METHODOLOGICAL APPROACH TO THE EFFICIENCY OF THE UNIVERSAL POSTAL SERVICE

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Summary: *The article presents a methodological approach to assessing the efficiency of providing universal service in the Republic of Croatia (RoC). Over the last 30 years the area of postal services has been characterized by extensive technological, regulatory and organizational changes as a result of the complete liberalization of the postal services market in the European Union (EU), the introduction of new knowledge and technologies with a strong tendency to strengthen substitution of part of postal services by the electronic communications services, a significant growth of services related to e-commerce and the changed habits of postal service users. By opening up the EU, postal services market the successfully and effective providing of universal (postal) services becomes an increasing business and regulatory challenge for national postal service providers and regulatory bodies of the EU Member States. In the last period, within the scope of implementation of the fulfilment of legal obligations in order to provide universal service and its overall sustainability and efficiency throughout the territory of the RoC, in addition to several regulatory analyses HAKOM has developed and practically applied new measures and regulatory tools for assessing the efficiency of universal service of the HP-Croatian post Inc. (Croatian Post) as the appointed national universal service provider.*

1. Introduction

Benchmarking is focused on the difference between the efficiency of national universal service providers within the EU. Efficiency is one of the basic economic categories because, due to the fact that human needs are unlimited, the resources are not unlimited, it becomes clear that with limited resources it needs to be managed as efficiently as possible and thus to satisfy as much needs and desires as possible.

It is also a bit of economics - due to limited resources; the most successful ones will be those who will know that they are most exploited. This fact applies not only to the production of goods but to the production of services. In the fast-changing world of postal services and rapid technological development, it is important to know how to evaluate the technical and cost effectiveness of existing national providers of complete services. If national providers become more efficient, we can expect higher profitability and higher volumes of produced products and services, which ultimately implies lower prices and better quality of products and services for consumers.

2. Effective Measuring by Comparative Benchmarking

Benchmarking is a systematic and repetitive process of rating or selection of leading companies in the industry. Benchmarking does not only predict determination of leaders in the industry and determination the goals we want to achieve, but also determining what methods to use in order to achieve set goals. Benchmarking can be used to calculate relative efficiency in relation to the best company in the sample. It is therefore necessary to provide a comparison of the unit in the sample. For a comparison, it is possible to choose the best or the most efficient company, entitled as *frontier benchmarking* or averagely effective company from the sample entitled as *average benchmarking*.

So far, many approaches have been developed to measure non- efficiency. There are two groups of methods allowing the evaluation of the boundary curves the parametric or stochastic methods, and on the other hand, the nonparametric method which means, the analysis of data confinement based on linear programming techniques.

3. Stochastic Method - SFA or Stochastic Frontier Analysis

Stochastic Frontier analysis (SFA) is stochastic parametric method which includes the assumption that deviations from boundary efficiency functions (e) are not only a consequence of inefficiency, but also errors in measurement, random errors and statistical deviations of "*noise*" -v).

The SFA method estimates the selected production, cost or profit function, and for the regression model errors it is assumed to be consisted of two parts: random deviations that are distributed in the form of symmetric distribution (usually normal) and component(s) efficiency for which is assumed to be asymmetric distribution. The most common is semi-normal distribution, exponential distribution or gamma distribution. The assumption of the asymmetry of the effectiveness component is necessary in case of selecting some form of functions because that component can only assume negative or positive values depending on what function we think. In addition, it should be emphasized that the SFA method is just one of many parametric methods for measuring efficiency. In economic literature, along with the econometric methods, i.e. the SFA method there is (DFA) (*distribution fee approach method)* as well as (TFA) (*thick frontier method*). The DFA method does not include relatively stringent assumptions about the distribution of random deviations and performing components, whereas the TFA method firstly allows the determination of grades with differences in efficiency between production units and their ranking from the most effective to the least effective.

4. Deterministic or nonparametric method - DEA or data envelopment analysis

Among nonparametric methods, the most important is the most commonly used data envelopment analysis (DEA) based on the usage of linear programming techniques. The access of linear programming enables finding a boundary efficiency function, which best determines the observed sample value of the surveyed companies.

The DEA method was initially developed with the aim to determine technological efficiency. Technological efficiency is considered to be an effective company if it minimizes its inputs in relation to output or maximizes outputs in relation

to inputs. In the case of determining the cost e efficiency, the established boundary function shows those companies which, along with certain cost of production factors, produce a certain combination and quantity of the product at the lowest cost. No production unit (e.g. postal service provider) or a linear combination of production units achieves lower production cost than the cost that determines the marginal cost efficiency function.

Production units lying on the curve are most effective at a certain degree of technology development. The relative cost efficiency of a particular production unit when using the DEA method can be determined by calculating the ratio between the costs of the observed production unit and costs of lying at the efficiency curve limit by producing the same amount and combination having the same input prices.

Due to the fact that most production units (as well as national universal service providers) have no control over output (e.g. postal letters), the analysis focuses on an input-oriented model. The analysis uses an approach that minimizes inputs to achieve certain outputs. This approach shows how much a production unit can reduce inputs to achieve a certain output. The link between the unit's size and the costs indicates the return on scale. The DEA method recognizes more yield patterns that are most commonly used:

- Constant Returns to Scale CRS model, with assumption that all units of business decision are equally large functioning in an optimal manner
- Variable Returns to Scale VRS model, with assumption that all units of business decision making represent similar size.

Constant Returns Scale Model (CRS) assumes that all study units are optimally working and are all equally large. The formerly described content returns to scale model is less likely to happen in today's world characterized by imperfect competition, government regulation, financial constraints and more. That is the reason for most often usage of the VRS because it allows comparison of small production units with small ones and large production units with large ones. In this way, the effect of efficiency resulting from business services eliminates productivity, i.e. cost analysis.

5. Benchmark of technical efficiency in the EU postal services sector

The benchmark of the technical effectiveness of national universal service providers in the EU is focused on measuring the efficiency of postal business operations by using mathematical methods. In this chapter, attention is also focused on the content definition of the variables included in the calculation of efficiency. The chapter was concluded by reviewing the basic results obtained by evaluating the mathematical cost-effectiveness model based on the approach of linear programming or DEA data envelopment analysis.

As previously mentioned, the DEA method is extremely sensitive to discussed variables, because exclusion of the important inputs or outputs can lead to biased results. Therefore, when using nonparametric methods, special attention has to be focused on database design according to which the technical and economic efficiencies can be done. The universal postal union (UPU) was used as data base in order to ensure the comparability and consistency of the used data, although in some cases significant deviations of the data obtained by using different sources have been observed. Within the

scope of benchmark analysis of the postal sector's technical efficiency in the EU countries using the DEA method, the first thing is to obtain a database that would include data on individual inputs and outputs of the national universal service providers. The Benchmark analysis is largely based on data from the UPU database, whose aim is to collect postal data by its own (uniform) methodology, which should ensure standardization and comparability of data.

Within the scope of Benchmark Efficiency Analysis it was found that there was a significant discrepancy between the data in the UPU database, which included the UPU database and the data obtained from the annual reports of national universal service providers as well as those on the national postal regulators website. Due to the described deviation, the data from the UPU database was, where possible, cross-compared to other publicly available data or it was provided on the basis of its own expert judgment. Given the fact that a national service provider's universal service is used on the size of individual outputs and inputs generated on the basis of major sources (UPU, annual reports of national providers, reports of national regulators), the question arises about the standardization or uniqueness of the methodology of data collection (and cross- and panels). Potential non-standardization of data may be reflected in reduced objectivity of technical and cost analysis results, which means that it can affect the results obtained if it is established that facts deviate from the data used.

If you want to get the objective and reliable results of the analysis you need to work with other national postal sector regulators. In this way, it is possible to further check the credibility of the used data in the postal sector, and thus the reliability and timeliness of technical and cost effectiveness.

Table 1: List of Countries of National Universal Service Providers in the EU in 2016

COUNTRY	TIHE NUMBER OF SENT ITEMS	NUMBER OF EMPLOYEES	TIHE NUMBER OF CONTACT POINTS	OPERATIONAL EXPENSES
Austria	1.583.506.000	18.949	1.792	1.470.703.125
Bulgaria	167.069.202	10.508	2.980	61.111.245
Croatia	294.053.418	9.814	1.017	158.178.034
Czech Republic	1.978.788.501	30.908	3.382	556.143
Denmark	331.000.000	9.712	1.112	759.282.700
Estonia	83.805.013	2.200	323	63.493.750
Finland	778.000.000	15.148	900	1.252.265.625
France	11.529.000.000	230.689	17.133	17.432.031.250
Germany	14.651.000.000	459.262	24.002	43.752.343.750
Great Britain	12.280.000.000	142.000	11.634	8.315.596.330
Hungary	651.029.214	29.678	2.701	437.097.918
Italy	2.808.620.355	132.716	12.852	6.773.327.072
Latvia	25.201.667	**3.882**	1.019	47.394.541
Netherlands	2.213.000.000	46.456	1.800	2.446.875.000
Poland	1.355.497.557	77.993	7.490	974.513.424
Portugal	775.927.898	12.149	2.336	473.389.844
Slovakia	1.554.970.716	13.875	1.579	238.775.781
Slovenia	261.841.990	5.510	501	161.708.805
Sweden	1.970.438.000	21.146	1.803	2.461.412.151

Source:: Universal Postal Union, Annual reports of PSP, European postal markets

Table 2: Initial list of national providers of universal postal services in the EU in 2016

COUNTRY	NUMBER OF SENT ITEMS	NUMBER OF EMPLOYEES	OPERATIONAL EXPENSES
Austria	1.583.506.000	-	1.792
Croatia	285.748.200	8.078	1.017
Czech Republic	496.644.100	58.345	6.918
Denmark	-	9.314	1.077
Estonia	-	1.804	547
Finland	3.000.000.000	16.220	902
France	12.122.789.000	205.053	17.133
Germany	14.651.000.000	146.826	27.160
Great Britain	11.672.000.000	142.000	11.659
Hungary	630.074.200	27.967	3.778
Italy	3.526.287.300	-	12.845
Latvia	62.943.000	4.239	618
Netherlands	-	46.456	-
Poland	1.521.112.000	-	7.497
Portugal	748.972.000	10.881	2.363
Slovakia	-	14.049	1.602
Slovenia	244.429.000	5.510	531
Sveden	2.273.126.000	20.272	-

Source: HAKOM and Partner (BDO Consult)

The analysis of technical efficiency in the postal sector - the EU example, was made by the DEA method, assuming the VRS and Input-based variable assumptions, as they wanted to determine how to gain a specific output with as little input as possible. The model used included the usage of one output, mail addressed items, and two inputs, total number of staff and total number of permanent post offices (x2).

The financial data used for operating costs is in the UPU database for all countries converted into a Special Drawing Right Special Drawing Currency (SDR) at a rate published on the UPU's website. The list encompasses 19 decision-making units (DMUs). The average comparative analysis was made in 2016. As the mean value of the studied variables, the median was chosen because the form of distribution of the sample unit with respect to the value of the observed variables showed that it was a distribution 2asymmetry and a mean value measure that was insensitive to the extreme values of the variable was to be determined.

An analysis of technical efficiency in 2016 was made based on available data from UPU base. In table 1 are data for the year 2016 collected from UPU and DG GROWTH (European commission) database.

The data from the UPU database was used to analyze and display the data because of the unavailability of all required data in the GROWTH database. According to data from the UPU database in 2016, compared with 2015, there has been a decrease in the number of letters sent in the following countries: Austria, Czech Republic, Denmark, Finland, France, Great Britain, Italy, Netherlands, Poland and Portugal.

The most significant drop in letters sent by 29% is the Italy and Denmark. Germany recorded an increase of 8%, Sweden 5% and Slovenia by 3% more letters in

2016 compared to 2015. Most of the countries which participated in survey, as universal service providers, have reduced the number of employees and the number of contact points in 2016, particularly in four countries as follows: Denmark, Germany, the Netherlands and Slovenia. Denmark has a total of 9,712 employees in 2016, which is 23% less than in 2015. Germany has reduced the number of employees by 38,483 and the total number of contact points in 2016 was 24,002, which is 13% less than in 2015. The Netherlands and Slovenia recorded a drop in the number of employees by 6%, while the Netherlands has a drop in the number of contact points by 12.15%, ie 249 contact points less in 2016.

The tables below are descriptive statistics describing mean values (avarage , median), variability (SD, standard deviation) and minimum and maximum of researched studied variables. From the table below it can be seen that in the analyzed sample of national universal service providers there is a large asymmetry distribution because the arithmetic mean at each analyzed variable is significantly higher than the calculated median.

Table 3: Average, median, standard deviation, minimum and maximum variables in 2016

COUNTRY	TIHE NUMBER OF SENT ITEMS	NUMBER OF EMPLOYEES	TIHE NUMBER OF CONTACT POINTS	OPERATIONAL EXPENSES
Austria	1.583.506.000	18.949	1.792	1.470.703.125
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Sweden	1.970.438.000	21.146	1.803	2.461.412.151
AVARAGE	2.910.144.712	66.979	5.071	4.593.687.184
MEDIJAN	1.355.497.557	18.949	1.803	759.282.700
SD. STANDARD DEVIATION	4.513.782.798	112.666	6.614	10.408.515.589
MAX	14.651.000.000	459.262	24.002	43.752.343.750
MIN	25.201.667	2.200	323	556.143

Source:: *Universal Postal Union, Annual reports PSP, European postal markets*

In this case, the usage of a median as a measure is more appropriate than the arithmetic mean because it is insensitive to the extreme valuesof the variable. For the analyzed variables there is also an exceptionally high variability of data, which shows the calculated standard deviations of individual variables. If we calculate the variation coefficients, we can determine that the share of standard deviation in the arithmetic mean is significantly higher than the unscripted rule of 25% and represents moderate variability of the data series.

6. Results of technical envelopment analysis

The final list of national universal service providers in the EU in 2016 was consisted of 16 countries. According to the list below regarding inputs and outputs, the technical and cost effectiveness of individual postal operators in the EU Member States was calculated in the next step. Descriptive statistical values were calculated for additional argumentation in decision-making on the choice VRS model.

As already mentioned, the CRS model is characterized by the assumption that all business decision-makers are equally large and function optimally, which means that the size of a single universal service provider does not affect the measured effectiveness. When these assumptions can not be confirmed, VRS model is used. As shown, there is considerable variability between the countries studied, which means that the right decisio VRS model.

Table 4: Results of technical data demarcation analysis - deterministic calculation for 2016

COUNTRY	TECHNICAL EFFICIENCY	CLEAR TECHNICAL EFFICIENCY	SSCALE EFFICIENCY	RANG TE	RANG PURE TE
Austria	0,815	0,810	0,660	4	7
Czech Republic	0,582	0,581	0,338	7	12
Denmark	0,303	0,636	0,193	12	8
Finland	0,649	1,000	0,649	6	1
France	0,554	0,606	0,336	8	10
Croatia	0,279	0,588	0,164	13	11
Italy	0,204	0,263	0,054	14	14
Germany	0,437	0,468	0,205	11	13
Netherlands	0,800	1,000	0,800	5	1
Poland	0,168	0,167	0,028	15	15
Portugal	0,464	0,623	0,289	10	9
Slovakia	1,000	1,000	1,000	1	1
Slovenia	0,473	1,000	0,473	9	1
Sweden	0,958	0,950	0,910	2	6
Great Britain	0,908	1,000	0,908	3	1

Source: HAKOM and partners (BDO Consult)

Table 4 describes the technical effectiveness of national universal service providers. The aim of the analysis was to study what output was achieved by the company with the lowest input consumption:

- By analyzing technical efficiencyusing the CRS model it can be established that Slovakia is country with global technically efficiency Croatia's global technical efficiency is showing increasing variable returns to scale which means that its business size is too small in reference to its l optimum and it should increase its scope of its business activities as increasing returns to scale means tha by increasing the number of inputs above the proportional the output increases as well In theory this means that Croatian Post has the ability to achieve efficiency by adjusting the amount of output.

- Acording to the technical efficiency Croatia ranks 13th with 42% lower technical efficiency compared to the best EU practice (Slovakia ranks 1st and , Sweden ranks second with a technical efficiency of 0.958).

In Table 4, aside from TE, the so-called "pure technical efficiency" is shown (the pure technical efficiency core of national universal service providers). As we have already pointed out on the previous pages, the advantage of the VRS model is that it allows one to compare small states with small and large states with big ones. This model eliminates the impact of service efficiency and takes into account only pure technical efficiency. The choice of return to scale can significantly affect the efficiency calculation. The Constant Product Model can also estimate both input and output efficiency, so in the literature that analyzes the efficiency of national postal operators, the most commonly used variable yielding method is used.

Therefore, the rank obtained on this basis is considered an objective indicator of the achieved efficiency.

- According to the VRS model, average pure technical efficiency in 2016 was 68.14%. According to the VRS model in 2016, the countries such as: Finland, Great Britain, the Netherlands, Slovenia and Slovakia achieved full efficiency. Referring zo the calculated average pure technical efficiency, which, in 2016 , was 68.1%, it was established that improving the company's management with an equal amount of output (number of sent postal items) could achieve 31.86% better avarage technical efficiency

- When calculating pure technical efficiency, the state is divided into 5 groups according to the number of sent letters. . The first group includes countries with more than 10 billion letters sent, the second group being the state with a total number of sent letters of 1.3 to 1.9 billion, and in the third group there are countries with between 2 and 3 billion letters sent. The fourth group includes countries with a total number of letters between 600,000 and 800,000. The last group , which includes Croatia ,comprises the countries which sent up to 400,000 letters in 2016.

- Accordng to the pure technical efficiency Croatia takes the 11th place with a 42 percent lower technical efficiency compared to the best EU practice.

Benchmarking performance analysis focused on the analysis of the European postal sector in terms of efficiency. As we have found in the analysis, efficiency is one of the basic economic categories that we need to ignore in the fast changing world of postal

services and rapid technological development because the ability to evaluate technical efficiency is extremely significant.

Because if the providers of postal services become more effective then we can expect higher profitability and larger quantities of produced products and services, which implies lower prices and better quality of products and services for consumers.

7. Conclusions

Within the scope of the technical efficiency calculation, it has been established that by using the of realistic assumptions, VRS methods, Croatian Post did not achieve pure technical efficiency with a value of 1 but smaller, meaning that output data have not been produced with minimal inputs. Referring to the fact that inputs and output quantities between individual postal operators differ and that postal operations are subject to numerous exogenous / endogenous shocks and accidental factors, it is clear that there is a certain bias that we equalize individual postal operators (equality of efficiency). The mentioned deficiency was attempted to be eliminated by the stochastic data bundling method, but it was found that some bias measures for some countries were estimated, suggesting a potential questionnaire for database quality. It is estimated that the standardization or consolidation of the database (which also implies cooperation with other regulators) could significantly improve the confidence intervals, which means that the obtained results on the placement of individual states would be more reliable.

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Sažetak: *U članku je prikazan metodološki pristup procjene učinkovitosti obavljanja univerzalne usluge u Republici Hrvatsko (RH). Područje pružanja poštanskih usluga u zadnjih 30 godina karakteriziraju opsežne tehnološke, regulatorne i organizacijske promjene kao posljedica potpune liberalizacije tržišta poštanskih usluga u Europskoj Uniji (EU), uvođenja novih znanja i tehnologija sa snažnom tendencijom jačanja zamjenjivosti dijela poštanskih usluga uslugama elektroničkih komunikacija, značajnog porasta usluga povezanih s e-trgovinom i promijenjenih navika korisnika poštanskih usluga. Otvaranjem tržišta poštanskih usluga u EU uspješno, kvalitetno i efikasno obavljanje univerzalnih (poštanskih) usluga postaje sve veći poslovni i regulatorni izazov nacionalnim davateljima poštanskih usluga i regulatornim tijelima država članica EU. U sklopu primjene ispunjenja zakonskih obveza obavljanja univerzalne usluge i njene ukupne održivosti i učinkovitosti na cijelom teritoriju RH, u proteklom razdoblju HAKOM je pored više regulatornih analiza, razvio i praktično primjenjuje nove mjere i regulatorne alate za procjenu učinkovitosti obavljanja univerzalne usluge HP-Hrvatske pošte d.d. (HP) imenovanog nacionalnog davatelja univerzalne usluge*.

METODOLOŠKI PRISTUP PROCENE EFIKASNOSTI OBAVLJANJA UNIVERZALNE POŠTANSKE USLUGE

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