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# Determinants of scientific categories in the field of Economic Sciences
## Assumptions and results of the parameterisation in 2017

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**Abstract**

The aim of the article is to identify the main determinants of categories ascribed to scientific research units in the field of Economic Sciences in 2017. In the first part of the article, the legal and substantive basis for the evaluation of such institutions is presented. The second part of the text provides a verification of the evaluation assumptions included in the legal regulations (their advisability and significance). The verification is based on the statistical analysis of the obtained results. There are only two criteria out of four that determine the ascribed scientific categories: the first criterion refers to scientific achievements (publications) and the second one refers to scientific potential (scientific promotion and academic staff mobility). The other criteria – the third one (commercialisation of the research) and the fourth one (impact of the research exerted on economy and its internationalisation) did not affect the comprehensive evaluation in any significant way. The number of registered academic employees was not of any significance either.

*Key words:* Parameterisation, scientific categories, evaluation of scientific research activities

### Introduction

Commonly accepted, a definition of science states that it refers to all activities that are involved in scientific research aimed at generation and development of knowledge, in accordance with methods that provide objective, advisable and systematised cognition of particular fields of our reality (Cynarski, 2000, p. 26). Such activities involve establishment and dissemination of results obtained during scientific research, along with implementation of those results into practice. Consequently, science is approached in an institutional aspect. Science comes as a subject of the statutory operation of various institutions organised in the form of scientific and academic units (higher education institutions), research centres, scientific institutes and other research and academic bodies (Apanowicz, 2002, p. 15).

The discussed functional and institutional approach towards science comes as a legal basis for organising scientific activities in Poland. In accordance with the Articles 4 and 6 of the current Act on Higher Education Law, which has been in force since September 2018 (AoHEL, 2017), each higher education institution has the right and obligation to run scientific research. This principle shall be continued under the new regulations. Regardless of the (public or non-public) character of particular higher educa22tion institutions, the responsibility for providing funds for research activities rests mainly with the state. Funding covers, among others, statutory activities of scientific units, that is, namely: maintenance of their research potential (including specialist research equipment), the restructuring of

scientific units and support facilitating the access to scientific information. The amount of the state funds that are granted depends, first of all, on a scientific category assigned to a particular unit, as a result of the comprehensive evaluation of its scientific activities. The process is referred to as the parameterisation (Act on Principles of Funding Science, 2010, Art. 18 and 42). It implies that – apart from the prestige – the measurement and quantification referring to the evaluation of the research activities performed by particular units have also a financial dimension, which makes it possible to position scientific institutions according to their performance.

Considering the purposes related to systematisation and organisation, apart from the discussed institutions and their tasks in the field of scientific activities, it is also possible to find their formal classification in relevant legal regulations (Ordinance of the Minister of Science and Higher Education, 2011). The three-tier division of science includes 8 scientific areas, which are subsequently divided into 22 scientific fields. The fields are sub-divided into scientific disciplines. In the area of social sciences and humanities, the field of economic sciences is distinguished, and it includes four disciplines: economics, management sciences, finance and commodity sciences. In accordance with the list of scientific units provided by the Ministry of Science and Higher Education (POLON, 2018), there are 66 scientific units that operate in Poland and are authorised to confer scientific degrees in the selected disciplines of economic sciences. There are also 20 up to 40 (depending on time) units that have applied for such authorisation. In 2017, all the above-mentioned units had the right to undergo a comprehensive evaluation of their scientific activities, under the procedures defined by the Ordinance of the Ministry of Science and Higher Education (Ordinance of MSHE, 2016), in order to be assigned with a proper scientific category, according to the results of the evaluation.

The above-mentioned Ordinance provides some detailed procedures for the parameterisation of scientific activities, which include the process of application and its contents, deadlines and conditions that must be met to apply for a reviewed evaluation, the criteria and detailed principles for the evaluation.

In October 2018, a new legal regulation came into force. It refers to the organisation of science and higher education in Poland (AoSHEL, 2018). Referred to also as 'the Constitution for Science' or 'the Act 2.0', the act is intended to improve standards related to scientific research carried out in Poland. It should be translated into higher quality and a broader scope of disseminating its results. In comparison to the present situation, in the Constitution for Science, some more significance is ascribed to the parameterisation of scientific units. The results of such parameterisation will determine not only the amount of the funds for science but also the academic authorisation of higher education institutions, and it will also largely affect scientific careers of their employees. Carried out in accordance with the new regulations, the first parameterisation will probably take place in 2021. In its project (*The Project* … 2018), the Ministry presents a draft of such an evaluation. At present, it is still being discussed and the ultimate details referring to the methodology and the criteria for scientific unit evaluation are not known. The distant deadline of the next categorisation prompts the Authors to make an attempt at providing an analysis of the current experience in that field in order to use it for proper preparation towards such procedures in the future.

The aim of the article is to identify the main determinants of the categories assigned to the scientific units in the field of economic sciences in 2017. In the first part of the article, the legal and substantive basis for the evaluation of such units is presented. The second part of the article presents the verification of the evaluation assumptions included in the legal regulations (their advisability and significance), which is based on the statistical analysis of the obtained results.

## Assumptions of parameterisation in 2017

Problems related to parameterisation of scientific activities is relatively scarcely discussed in the literature. Theoretical foundations and history of parameterisation is described by Antonowicz (2011). The experience of other countries (of Great Britain mostly) indicates that the positioning of higher education institutions with regard to their performance in the field of scientific activities comes as a significant question, with consideration of two key viewpoints important for science. The first one refers to disbursement of public funds in the macro-scale. The review of scientific potential in the national scale facilitates the identification of entities, which have won their strong scientific positions, deserving increased funding and weaker entities, the funding of which should assume tasks motivating them for further development. The second viewpoint refers to the micro-scale involving one particular scientific unit. Obtaining an adequate and fair evaluation allows that unit and its authorities to perform self-assessment of their activities and to provide proper management.

The parametric evaluation of scientific activities has got a long tradition in Poland. It has been performed by the Ministry of Science and Higher Education (MSHE) every four years for over 20 years. Practically, each edition of parameterisation was based on slightly different principles that were developed on the basis of the experience gained during the previous editions. As a result of a discussion, which could be followed in some scientific periodicals (e.g., Antonowicz and Brzeziński, 2013; Sadowski and Mach, 2013), the Minister announced an Ordinance that was to regulate organisation, methods, criteria and techniques assumed for the evaluation of scientific activities. The last parameterisation took place in 2017, and its principles were developed one year before (Ordinance of the MSHE, 2016).

In the Ordinance, the Ministry defined four main criteria for the comprehensive evaluation of scientific activities of scientific units, assigning them with due weights in the general evaluation:

1. scientific and artistic achievements – 65%
2. scientific potential – 15%
3. practical outcomes of scientific and artistic activities – 5%
4. other outcomes of scientific and artistic activities – 15%

The evaluation was based on a questionnaire that included properly classified achievements of scientific units, in accordance with the above-mentioned criteria. The submitted achievements referred to the indicated evaluation period, namely: the years 2013–2016. It should also be emphasized that it was the first time in history when scientific units provided self-evaluation reports via electronic means only. It referred to the basic deadline for the submission of the evaluation application and to the appeal procedures. The completed questionnaire form was verified by the evaluation team consisting of three members appointed by the Minister. The team evaluated achievements on the basis of electronic databases of scientific publications, the information about research teams and institutions presented on various websites along with the outcomes of their research studies and on the basis of their own expert knowledge. The Minister assumed that these principles would be binding until the next edition of parameterisation of scientific units, scheduled for 2021.

One of the key parameters in the parameterisation of 2017 was the N number. The number referred to the average annual employment of academic and teaching employees at a particular unit, who had agreed to be included in such a number. Considering such employees, the Ordinance defined the No number which referred to the average annual number of employees included in the N number, who did not publish any scientific studies during the evaluation period.

The N and No numbers were used under the first criterion of the parametric evaluation. Scientific and creative achievements were evaluated on the basis of the number of points ascribed to one person included in the N number for scientific publications. These points were defined for scientific articles, according to the list of the JCR-indexed journals, which was announced by the Minister. The points for other publications were indicated in the Ordinance. The number of publications that were taken into consideration was defined in accordance with the following equation:

$$\text{The number of publications} = 3N - 2N_0 \qquad (1)$$

The evaluation under the first criterion is expressed with the following relation:

$$\frac{\text{points granted for scientific publications} * 48}{\text{N} * \text{the number of evaluated months}} \qquad (2)$$

The second criterion of the parametric evaluation included the point-based characteristics of development of academic staff (e.g., for the conferment of a scientific title – 10 points; the conferment of the habilitation degree – 7 points, etc.), which was extended by academic staff mobility (e.g., the conferment of Ph.D. degree at another higher education institution – 2–5 points, internship abroad longer than 3 months – 2 points, etc.). The membership of employees in expert panels was also taken into consideration (e.g., expert panels of the National Science Centre – 2 points, membership in the authorities of foreign scientific organisations – 2 points).

The third criterion referred to the evaluation of outcomes achieved in the commercialisation of results of scientific research. It was based on a point-based method in which points were granted on the basis of a documented income earned by a particular higher education institution for such commercialisation (1 point – 100 000 PLN). In the evaluation, it was also possible for scientific units to declare their performance in terms of practical application of their research achievements, which did not generate any income, but it was possible to document their scope (local – 2 points, international – 10 points). The

final evaluation under the third criterion was the number of points calculated for one employee included in the N number.

The fourth criterion referred to two parameters: other than those which were included in the first three criteria, exceptional scientific achievements of international scope documented by the assessed units and documented results of the research that contributed to the innovativeness in economy, security and protection of natural environment and which proved the international position taken by a particular unit in terms of the research projects and popularisation activities undertaken by that unit. It was possible for a unit to submit its 10 achievements for evaluation. The competences of the evaluation team included assigning the submitted achievements to both parameters and providing a relevant point-based evaluation. The evaluation could reach the maximum level of 50 points for each parameter.

Hence, the comprehensive parametric evaluation of a scientific unit is composed of four point-based assessments, calculated under each of the above-mentioned criterion. The integration of four assessments took place by their comparison to the reference evaluation for the relevant scientific categories. Such comparison was performed under the joint evaluation group (JEG) defined by the relevant committee of the Ministry. The group consisted of scientific units characterised by similar research profiles and scientific disciplines (Ordinance of the MSHE, 2016). The reference evaluation for the JEG defined by the Ministry as HS1EK (the field of Economic Sciences) is presented in Table 1.

Table 1. Reference evaluation for the JEG HS1EK

| | Criterion I | Criterion II | Criterion III | Criterion IV |
|---|---|---|---|---|
| Category A | 47.80 | 230.00 | 0.26 | 70.00 |
| Category B | 32.80 | 47.00 | 0.13 | 40.00 |
| Scientific unit (an example) | 38.95 | 801.84 | 0.16 | 20.00 |

Source: (http://www.nauka.gov.pl/g2/oryginal/2017_10/e3bd00e5aaade519e14b17d2531487d0.pdf)

The comparison to the reference evaluation follows a specific algorithm. In accordance with the Ordinance (Ordinance of the MSHE, 2016), for each of the assumed criteria, the comprehensive evaluation should be converted into point-based results (P). The point-based result can reach the value from -1 to +1.

The key element in that procedure is establishing the threshold values, marked as D and G, which define the conditions for application of the equations stated in the Ordinance:

$$P = \begin{cases} 0, for\ R \le X\ \le 1.1\ R \\ \frac{X-1.1R}{0.2R}, for\ 1.1\ R\ < X\ < 1.3\ R \\ 1, for\ X\ \ge 1.3\ R \end{cases} \quad (3)$$

If the evaluation of a unit under a particular criterion was X and it was higher than the reference value (R), then the D value = 10% of the reference value and the G value = 30% of the same value. If the exceeding of X-R was lower than D, the unit was considered to be indistinctive from the reference unit and its point-based result was 0. If the evaluation under a particular criterion exceeded the reference value (R) by more than G, then the point-based result was +1. For the evaluation of a unit under the particular criterion with the X value between 110% and 130% of the reference value, the linear approximation was applied.

If the evaluation of the unit (X) was lower than the reference value, then the analogical algorithm was applied, and the D and G thresholds were defined with regard to the lower value, that was namely: the evaluation of the unit (X):

$$P = \begin{cases} 0, for\ R - 1.1X \le X \le R \\ -\frac{R-1.1X}{0.2X}, for\ R - 1.3X < X < R - 1.1X \\ -1, for\ X\ \le R - 1.3X \end{cases} \quad (4)$$

Assuming the average values of the evaluation obtained by the JEG = HS1EK for the point-based evaluation (see: Table 2) with regard to the reference values of the B category, the particular point-based results (P1 to P4) were:

- $P1 = \frac{X-1.1R}{0.2R} = \frac{42.50-1.1*32.80}{0.2*32.80} = 0.9787$ because $1.1R < X < 1.3R$

- $P2 = 1$, because $X > 1.3R$
- $P3 = 1$, because $X > 1.3R$ (5)
- $P4 = -\frac{R-1.1X}{0.2X} = -\frac{40.00-1.1*32.53}{0.2*32.53} = -0.6484$ because $R$-$1.3X < X < R$-$1.1X$

The final comprehensive evaluation was established on the basis of the weighted average of the point-based values obtained by the unit under the subsequent criteria:

$$OK = 65\% * P1 + 15\% * P2 + 5\% * P3 + 15\% * P4 \quad (6)$$

If the evaluation reached the value higher than 0, then the unit was assigned with one of the three scientific categories (B, A and A+), depending on the reference values assumed in the algorithm. For example, a unit (see: Table 1) obtains the following final evaluation:

$$OK = 65\% * 0.9787 + 15\% * 1 + 5\% * 1 + 15\% * (-0.6484) = 0.7389 \quad (7)$$

The final evaluation is higher than 0, which means that the unit with the point-based evaluation different than the average of the units functioning in the field of Economic Sciences will obtain the scientific category of B.

The preliminary analysis of the algorithm assumed for the calculation of the final evaluation indicates that the point-based result under the first criterion (P1) is dominant. The unit cannot obtain a particular scientific category even if all the point-based assessments under other three criteria reach their maximum (+1). The low evaluation under the first criterion (65%*P1 < -0.35, hence $X < 85\%R$) may result in the fact that the comprehensive evaluation will not exceed the threshold value of 0:

$$for\ P2 = P3 = P4 = 1, OK = 0 \text{ if } 65\% \times P1 = -0.35 \quad (8)$$
$$\text{hence, for } P1 \in [-1.0, -0.5385)\ OK < 0,$$

calculating X on the basis of the following relation (4) $-\frac{R-1.1X}{0.2X} < -0.5385$ we obtain for X < 83%*R OK is always lower than 0.

It is possible to assume an opposite situation, where the final evaluation is exclusively decided only by a high result obtained under the first criterion. If 65%*P1=0.35 (i.e., $X = 121\%$ of the reference value), the unit obtains an expected category, regardless of the other point-based values (P2, P3, P4). Only in a situation when the weighted point-based value under the first criterion (65%*P1) ranges from -0.35 to 0.35 ($83\%*R < X < 121\%*R$), do the results obtained under the other criteria decide about assigning a particular scientific category (P2, P3, P4).

## The research problem, material and methods

The procedure of the parameterisation of 2017 allows the Authors to formulate the following research problem: Which of the criteria assumed in the Ordinance of the Minister for the evaluation of scientific units significantly affected the scientific category obtained in the JEG = HS1EK? The answer to this question will make it possible to:

1) indicate to what extent the parameterisation procedure defined in the Ordinance is relevant to the specificity of scientific units carrying out their research studies in the field of Economic Sciences
2) establish strong and weak points of such units with regard to expectations of the state, which is the main sponsor financing their activities.

The research material is based on the results of the parameterisation announced by the Minister for the JEG = HS1EK (*The results…,* 2017). The list includes all the units in the particular evaluation group, along with the data including the N number, partial point-based assessments under all four criteria and the obtained scientific category. Hence, the research sample included 88 higher education institutions, 3 of which were granted the scientific category of A+, 22 were granted the A category, 44 obtained the B category and 19 were given the C category. These data were assumed as the variables for the statistical analysis. Table 2 presents the descriptive statistics of the research sample.

Table 2. The descriptive statistics of the variables

| Value | N number | Point-based evaluation Criterion I (O1) | Point-based evaluation Criterion II (O2) | Point-based evaluation Criterion III (O3) | Point-based evaluation Criterion IV (O4) |
|---|---|---|---|---|---|
| Min | 2.00 | 18.35 | 0.00 | 0.00 | 0.00 |
| Max | 355.58 | 72.29 | 932.57 | 3.87 | 100.00 |
| Median | 74.75 | 44.58 | 182.88 | 0.26 | 27.50 |
| Arithmetical average | 78.54 | 42.50 | 267.49 | 0.57 | 32.53 |
| Standard deviation | 54.51 | 10.55 | 259.21 | 0.82 | 22.91 |
| Coefficient of variation (%) | 69.40 | 24.83 | 96.91 | 144.52 | 70.42 |
| Skewness | 1.74 | -0.33 | 0.91 | 2.18 | 0.89 |

Source: the Authors' own calculations

The most differentiated distribution can be observed in the point-based evaluation under the third criterion (the coefficient of variation = 144.52%), whereas the evaluation for scientific achievements is the least differentiated (the coefficient of variation = 24.83%). The distributions of the most variables are positively skewed (skewness > 0). It means that there were more assessments that were lower than the arithmetic average. The assessments obtained under the first criterion were the only ones characterised by negatively skewed distribution; it means that – considering the scientific achievements – there were more assessments that were higher than the reported average.

It was decided that in order to provide the evaluation of the relation between the obtained scientific category and the point-based characteristics of the unit, the tools of econometric modelling would be applied. The following independent variables were assumed: N – the N number, O1 to O4 – point-based evaluation under the particular criteria. The dependent value ($y_i$) was the category obtained by the unit. As it was a discrete variable (it took four values: C, B, A, A+), a polynomial ordered logit model was applied to analyse the relation between the variable and independent variables, in the following form:

$$y_i^* = x_i^T * \beta + u_i \qquad (9)$$

where:

$y_i^*$ - a non-observable variable referring to the i[th] observation (of a scientific unit, i = 1,2,…,88), related to the $y_i$ variable in the following way: $y_i = j \Leftrightarrow k_{j-1} < y_i^* \leq k_j$,

$k_j$ - threshold values (usually unknown – they were estimated along with the parameters), where: $k_0 = -\infty < k_1 < \cdots < k_{J-1} < k_J = +\infty$, where $J = 4$, because the dependent variable took four values

$x_i^T$ - the vector of the dependent variables for the i[th] observation given in the row index notation

β - the vector of parameters

$u_i$ - random components of logistic distribution

The scientific categories were marked with the subsequent natural numbers so that the higher category was marked with a higher number. Hence, the C category was assigned with the value of 1 and the +A category was assigned with the value of 4.

The designed model assumes that the parameters for the dependent variables are the same for each category of the j[th] dependent variable, that is, namely: that the assumption of the proportional odds (parallel regression) is met. The assumption can be verified with the use of the Brant test (1990) or the Wolfe and Gould test (1998). If the assumption is not met, the J-1 binary regression or a generalised ordered model should be estimated (Gruszczyński, 2010).

The evaluation of the quality of the estimated models has been provided with the following tests: the Cox and Snell pseudo $R^2$ and the Nagelkerke pseudo $R^2$ (Gruszczyński, 2010; Cox and Snell, 1989; Nagelkerke, 1991) and the Wald test that verifies the significance of the evaluation of the model parameters. In order to assess the extent to which the obtained model is suitable to classify each observation to the particular categories of the dependent variable, the calculated $R^2$ is applied, which comes as the quotient of the number of the right predictions to the total number of the observations (Gruszczyński, 2010).

The estimation methods of the polynomial ordered logit model are presented in the studies of Cameron and Trivedi (2009) and Hilbe (2009).

## The results of the research

Firstly, the generalised ordered logit model has been estimated. Table 3 presents the estimation of the parameters.

Table 3. The results of the estimation of the ordered logit model for a scientific category

| Independent variables | Parameter $\hat{\beta}$ | Standard deviation | Wald statistics | Level of significance $p$ | 95% Confidence interval | |
|---|---|---|---|---|---|---|
| | | | | | Lower limit | Upper limit |
| cut 1 | 16.438 | 3.530 | 21.687 | 0.000 | 9.520 | 23.356 |
| cut 2 | 26.002 | 5.062 | 26.386 | 0.000 | 16.081 | 35.923 |
| cut 3 | 33.370 | 6.384 | 27.319 | 0.000 | 20.856 | 45.883 |
| N | -0.004 | 0.008 | 0.174 | 0.676 | -0.020 | 0.013 |
| O1 | 0.430 | 0.088 | 23.608 | 0.000 | 0.256 | 0.603 |
| O2 | 0.010 | 0.003 | 8.831 | 0.003 | 0.003 | 0.017 |
| O3 | 0.568 | 0.444 | 1.638 | 0.201 | -0.302 | 1.438 |
| O4 | 0.026 | 0.029 | 0.790 | 0.374 | -0.031 | 0.083 |
| The $R^2$ of Cox and Snell = 0.809; the $R^2$ of Nagelkerke = 0.901; the percentage of the correct classification = 90.9% | | | | | | |

Source: the Authors' own calculations

Based on the obtained estimation, it has been stated that the only significant independent variables are the assessments O1 $(p < 0{,}01)$ and O2 $(p = 0{,}03)$. The positive evaluation of the parameters for these variables indicate that the higher the value of the particular assessment, the higher is the likelihood of obtaining a higher scientific category.

The measures of the quality of the model fitting indicate that it is well-fitted to the data; however, the test of line parallelism (chi-squared = 54.895, $p < 0{,}01$) indicates that it does not meet the assumption of proportional odds. It means that some or all the coefficients for the independent variables may differ significantly between the pairs of the compared categories; therefore, it has been decided to estimate three binary regressions, respectively to the subsequent groups of the scientific categories (between the C category and other categories: B, A and A+; between C, B and A, A+; and between C, B, A and A+). It is presented in Table 4.

Table 4. The results of the estimation of the logit models for the pairs of the particular groups of the scientific categories

| Independent variables | Parameter $\hat{\beta}$ | Standard deviation | Wald statistics | Level of significance $p$ | Quotient of odds $\exp(\hat{\beta})$ |
|---|---|---|---|---|---|
| the C category in comparison to the B,A, A+ categories | | | | | |
| O1 | 1.220 | 0.769 | 2.517 | 0.113 | 3.386 |
| Stała | -44.314 | 28.918 | 2.348 | 0.125 | 0.000 |
| The Cox and Snell $R^2$ = 0.623342; the Nagelkerke $R^2$ = 0.962346; Percentage of correct classification = 98.863636 | | | | | |
| the C, B categories in comparison to the A, A+ categories | | | | | |
| O1 | 0.530 | 0.158 | 11.257 | 0.001 | 1.700 |
| O2 | 0.013 | 0.004 | 11.599 | 0.001 | 1.013 |
| Stała | -30.758 | 8.812 | 12.183 | 0.000 | 0.000 |
| The Cox and Snell $R^2$ = 0.568; the Nagelkerke $R^2$ = 0.815; Percentage of correct classification = 90.909091 | | | | | |
| The C, B, A categories in comparison to the A+ category | | | | | |
| O4 | 0.090 | 0.036 | 6.121 | 0.013 | 1.094 |
| Stała | -8.394 | 2.775 | 9.153 | 0.002 | 0.000 |

| The Cox and Snell $R^2 = 0.120655$; the Nagelkerke $R^2 = 0.469049$; Percentage of correct classification = 98.863636 |
|---|

Source: the Authors' own calculations

In those models, only the statistically significant variables at the level of 0.05 have been retained, with an exception of the model comparing scientific units of the lowest C category with the units of higher categories (B, A, A+). After the application of the forward conditional method, the O1 variable is left in the model. Despite the fact that this variable is statistically insignificant, the model is characterised by very high accuracy of predictions – only one observation has been inadequately classified in this model. It means that based on the O1, it is possible to state whether a particular scientific unit will be assigned with the C category or whether it will obtain a higher category. The unit growth of the O1 increases the chance of obtaining a higher scientific category by 3,386 times.

Considering further comparison of the categories (the C, B categories in comparison to the A, A+ categories), it is possible to notice that obtaining a higher category is decided by the O1 and O2 variables. In this model, 8 observations have been inadequately classified. Subsequently, while comparing scientific units that have obtained lower categories (C, B, A) to scientific units of the highest category (A+), it is possible to notice that the odds to obtain the highest scientific category have been affected by the O4 variable. In this model, only one observation has been inadequately classified.

## Conclusions

On the basis of the research, it is possible to provide an explicit solution to the research problem, which has been formulated. The variables that have decided about the scientific category assigned in the JEG = HS1EK are the assessments under the first criterion (O1) and the second criterion (O2). Considering the assignment to the highest category +A, the assessment obtained under the last criterion (O4) may also have some influence. However, the number of the cases included in that category (3 observations) is too low and it does not allow the Authors to draw such a conclusion. Other variables assumed for the research, which may affect the assignment of the scientific category to a scientific unit, have been of no considerable significance for the final result of the categorisation.

The significant influence exerted by the first criterion on the assignment of a scientific category should be expected with regard to the weight assigned to it in the final evaluation (65%). The weight implies that the basic determinant of a scientific category is the aggregated quality of the submitted publications. The results of the research confirm such dependence. The quality and the number of submitted publications indirectly depend on the number of academic employees (N). The research indicates that two units that employ a similar number of people may obtain extremely different scientific categories (no statistically significant dependence has been identified between the obtained category and the N variable). It indicates high differentiation in the quality of scientific work provided by academic employees, depending on the unit at which they are employed.

The second significant criterion, namely: the evaluation of the scientific potential (O2) also refers to individual achievements of employees working at a particular unit (academic promotion and mobility). It should be emphasized that this criterion has been given low weight (15%), but still, it has proved to be significant in the categorisation. It means that the higher education institutions whose employees were conferred their scientific degrees (titles) during the evaluation period had much better chances to obtain a higher scientific category, along with the higher education institutions that employed people after their recent scientific promotion.

The last two criteria (O3 and O4) refer mainly to the capabilities of higher education institutions, viewed as organisations, to translate the outcomes of the research carried out by their employees into their application in economic practice or into scientific success of international importance. Both criteria did not play any significant role during the categorisation. The third criterion was not assigned with any great weight (5%), and it could be expected that it would not have any significant influence on the obtained category. The fourth criterion (O4) – despite the fact that its weight was identical to the weight assigned to O2 (15%) – was not translated into the final evaluation of the units.

Considering the above-mentioned conclusions, in the context of the current principles of the categorisation, it is possible to observe that:

- Units that carry out their scientific research in the field of Economic Sciences are strong with the individual strength of their employees.
- There is relatively slight (25%) differentiation in the quality of the research that is carried out, regardless of the number of employees. Nevertheless, the differentiation significantly affect the evaluation of the units.
- Despite very high differentiation, institutional operations undertaken by the units for commercialisation and internationalisation of their employees' scientific activities did not play any significant role in the parameterisation.

The announced draft Ordinance on the categorisation of 2021 does not involve many changes to the currently described general principles. The main differences refer to the detailed calculation of points assigned for the submitted publications and the number of publications that may be submitted by particular employees. In the final evaluation, the particular criteria are assigned with different weights. The weight of the evaluation of the outcomes of scientific research (the first criterion) has been increased from 65% to 70%. The second criterion (the scientific potential) has been removed from parameterisation, and the third (commercialisation of scientific research) and the fourth (the impact of the research on the society and economy, internationalisation) criteria have been assigned with greater weights – respectively 10% and 20%.

So far, the number of publications submitted by one employee has not been limited; in the future, however, these will be 4 best publications within a four-year evaluation period. It is intended in order to prevent scientific units from employing several outstanding scientists whose publications would cover the lack of scientific publications submitted by other employees. In the context of the results of the discussed research, such a direction of changes does not have any justification because scientific categories depend neither on the number of employees (N) nor, indirectly, on the number of publications (3N-2No).

The removal of the criterion referring to mobility and scientific promotion seems to be a controversial decision. Considering the fact that the categorisation procedures will not promote such behaviour, higher education institutions may stop supporting scientific promotion and employing young academic employees.

In the context of the results obtained after the research, the increase in the weights referring to the criteria related to the institutional support of scientific and science-related activities should be considered as desirable; however, the Authors believe that it is insufficient to convince higher education institutions to promote and to organise such activities.

**Literature**

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