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## Earnings management model for Visegrad Group as an immanent part of creative accounting

**JEL Classification:** C22; C52; M41

**Keywords:** *creative accounting; central Europe countries; model of creative accounting; regression analysis*

### Abstract

**Research background:** Creative accounting practices do not frequently violate the law and are not considered illegal; however, accounting managers may exploit legal ambiguities to portray the company's financial standing in accordance with management preferences. Therefore, the analysis is focused on the detection of earnings management in companies operating in the Visegrad

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Group, which represents one of the most commonly used techniques for revealing creative accounting.

**Purpose of the article:** The aim of the presented study is to reveal the presence of creative accounting through the detection of earnings management in the countries of the Visegrad Group and, based on the detected results, to propose a regression model of earnings management in the Visegrad Group.

**Methods:** To reveal the use of creative accounting in the Visegrad Group, ten selected models of earnings management were applied during the period 2016–2020 to a set of 8,134 companies. The Mann-Whitney test and multiple linear regression were used to verify the existence of earnings management. These findings served as the basis for the creation of the linear regression model of earnings management in the Visegrad Group.

**Findings & value-added:** The presence of earnings management was best captured by the Hribar and Collins model in companies operating in the Visegrad Group in the period 2016–2020. The findings also confirmed that positive discretionary accruals acquired higher values over the entire period when compared to negative discretionary accruals, confirming that companies in the surveyed group manage their profits primarily by increasing them. Therefore, we created a regression model, that can serve as a unique basis and is capable of revealing the use of earnings management in the Visegrad Group, as until now nothing like this has been implemented in these countries. In conclusion, this study offers insights for academicians and researchers on creative accounting in the selected period. Lastly, the study contributes to the existing theory by conducting new research on the earnings management determinants of the countries studied.

## Introduction

One of the most successful means of communication between businesses and stakeholders is through corporate annual reports. For those involved in the decision-making process, it serves as the main source of financial and non-financial information (Akpanuko & Umoren, 2018, pp. 292–310; Renu & Nishant, 2020, pp. 19–27; Safta *et al.*, 2020; pp. 90–107). Saleh *et al.* (2021) showed that corporate financial reports now contain a greater degree of narrative disclosure and that stakeholders, including investors, rely on this data when making investment decisions. Decision-makers' capacity to reach pertinent conclusions is weakened if these disclosures are convoluted and challenging to understand (Rueangsuwan & Jevasuwan, 2022; Abdullah & Nabar, 2022; Kliestik *et al.*, 2022b, pp. 57–69). Readability is one of the most crucial factors for the quality of annual reports.

Financial records should provide true and relevant information in accordance with current national and international accounting and reporting standards. The accounting function is required to record all economic transactions in such a way that financial records will present a true and fair view of the facts that are the subject of accounting (Son & Jeong, 2022). The manner in which economic transactions are reported demonstrates the company's financial stability and earnings quality (Viana *et al.*, 2022; Li *et al.*, 2022a). Financial reporting, or disclosing financial results and related information to all stakeholders, falls under the purview of top management or

company owners (assuming that the ownership structure also serves as the management body of the company) (Guo *et al.*, 2022, pp. 1–12). It is important for managers to share financial data with other parties to help them better understand the company's past, present, and future financial performance (Afifa *et al.*, 2022; Durana *et al.*, 2021c, pp. 20–30; Virglerova *et al.*, 2017, pp. 87–101).

An integral component of creative accounting is the manner in which data is reported and the corresponding earnings quality. However, creative accounting is seen as opportunistic behavior by managers who act for reasons other than improving truthful reporting, creating a somewhat bad perception of the practice (Imhanzenobe, 2022; Zvarikova *et al.*, 2021, pp. 9–21).

When individual gain influences the control or handling of financial records, earning is merely managed to present a more favorable picture of the company. This is especially acute when financial records are handled in an unethical manner, outside of legal frameworks (Kaya & Turegun, 2017; Fera *et al.*, 2022; Kovacova *et al.*, 2022, pp. 7–21).

In order to legally manipulate profits, creative management employs a range of procedures and strategies. Examples include: property valuation, distortion of reported sales and revenues, creation of deliberate errors in accounting, earnings quality, and earnings management (Lin *et al.*, 2022, pp. 133–159). Earnings management techniques and principles are widespread, using various practices and models (such as accounting principles, creative accounting, discretionary accruals, and non-discretionary accruals). Therefore, it is crucial to expose the models and methods used in other countries, discover new earnings management detection models, and identify trends. Kowo and Akinbola (2019, pp. 38–50) attest to the fact that strategic planning has a substantial impact on sustaining corporate profit performance. We propose that managers in Visegrad Group employ earnings management to a greater extent.

Various research studies have been devoted to the issue of creative accounting and models of earnings management in last decade. These models were created in a different economic environment, detecting accounting or economic earnings management, or the combination of these. More than thirty models have been developed, however currently there is no model can reveal the use of earnings management in Visegrad Group. Compared to developed capital markets, research into accounting manipulations in emerging economies is less developed, particularly in Visegrad Group. Therefore, the development of such model can uniquely contribute to the theory and practice of creative accounting of researched countries. These countries were selected within this study because earnings management has

not been examined and compared sufficiently in these politically, economically and geographically similar countries and environments. Countries of Visegrad Group (known as the V4) have previously been compared to the Soviet-controlled Eastern bloc countries, based on their historical development. However, there was a clear political shift when the V4 joined the European Union in 2004, starting a new political age.

The ten most frequently used and appropriate models were identified and used to understand the incentives for using creative accounting techniques on a sample of 33,357 companies from Visegrad Group over a 4-year period (2016–2020). The main aim of this study is to reveal the presence of earnings management in Visegrad Group, and propose a regression model of earnings management in V4 based on the detected results. To fulfil the stated aims, seven research questions were identified in this paper, namely:

1. Do existing models capture the presence of earnings management in the Visegrad Group?
2. Which model best captures the presence of earnings management in each of the Visegrad Group countries?
3. What is the direction, degree, and scope of earnings management in each of the Visegrad Group countries?
4. Is it possible to construct a unified model for measuring the presence of earnings management for the Visegrad Group?
5. Does this model capture the presence of earnings management in the V4?
6. What is the direction, degree, and scope of earnings management in the Visegrad Group?
7. How does the total accrual change depending on the variables entering the model to identify the presence of earnings management in the V4?

This study is structured as follows. First, a literature review provides the theoretical background and recent incentives on creative accounting and earnings management techniques. Second, the research methodology presents the financial datasets used, and the statistical procedures employed. Third, we present the results to reveal instances of creative accounting in Visegrad Group, followed by regression analysis to propose a model. Within our discussion, we discuss the results of our study in relation to comparable studies. Finally, we conclude the results of the study and discuss the practical implications, limitations of the research, and potential areas of further research.

## Literature review

Often, creative accounting is considered from a negative viewpoint. Accordingly, it is described as a method of manipulating information in financial statements with the intention of misleading investors and other users of accounting information (Olojede & Erin, 2021, pp. 207–222). However, creative accounting can be viewed from both a positive and a negative viewpoint. The implementation of accounting principles and practices recognizing changes in business environments, and resultantly lessen profit unpredictability, is referred to as positive creative accounting. Shareholders gain from the increased earnings as a result of both decreased uncertainty that frequently arises, and the enhanced prediction of future earnings (Koutoupis & Davidopoulos, 2022; Mnif & Slimi, 2022).

Conversely, negative creative accounting is defined as unethical methods of raising cash from the market by giving prospective investors a false impression of the company's financial situation (Hammami & Zadeh, 2022). It results from the abuse of the flexibility of accounting standards. Although not illegal, it often misleads investors and other users of accounting information and distorts reality.

Managers manipulate both accrual and real activities to meet predetermined financial targets, according to accounting literature (Abed *et al.*, 2022c). Additionally, the majority of corporate managers surveyed said that organizations control earnings in order to achieve predetermined targets (Li *et al.*, 2022b; Boll *et al.*, 2022; Lin & Wang, 2022).

Additionally, experimental data demonstrates that executives and recruiting specialists in for profit companies favor hiring accounting managers with personality traits that make them more likely to engage in creative accounting and earnings management (Malkogianni & Cohen, 2022; Chouaibi & Zouari, 2022; Zhong *et al.*, 2022).

Skoda *et al.* (2017) revealed four key variables of creative accounting: ethical considerations, disclosure quality, internal control, and ownership structure. However, it is unknown whether these four key variables relate to financial reporting. Demirkan *et al.* (2022, pp. 963) followed the Kothari and Jones models to investigate if managers actively manipulate company performance prior to an acquisition; how the degree of manipulation affects the long-term performance; if the management's decision to purchase the asset will negatively affect company organizational performance; if it is possible to identify hubristic management before the decision is implemented; and how hubristic management behaviors impact the long-term market performance of the company. The impact of a CEO's attributes on managing profitability measured by discretionary accruals was proposed by

Altarawneh *et al.* (2022). Their results, based on the modified Jones model, showed a strong inverse relationship between discretionary accruals and CEO tenure, network, and gender; resultantly, CEO's with longer tenures at the company, more external directorships, and are female, are more rigorous in improving their strategic decisions and less likely to engage in earnings management. With the application of Beneish model and the Piotrski model, Adamikova and Corejova (2021) argued that depending on the type of accounting intervention used, and whether the expert can identify it, accounting interventions can have a major impact on the company's value. The use of innovative accounting techniques, such as earnings management to minimize taxes, and fulfil profitability criteria was also proven by Drabkova and Pech (2022, pp. 113–129) using the Beneish M-score.

The relationship between company life cycle and earnings management with the moderating role of state ownership was studied by Khuong *et al.* (2022). According to statistics, there are differences in accrual earnings management behavior throughout life cycle phases. The results of the study showed a U-shaped pattern, with discretionary accruals being less notable in the growth stage and more notable during the introduction and decline stages. Similarly, Durana *et al.* (2021b, pp. 425–461) used a modified Jones model, Kothari model, and Teoh model, to demonstrate that financially distressed companies reduced reported accounting profit at the introduction, decline, and to a lesser extent, the growth stage, according to a U-shaped relationship between profits management and bankruptcy risk. Studies also imply that both companies in decline, and start-ups, falsify financial reports to achieve more lenient loan covenants. Therefore, employing life-cycle subsamples to estimate discretionary accruals can increase the accuracy of accrual earnings management models. Valaskova *et al.* (2021b, pp. 167–184) applied the Beneish M-score, and modified Jones model to find that businesses in the shadow economy, or under fear of bankruptcy, often falsify earnings to stay credible, creditworthy, and competitive.

The impact of the audit committee on creative accounting determination was studied by Abed *et al.* (2022b). Their findings demonstrated that the audit committee significantly limits the use of creative accounting when determining the accuracy of financial reporting in the commercial banking industry. Additionally, Abed *et al.* (2022a) investigated the effects of Corporate Social Responsibility (CSR) on improving the strength of influencing factors of creative accounting, and the standard of financial reporting in the setting of commercial banks. Their findings demonstrated strong moderating effects of CSR on the relationship between the factors of innovative accounting, and the caliber of banks' financial reporting in terms of competitive advantages. This can be further proven by Khenissi *et al.* (2022),

who examined the impact of adding CSR requirements to CEO incentive compensation on the methods used by French companies listed on the SBF 120 index (French Stock Market index) for managing profitability. They applied Kothari, Hribar and Nichols and Roychowdhury models, and their empirical research demonstrates that the level of earnings management is reduced when CSR requirements are included in compensation contracts (as measured by discretionary accruals and real earnings management).

A notable study was undertaken by Han *et al.* (2022, pp. 114–133). They inspected whether foreign investors reduce managerial efforts for earnings management through discretionary accruals. They identified that foreign investors have a significant role in discouraging opportunistic management behavior in emerging markets, by displaying excellent market discipline and providing monitoring benefits through the improvement of corporate transparency. Likewise, Le and Trinh (2022) examined, using the Jones model, whether companies managed by analysts who lack focus, manage their earnings more carefully. Furthermore, they show how analysts' lack of focus might impair the accuracy of business financial reporting. Similarly, Cannon *et al.* (2022) applied Roychowdhury and Zang models to examine connections between ownership type and earnings management.

The findings of Githaiga *et al.* (2022) revealed a substantial and favorable correlation between board size and earnings management by applying the modified Jones model. Additionally, their research revealed that the board's independence, gender diversity, and financial expertise all had a detrimental and significant impact on earnings management. Results further showed that the association between board size, independence, gender diversity, and earnings management was mitigated by company size.

Alternatively, Hirota and Yunoue (2022) argued that by raising expenditure and income through intergovernmental transfers, municipalities participate in stock-flow adjustments, which are problematic since they allow them to postpone improving their financial situation. The impact of internationalization on the corporate misconduct of earnings management by emerging market multinational companies was investigated by Popli *et al.* (2022), with the use of modified Jones, Dechow, and Kothari models. They discovered that internationalization-induced “external monitoring,” replacing “internal monitoring” processes of company governance in terms of managing profitability. This was proven also by Biswas *et al.* (2022); Islam *et al.* (2022); Olojede and Erin (2021, pp. 207–222); and Ababneh and Aga, (2019).

In a central European environment, limited research on creative accounting and earnings management is available, primarily focusing on re-

vealing the extent and techniques of earnings manipulation. Durana *et al.* (2021a, pp. 39–55) tested Earnings Before Interest and Taxes (EBIT) using the Ljung and Box test and Dickey-Fuller test and confirmed the application of earnings management in the Visegrad Group as well as Baltics group countries. Similarly, Kliestik *et al.* (2020, pp. 371–400) tested EBIT in the V4 to reveal earnings manipulations. Kliestik *et al.* (2021, pp. 1452–1470) investigated 8 popular models, namely: Jones; modified Jones; Industry based; Jeter and Shivakumar; Kasznik, Key; Teoh *et al.*; and Kothari, to detect earnings manipulation in the Visegrad Group. Similarly, Valaskova *et al.* (2021a, 631–669) detected earnings manipulations in the Visegrad Group using the modified Jones model. Further research has focused on the Slovak environment. Svabova *et al.*, (2020, pp. 485–508) modified the Beneish model in Slovak conditions, while Durana *et al.* (2022, pp. 481–510) applied both the Beneish model and Jones model to reveal creative accounting practices. Kliestik *et al.* (2022b, pp. 475–509) focused on another view of stability of profits and earnings management in the transport sector of the Visegrad Group. Through the study of EBITDA and calculation of manipulative behavior detected by modified Jones model they propose new methodology using time series analysis, earnings management analysis and regression analysis.

A pioneering study has investigated the influence of COVID-19 on earnings management affected by the COVID-19 pandemic (Fu *et al.*, 2022). The study supported the notion that the businesses are less willing to share their management's earnings forecast, and the forecasts that are publicly available typically have lower quality. Second, increased media analysis and a more favorable legal climate can lessen the detrimental effects of the COVID-19 pandemic on the willingness and accuracy of management earnings prediction disclosure.

## **Research methods**

This study focused on the countries forming the Visegrad Group. The Visegrad Group consists of four central European countries, including: Slovakia; the Czech Republic; Poland; and Hungary. These countries were chosen due to the existence of similarities between them, including socio-economic, cultural-historical, and economic similarities. The similarity of individual countries of the Visegrad Group can also be characterized based on their historical development, interconnectedness of economies, long-term cooperation of individual countries within the framework of inter-



national trade, and similar solutions to economic and regional differences (Kliestik *et al.*, 2020, pp. 371–400).

For the sample of companies in the Visegrad Group, information was drawn from the ORBIS financial database, which contains information from the financial statements of individual companies for the period 2016–2020.

The original dataset contained 100,057 companies. We further refined this sample according to the missing and outlying values, reducing the sample to 33,357 companies. The final dataset for the observed period of five years (2016–2020) includes 8,134 companies from Slovakia, 5,782 companies from the Czech Republic, 15,054 companies from Poland, and 4,387 companies from Hungary. The sample includes small, medium, large, and very large companies. The collection of companies for all countries is shown in Table 1.

To reveal the earnings management in selected countries, we have included profit accounting models in the analysis, selected according to provided literature review. It is possible to obtain most information from the financial statements to identify earnings management in the companies for the individual countries of the Visegrad Group. These are the following models (variables and their abbreviation are shown in Table 2):

Industry model

$$NDA_t = \gamma_1 + \gamma_2 \cdot \text{median}(TA_t) \quad (1)$$

Jones model

$$\frac{NDA_{it}}{A_{it-1}} = \frac{TA_{it}}{A_{it-1}} = \alpha_0 \frac{1}{A_{it-1}} + \alpha_1 \frac{\Delta REV_{it}}{A_{it-1}} + \alpha_2 \frac{PPE_{it}}{A_{it-1}} + \varepsilon_{it} \quad (2)$$

Modified Jones model

$$\frac{NDA_{it}}{A_{it-1}} = \frac{TA_{it}}{A_{it-1}} = \alpha_0 \frac{1}{A_{it-1}} + \alpha_1 \frac{\Delta REV_{it} - \Delta REC_{it}}{A_{it-1}} + \alpha_2 \frac{PPE_{it}}{A_{it-1}} + \varepsilon_{it} \quad (3)$$

Jeter and Shiwakumar model

$$\frac{TA_{it}}{A_{it-1}} = \alpha_0 \frac{1}{A_{it-1}} + \alpha_1 \frac{\Delta REV_{it}}{A_{it-1}} + \alpha_2 \frac{PPE_{it}}{A_{it-1}} + \alpha_3 \frac{CFO_{it}}{A_{it-1}} + \varepsilon_{it} \quad (4)$$

Kasznik model

$$\frac{NDA_{it}}{A_{it-1}} = \frac{TA_{it}}{A_{it-1}} = \alpha_0 \frac{1}{A_{it-1}} + \alpha_1 \frac{\Delta REV_{it}}{A_{it-1}} + \alpha_2 \frac{PPE_{it}}{A_{it-1}} + \alpha_3 \frac{\Delta CFO_{it}}{A_{it-1}} + \varepsilon_{it} \quad (5)$$

Key model

$$\frac{TA_{it}}{A_{it-1}} = \alpha_0 \frac{1}{A_{it-1}} + \alpha_1 \frac{\Delta REV_{it}}{A_{it-1}} + \alpha_2 \frac{PPE_{it}}{A_{it-1}} + \alpha_3 \frac{IA_{it}}{A_{it-1}} + \varepsilon_{it} \quad (6)$$

Teoh, Welch, and Wong model

$$\frac{NDA_{it}}{A_{it-1}} = \frac{TA_{it}}{A_{it-1}} = \alpha_0 \frac{1}{A_{it-1}} + \alpha_1 \frac{\Delta SALE_{it} - \Delta REC_{it}}{A_{it-1}} + \varepsilon_{it} \quad (7)$$

Kothari model

$$\frac{NDA_{it}}{A_{it-1}} = \frac{TA_{it}}{A_{it-1}} = \alpha_0 \frac{1}{A_{it-1}} + \alpha_1 \frac{\Delta REV_{it} - \Delta REC_{it}}{A_{it-1}} + \alpha_2 \frac{PPE_{it}}{A_{it-1}} + \alpha_3 \frac{ROA_{it}}{A_{it-1}} + \varepsilon_{it} \quad (8)$$

Hribar and Collins model

$$TA_{it} = EAT - CFO_{it} \quad (9)$$

Kang model

$$\frac{TA_{it}}{A_{it-1}} = \alpha_0 \frac{1}{A_{it-1}} + \alpha_1 \frac{\Delta REV_{it}}{A_{it-1}} + \alpha_2 \frac{EXP_{it}}{A_{it-1}} + \alpha_3 \frac{PPE_{it}}{A_{it-1}} + \varepsilon_{it} \quad (10)$$

The evaluation of earnings management models was based on five criteria: a) an adjusted coefficient of determination measuring the explanatory power of existing earnings management models, and through which it is possible to assess the relevance and variability of the total accrual (TA) of earnings management models; b) standard deviation, through which it is possible to assess the variability of the achieved values of variables entering the existing earnings management models; c) the predicted sign; d) the statistical significance of the variables; e) the statistical significance of the earnings management models.

According to the number of met criteria, the application of selected earnings management models for each Visegrad Group country was subsequently proposed. The application of the selected models was performed by estimating the parts of the discretionary accrual for each company in the sample of companies, and each V4 country, to interpret its prediction error. Subsequently, it was necessary to verify the existence of earnings management in the sample of companies.

To verify its existence, a fictitious set of companies was created based on the assumption, highlighting the absence of earnings management. This enabled us to compare the differentiation of acquired discretionary accrual

(DA) values in the fictitious set of companies, and our analyzed sample of companies for each Visegrad Group country. Based on the finding and verification of the occurrence of earnings management in the sample of companies of the Visegrad Group; we determined the direction, degree, and extent of earnings management through discretionary and non-discretionary accruals.

Research findings served as a base on which we subsequently created a unified model for identifying the presence of earnings management in the Visegrad Group. We used multiple linear regression to create the regression model. During the analysis, we also assessed a) heteroskedasticity, b) multicollinearity, c) the autocorrelation of residues, d) the statistical significance of the model as a whole, and e) the statistical significance of variables.

## **Results**

### *Analysis of existing EM models*

First, we focused our research to reveal the existence of earnings management in Visegrad Group. According to Figure 1, we analyzed the selected models of earnings management in the V4 countries for the observed period 2016–2020, according to set criteria: a) adjusted coefficient of determination, b) standard deviation, c) predicted sign of variables, d) the statistical significance of models and their variables. This enabled us to find out which of the existing models best captures the presence of earnings management in the V4. Multiple linear regression was used to obtain the values of the set criteria. Since the calculation tables of the individual models are extensive, we present the results in abbreviated graphic form. Yellow identifies those models that meet the analyzed criteria within the detection of earnings management in Slovakia. Green identifies those models that meet the analyzed criteria within the detection of earnings management in the Czech Republic. Orange identifies those models that meet the analyzed criteria within the detection of earnings management in Poland. Blue identifies those models that meet the analyzed criteria within the detection of earnings management in Hungary.

Based on the results of multiple linear regression, we found that the Hribar and Collins model best captures the presence of earnings management in companies operating in the V4 in the observed period.

Within Slovakia, the second-best model was the Industry model, which met the criteria of standard deviation, the statistical significance of the

model, and its variables. The Teoh et al. model satisfies the statistical significance of the model and its variables. The Kothari model, the Modified Jones model, the Kasznikov model, and the Kang model also meet the statistical significance of the model. The Jones model, Jeter's and Shiwakumar's model, and Key's model did not meet either of the established criteria.

In the Czech Republic, the second-best model was the Modified Jones model, which met the criteria of standard deviation, the statistical significance of the model and its variables, and the predicted sign of the variables. The Teoh, Welch, and Wong model, and the Industry model met the standard deviation and statistical significance of the model and its variables. Kothari's model met the adjusted coefficient of determination, the statistical significance of the model and its variables, Kang's model met the adjusted coefficient of determination, the statistical significance of the model and the predicted sign, The Jones model, Jeter and Shiwakumar model and Key's model met the statistical significance of the model and the predicted sign. Kasznikov's model met only the statistical significance of the model.

In Poland, the other models achieved a lower number of met criteria compared to the Hribar and Collins model. For example, the Industry model meets three criteria, namely the standard deviation, the statistical significance of the model, and its variables. The remaining models reached a total of two criteria.

In Hungary, the Modified Jones model met the adjusted coefficient of determination, the statistical significance of the model and its variables, and the predicted sign of the variables. Kothari's model met the criteria of the adjusted coefficient of determination, the statistical significance of the model, and its variables. It did not meet the criteria of the predicted sign of the variables and the standard deviation. The Jones model, Jeter and Shiwakumar, and Key's model met the adjusted coefficient of determination, the statistical significance of the model, and the predicted sign. The Teoh, Welch, and Wong model met only the statistical significance of the model and its variables.

Table 3 presents the results of the Mann-Whitney test, through which the Hribar and Collins model was applied to verify the existence of earnings management in companies in the V4. In Slovakia, Poland, and Hungary, the H1 hypothesis was accepted throughout the whole observed period 2016–2020. This confirmed the presence of earnings management in companies in the V4 as the value of  $p$  was lower than the level of significance set at 0.05. However, in the case of the Czech Republic, specifically in 2017, this hypothesis was not confirmed, meaning the occurrence of earnings management was not confirmed in that year.

Subsequently, the direction, degree, and extent of earnings management in the V4 were examined through a discretionary accrual (Table 4). The direction of earnings management was examined through discretionary accrual percentages, while the percentage of discretionary accruals was calculated as the ratio of the number of companies with positive accrual and negative accrual, respectively, and the total number of companies in the examined group. Based on the results, in the observed period 2016–2020, the positive discretionary accrual reached a higher percentage compared to the negative discretionary accrual, meaning companies in the surveyed group in the V4 try to manage profits by increasing them. We examined the degree of earnings management using the average values of discretionary accruals. Based on the results, we can see that the values of positive discretionary accruals in the observed period 2016–2020 acquired higher values compared to negative discretionary accruals, thus confirming the more significant management of profit by increasing it. To determine the scope of earnings management in the researched group of companies operating in Slovakia, the percentages of discretionary accruals and their average values were used. We calculated the earnings management range as their product. Results confirmed that the companies in the surveyed group in the V4 manage their profits by increasing them, as the values of positive discretionary accruals in the entire observed period acquire higher values compared to negative discretionary accruals.

*Creating a regression model to reveal and identify the presence of earnings management in central European countries*

Second, we focused on the proposition of the regression model to reveal earnings management in the V4. In addition to the variables used in the models existing for the detection of earnings management, other variables are dependent on the presence of earnings management in companies operating in the V4 may be affected. Based on this statement, we created a regression model including explanatory variables such as: *cash flow*, *receivables*, *sales*, *return on assets*, *tangible fixed assets*, *intangible fixed assets*, *country*, *SK NACE classification*, *company size*, *legal form of the company* and *life cycle stage of the company*.

For the creation of the model, multiple linear regression was used to identify the presence of earnings management, specifically the Enter method, through which all variables considered as relevant were included in the first stage, including dummy variables. Based on the results of this method, presented in Table 5, we discovered that the model is statistically significant. The statistical significance of the model was verified through the fol-

lowing hypotheses  $H_0$ : The created model is not statistically significant, and  $H_1$ : The created model is statistically significant. Based on the comparison of the p-value with a 5% significance level, the statistical significance of the model was confirmed. The value of the adjusted coefficient of determination was at the level of 0.032. However, the results of the Enter method point to the statistical insignificance of some variables, which cannot be included in the regression model, as their quality of use would be reduced. For this reason, we also used the Stepwise method, which gradually includes in the model only those variables that are in a statistically significant (Table 6) relationship with the dependent variable, and thus creates the “best” regression model. The Stepwise method consisted of 23 steps, and its results confirmed the statistical significance of our previously created model with the value of the adjusted coefficient of determination at the level of 0.032.

Subsequently, we verified the multicollinearity of the variables using the variance inflation factor (VIF) measuring the correlation and the strength of this correlation between the examined variables entering the regression model. Based on the results in Table 7, the values of VIF for all variables included in the model are in the range 1 — 5, meaning there is no strong relationship between the predictor variable and other variables.

To test for autocorrelation of residues, we used the Durbin-Watson test, which showed that the presence of residue autocorrelation was not confirmed in our regression model, as the value of this test was 1.98, meaning that our achieved value is close to 2, which indicates the absence of residual autocorrelation in the regression model (Table 8). The equation of the regression model we created is as follows:

$$\begin{aligned} \frac{TA}{A_{t-1}} = & -0.05 + 0.196 \frac{\Delta CFO}{A_{t-1}} - 0.023 \frac{\Delta REV - \Delta REC}{A_{t-1}} + 1.280 \frac{ROA}{A_{t-1}} - \\ & - 0.199 \frac{IA}{A_{t-1}} - 0.010 \frac{PPE}{A_{t-1}} + 0.08Krajina_2 + 0.041L - 0.016C - \\ & - 0.025H + 0.200N + 0.027R + 0.020D + 0.029K - 0.017Q - \\ & - 0.007F + 0.020VP_3 + 0.018VP_4 + 0.005VP_1 - 0.014PF_5 - \\ & - 0.030PF_9 - 0.167PF_2 + 0.029PF_7 - 0.012F\check{Z}CP_3 \end{aligned} \quad (11)$$

To verify the created earnings management model (variables and abbreviations shown in Table 9), the random selection of a sample was taken from companies that are classified as large, the legal form of sole proprietors, life cycle stage of establishment, and classified in the SK NACE category under the letter C — Industrial production. The model was tested on companies in all countries of the Visegrad Group for a period of five years 2016-2020. Table 10 presents the results confirming the presence of earn-

ings management captured by the created regression model in the V4 for the observed period.

To reassess the direction, degree, and extent of earnings management in the V4, the discretionary accrual was re-used, finding that companies operating in the V4 manage profit by increasing it. This indicates an increase in the tax base, as positive discretionary accruals reached a higher percentage in all periods studied compared to negative discretionary accruals (Table 11).

We interpreted the total accruals using statistically significant variables (coefficients listed in Table 6).

The locating constant represents the theoretical total accrual, meaning that if all other variables in the regression model were zero, then the value of the total accrual would decrease by -0.05. The coefficient of the  $\Delta$ CFO variable reaches +0.196, meaning that if the change in cash flow increases by one unit, the total accrual will increase by 0.196 (19.6%). Furthermore, subject to the condition of *ceteris paribus* (otherwise unchanged conditions), companies with the same change in: sales and receivables, return on assets, intangible and tangible fixed assets belonging to the same country, SK NACE category, company size, legal form and life cycle stage, increase the total accrual by 19.6% compared to companies that do not have the same features. The coefficient of the variable  $\Delta$ REV- $\Delta$ REC show a value of -0.023, meaning that companies with the same: change in cash flow, return on assets, intangible fixed assets, tangible fixed assets belonging to the same country, SK NACE category, company size, legal form, and life cycle stage, reduce the value of the total accrual by 2.3% compared to companies that do not have the same characteristics. The coefficient of the ROA variable reaches the value +1.280, demonstrating the increase of the total accrual by 1.280 if the ROA changes by one unit. Through this variable, we imply that companies with the same change in cash flow, sales, receivables, intangible and tangible fixed assets belonging to the same country, SK NACE category, company size, legal form, and life cycle stage, increase the value total accrual by 1.280 compared to companies not showing the same characteristics. The coefficient of the variable IA took on the value -0.199. This value indicates a decrease in total accrual by 0.199 if the value of the variable IA changes by one unit thus, due to compliance with the *ceteris paribus* rule, we can say that companies with the same: change in cash flow, sales, receivables, with the same profitability, long-term tangible assets belonging to the same country, the same category according to SK NACE, with the same size, legal form, and life cycle phase, reduce the total accrual by 19.9% compared to companies that do not belong to the group with the same features. The coefficient of the PPE variable reached the value -0.010,

this value indicates that companies belonging to: the group with the same change in cash flow, sales, receivables, with the same return on assets, long-term intangible assets belonging to the same country, SK NACE category, with the same the size, legal form, and life cycle phase, will lead to a situation in which the total accrual will be reduced by -0.010 in comparison with companies with different characteristics. The variable, Country 2, acquires the value of the regression coefficient +0.08, meaning that companies operating in the Czech Republic increase the total accrual by 0.08 compared to companies operating in Slovakia, Poland, and Hungary. Within the SK NACE variable, categories L, C, H, N, R, D, K, Q, and F were included in the regression model, meaning that in these categories the total accrual differs significantly from the SK NACE categories not included in the regression model. The reference category is SK NACE G. The value of the regression coefficient of category L is +0.041, meaning that the total accrual measuring the presence of earnings management for companies belonging to this SK NACE category increases by 0.041 compared to companies belonging to category G. The value of the regression coefficient of category C is -0.016, which represents a reduction in the total accrual for companies belonging to this category compared to companies classified in category G. Companies belonging to another SK NACE category reduce the total accrual by -0.05. The value of the regression coefficient of category H is -0.025, meaning that the total accrual for companies belonging to SK NACE category H decreased by -0.025 compared to the total accrual belonging to companies from another SK NACE category. The regression coefficient of category N acquired a value of +0.200, meaning that the total accrual in companies classified in SK NACE category N increases compared to the total accrual in companies classified in another SK NACE category. The regression coefficient of category R reached +0.027. Based on its value, we can say that the total accrual increases by 0.027 in companies belonging to SK NACE category R compared to companies from another SK NACE category, which were not included in the model. The value of the regression coefficient of category D reached the value of +0.020, meaning that the value of the total accrual of companies included in this SK NACE category increases the value of the total accrual by 0.020 compared to companies from another SK NACE category that were not included in the model. Companies with other SK NACE not included in the model reduce the total accrual by -0.05. The value of the regression coefficient for category K is +0.029. The value of the total accrual for companies belonging to this category increases by 0.029 compared to the total accrual for companies belonging to another SK NACE category not included in our regression model. The value of the regression coefficient of category Q is



-0.017. This value means that companies belonging to this SK NACE category reduce the total accrual by -0.017 compared to companies belonging to another SK NACE category that reduces the total accrual by -0.05. The regression coefficient of category F showed a value of -0.007, meaning that companies belonging to this SK NACE category reduce the total accrual by -0.007 in comparison with companies from another SK NACE category. The given interpretations apply in terms of *ceteris paribus* (other factors of the regression equation unchanged).

Examining the total accrual according to the dummy variable companies' size, we found that the presence of earnings management expressed in total accrual is significantly evident in large companies, very large companies, and small companies. Medium-sized companies form a reference category, as their number is the highest in the examined group. The value of the regression coefficient for small businesses is + 0.020. This value indicates an increase in the total accrual for small companies compared to the total accrual for medium-sized companies. In the case of very large companies, the total accrual increases by + 0.018 compared to medium-sized companies. The total accrual for large companies increases by + 0.005 compared to the total accrual of medium-sized companies. The total accrual of companies not included in the model decreases by - 0.05. The given interpretations apply in terms of *ceteris paribus* (other factors of the regression equation unchanged).

Considered next is the dummy variable legal form of the business. As part of the study of the total accrual, we found that in companies with unknown legal forms, partnerships, state, and public authorities and sole proprietors, the presence of earnings management is more pronounced. In companies belonging to partnerships, the total accrual decreases by - 0.014 in comparison with companies belonging to the legal form of a limited liability company (reference category). The total accrual of companies belonging to an unknown legal form of business is reduced by - 0.016 compared to the reference category. When we look at companies belonging to public and state authorities, there is an increase in total accrual by + 0.029 compared to the reference category. The last group in which earnings management is more significantly detected are self-employed persons, whose total accrual decreases by - 0.030 compared to the total accrual belonging to the reference category. The final dummy variable is the life cycle phase of the business. Examining the relationship between total accrual and the life cycle in which companies are located, we found that the total accrual of companies in the stabilization phase decreases by - 0.012 compared to the total accrual of companies in the crisis phase.

## Discussion

Earnings management has been discussed in the Visegrad Group by Callao *et al.* (2017, pp. 222–259) through ten profit accounting models which have been presented in our study. Previous academics have also used three identical criteria as our study, namely the adjusted coefficient of determination, the standard deviation, and the statistical significance of the variables entering the selected models. In the research results, they found that the high value of the adjusted coefficient of determination is achieved by the Yoon and Miller model, Shiwakumar model, and the Kasznik model. A low value of the adjusted coefficient of determination was recorded for the Jones model; Kang model; Shivaranakrishnan models; Teoh, Welch, and Wong model; Dechow model; Richardson model; Tuna models; and the Kothari model. Furthermore, in their research, they recorded low values of the standard deviation for the Jones and Modified Jones model. Statistical significance was demonstrated for the variables entering the Jones model and the Shiwakumar model in all V4 countries except Slovakia, where the statistical insignificance of the variables was confirmed. The achieved results of previous studies prove that the most suitable models in the detection of earnings management include the Jones model, Shiwakumar model, Kasznik model, Yoon and Miller model. In addition, the research highlighted that despite the less frequent use of the Yoon and Miller model to detect earnings management, this model achieved the highest adjusted coefficient of determination, indicating the highest explanatory power of the model compared to other existing models. Contrastingly, the Jones model, perceived in the literature as one of the most effective models for measuring earnings management, did not show such a detection capability as expected. Compared to results presented in our study, there are significant differences in detected models.

We consider it crucial for possible replication of our study and future development, that we discuss the work of domestic academics who deal with the given issue in same economic environment. Valaskova and Durana (2020, pp. 1–9) assessed the detection capability of earnings management models applied in the national environment of Slovakia through 10 earnings management models (8 models were as also used in our study, namely Jones, modified Jones, Industry, Kasznik, Key, Jeter and Shiwakumar, Teoh *et al.*). The authors discovered that downward profit manipulation is used by companies that achieve relatively high profits. For example, companies providing financial and insurance activities, or companies operating in the IT sector. The reason for the use of downward profit manipulation may be to reduce the tax base for tax expenditures, as such companies are

regulated by specific legislation in the national economy and aim to limit regulation to impose strict measures detrimental to their business. They identified the Jones model as the most suitable, while in our study Jones model was one of the least appropriate.

Similarly, Klietnik *et al.* (2020, pp. 371–400) applied selected earnings management detection models to determine whether earnings management is a widespread practice among businesses in the V4. They detected that for detailed computations to identify earnings manipulation in these nations, the modified Jones model rather than the Kothari model was most appropriate. This is again in contrast with results detected in our study. Additionally, their study found that the various nations have many similarities. At a level similar to that of the Czech Republic and Hungary, Polish businesses manipulate profits the most, whilst Slovak businesses manipulate the least. Manipulation of earnings through EBIT investigation in the V4 was further confirmed by Durana and Bacik (2021, pp. 1–9), with the result that the issue of earnings management is not only a local tool for earnings management, but also a global problem in the world of finance.

Similar research by Valaskova *et al.* (2021a, 631–669) confirmed that the economic sector is one of the most important earnings management determinants. In specific economic conditions, company size is also a relevant indicator (Hungary), or company age, legal form, and ownership structure (Poland). In our study we included size of the company, legal form of the company, and economic classification of the company as dummy variables for the regression model. Therefore, we confirm that these aspects are also important earnings management determinants according to results of our study.

Durana *et al.* (2021a, pp. 39–55) confirmed significant differences in the use of earnings management in the Visegrad Group and the Baltic countries.

As utilized in our study, regression models were employed by Piosik and Genge (2020, 152), who based their study on information from businesses that are listed on the Warsaw Stock Exchange in Poland. The relationship between the slope of overall upward real earnings management and shareholder concentration is U-shaped, according to their empirical findings.

Research solely on Slovak companies was conducted by Svabova *et al.* (2020, pp. 485–508), by extended the original Beneish model taking into account the values of indicators from three consecutive years, considering the development of the potential tendency of companies to be involved in opportunistic earnings management. Their model correctly identified 86.4% of fraudulent companies and overall reaches 84.1% classification ability.

Both models were applied on empirical data on 1,900 Slovak companies in the years 2016–2018, while their overlap was 32.7% for fraudulent companies and 38.4% for non-fraudulent companies.

## **Conclusions**

There are several methods for detecting creative accounting; these methods primarily focus on earnings quality and earnings management. The majority of earnings management models were developed in the US accounting environment for publicly traded companies, an important fact to consider. Consequently, applying these models in the context of European accounting standards and different economic environments may significantly reduce their efficiency. Furthermore, research shows that creative accounting is a massive phenomenon with a non-declining trend on a global scale. Therefore, the aim of this study was to reveal the presence of creative accounting in Visegrad Group and based on the detected results propose a regression model of earnings management in V4.

Through the application of ten most recognized earnings management models, we have revealed that companies in the V4 manage their profits mainly by increasing them. As the most suitable model identified was the Hribar and Collins model, we applied this to all researched countries. Based on the results of the application of selected models we have a proposed regression model. The dependent variable is the total accrual reduced by assets, while independent variables entering the model were cash flow, sales, receivables, return on assets, tangible and intangible fixed assets, country, size of the company, legal form of the company, economic classification, and the life cycle of the company.

Therefore, we propose the linear regression model of earnings management in Visegrad Group. Such a unique model, capable of revealing the use of earnings management in selected countries, has until now not been implemented in theory or practice. Therefore, it can further serve as a basis to be implemented in conditions of other countries with similar economic situation (such as Baltic countries) to propose such models not only for individual countries, but also for group of countries.

Auditors and fiscal authorities may use the practical implications of these findings to monitor the prevalence and risk of creative accounting not only in the V4 but also across Europe. Another implication is the proposed new methodology and regression model, which may be applied in various sectors of national economies as well as in all central European companies. Before conducting a thorough examination of a specific organization and

the due diligence phase, auditors may use the technique as a starting point to identify the presence of earnings manipulation.

We consider unacceptable the absence of financial data required for the calculation of variables entering into models of economic management, or variables entering into models that arose as a combination of accounting and economic management. Then it is impossible to compare the behavior of individual models of earnings management in terms of their forms. We therefore cannot say unequivocally which models are more effective and usable in the Visegrad Group countries for detecting earnings management. Another issue, arising due to the Covid-19 pandemic spanning 2020–2021, is the time horizon. This is an important measure, where macro and micro economic factors were particularly influenced. Another limitation is the focus on ten selected earnings management models. Deeper analysis could be provided with the direct contact to managers of the companies involved in the study.

Future research should mainly examine the impact of the Covid-19 pandemic on earnings management through the use of longitudinal analysis based on statistical panel data methods, while the proposed regression model will be tested.

## References

- Ababneh, T. A. M., & Aga, M. (2019). The impact of sustainable financial data governance, political connections, and creative accounting practices on organizational outcomes. *Sustainability*, *11*, 5676. doi: 10.3390/su11205676.
- Abdullah, Y., & Nabar, S. (2022). Accrual earnings management: do Chief Financial Officer power and career horizon matter? *Journal of Corporate Accounting & Finance*. Advance online publication. doi: 10.1002/jcaf.22573.
- Abed, I. A., Hussin, N., Haddad, H., Al-Ramahi, N. M., & Ali, M. A. (2022a). The moderating effects of corporate social responsibility on the relationship between creative accounting determinants and financial reporting quality. *Sustainability*, *14*, 1195. doi: 10.3390/su14031195.
- Abed, I. A., Hussin, N., Haddad, H., Al-Ramahi, N. M., & Ali, M. A. (2022b). The moderating impact of the audit committee on creative accounting determination and financial reporting quality in Iraqi commercial banks. *Risks*, *10*, 77. doi: 10.3390/risks10040077.
- Abed, I. A., Hussin, N., Ali, M. A., Haddad, H., Maha, S., & Hasan, E. F. (2022c). Creative accounting determinants and financial reporting quality: systematic literature review. *Risks*, *10*, 76. doi: 10.3390/risks10040076.
- Adamikova, E., & Corejova, T. (2021). Creative accounting and the possibility of its detection in the evaluation of the company by expert. *Journal of Risk and Financial Management* *14*(7), 327. doi: 10.3390/jrfm14070327.

- Afifa, A. M., Saleh, I., Al-shoura, A., & Vo Van, H. (2022). Nexus among board characteristics, earnings management and dividend payout: evidence from an emerging market. *International Journal of Emerging Markets*. Advance online publication. doi: 10.1108/IJOEM-12-2021-1907.
- Akpanuko, E. E., & Umoren, N. J. (2018). The influence of creative accounting on the credibility of accounting reports. *Journal of Financial Reporting and Accounting*, 16(2), 292–310. doi: 10.1108/JFRA-08-2016-0064.
- Altarawneh, M., Shafie, R., Ishak, R., & Ghaleb, B. A. A. (2022). Chief executive officer characteristics and discretionary accruals in an emerging economy. *Cogent Business & Management*, 9(1), 2024117. doi: 10.1080/23311975.2021.2024117.
- Biswas, S., Bhattacharya, M., Sadarangani, P. H., & Jin, J. Y. (2022). Corporate governance and earnings management in banks: an empirical evidence from India. *Cogent Economics & Finance*, 10(1), 2085266. doi: 10.1080/23322039.2022.2085266.
- Boll, D., Müller, H., & Sidki, M. (2022). Determining the drivers of earnings management among municipal enterprises: evidence from Germany. *Public Money & Management*. Advance online publication. doi: 10.1080/09540962.2022.2076515.
- Callao, S., Jarne, J. I., & Wroblewski, D. (2017). Detecting earnings management investigation on different models measuring earnings management for emerging eastern European countries. *International Journal of Research*, 5(11), 222-259. doi: 10.5281/zenodo.1095448.
- Cannon, J. N., Lamboy-Ruiz, M. A., & Watanabe, O. V. (2022). Ownership type and earnings management in U.S. hospitals. *Advances in Accounting*, 58, 100612. doi: 10.1016/j.adiac.2022.100612.
- Chouaibi, Y., & Zouari, G. (2022). The mediating role of real earnings management in the relationship between CSR practices and cost of equity: evidence from European ESG data. *EuroMed Journal of Business*. Advance online publication. doi: 10.1108/EMJB-12-2021-0183.
- Demirkan, I., Demirkan, S., & Kiessling, T. S. (2022). Strategic decision making of top management: earnings management and corporate acquisitions. *IEEE Transactions on Engineering Management*, 69(4), 963. doi: 10.1109/TEM.2020.2965170.
- Drabkova, Z., & Pech, M. (2022). Comparison of creative accounting risks in small enterprises: the different branches perspective. *E&M Economics and Management*, 25(1), 113–129. doi: 10.15240/tul/001/2022-1-007.
- Durana, P., & Bacik, R. (2021). Earnings management: local or global phenomenon in the Visegrad Four? *Proceedings of Globalization and Its Socio-economic Consequences*, 92, 1–9. doi: 10.1051/shsconf/20219202015.
- Durana, P., Blazek, R., Machova, V., & Krasnan, M. (2022). The use of Beneish M-scores to reveal creative accounting: evidence from Slovakia. *Equilibrium. Quarterly Journal of Economics and Economic Policy*, 17(2), 481–510. doi: 10.24136/eq.2022.017.

- Durana, P., Ginevicius, R., Urbanski, M., Podhorska, I., & Tumpach, M. (2021a). Parallels and differences in earnings management of the Visegrad four and the Baltics. *Journal of Competitiveness Review*, 13(3), 39–55. doi: 10.7441/joc.2021.03.03.
- Durana, P., Michalkova, L., Privara, A., Marousek, J., & Tumpach, M. (2021b). Does the life cycle affect earnings management and bankruptcy? *Oeconomia Copernicana*, 12(2), 425–461. doi: 10.24136/oc.2021.015.
- Durana, P., Perkins, N., & Valaskova, K. (2021c). Artificial intelligence data-driven internet of things systems, real-time advanced analytics, and cyber-physical production networks in sustainable smart manufacturing. *Economics, Management, and Financial Markets*, 16(1), 20–30. doi: 10.22381/emfm16120212.
- Fera, P., Moscarriello, N., Pizzo, M., & Ricciardi, G. (2022). The relationship between minority directors and earnings management: an empirical analysis in the Italian institutional setting. *Corporate Governance*. Advance online publication. doi: 10.1108/CG-06-2021-0224.
- Fu, X., Xu, Y., Zhou, F., & Zhao, L. (2022). The influence of covid-19 pandemic on management earnings forecasts. *Frontier in Psychology*, 13, 918560. doi: 10.3389/fpsyg.2022.918560.
- Githaiga, P. N., Kabete, P. M., & Bonareri, T. C. (2022). Board characteristics and earnings management. Does firm size matter? *Cogent Business & Management*, 9(1), 2088573. doi: 10.1080/23311975.2022.2088573.
- Guo, H., Wang, Y., Wang, B., & Ge, Y. (2022). Does prospectus AE affect IPO underpricing? A content analysis of the Chinese stock market. *International Review of Economics and Finance*, 82, 1–12. doi: 10.1016/j.iref.2022.06.001.
- Hammami, A., & Zadeh, M. H. (2022). Predicting earnings management through machine learning ensemble classifiers. *Journal of Forecasting*. Advance online publication. doi: 10.1002/for.2885.
- Han, M., Ding, A., & Zhang, H. (2022). Foreign ownership and earnings management. *International Review of Economics and Finance*, 80, 114–133. doi: 10.1016/j.iref.2022.02.074.
- Hirota, H., & Yunoue, H. (2022). Fiscal rules and creative accounting: evidence from Japanese municipalities. *Journal of The Japanese and International Economies*, 63, 101172. doi: 10.1016/j.jjie.2021.101172.
- Imhanzenobe, J. (2022). Value relevance and changes in accounting standards: a review of the IFRS adoption literature. *Cogent Business & Management*, 9(1), 2039057. doi: 10.1080/23311975.2022.2039057.
- Islam, R. M., Haque, Z. M., & Moutushi, R. H. (2022). Earnings quality and financial flexibility: a moderating role of corporate governance. *Cogent Business & Management*, 9(1), 2097620. doi: 10.1080/23311975.2022.2097620.
- Kaya, C. T., & Turegun, N. (2017). Associations between earnings management manipulation types and debt contracts, political costs and characteristics of board of directors. *International Journal of Academic Research in Accounting, Finance and Management Sciences*, 7(2), 208–214. doi: 10.6007/IJARAFMS/v7-i2/2995.

- Khenissi, M., Jahmane, A., & Hofaidhllaoui, M. (2022). Does the introduction of CSR criteria into CEO incentive pay reduce their earnings management? The case of companies listed in the SBF 120. *Finance Research Letters*, 48, 102880. doi: 10.1016/j.frl.2022.102880.
- Khuong, N. V., Anh, L. H. T., & Hong Van, N. T. (2022). Firm life cycle and earnings management: the moderating role of state ownership. *Cogent Economics & Finance*, 10(1), 2085260. doi: 10.1080/23322039.2022.2085260.
- Kliestik, T., Belas, J., Valaskova, K., Nica, E., & Durana, P. (2021). Earnings management in V4 countries: the evidence of earnings smoothing and inflating. *Economic Research – Ekonomika Istraživanja*, 34(1), 1452–1470. doi: 10.1080/1331677X.2020.1831944.
- Kliestik, T., Novak Sedlackova, A., Bugaj, M., & Novak, A. (2022a). Stability of profits and earnings management in the transport sector of Visegrad countries. *Oeconomia Copernicana*, 13(2), 475–509. doi: 10.24136/oc.2022.015.
- Kliestik, T., Valaskova, K., Nica, E., Kovacova, M., & Lazaroiu, G. (2020). Advanced methods of earnings management: monotonic trends and change-points under spotlight in the Visegrad countries. *Oeconomia Copernicana*, 11(2), 371–400. doi: 10.24136/oc.2020.016.
- Kliestik, T., Zvarikova, K., & Lazaroiu, G. (2022b). Data-driven machine learning and neural network algorithms in the retailing environment: consumer engagement, experience, and purchase behaviors. *Economics, Management, and Financial Markets*, 17(1), 57–69. doi: 10.22381/emfm17120224.
- Koutoupis, A. G., & Davidopoulos, L. G. (2022). Dividend policy and earnings management: evidence from the U.S. aerospace and defence industry. *Defence and Peace Economics*. Advance online publication. doi: 10.1080/10242694.2022.2079282.
- Kovacova, M., Machova, V., & Bennett, D. (2022). Immersive extended reality technologies, data visualization tools, and customer behavior analytics in the metaverse commerce. *Journal of Self-Governance and Management Economics*, 10(2), 7–21. doi: 10.22381/jsme10220221.
- Kowo, S. A., & Akinbola, O. A. (2019). Strategic leadership and sustainability performance of small and medium enterprises. *Ekonomicko-manazerske Spektrum*, 13(1), 38–50. doi: 10.26552/ems.2019.1.38-50.
- Le, T. D., & Trinh, T. (2022). Distracted analysts and earnings management. *Finance Research Letters*, 49, 103038. doi: 10.1016/j.frl.2022.103038.
- Li, Y., Zhang, W., Urquhart, A., & Wang, P. (2022a). The unintended consequence of social media criticisms: an earnings management perspective. *European Journal of Finance*. Advance online publication. doi: 10.1080/1351847X.2022.2097885.
- Li, W., Chen, L., & Sheng, P. (2022b). The tone from above: does tunnelling by ultimate owners impinge on the relations between managerial compensation and earnings management? *Australian Economic Papers*. Advance online publication. doi: 10.1111/1467-8454.12270.



- Lin, H., Tao, X., & Wu, Ch. (2022). Forecasting earnings with combination of analyst forecasts. *Journal of Empirical Finance*, 68, 133–159. doi: 10.1016/j.jempfin.2022.07.003.
- Lin, Z., & Wang, L. (2022). Analyst following, financial constraint, and audit opinion shopping: from the perspective of earning management. *Journal of International Financial Management & Accounting*. Advance online publication. doi: 10.1111/jifm.12163.
- Malkogianni, I., & Cohen, S. (2022). Earnings management in public hospitals: the case of Greek state-owned hospitals. *Public Money & Management*. Advance online publication. doi: 10.1080/09540962.2022.2071005.
- Mnif, Y., & Slimi, I. (2022). Former auditors on the audit committee and earnings management: evidence from African banks. *Accounting & Finance*. Advance online publication. doi: 10.1111/acfi.12973.
- Olojede, P., & Erin, O., (2021). Corporate governance mechanisms and creative accounting practices: the role of accounting regulation. *International Journal of Disclosure and Governance*, 18, 207–222. doi: 10.1057/s41310-021-00106-4.
- Piosik, A., & Genge, E. (2020). The influence of a company's ownership structure on upward real earnings management. *Sustainability*, 12(1), 152. doi: 10.3390/su12010152.
- Popli, M., Raithatha, M., & Goyal, L., (2022). Avoiding the risk of de-legitimation: Impact of internationalization on earnings management of emerging market firms. *Finance Research Letters*, 48, 102979. doi: 10.1016/j.frl.2022.102979.
- Renu, A., & Nishant, S. (2020). Creative accounting: an interaction of HR and accounting. *Journal of Indian Management & Strategy*, 25(1), 19–27. doi: 10.5958/0973-9343.2020.00003.4.
- Rueangsawan, S., & Jevasuwan, S. (2022). Earnings management in times of natural disasters. *Journal of Financial Reporting and Accounting*. Advance online publication. doi: 10.1108/JFRA-10-2021-0377.
- Safta, I. L., Achim, M. V., & Borlea, S. N. (2020). Manipulation of financial statements through the use of creative accounting. Case of Romanian companies. *Studia Universitatis „Vasile Goldis” Arad – Economics Series*, 30(3), 90–107. doi: 10.2478/sues-2020-0019.
- Saleh, M. M. A., Jawabreh, O., & Abu-Eker, E. F. M. (2021). Factors of applying creative accounting and its impact on the quality of financial statements in Jordanian hotels, sustainable practices. *Journal of Sustainable Finance & Investment*. Advance online publication. doi: 10.1080/20430795.2021.1962662.
- Skoda, M., Lengyelfalussy, T., & Gabrhelová, G. (2017). Creative accounting practices in Slovakia after passing financial crisis. *Copernican Journal of Finance & Accounting*, 6(2), 71–86. doi: 10.12775/CJFA.2017.012.
- Son, M. H., & Jeong, K. (2022). The informational role of aggregate accounting earnings and their components in predicting GDP growth – evidence from Korea. *Cogent Business & Management*, 9(1), 2096800 doi: 10.1080/23311975.2022.2096800.

- Svabova, L., Kramarova, K., Chutka, J., & Strakova, L. (2020). Detecting earnings manipulation and fraudulent financial reporting in Slovakia. *Oeconomia Copernicana*, 11(3), 485–508. doi: 10.24136/oc.2020.020.
- Valaskova, K., Adamko, P., Frajtova Michalikova, K., & Macek, J. (2021a). Quo Vadis, earnings management? Analysis of manipulation determinants in Central European environment. *Oeconomia Copernicana*, 12(3), 631–669. doi: 10.24136/oc.2021.021.
- Valaskova, K., Androniceanu, A-M., Zvarikova, K., & Olah, J. (2021b). Bonds between earnings management and corporate financial stability in the context of the competitive ability of enterprises. *Journal of Competitiveness*, 13(4), 167–184. doi: 10.7441/joc.2021.04.10.
- Valaskova, K., & Durana, P. (2020). Global context of disparities in earnings management among enterprises: evidence from Slovakia. *Proceedings of Globalization and Its Socio-economic Consequences*, 74, 1–9. doi: 10.1051/s\_hconf/20207401034.
- Viana, D. B. C., Lourenço, I. M. E. C., & Paulo, E. (2022). The effect of IFRS adoption on accrual-based and real earnings management: emerging markets' perspective. *Journal of Accounting in Emerging Economies*. Advance online publication. doi: 10.1108/JAEE-05-2021-0172.
- Virglerova, Z., Homolka, L., Smrcka, L., Lazanyi, K., & Kliestik, T. (2017). Key determinants of the quality of business environment of SMEs in the Czech Republic. *E & M Ekonomie a management*, 20(2), 87–101. doi: 10.15240/tul/001/2017-2-007.
- Zhong, X., Ren, L., & Wu, X. (2022). Founder domination, industry environment, and family firms' earnings management. *Baltic Journal of Management*. Advance online publication. doi: 10.1108/BJM-09-2021-0360.
- Zvarikova, K., Rowland, M., & Krulicky, T. (2021). Sustainable industry 4.0 wireless networks, smart factory performance, and cognitive automation in cyber-physical system-based manufacturing. *Journal of Self-Governance and Management Economics*, 9(4), 9–21. doi: 10.22381/jsme9420211.

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## Annex

**Table 1.** The number of enterprises in the V4 countries

<b>Observed period in years</b>	<b>2016-2020</b>
<b>Financial data is expressed in units</b>	<b>one thousand €</b>
<b>The value of total assets minimum</b>	<b>500 000 €</b>
<b>Total number of enterprises in the database for V4 countries</b>	<b>100 057</b>
Total number of enterprises in the Slovak Republic	17 299
Total number of enterprises in the Czech Republic	20 161
Total number of enterprises in the Republic of Poland	36 884
Total number of enterprises in the Republic of Hungary	25 713
<b>Total number of enterprises after removal of missing values</b>	<b>48 189</b>
Total number of enterprises in the Slovak Republic	12 145
Total number of enterprises in the Czech Republic	11 154
Total number of enterprises in the Republic of Poland	19 134
Total number of enterprises in the Republic of Hungary	5 756
<b>The total number of businesses after the removal of extreme</b>	<b>33 357</b>
Total number of enterprises in the Slovak Republic	8 134
Total number of enterprises in the Czech Republic	5 782
Total number of enterprises in the Republic of Poland	15 054
Total number of enterprises in the Republic of Hungary	4 387

**Table 2.** The variables and their abbreviations found in the models

<b>Abbreviation</b>	<b>Variables</b>
NDA	Non-discretionary accrual
TA	Total accrual
Median (TA)	Median value of the total average accrual for all companies in the same industry according to the industry classification and in the same year
A	Assets
$\Delta$ REV	Annual change in sales
PPE	Long-term tangible assets
$\Delta$ REC	Annual change in receivables
$\Delta$ REV - $\Delta$ REC	The difference between annual changes in sales and annual changes in receivables
CFO	Cash flow from operations
$\Delta$ CFO	Annual change in cash flow from operations
IA	Intangible assets
$\Delta$ SALE - $\Delta$ REC	The difference between annual changes in sales and annual changes in receivables
ROA	Return on assets
EXP	Operating expenses (cost of goods sold, selling and administrative expenses before depreciation)
EAT	Profit after tax
$\varepsilon$	Prediction error
$\alpha_0, \alpha_1, \alpha_2 \dots \alpha_n$	Regression coefficients
$\gamma_1, \gamma_2$	Industry-specific parameters
i	Business index (i = 1, 2, ...N)
t	Period index (t = 1, 2, ...N)

**Table 3.** Verification of the presence of EM using the Mann-Whitney test

<b>Verification of the presence of EM - Slovakia</b>					
<b>Indicator</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>
The value of $\alpha$	0.05	0.05	0.05	0.05	0.05
The value of p	<0.0001	<0.0001	<0.0001	<0.0001	0.0001
Hypothesis	H1	H1	H1	H1	H1
EM result	Confirmed	Confirmed	Confirmed	Confirmed	Confirmed
<b>Verification of the presence of EM - Czechia</b>					
<b>Indicator</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>
The value of $\alpha$	0,05	0,05	0,05	0,05	0,05
The value of p	< 0.0001	1.00	< 0.0001	< 0.0001	< 0.0001
Hypothesis	H1	H0	H1	H1	H1
EM result	Confirmed	Unconfirmed	Confirmed	Confirmed	Confirmed
<b>Verification of the presence of EM - Poland</b>					
<b>Indicator</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>
The value of $\alpha$	0.05	0.05	0.05	0.05	0.05
The value of p	<0.0001	<0.0001	<0.0001	<0.0001	0.0001
Hypothesis	H1	H1	H1	H1	H1
EM result	Confirmed	Confirmed	Confirmed	Confirmed	Confirmed
<b>Verification of the presence of EM - Hungary</b>					
<b>Indicator</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>
The value of $\alpha$	0.05	0.05	0.05	0.05	0.05
The value of p	<0.0001	<0.0001	<0.0001	<0.0001	0.0001
Hypothesis	H1	H1	H1	H1	H1
EM result	Confirmed	Confirmed	Confirmed	Confirmed	Confirmed

**Table 4.** Direction, degree, and scope of earnings management

<b>EM direction expressed as DA percentages - Slovakia</b>						
<b>DA</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>Average</b>
+DA	58.36%	57.23%	58.89%	53.17%	51.64%	55.86%
-DA	41.64%	42.77%	41.11%	46.83%	48.36%	44.14%
<b>EM direction expressed as DA percentages - Czechia</b>						
<b>DA</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>Average</b>
+DA	56.62%	50.00%	55.34%	54.96%	52.33%	53.85%
-DA	43.38%	50.00%	44.66%	45.04%	47.67%	46.15%
<b>EM direction expressed as DA percentages - Poland</b>						
<b>DA</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>Average</b>
+DA	57.98%	55.00%	53.08%	49.31%	43.18%	51.71%
-DA	42.02%	45.00%	46.92%	50.69%	56.82%	48.29%
<b>EM direction expressed as DA percentages - Hungary</b>						
<b>DA</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>Average</b>
+DA	64.53%	54.80%	51.79%	51.79%	47.44%	54.07%
-DA	35.47%	45.20%	48.21%	48.21%	52.56%	45.93%

**Table 4.** Continued

<b>Degree of EM expressed in terms of average DA values - Slovakia</b>						
<b>DA</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>Average</b>
+DA	0.09136	0.08582	0.08250	0.07684	0.07303	0.08191
-DA	-0.12833	-0.12379	-0.10753	-0.09679	-0.09311	-0.10991
The Difference	0.21970	0.20961	0.19003	0.17364	0.16613	0.19182
<b>Degree of EM expressed in terms of average DA values - Czechia</b>						
<b>DA</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>Average</b>
+DA	0.06940	0.06803	0.06860	0.07011	0.06784	0.06880
-DA	-0.09781	-0.09025	-0.08813	-0.07822	-0.09058	-0.08900
The Difference	0.16721	0.15828	0.15673	0.14832	0.15842	0.15779
<b>Degree of EM expressed in terms of average DA values - Poland</b>						
<b>DA</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>Average</b>
+DA	0.09091	0.08807	0.08001	0.07578	0.08049	0.08305
-DA	-0.12861	-0.11341	-0.10319	-0.10080	-0.11286	-0.11177
The Difference	0.21953	0.20148	0.18320	0.17659	0.19335	0.19483
<b>Degree of EM expressed in terms of average DA values - Hungary</b>						
<b>DA</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>Average</b>
+DA	0.10255	0.07796	0.07629	0.07960	0.08375	0.08403
-DA	-0.12667	-0.11040	-0.10290	-0.10332	-0.10623	-0.10990
The Difference	0.22922	0.18836	0.17920	0.18292	0.18998	0.19394
<b>EM range using DA - Slovakia</b>						
<b>DA</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>Average</b>
+DA	0.05332	0.04912	0.04858	0.04086	0.03771	0.04592
-DA	-0.05344	-0.05295	-0.04421	-0.04533	-0.04503	-0.04819
<b>EM range using DA - Czechia</b>						
<b>DA</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>Average</b>
+DA	0.03930	0.03401	0.03796	0.03853	0.03551	0.03706
-DA	-0.04243	-0.04512	-0.03936	-0.03523	-0.04318	-0.04106
<b>EM range using DA - Poland</b>						
<b>DA</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>Average</b>
+DA	0.05271	0.04843	0.04247	0.03737	0.03475	0.04315
-DA	-0.05405	-0.05104	-0.04841	-0.05110	-0.06413	-0.05375
<b>EM range using DA - Hungary</b>						
<b>DA</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>Average</b>
+DA	0.06618	0.04272	0.03951	0.04123	0.03973	0.04587
-DA	-0.04493	-0.04990	-0.04961	-0.04981	-0.05584	-0.05002

**Table 5.** Model summarization according to the Enter method

Model summarization					
Model	R	R Square	Adjusted R	Std. Error of the Esti.	
1	0.183a	0.033	0.032	0.1374823422	
Anova					
	$\Sigma$ Squares	df	Mean	F	Sig.
Regression	21.706	41	0.529	28.010	0,000
Residual	629.700	33315	0.019	-	
Total	651.406	33356	-	-	

**Table 6.** Statistically significant variables

Variables	Coefficient	Statistical Significance
Constant	-0.050	0.000
$\Delta$ CFO	0.196	0.000
SKNACE <sub>12</sub>	0.041	0.000
SKNACE <sub>3</sub>	-0.016	0.000
SIZE OF COMPANY <sub>3</sub>	0.020	0.000
$\Delta$ REV- $\Delta$ REC	-0.023	0.000
ROA	1.280	0.000
SKNACE <sub>8</sub>	-0.025	0.000
LEGAL FORM <sub>5</sub>	-0.014	0.000
BUSINESS LIFE CYCLE STAGE <sub>3</sub>	-0.012	0.000
IA	-0.199	0.000
SKNACE <sub>14</sub>	0.020	0.000
SKNACE <sub>18</sub>	0.027	0.002
SKNACE <sub>4</sub>	0.020	0.000
SIZE OF COMPANY <sub>4</sub>	0.018	0.000
PPE	-0.010	0.000
COUNTRY <sub>2</sub>	0.008	0.000
SKNACE <sub>11</sub>	0.029	0.002
LEGAL FORM <sub>9</sub>	-0.030	0.004
SKNACE <sub>17</sub>	-0.017	0.004
SIZE OF COMPANY <sub>1</sub>	0.005	0.011
LEGAL FORM <sub>2</sub>	-0.167	0.015
LEGAL FORM <sub>7</sub>	0.029	0.019
SKANCE <sub>6</sub>	-0.007	0.039

**Table 7.** Inflation dispersion factor (VIF)

Variables	VIF
Constant	-
$\Delta$ CFO	1.285
SKNACE <sub>12</sub>	1.158
SKNACE <sub>3</sub>	1.173
SIZE OF COMPANY <sub>3</sub>	1.086
$\Delta$ REV- $\Delta$ REC	1.113
ROA	1.294
SKNACE <sub>8</sub>	1.054
LEGAL FORM <sub>5</sub>	1.076
BUSINESS LIFE CYCLE STAGE <sub>3</sub>	1.082
IA	1.030
SKNACE <sub>14</sub>	1.032
SKNACE <sub>18</sub>	1.229
SKNACE <sub>4</sub>	1.041
SIZE OF COMPANY <sub>4</sub>	1.060
PPE	1.136
COUNTRY <sub>2</sub>	1.110
SKNACE <sub>11</sub>	1.017
LEGAL FORM <sub>9</sub>	1.007
SKNACE <sub>17</sub>	1.037
SIZE OF COMPANY <sub>1</sub>	1.128
LEGAL FORM <sub>2</sub>	1.002
LEGAL FORM <sub>7</sub>	1.220
SKANCE <sub>6</sub>	1.063

**Table 8.** Durbin-Watson test

Model	R	R Square	Adjusted R Square	Durbin-Watson
1	0.097	0.009	0.009	
2	0.131	0.017	0.017	
3	0.140	0.020	0.020	
4	0.147	0.022	0.022	
5	0.154	0.024	0.023	
6	0.159	0.025	0.025	
7	0.163	0.027	0.026	
8	0.167	0.028	0.028	
9	0.169	0.028	0.028	
10	0.170	0.029	0.029	
11	0.171	0.029	0.029	
12	0.173	0.030	0.029	
13	0.174	0.030	0.030	
14	0.175	0.031	0.030	

**Table 8.** Continued

Model	R	R Square	Adjusted R Square	Durbin-Watson
15	0.176	0.031	0.031	
16	0.177	0.031	0.031	
17	0.178	0.032	0.031	
18	0.178	0.032	0.031	
19	0.179	0.032	0.031	
20	0.180	0.032	0.032	
21	0.180	0.032	0.032	
22	0.180	0.033	0.032	
23	0.181	0.033	0.032	<b>1.985</b>

**Table 9.** The variables and their abbreviations of created model

Abbreviation	Variables
TA	Total accrual
A	Assets
PPE	Long-term tangible assets
$\Delta REV - \Delta REC$	The difference between annual changes in sales and annual changes in receivables
$\Delta CFO$	Annual change in cash flow from operations
IA	Intangible assets
ROA	Return on assets
t	Period index (t = 1, 2, ...N)
Krajina <sub>2</sub>	Number characterizes a specific country from the V4 countries: 2 - Czech Republic
L, C, H, N, R, D, K, Q, F	SK NACE category
VP <sub>3</sub> , VP <sub>4</sub> , VP <sub>1</sub>	Size of company (the number characterizes a specific size of company: 3 - small company, 4 - very large company, 1 - large company)
PF <sub>5</sub> , PF <sub>9</sub> , PF <sub>2</sub> , PF <sub>7</sub>	Legal form of company (the number characterizes a specific legal form of company: 5 - partnerships, 9 - sole trader, 2 - companies with unknown/unregistered legal form, 7 - public authorities)
FŽCP	Phase of the business life cycle

**Table 10.** Capturing the presence of EM in the V4 countries created by the model

Indicator	Verification of the presence of EM – Countries of V4				
	2016	2017	2018	2019	2020
The value of $\alpha$	0.05	0.05	0.05	0.05	0.05
The value of p	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Hypothesis	H1	H1	H1	H1	H1
EM result	Confirmed	Confirmed	Confirmed	Confirmed	Confirmed



**Table 11.** Direction, degree, and scope of earnings management in V4 countries (new model)

<b>EM direction expressed as DA percentages – Slovakia</b>						
<b>DA</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>Average</b>
+DA	15.26%	15.61%	15.81%	15.93%	15.92%	15.71%
-DA	9.12%	8.77%	8.57%	8.45%	8.47%	8.68%
<b>EM direction expressed as DA percentages - Czechia</b>						
<b>DA</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>Average</b>
+DA	11.69%	19.05%	11.74%	12.11%	12.05%	13.33%
-DA	5.64%	6.38%	5.59%	5.23%	5.28%	5.63%
<b>EM direction expressed as DA percentages - Poland</b>						
<b>DA</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>Average</b>
+DA	33.02%	32.74%	33.45%	32.63%	30.17%	32.40%
-DA	12.11%	12.39%	11.68%	12.50%	14.96%	12.73%
<b>EM direction expressed as DA percentages - Hungary</b>						
<b>DA</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>Average</b>
+DA	10.12%	9.24%	9.26%	10.14%	8.91%	9.54%
-DA	3.03%	3.92%	3.89%	3.01%	4.24%	3.62%
<b>Degree of EM expressed in terms of average DA values - Slovakia</b>						
<b>DA</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>Average</b>
+DA	0.10249	0.09893	0.09638	0.09256	0.09013	0.09610
-DA	-0.14113	-0.13875	-0.11990	-0.10870	-0.10234	-0.12216
The Difference	0.24362	0.23768	0.21628	0.20126	0.19248	-0.01303
<b>Degree of EM expressed in terms of average DA values - Czechia</b>						
<b>DA</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>Average</b>
+DA	0.09342	0.09101	0.09178	0.09300	0.08935	0.09171
-DA	-0.10988	-0.10068	-0.09793	-0.08708	-0.10116	-0.09935
The Difference	0.20329	0.19169	0.18971	0.18009	0.19051	-0.00382
<b>Degree of EM expressed in terms of average DA values - Poland</b>						
<b>DA</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>Average</b>
+DA	0.11708	0.11856	0.11160	0.10609	0.10533	0.11173
-DA	-0.15643	-0.13395	-0.12063	-0.11792	-0.12049	-0.12988
The Difference	0.27351	0.25251	0.23223	0.22401	0.22583	-0.00908
<b>Degree of EM expressed in terms of average DA values - Hungary</b>						
<b>DA</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>Average</b>
+DA	0.14304	0.11191	0.10927	0.10964	0.10872	0.11652
-DA	-0.15567	-0.12505	-0.11684	-0.11955	-0.11311	-0.12604
The Difference	0.29871	0.23696	0.22610	0.22919	0.22183	-0.00476
<b>EM range using DA - Slovakia</b>						
<b>DA</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>Average</b>
+DA	0.01564	0.01544	0.01524	0.01475	0.01435	0.01508
-DA	-0.01287	-0.01217	-0.01028	-0.00919	-0.00866	-0.01064

**Table 11.** Continued

EM range using DA - Czechia						
DA	2016	2017	2018	2019	2020	Average
+DA	0.01092	0.01733	0.01078	0.01126	0.01077	0.01221
-DA	-0.00620	-0.00643	-0.00548	-0.00455	-0.00534	-0.00560
EM range using DA - Poland						
DA	2016	2017	2018	2019	2020	Average
+DA	0.03867	0.03881	0.03733	0.03462	0.03178	0.03624
-DA	-0.01894	-0.01660	-0.01409	-0.01474	-0.01803	-0.01648
EM range using DA - Hungary						
DA	2016	2017	2018	2019	2020	Average
+DA	0.01448	0.01034	0.01012	0.01112	0.00969	0.01115
-DA	-0.00471	-0.00490	-0.00455	-0.00359	-0.00480	-0.00451

**Figure 1.** Summary of met criteria of AEM models

Analyzed AEM model	Adjusted coefficient of determination			Standard deviation			Statistical significance of the model			Statistical significance of variables			Predicted sign			SK	CZ	PL	HU
<i>Industry model</i>																3	3	3	3
<i>Jones model</i>																0	2	2	3
<i>Modified Jones model</i>																1	4	2	4
<i>Jeter and Shivakumar model</i>																0	2	2	3
<i>Kaszniak model</i>																1	1	2	3
<i>Key model</i>																0	2	2	3
<i>Teoh, Welch and Wong model</i>																2	3	2	2
<i>Kothari model</i>																1	3	2	3
<i>Hribar and Collins model</i>																5	5	5	5
<i>Kang model</i>																1	3	-	-