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DATA ENVELOPMENT ANALYSIS AS AN INSTRUMENT FOR MEASURING THE EFFICIENCY OF COURTS

The paper addresses the problem of measuring the efficiency of civil jurisdiction courts. Non-parametric data envelopment analysis (DEA) has been proposed as a measurement instrument. Hearing (settling) a case within a reasonable time, as seen from the perspective of a citizen, is defined to be a positive output (result) of a court action. The production factors considered include human resources directly related to legal processes. The analysis was carried out for the 26 Cracow district courts. The goal has been assumed to be achieving the best possible outputs, without increasing resources. The results obtained prove that there exist reserves within these organizations that would allow them to shorten the queue of pending cases. The proposed method of measuring efficiency may constitute a starting point for further work on trying to create measurable standards of the functioning of the judiciary in Poland.

Keywords: *DEA, efficiency measure, civil courts*

1. Introduction

Solving the problem associated with the measurement and assessment of court efficiency is one of the necessary elements of efficient management. The relatively high amount of public expenditure on justice, in conjunction with the time which courts need for issuing judgements in cases, constitutes a subject of public debate, in which criticism related to the functioning of the justice system has been raised for years. At present, expenditure on the judiciary represents almost two percent of the state budget[2]. Against

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[2]The Budget Act for 2015 of 15 January 2015. OJ of 2015. pos. 153.

this background, analysis of the efficiency of a court as an institution with specific functions and, at the same time, of fundamental significance for the smooth functioning of the state is of special relevance. Society expects efficiency from the judicial system, where efficiency is understood in a number of dimensions, e.g. the ability to hear a case within a reasonable time, rationality in the management of assets and finance from the state budget and the ethicality of proceedings, in accordance with the adopted system of values. This raises an obvious need for the development and use of instruments that enable objective assessment of a court's functioning. Statistics, econometrics and the dynamic development of management sciences have provided an increasing number of ever improving instruments for enabling the measurement of the effectiveness of organizations. These include, inter alia, parametric and non-parametric methods. Parametric methods, based on the production function approach to modelling the shape of the efficiency threshold, come from economic theory, e.g. stochastic frontier analysis (SFA). However, the applicability of this theory as a basis for analyzing the efficiency of courts has still to be proved. Non-parametric methods based on linear programming such as, e.g. data envelopment analysis (DEA), where an efficiency threshold is precisely defined based on empirical data and therefore is not solely dependent on conclusions drawn from theoretical considerations. This paper proposes the application of DEA, a method for analyzing frontier data, as a universal instrument enabling the measurement and comparison of the efficiency of courts on the basis of the available statistical data.

2. Assumptions of DEA

Analysis of the efficiency of an organization is a complex undertaking. The base constituting the starting point of building analytical instruments to measure the production efficiency of an organization were presented in a paper by Farrell [12]. Generally speaking, efficiency is defined as the ratio between the degree of achievement of objectives and the level of resource usage

$$E = \frac{Y}{X} \tag{1}$$

where: Y – level of output, X – level of input, E – efficiency ratio.

Efficiency is also defined as the effective use of the resources of society in the process of meeting the needs of people [25]. In turn, Stoner, Freeman and Gilbert define efficiency as a measure of the effectiveness and capability of achieving the desired objectives [26].

The efficiency of entities functioning in the economy shall be assessed using various methods belonging to one of the three following groups [18, 5, 28]:

- classical methods utilizing financial ratios,
- parametric methods based on econometric models,
- nonparametric methods.

Although the term efficiency is derived from economics and the management sciences, it is increasingly being used to assess the functioning of public institutions, including courts and other judicial institutions. Since the early nineties of the last century, there has been a worldwide discussion on methods for assessing the efficiency of the judiciary and selecting ratios which enable the measurement and assessment of "products" of the judiciary [4]. The effectiveness of public institutions in meeting the needs of the entities utilizing their services is a measure of their success [15]. In circumstances where courts are the only institutions providing services in the field of the administration of justice, it is essential to create ratios to assess the courts' levels of functioning and make comparisons. As units of the public sector, courts, create values for citizens. If they are effective, then they achieve their statutory goals. If they are efficient, then they do it cheaply [20].

DEA, developed by Charnes and Cooper [6], is one of the nonparametric methods used in the study of the efficiency of units in the public finance sector. In the Polish literature, it was first presented in the 90s of the last century as an instrument to assess the functioning of banks [24, 23], the efficiency of institutions of higher education [21], or service companies [17]. DEA was also used to evaluate the efficiency of public prosecutors [13] and courts [1, 29].

DEA is based on a multidimensional approach to the concept of productivity [11, 12], with reference to outputs and inputs. To analyze the level of output and input in an empirical manner, one looks for weights maximizing the efficiency of an individual organization. DEA evaluates technical efficiency using inputs (factors) or production outputs [14]. A measure of pure technical efficiency can take values from 0 to 1, where one indicates full efficiency. Measures of technical efficiency based on inputs require a constant level of production and assess the relative level of production inputs. The measures of technical efficiency based on outputs (results) assume a constant level of inputs and evaluate the relative level of the results achieved.

In line with the assumptions of the method outlined in [11, 12], technical efficiency is calculated using mathematical programming:

$$\Theta_s = \frac{\sum_{r=1}^{R} \mu_r y_{ri}}{\sum_{m=1}^{M} v_m x_{mi}} \rightarrow \max \tag{2}$$

together with the constraints that none of the units can have an efficiency greater than 1 (Constraint (3)), and the weights can assume any nonnegative value (Constraints (4)):

$$\frac{\sum_{r=1}^{R} \mu_r \times_{rs}}{\sum_{m=1}^{M} v_m x_{ms}} \leq 1 \tag{3}$$

$$\mu_r \geq 0, \qquad v_m \geq 0 \tag{4}$$

where: θ_s – efficiency of unit s ($s = 1, \ldots, J$), y_{rs} – output of product r in unit s, x_{ms} – input of production factor m in unit s, μ_r – weight attributed to product r ($r = 1, \ldots, R$), and $\mu_r \geq 0$, v_m – weight attributed to factor m ($m = 1, \ldots, M$), and $v_m \geq 0$.

The solution of this mathematical programming task is the pair of weights, μ_r and v_i, that maximize the efficiency of the assessed entity. The model described by Eqs. (2)–(4) can be reduced to a linear programme [6]. Based on output, this takes the form:

$$\sum_{r=1}^{R} \mu_r y_{rs} \rightarrow \max \tag{5}$$

$$\sum_{m=1}^{M} v_m x_{ms} = 1 \tag{6}$$

$$\sum_{r=1}^{R} \mu_r y_{rs} - \sum_{m=1}^{M} v_m x_{ms} \leq 0 \tag{7}$$

$$\mu_r \geq 0, \qquad v_m \geq 0 \tag{8}$$

The fact that multiplying all the weights in expression (3) by the same positive constant gives the same value of the objective function means that there are an infinite number of solutions [3]. Therefore, an additional constraint is necessary, according to which either the numerator or denominator of the quotient in Eq. (2) takes the value 1. This corresponds to maximization of the weighted output for a given weighted sum of inputs equal to 1 (6), or minimization of the weighted sum of inputs (Ex. (10)) at a predetermined weighted output equal to 1 [22], as appropriate.

The model based on production factors takes the following form:

$$\sum_{r=1}^{R} \mu_r y_{rs} = 1 \tag{9}$$

$$\sum_{m=1}^{M} v_m x_{ms} \rightarrow \min \tag{10}$$

$$\sum_{r=1}^{R} \mu_r y_{rs} - \sum_{m=1}^{M} v_m x_{ms} \geq 0 \tag{11}$$

$$\mu_r \geq 0, \qquad v_m \geq 0 \tag{12}$$

DEA may be oriented or non-oriented, where orientation is based on either inputs or outputs [10, 16, 13, 19]:

Models based on outputs or inputs include:

- Charnes, Cooper and Rhodes (CCR) model with constant returns to scale (CRS) [7],
- Banker, Charnes and Cooper (BCC) model with variable returns to scale (VRS) [2],
- non-increasing return to scale model (NIRS),
- non-decreasing return to scale model (NDIRS),
- non-oriented models:

– additive,
– with CRS,
– with VRS.

The CCR model can be converted into a dual form [7]:

- The dual to the CCR model based on inputs:

$$\Theta_s \rightarrow \min \tag{13}$$

$$\sum_{j=1}^{J} x_{mj} \lambda_{sj} \leq \Theta_s x_{ms} \tag{14}$$

$$\sum_{j=1}^{J} y_{rj} \lambda_{sj} \geq y_{rs} \tag{15}$$

$$\lambda_{sj} \geq 0 \tag{16}$$

- The dual to the CCR model based on outputs:

$$\Theta_s \rightarrow \max \tag{17}$$

$$\sum_{j=1}^{J} x_{mj} \lambda_{sj} \leq x_{ms} \tag{18}$$

$$\sum_{j=1}^{J} y_{rj}\lambda_{sj} \geq \Theta_s y_{rs} \tag{19}$$

$$\lambda_{sj} \geq 0 \tag{20}$$

where: θ_s – the efficiency ratio for entity s, λ_{sj} – the weights maximizing the efficiency of entity s.

According to the CCR model, assuming CRS, any change in the outputs is directly proportional to the change in the inputs at a given level of efficiency (Fig. 1). The BCC model assumes VRS, taking into account the fact that not all of the assessed units operate at the optimum scale [2]. In this case, changes in outputs and inputs are not directly proportional to each other.

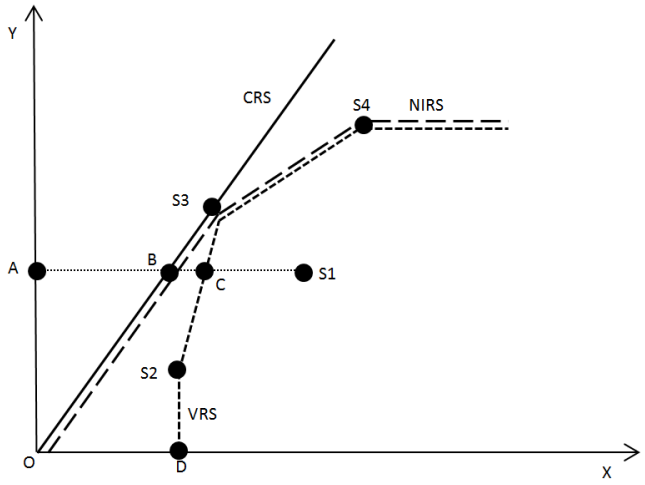

Fig. 1. Constant and variable returns to scale according to the DEA model.
Source: Author's calculations based on [15]

To clarify the case of VRS, we will use the dual form of the model, introducing additional constraints in the form of:

$$\sum_{j=1}^{J} \lambda_{sj} = 1 \tag{21}$$

Constraint (21) means that the inefficient entity S1 (see Fig. 1) will be compared with entities of similar size, in this case S2 and S3.

Based on the input factor x which may depict, for example, human resources, the technical efficiency of entity S1 at CRS can be calculated from the formula:

$$ET_{\mathrm{S1},\,x,\,\mathrm{CRS}} = \frac{AB}{AS1} \tag{22}$$

The technical efficiency of S1 for VRS is:

$$ET_{\mathrm{S1},\,x,\,\mathrm{VRS}} = \frac{AC}{AS1} \tag{23}$$

Scale efficiency can thus be represented by the ratio between the two measures above, i.e.:

$$ES_x = \frac{AB}{AC} \tag{24}$$

Finally,

$$ET_{x,\,\mathrm{CRS}} = ET_{x,\,\mathrm{VRS}} ES_x \tag{25}$$

The technical efficiency measures calculated using the method based on VRS will therefore be greater than or equal to the measures calculated using the method based on CRS [8]. Additionally, constraint (21) means that the compared units operate at the same scale. In the case of the CRS analysis, scale change is permitted.

The introduction of the following condition:

$$\sum_{j=1}^{J} \lambda_{sj} \leq 1 \tag{26}$$

enables us to get information on whether an entity is operating in the region of increasing or decreasing returns to scale (NIRS, see Fig. 1). Comparison of the value of $ET_{\mathrm{S1},\,x,\,\mathrm{VRS}}$ with the value of $ET_{\mathrm{S1},\,x,\,\mathrm{NIRS}}$ based on the ratio (24), answers the question as to whether an entity is operating in the region of increasing $(ET_{\mathrm{S1},\,x,\,\mathrm{VRS}} \neq ET_{\mathrm{S1},\,x,\,\mathrm{NIRS}})$ or decreasing $(ET_{\mathrm{S1},\,x,\,\mathrm{VRS}} = ET_{\mathrm{S1},\,x,\,\mathrm{NIRS}})$ returns to scale [9, 3]. In this case, entity S2 is characterized by increasing returns to scale, S4 by non-increasing (decreasing) returns to scale, S3 is efficient with reference to both VRS and CRS.

DEA as an instrument for measuring efficiency has its advantages and disadvantages. The advantages include:

- ease of application,
- the ability to analyze multiple inputs and multiple outputs,

- the ability to analyze entities which cannot be characterized using financial ratios,
- inputs and outputs in the each entity can be expressed in the appropriate units.

The disadvantages which should be noted include:

- relative nature of efficiency, established with reference to other entities,
- poor information regarding the quality of outputs, which may lead to difficulty in choosing the most appropriate model of DEA [14].

3. Analysis of the efficiency of the district courts of the Cracow ward

The issue of assessing the efficiency of courts of general jurisdiction fits perfectly into the activities related to the reform of the judiciary in Poland. It forms part of the discussion on how to ensure the smooth functioning of independent and impartial courts with limited resources.

DEA was carried out for the district courts of the Cracow ward. The data for these calculations were taken from statistical reports for 2013. The efficiency frontier is determined by the courts which obtain the best ratio of closed cases to given resources (based on output), or the courts which use the lowest level of inputs to close a case (based on factors). This way of assessing courts is in compliance with Art. 44, Par. 3, Point 1 of the *Public Finance Act*, which requires public spending to be purposeful and cost-effective, while respecting the following principles [28]:

- obtaining the best outputs with the given inputs (focus on results),
- optimal approaches to achieving objectives (focus on inputs).

The courts whose efficiency ratio is considered to be exemplary form the frontier (envelope) in the two-dimension space created by factors (inputs) and outputs. The distance of the remaining courts to the designated frontier indicates the extent to which they can improve their results based on their current resource use or reduce their use of inputs to achieve the current level of closed cases.

The analysis was carried out on district courts, because the organizational structure and the scope of the cases these units process are similar. The data used for these calculations primarily involve civil and criminal cases. Cases involving either real estate registers or the national court register were not taken into account, due to the different way in which they are processed.

The efficiency analysis includes the following:

- Inputs – human resources directly involved in legal processes (judges, assistants and officials of court secretariats, see Table 1).
- Outputs (products) of court actions – the number of settlements per year (see Table 1).
- Registrations – the number of letters registered by an entity during the reporting period, representing a factor initiating proceedings (see Table 2).

• Settlement – based on statistical reports, denotes the end of proceedings from the point of view of the district court[3] in the analyzed period (see Table 2).

• Pending cases – number of cases pending at the end of the reported period to be settled next year (see Table 2).

Efficiency ratios regarding proceedings as reported in statistical reports drawn up by the courts[4]:

Registration handling ratio (see Table 2):

$$W_{OW} = \frac{\text{settlements}}{\text{registrations in the analyzed period}}$$

The pending cases ratio, otherwise known as the ratio of proceedings duration, tells us how many more months are needed to handle the number of registered cases in a given statistical period (see Table 2):

$$W_P = \frac{\text{pending cases} \times 12 \text{ months}}{\text{registrations}}$$

It should be noted, however, that the methods for calculating the ratios of registration handling W_{OW} and of pending cases W_P do not consider pending cases from previous years. For this reason, adjusted ratios, W_{OWs} and W_{Ps}, were proposed that take into account other variables which have a significant impact on the informative and management values of reports. These include:

The adjusted registration handling ratio which takes into account the number of pending cases from the previous period (see Table 3):

$$W_{OWs} = \frac{\text{settlements}}{\text{initial status + registration in the analyzed period}}$$

The adjusted pending cases ratio. This ratio takes into account the number of settlements rather than registrations as the basis for calculating the time needed to handle the pending cases (see Table 3):

$$W_{Ps} = \frac{\text{pending cases} \times 12 \text{ months}}{\text{settlements}}$$

[3]From the perspective of a citizen, a case is finalized when a preliminary ruling is issued, ending the proceedings of the case.

[4]http://bip.ms.gov.pl/pl/dzialalnosc/statystyki/statystyki-2013/

Constraints related to the financing of courts from the state budget (annual budget of expenditure and revenue, discipline regarding public finances) as well as rigid legal regulations concerning, in principle, each area of the functioning of individual courts, are sometimes reasons for the inefficiency of courts. For this reason, assessing the scale at which the analyzed units operate plays an important role in choosing the appropriate model based on the nature of returns to scale (CRS or VRS). In both cases, the calculations require the same data. From the point of view of a citizen, the scale and extent of court actions do not matter, what matters is only the efficiency and duration of proceedings. In this case, CRS analysis will be more appropriate. On the other hand, the Ministry of Justice may expect comparisons between courts of a similar size and scale of operations (Fig. 1). From this perspective, an analysis assuming VRS and the necessity of preserving resources in readiness to provide services would appear to be more accurate.

Table 1. Inputs, outputs and efficiency based on the DEA model

Court	Inputs			Outputs	DEA efficiency		
	Judges	Assistants	Officials	No. of settlements in 2013	CRS	VRS	NIRS
S1	10.28	2	29	3178	0.805479	0.858284	0.805479
S2	11	2	29	3735	0.89129	1	0.89129
S3	21.24	1	58	6341	1	1	1
S4	21	7	43	7824	1	1	1
S5	9.17	1	29	3438	0.972773	1	0.972773
S6	18.05	2.5	53.5	5614	0.806242	0.820955	0.820955
S7	66	16	155.5	22 734	0.913853	1	1
S8	11.8	3	30	3806	0.849266	0.913743	0.849266
S9	39.25	18	99	11 495	0.770906	0.808958	0.808958
S10	48.25	21	115	16 401	0.899834	0.965937	0.965937
S11	39.3	18	140	15 561	1	1	1
S12	79.75	43	190	21 581	0.716387	0.949283	0.949283
S13	10	3	31.5	3132	0.804822	0.830304	0.804822
S14	10.84	4	31	3632	0.870275	0.895064	0.870275
S15	31	5	87	11 220	0.943857	1	1
S16	17.5	2	47	4843	0.738436	0.754177	0.754177
S17	14	6	37	4528	0.847204	0.855668	0.847204
S18	25.17	7	66.5	8764	0.912973	0.931642	0.931642
S19	19.1	6	46	6917	0.958138	0.958505	0.958138
S20	17.9	3.9	54.5	5815	0.838844	0.838906	0.838844
S21	13.88	3	38	5053	0.951474	0.957225	0.951474
S22	13.88	1	40	5334	1	1	1
S23	45.2	7	119.25	15 440	0.896818	1	1
S24	22	10	65.75	7376	0.866119	0.866939	0.866119
S25	12.54	6	33	3834	0.801239	0.817874	0.801239
S26	11	3	29	3950	0.941809	1	0.941809

Source: Author's calculations based on the courts' statistical reports for 2013.

An analysis of the 26 district courts, from S1 to S26, was carried out taking into account the possibility of CRS, VRS or NIRS based on outputs (Table 1). The effect of any change in efficiency on the key ratios that must be presented, by law, in the courts' statistical reports (Tables 2 and 3).

Table 2. Statistical data for the analyzed district courts

Court	Cases pending from 2012	Registrations	Settlements in 2013	Cases pending for 2014	Registration handling ratio in 2013	Pending cases ratio
S1	346	3281	3178	449	96.86	1.64
S2	487	3751	3735	503	99.57	1.61
S3	1447	6609	6341	1715	95.94	3.11
S4	1663	8195	7824	2034	95.47	2.98
S5	973	3723	3438	1258	92.34	4.05
S6	1165	5919	5614	1470	94.85	2.98
S7	7192	24071	22 734	8529	94.45	4.25
S8	676	3930	3806	800	96.84	2.44
S9	4390	12 353	11 495	5248	93.05	5.10
S10	6966	17 064	16 401	7629	96.11	5.36
S11	4569	16 468	15 561	5476	94.49	3.99
S12	7709	22 987	21 581	9115	93.88	4.76
S13	916	3177	3132	961	98.58	3.63
S14	1153	3858	3632	1379	94.14	4.29
S15	3991	12297	11 220	5068	91.24	4.95
S16	1456	5390	4843	2003	89.85	4.46
S17	1149	4700	4528	1321	96.34	3.37
S18	1971	9265	8764	2472	94.59	3.20
S19	2172	7250	6917	2505	95.41	4.15
S20	1165	6576	5815	1926	88.43	3.51
S21	1178	5161	5053	1286	97.91	2.99
S22	756	5465	5334	887	97.60	1.95
S23	3263	16 411	15 440	4 234	94.08	3.10
S24	1941	8 014	7 376	2 579	92.04	3.86
S25	1577	4 120	3 834	1 863	93.06	5.43
S26	1048	4 150	3 950	1 248	95.18	3.61

Source: Author's calculations based on statistical reports for 2013.

Analysis based on the assumption of CRS showed that, in the analyzed group of 26 district courts, four courts (S3, S4, S11, S22) are efficient (Table 1). The remaining units have reserves and could achieve better registration handling ratios. However, it is important that the method of calculating the registration handling ratio does not take into account cases pending from previous years, which has an adverse impact on the informative value of the W_P and W_{OW} ratios (Table 2).

Table 3. Adjusted efficiency ratios for proceedings

Court	Cases pending from 2012	Registrations	Settlements in 2013	Cases pending for 2014	Registration handling ratio in 2013	Pending cases ratio
S1	346	3281	3178	449	87.62	1.49
S2	487	3751	3735	503	88.13	1.42
S3	1447	6609	6341	1715	78.71	2.55
S4	1663	8195	7824	2034	79.37	2.48
S5	973	3723	3438	1258	73.21	3.21
S6	1165	5919	5614	1470	79.25	2.49
S7	7192	24 071	22 734	8529	72.72	3.27
S8	676	3930	3806	800	82.63	2.08
S9	4390	12 353	11 495	5248	68.66	3.76
S10	6966	17 064	16401	7629	68.25	3.81
S11	4569	16468	15 561	5476	73.97	3.12
S12	7709	22 987	21 581	9115	70.31	3.56
S13	916	3177	3132	961	76.52	2.82
S14	1153	3858	3632	1379	72.48	3.30
S15	3991	12 297	11 220	5068	68.89	3.73
S16	1456	5390	4843	2003	70.74	3.51
S17	1149	4700	4528	1321	77.41	2.71
S18	1971	9265	8764	2472	78.00	2.64
S19	2172	7250	6917	2505	73.41	3.19
S20	1165	6576	5815	1926	75.12	2.99
S21	1178	5161	5053	1286	79.71	2.43
S22	756	5465	5334	887	85.74	1.71
S23	3263	16411	15 440	4234	78.48	2.58
S24	1941	8014	7376	2579	74.09	3.11
S25	1577	4120	3834	1863	67.30	3.92
S26	1048	4150	3950	1248	75.99	2.88

Source: Author's calculations based on statistical reports for 2013.

For example, court S12, which declared 21 581 settlements in 2013, reported the registration handling ratio, W_{OW}, of 93.88%, and the pending cases ratio W_P of 4.76 months (Table 2). Taking into account the 7 709 pending cases from 2012, the adjusted W_{OWs} was equal to 70.31%, and the W_P was equal to 5.07 (Table 3). This means in practice that court S12 was expected to need more than 5 months to handle the cases pending at the end of 2013. Using its capabilities in a fully efficient manner, as exhibited by S3, S4, S11, S22, and not, as currently, at the level of 72% (Table 1), it could have achieved 30 125 settlements (Table 4). Thereby, the registration handling ratio of court S12 would have been equal to 98.14%. As a result, this would have enabled the court to decrease the number of pending cases from 9 115 to 571, and the W_{Ps} would have decreased from 5.07 to 0.2 months.

Analyzing efficiency based on the possibility of VRS or NIRS), court S12 could have achieved 22 734 settlements (Table 5). In this case, the registration handling ratio of court S12 would have been equal to 74.06%. This would have enabled the court to decrease the number of pending cases from 9115 to 7962 and the W_{Ps} would have decreased from 5.07 to 4.2 months. With regard to the fact that $ET_{Sj,\,VRS} = ET_{Sj,\,NIRS}$ in the case of court S12, it can be stated that court S12 is an entity acting in the area of decreasing returns to scale.

Table 4. Effects of working at full efficiency based on CRS

Court	Settlements in 2013	Cases pending in 2014	W_{OWs}	W_{Ps}
S1	3945	0	108.78	–1.1
S2	4191	47	98.88	0.1
S3	6341	1715	78.71	2.6
S4	7824	2034	79.37	2.5
S5	3534	1162	75.26	3.0
S6	6963	121	98.29	0.2
S7	24 877	6386	79.57	2.5
S8	4482	124	97.30	0.3
S9	14 911	1832	89.06	1.3
S10	18 227	5803	75.85	2.9
S11	15 561	5476	73.97	3.1
S12	30 125	571	98.14	0.2
S13	3892	201	95.08	0.6
S14	4173	838	83.28	2.0
S15	11 887	4401	72.98	3.2
S16	6558	288	95.80	0.5
S17	5345	504	91.38	1.0
S18	9599	1637	85.43	1.7
S19	7219	2203	76.62	2.8
S20	6932	809	89.55	1.3
S21	5311	1028	83.78	1.9
S22	5334	887	85.74	1.7
S23	17 216	2458	87.51	1.5
S24	8516	1439	85.55	1.7
S25	4785	912	83.99	1.9
S26	4194	1004	80.69	2.3

Source: Author's calculations based on statistical reports for 2013.

In the analyzed group of 26 district courts, 13 operate in the area of increasing returns to scale (S1, S2, S5, S8, S13, S14, S17, S19, S20, S21, S24, S25, S26), while 9 operate in the area of decreasing returns to scale (S6, S7, S9, S10, S12, S15, S16, S18, S23). Based on the assumption of CRS, 4 courts turned out to be efficient (S3, S4, S11, S12), 10 courts were deemed to be efficient based on the assumption of VRS, (S2, S3,

S4, S5, S7, S11, S15, S22, S23, S26), and 7 courts were effective based on the assumption of non-decreasing returns to scale (S3, S4, S7, S11, S15, S22, S23) (Table 1).

By achieving full efficiency based on CRS, the appeal courts of the Cracow district could have achieved a total of 241 943 settlements in 2013, 14.36% more than the actual amount. In this case, the number of cases pending for 2014 would have decreased by 41.10% to 43 561. By achieving full efficiency based on VRS, the number of settlements could have increased by 6.7% and, as a result, the number of pending cases would have decreased by 19.25%. By achieving full efficiency based on non-increasing returns to scale (NIRS), the number of settlements could have increased by 7.6%, and the number of pending cases could have decreased by 26.66%.

Table 5. Effects of working at full efficiency based on VRS and NIRS

Court	Settlements in 2013		Cases pending in 2014		W_{OWs}		W_{Ps}	
	VRS	NIRS	VRS	NIRS	VRS	NIRS	VRS	NIRS
S1	3703	3945	0	0	102.09	108.78	–0.2	–1.0
S2	3735	4191	503	47	88.13	98.88	1.6	0.1
S3	6341	6341	1715	1715	78.71	78.71	3.2	3.2
S4	7824	7824	2034	2034	79.37	79.37	3.1	3.1
S5	3438	3534	1258	1162	73.21	75.26	4.4	3.9
S6	6838	6838	246	246	96.53	96.53	0.4	0.4
S7	22 734	22 734	8529	8529	72.72	72.72	4.5	4.5
S8	4165	4482	441	124	90.43	97.30	1.3	0.3
S9	14 210	14 210	2533	2533	84.87	84.87	2.1	2.1
S10	16 979	16 979	7051	7051	70.66	70.66	5.0	5.0
S11	15 561	15 561	5476	5476	73.97	73.97	4.2	4.2
S12	22 734	22 734	7962	7962	74.06	74.06	4.2	4.2
S13	3772	3892	321	201	92.16	95.08	1.0	0.6
S14	4058	4173	953	838	80.98	83.28	2.8	2.4
S15	11 220	11 220	5068	5068	68.89	68.89	5.4	5.4
S16	6422	6422	424	424	93.80	93.80	0.8	0.8
S17	5292	5345	557	504	90.47	91.38	1.3	1.1
S18	9407	9407	1829	1829	83.72	83.72	2.3	2.3
S19	7216	7219	2206	2203	76.59	76.62	3.7	3.7
S20	6932	6932	809	809	89.54	89.55	1.4	1.4
S21	5279	5311	1060	1028	83.27	83.78	2.4	2.3
S22	5334	5334	887	887	85.74	85.74	2.0	2.0
S23	15 440	15440	4234	4234	78.48	78.48	3.3	3.3
S24	8508	8516	1447	1439	85.47	85.55	2.0	2.0
S25	4688	4785	1009	912	82.28	83.99	2.6	2.3
S26	3950	4194	1248	1004	75.99	80.69	3.8	2.9

Source: Author's calculations based on statistical reports for 2013.

4. Conclusions

The concept of measuring the efficiency of civil courts by means of DEA, as presented in this paper, is an attempt to measure courts' efficiency with reference to their use of resources with the aim of closing cases. This analysis was carried out for the district courts of the Cracow ward. The product of court actions was assumed to be closing a case (settlement). The human resources directly related to the adjudicatory process were assumed to be the input. Efficiency was measured based on the outputs of the district courts relative to the human resources they possess. This analysis took into account the efficiency of a court from the perspective of a citizen awaiting the settlement of a case (CRS) and from the point of view of the managers of these institutions (VRS and NIRS). In effect, the results obtained demonstrate the reserves of the courts, which if accessed would enable them to reduce the number of pending cases. Despite the fact that no standard measure of the efficiency of courts has been established, it has been shown that DEA may successfully fill this gap. In addition, this paper addresses the issue of the quality of the information presented in the statistical reports compiled by the courts, indicating the imperfect quality of the methods used to measure the efficiency of courts. The paper also includes a proposal to introduce adjustments to these measures, by taking into consideration cases pending from previous years. The application of DEA can be used as a starting point to analyzing the factors affecting the efficiency of a court. The results can thus be used as a basis for creating best practices (benchmarks), to manage not only the structure of district courts, but also the assignment of cases.

The author's conclusions should be treated as a contribution to further discussion on the reform of justice, bearing in mind that the criterion of efficiency is not the only one related to the quality of the functioning of the judiciary system in Poland.

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