themes that the political parties chose for their promotion had a significant impact on the final election results.

3   MODELING POLITICAL CAMPAIGN EFFICIENCY

Measuring the efficiency of a political campaign was based on an intuitive relationship between the cost of the election campaign and the success of the election (obtaining seats in the parliament). The cost of the election campaign represents the inputs to the production process, which results in the number of votes obtained in the election, the way and program of the political campaign quantified by the number of points for this campaign and the number of members of the government. The following chapter will describe the database for the analysis and methodology of measuring the efficiency of the parties' political campaign in the parliamentary elections 2020.

3.1 Data for the analysis and discussion of the selection of variables

The choice of inputs and outputs and the sources of the data are summarized in Table 1.

Table 1: Overview of input and outputs used in the analysis

Variable	Unit of measure	Desired value
Inputs		
I: Election campaign costs*	EUR	min
Outputs		
O1: Number of votes obtained•	count	max
O2: Number of points for campaign☐	count	max
O3: Number of members of the government~	count	max

Source: *   http://www.minv.sk/?nr20-report,
         •   https://volby.statistics.sk/nrsr/nrsr2020/sk/data02.html,
         ☐   https://iness.sk/sk/hodnotenie-volebnych-programov-2020,
         ~   https://www.vlada.gov.sk/clenovia-vlady/

The main data sources for the analysis were data from the website of the Statistical Office of the Slovak Republic, final reports with election campaign costs, evaluation of election programs from Institute of economic and social studies (INESS). The basis for measuring the efficiency of the election campaign are the data of 24 political parties in the parliamentary elections 2020. Each political party represents a decision making unit (DMU). It is recommended that the total sum of inputs and outputs does not exceed 1/3 of the amount of DMUs examined (Klieštik, 2009). In the analysis, we met the condition. The input to the production process of evaluating the efficiency of the election campaign are the costs of the election campaign. This variable is the sum of the costs of the election campaign and the costs incurred by the political party for its promotion in the time beginning 180 days before the day of the announcement of the elections (9.5.2019 to 4.11.2019), shown on the Graph 1. The cost items are divided between: the cost of paying for the opinion polls, the cost of paying for paid advertising and promotion costs, the cost of paying for election posters, travel expenses for the election campaign and other costs.

Graph 1: Campaign costs in the parliament election 2020
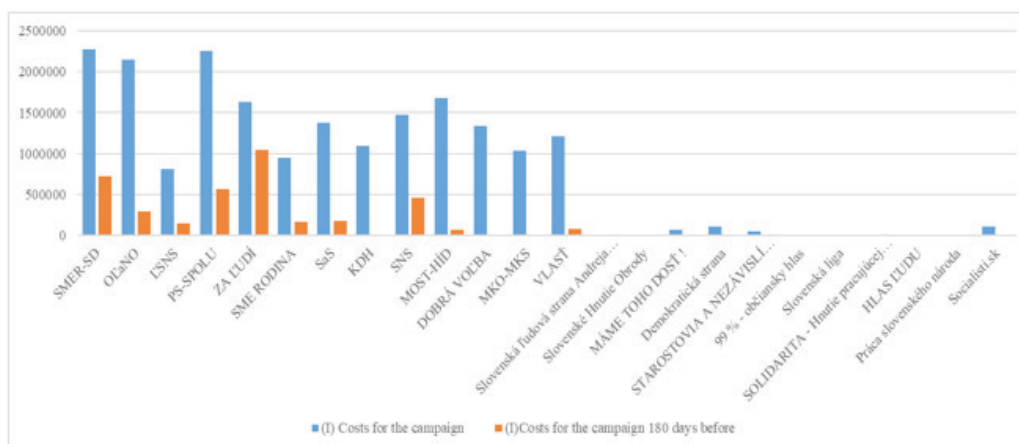
Source: Final reports from the Ministry of Interior

There are three outputs of the production process. The first output is the number of valid votes cast in elections for a political party. The main goal of a political party is to maximize this variable.

The second output is the number of points earned for the political campaign. This output is based on the data from the Institute INESS. They evaluated the electoral programs of political parties, dividing its evaluation into the following areas: education, tax policy, agriculture, business environment and labor market and healthcare. Based on the scoring method, they evaluated election programs in the given area. In our study, we calculated a complex indicator for the needs of analysis using the scoring method, which summarizes the individual evaluated areas. The SaS party received the most points, followed by PS-Spolu, Za ľudí, OĽANO, Sme rodina and KDH, MKO-MKS, Most-HÍD and SNS. The remaining parties did not receive any points due to the non-publication of the relevant program. The main goal of a political party should be to draw up the most comprehensive election program in important strategic areas, which will attract as many voters as possible. The goal of a political party is therefore to maximize the number of points for a political campaign.

The last output is the number of members of the government. The aim of a political party is to obtain as many key positions and ministries as possible, which depends on the number of votes obtained in the elections and the agreement of the coalition parties.

3.2   Method for the analysis: BCC output oriented DEA model

DEA is a non-parametric linear programming based technique for measuring the relative efficiency of a set of similar units, usually referred to as decision making units (DMUs). In our study, the DMUs are represented by 24 political parties. DEA was introduced by Charnes et al. (1978) based on Farrell's pioneering work (1957). In their original DEA model, Charnes, Cooper and Rhodes (CCR model) proposed that the efficiency of a DMU can be obtained as the maximum of a ratio of weighted outputs to weighted inputs, subject to the condition that the same ratio for all DMUs must be less than or equal to one. The envelopment in CCR is constant returns to scale (CRS) meaning that a proportional increase in inputs results in a proportionate increase in outputs. Banker et al. (1984) developed a DEA model known as BCC model, which expresses the economic notion of variable returns to scale (VRS). This model aims to calculate efficiency considering the production scale under which the DMU operates (Banker et al., 2004). In this model, efficient DMUs do not need to provide the same virtual output/input ratio of the most productive DMU (Banker et al., 1996). The relaxation was achieved by imposing a new constraint into the formulation to impose a convexity condition. For our study, the BCC output-oriented DEA model was chosen due to the orientation of political parties to outputs and thus to obtain the largest possible number of votes from voters. We assume the orientation of political parties to increase outputs.

For the exact formulation of output-oriented BCC DEA model, we assume that we are working with n decision making units (DMUs), when DMU   produce from inputs   the outputs . Mathematical notation of output-oriented BCC model is defined as:

$$\max \ \varphi$$
$$-\varphi y^{(o)} + Y\lambda \geq 0$$
$$X\lambda \leq x^{(o)}$$
$$\lambda \geq 0$$
$$1^T \lambda = 1,$$

where is a measure of technical efficiency for output oriented DEA model. The political party is effective only if =1 and =1. The convexity condition ensures that in the model DMUs are compared only with DMUs of the same range.

4 RESULTS OF THE POLITICAL CAMPAIGN EFFICIENCY

The results of the campaign efficiency analysis of political parties are presented in Table 2, which shows the abbreviated names of the political parties and the value of technical efficiency (BCC score). A political party is effective if the value of technical efficiency is equal to 1 (BCC score=1) and at the same time zero slacks (s-, s+) have been identified in their activity.

Table 2: Results of the campaign efficiency analysis in parliament election

No.	Political party (DMU)	BCC score	No.	Political party (DMU)	BCC score
1	OĽaNO	1	13	SOLIDARITA - Hnutie pracujúcej chudoby	0,304
2	SME RODINA	1	14	MOST-HÍD	0,259
3	SaS	1	15	Slovenské Hnutie Obrody	0,228
4	Slovenská ľudová strana Andreja Hlinku	1	16	DOBRÁ VOĽBA	0,222
5	PS-SPOLU	0,902	17	VLASŤ	0,221
6	ĽSNS	0,799	18	HLAS ĽUDU	0,207
7	KDH	0,798	19	SNS	0,186
8	ZA ĽUDÍ	0,770	20	Práca slovenského národa	0,142
9	SMER-SD	0,731	21	99 % - občiansky hlas	0,109
10	MKO-MKS	0,662	22	Demokratická strana	0,104
11	Socialisti.sk	0,410	23	STAROSTOVIA A NEZÁVISLÍ KANDIDÁTI	0,090
12	MÁME TOHO DOSŤ !	0,317	24	Slovenská liga	0,075

Source: Own calculations

The technically efficient political parties are OĽANO, SME RODINA, SaS and Slovenská ľudová strana Andreja Hlinku. The first three political parties are currently coalition parties. The costs for the election campaign effectively turned into achievements. Slovenská ľudová strana Andreja Hlinku is effective, because in their final report published on the webpage of the Ministry of the Interior was mentioned that the party had zero expenses on their campaign. The coalition PS-SPOLU is ineffective and should reduce its election campaign costs by 42,31% (in absolute terms: 1 194 944 EUR). This political party incurred high campaign costs, due to the election results. The party remained very close to the gates of parliament, because a coalition of two parties must reach 7%. The party Za ľudí is currently part of the coalition in the parliament. However, election campaign spending was excessive in relation to the election results and should be reduced by 39,41% (in absolute terms 1 056 080 EUR). The party should have fought more for the posts of ministries and should have had one more key position. The party SMER-SD had excessive expenditures on their political campaign. These costs should be reduced by 18,51% in absolute terms by 555 044 EUR. Expenditures in their campaign should be directed towards the development of a quality election program, in which they should achieved at least 5 points. The analysis shows that, given the costs, these political parties should focus more on the election

program: ĽSNS, DOBRÁ VOĽBA, VLASŤ. The party MOST-HÍD also had excessive costs for their political campaign. Despite the fact that the party was part of the coalition in the previous election period, even higher expenditures on their political campaign did not help it to obtain the votes.

The results of the efficiency analysis show that the most effective political parties in the election campaign were parties that currently belong to the parliamentary coalition parties (OĽANO, Sme Rodina, SaS). The last party in the parliament coalition is Za ľudí. The party has been ower-spending on their political campaign. Nevertheless, it has few key positions in the government. The opposition parties SMER-SD and ĽSNS should focus on developing a quality election programs. Their political campaign expenditures were not well addressed in the light of the results (number of votes obtained).

5   CONCLUSION AND FUTURE RESEARCH DIRECTIONS

This study presents the possibility of applying a non-parametric DEA method in evaluating the political campaign of the parties. In the model we have chosen, the results of the technical efficiency also copy the current composition of the parliament. The possibilities of using DEA in measuring the efficiency are various. The efficiency measurement can be focused on other types of company campaigns, which transform inputs (campaign costs and others) into outputs in the form of sales, number of products sold, market share and others. The subjective attitude of the voter and sympathy for individual political parties and their representatives also play a key role in assessing the effectiveness of the election campaign. Therefore, the question remains not only to develop a quality election program, but also invest in attractive and interesting advertising that can attract a potential voter.

REFERENCES

Act n. 181/2014 Coll. about the political campaign.
Act n. 85/2005 Coll. about the political parties.
BANKER, R. D., LEE, S. POTTER, G., SRINIVASAN, D. Contextual analysis of performance impacts of incentive-based compensation. In Academy of

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Management Journal, Vol. 39, No. 4, 1996,   p. 920-948.

BANKER, R. D., CHANG, H., PIZZINI, M.J. The balanced scorecard: Judgmental effects of performance measures linked to strategy. In Accounting Review, Vol. 79, No. 1. 2004, p. 1-12.

BANKER, R.D., CHARNES, A., COOPER, W.W. Some Models for estimating Technical and Scale Inefficiencies in Data Envelopment Analysis. In Management Science, Vol. 30, No. 9, 1984, p. 1078-1092.

BERRY, B. J. L., CHEN, Y. S. Measurement of campaign efficiency using data envelopment analysis. In Electoral Studies, Vol. 18, No. 3, 1999, p. 379-395.

BÖTTCHER, L., MEZA, O.W., BROCKMANN, D. Temporal dynamics of online petitions. In PLoS one. Vol. 12, No. 5, 2017. [online], [cit. 27/7/2020]. Available on the internet: <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0178062>

CHARNES, A., COOPER, W. W., GOLANY, B., SEIFORD L., STUTZ J. Foundations of data envelopment analysis for Pareto-Koopmans efficient empirical production functions. In Journal of Econometrics. Vol. 30, No. 1-2, 1985, p. 91-107.

CHARNES, A., COOPER, W. W., RHODES, E. Measuring the efficiency of decision making units. In European Journal of Operational Research, Vol. 2, No. 6, 1978, p. 429-444.

COATES, D. The effects of campaign spending on electoral outcomes: A data envelopment analysis. In Public Choice, Vol. 99, No. 1-2, 1997, p. 15-37.

Data about election campaign costs, Final reports on the webpage of Ministry of Interior, http://www.minv.sk/?nr20-report.

Data about the number of members of the government, https://www.vlada.gov.sk/clenovia-vlady/.

Data about the number of points for campaign from institute INESS, https://iness.sk/sk/hodnotenie-volebnych-programov-2020.

 Data about the number of votes obtained from Statistical office of Slovak republic, https://volby.statistics.sk/nrsr/nrsr2020/sk/data02.html.

DOWNS, A. An economic theory of democracy. p. 310. ISBN: 978-0060417505.

EFFICIENCY_A_DEA_RANKING_OF_PRESIDENTS_1880-2008>.

FARELL, M. J. The Measurement of Productive Efficiency. In Journal of the Royal   Statistical Society. Vol. 120, No. 3, 1957. p. 253-290.

FARVAQUE, E., FOUCAULT, M., VIGEANT, S. The politician and the vote factory: Candidates Resource management skills and electoral returns. In Journal of Policy Modeling, Vol. 42, No. 1, 2019. p. 38-55.

HOFERER, M., BÖTTCHER, L., HERRMANN, H. J., GERSBACH, H. The impact of technologies in political campaigns. In Physica A: Statistical

Mechanics and its applications. Vol. 538, 2020. [online], [cit. 27/7/2020]. Available on the internet:<https://www.sciencedirect.com/

KLIEŠTIK, T. 2009. Kvantifikácia efektivity činností dopravných podnikov pomocou Data envelopment analysis. In Ekonomie a Management, Vol. 12, No. 1, 2009. p. 133-145, [online], [cit. 28/8/2020]. Available on the internet:<http://www.ekonomie-management.cz/download/1331826707_1add/13_kliestik.pdf>.

MELO, H. P. M., REIS, S. D. S., MOREIRA, A. A., MAKSE, H. A, ANDRADE, J. S. The price of a vote: Diseconomy in proportional elections. In PLoS one. Vol. 13, No. 8, 2018. [online], [cit. 27/7/2020]. Available on the internet: <https://journals.plos.org/plosone/ article?id=10.1371/journal.pone.0201654>

SEXTON, T. R., LEWIS, H. F. Measuring efficiency in the presence of head-to-head competition. In Journal of Productivity Analysis, Vol. 38, No. 2, 2011, p. 183-197.

SLOVENSKÉ VOĽBY 2020 V INFORMAČNOM PRIESTORE. [online], [cit. 28/8/2020]. Available on the internet:<https://www.globsec.org/wp-content/uploads/2020/03/Slovenske-volby-2020.pdf>.

TANKERSLEY, W. B., CUZÁN, A. G. Fiscal policy, economic performance, and vote-getting efficiency: A DEA ranking of presidents, 1880-2000. Southern Political Science Association, New Orleans, 10 Jan 2004. [online], [cit. 28/7/2020]. Available on the internet: <https://www.researchgate.net/publication/237678553_FISCAL_POLICY_ECONOMIC_PERFORMANCE_AND_VOTE-GETTING_

TONE, K. A slacks-based measure of efficiency in data envelopment analysis, In European Journal of Operational Research, Vol. 130, No. 3, 2001, p. 498-509.

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