ORIGINAL ARTICLE

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Does the life cycle affect earnings management and bankruptcy?

Abstract

Research background: Deteriorating economic conditions and a negative outlook increase the pressure on financial management and the need to show high financial performance. According to Positive Accounting Theory, the growing risk of bankruptcy is associated with the phenomenon of earnings management. Bankruptcy risk and the quality of reported profits, along with other

aspects of financial performance, vary throughout the company's life cycle. Nevertheless, these factors or their interactions are investigated only to a very small extent.

Purpose of the article: The aim of this study is to clarify the impact of corporate life cycle and bankruptcy on earnings management, in order to describe behaviour of companies at different stages of corporate life cycle.

Methods: A hierarchical mixed model with a random time and industry effect was chosen as appropriate because it allows the investigation of multilevel data that is not independent. The sample covers the financial indicators of more than 33,000 Central European companies from 2015–2019. The non-sequential Dickinson model, company age, and three models of accrual earnings management were used as proxies for the company's life cycle and quality of reported profit.

Findings & value added: Earnings management and bankruptcy risk have a U-shape, indicating that financially distressed firms reduce reported accounting profit at the Introduction, Decline and, to a lesser extent, at the Growth stage. Slovak and Czech companies manipulate profits to a similar extent, Hungarian companies increase accounting profit to a greatest extent than the surveyed countries by controlling bankruptcy — life cycle effect; however, the variability of accounting manipulations across industries has not been demonstrated. These findings imply that start-ups and declining businesses provide crooked financial statements to obtain more favourable debt covenants, and estimating discretionary accruals using life-cycle subsamples can improve the predictive power of accrual earnings management models.

Introduction

As stated by FitchRatings (2020) in the Global Economic Outlook, the escalation of the coronavirus crisis has deepened the global recession. The downturn in the world economy in 2020 varied between 4.5–4.3%, while the downturn in the euro area is forecast at 7.9% (OECD, 2020). Despite optimistic forecasts for 2021 (5% for global economic growth and 5.1% growth for the euro area), the latest report, World Economic Situation and Prospects by United Nations (2021) predicts only 4.7% global economic growth, which will primarily offset the losses incurred in 2020. World Bank (2021) emphasizes in Global Economic Prospect that while the world economy will gradually recover from the economic shock in 2020, it should have long-term consequences for the economy in the form of unemployment or underinvestment.

Moreover, the slowdown in economies brings worsened conditions for debt repayment, or the acquisition of additional debt. A significant increase in credit risk should result in an increase in insolvencies at the beginning of 2021 (Euler Hermes, 2020a). The global insolvency index for 2020 should be higher by 35% compared to 2019. Small pro-export economies such as Slovakia (38% increase in insolvencies), Hungary (20% increase) or Lithuania (49% increase) are significantly at risk. Euler Hermes (2020b) points out that the second wave of lockdowns could cause euro area operating income losses of up to 20% compared to the pre-crisis period, which could plunge more than 24% of businesses into a cash flow crisis. Euler Hermes

also assumes that European economies will be in "stop & go" mode by 2022.

These macroeconomic conditions put strong pressure on companies in terms of liquidity and the quality of reported profits. The relevance of the profit may be reduced due to manipulation of accounting numbers; the difference between cash flow and profit is due to the high value of accruals and the effect of earnings management. Earnings management has been the focus of many researchers in recent years (Beneish, 2001; Kothari *et al.*, 2005 or Burgstahler & Chuk, 2017). Most studies focus on the Anglo-American economic environment, with European emerging markets being examined to a small extent (Degiannakis *et al.,* 2019; Callao *et al.*, 2017; Kliestik *et al.,* 2020b; Sosnowski, 2017; 2018).

The application of earnings management techniques reduces the explanatory power of financial statements, which on the one hand improves the company's position, but reduces the ability to predict future bankruptcy and increases the risk of bankruptcy (Fialova & Folvarcna, 2020). Empirical evidence regarding earnings management during the crisis varies; Lisboa and Kacharava (2018) revealed that the level of earnings management increased during the last financial crisis, while Papadaki and Tzovas (2017) found that companies in the sample of 19 European countries used accrual earnings management to a lesser extent during the financial crisis. Campa and Camacho-Minano (2015) argue that companies with a higher risk of bankruptcy are more under pressure and use earnings management techniques more to report higher profits than healthy companies. Healthy businesses focus on techniques that report profit in order to reduce corporate tax (tax shield or tax shelter). Charitou *et al.* (2011) affirmed that the relationship between a company's financial health and earnings management is ambiguous. Jardin *et al.* (2019) point out that accounting manipulations can distort the results of bankruptcy prediction models, which is paradoxically very little documented. DeFond and Jiambalvo (1994) attribute to the higher accounting manipulations the possibility of technical default and debt covenants. Positive Accounting Theory implies that larger firms apply downward earnings management to a greater extent (Watts & Zimmerman, 1990), Rusmin (2010) combines the low discretionary accruals of large firms with control from auditing firms.

The corporate life cycle has its roots in the organizational science literature. Studies (Miller & Friesen, 1984; Adizes, 1979) show that firms at different stages of the life cycle have unique characteristics as an ownership structure (Faff *et al.,* 2016), financial and investment activities, accounting techniques (Moores & Yuen, 2001), but also the characteristics of earnings management as the value of accruals (Hastuti *et al.,* 2017; Chen, 2016).

Young growing businesses have more investment opportunities, less debt and less information asymmetry, which increases the likelihood that they have a CRA rating compared to start-ups (Blomkvist *et al.,* 2020). Hussain *et al.* (2020) found that managers influence reported profits more significantly in the start-up and decline phase, growing and mature businesses to a lesser extent. Bankruptcy risk develops similarly to earnings manipulation; mature businesses have a lower risk of bankruptcy than growing ones (Akbar *et al*., 2019; Akbar *et al.,* 2020).

Previous empirical studies imply that earnings management and financial indicators and bankruptcy are influenced by the company's life cycle. However, to the best of our knowledge, no empirical study has been designed to investigate the interconnected impact of earnings management, bankruptcy (financial distress), and the company's life cycle for Central European countries. In this context, the aim of the paper is to clarify the impact of corporate life cycle and bankruptcy on earnings management in order to describe behaviour of companies at different stages of corporate life cycle. The data cover more than 30,000 Central European companies and more than 140,000 observations from 2015–2019. Life cycle stages were determined according to the Dickinson (2011) model, earnings management using three accrual-based models — a modified Jones model by Dechow *et al.* (1995), Kothari *et al.* (2005) and Teoh *et al.* (1998). Financial distress was investigated by the Zmijewski model modified by Grice and Dugan (2003). This model, opposite to the original Zmijewski model, better estimates the probability of financial distress, as it was estimated on a sample of distressed firms. Control variables were estimated using financial indicators such as tangibility, leverage, corporate size, profitability and growth. The AGE variable was implemented to compare impact of risk of bankruptcy on earnings quality within firms of different age and within the various stages of the non-sequential Dickinson life cycle model. A hierarchical linear mixed model was used as a suitable method, as it allows to investigate data that are nested into several levels (country, industry and company level) for a more detailed description of the investigated companies.

This study primarily contributes to a better understanding of the behaviour of companies in the various stages of the life cycle, and secondly develops empirical research on earnings management in the emerging economies of Central Europe. Third, many studies adopt the Dickinson model as a life cycle proxy; this paper compares corporate behaviour according to this non-sequential model and the corporate age representing a linear view of the life cycle. Finally, our research can help all stakeholders (bondhold-

ers, banks, competitors) to interpret accounting information more accurately with respect to life cycles´ pattern and financial distress.

The study is designed as follows. The theoretical definition of earnings management and review of relevant life cycle literature is the content of the second chapter. The third chapter briefly describes the methodology of the hierarchical linear mixed model used, including information about the sample and dependent and independent variables. The results of the investigated model using the sequential Dickinson model and the age of the proxy together with a comparison of their effect on accounting manipulations are presented in the fourth chapter. Discussion compares our results with comparable studies and outlines some insights related to bankruptcy risk and earnings manipulation such as debt covenants violation, capital and the issue of financial health of the company in the context of the current pandemic and emerging economic crisis. The last chapter summarizes the main findings, the limitations of this approach and possible future directions of research.

Literature review

General overview of earnings management

Scott (1997) states that earnings management expresses a managerial accounting policy or activity that changes real income to achieve certain goals of profit reporting. McKee (2005) emphasizes the legal nature of earnings management and adds that this concept is identical with creative accounting, accounting alchemy, borrowing income from the future, accounting magic, window dressing. Iatridis (2010) summarizes four reasons why managers use earnings management techniques: a) reduce tax revenue to reduce tax liability, b) shift revenues (profits) from good years to bad years, c) reveal good results correlated with the trend of postponing negative profits (losses), d) increase managers' current or future revenues through discretionary accounting policies.

Cahan (1992), on the other hand, stated that earnings management can serve to evade anti-monopoly rules, Dechow (1994) affirmed that lower reported profits can strengthen a company's bargaining power vis-à-vis labor unions. Kramarova and Valaskova (2020) agree with the motives by Iatridis (2010) and emphasize in the Central European environment achieving more favourable debt covenants, reducing effective tax rates or increasing the value of the company. Kramarova (2021) corroborates that downward earnings management predominates in Slovak companies, but the interconnection

between accounting manipulations and tax avoidance cannot be confirmed. Furthermore, Svabova *et al.* (2020) combines fraudulent financial reporting with tax avoidance. Nonetheless, it is not possible to link every fraudulent accounting with financial statement fraud.

Dechow (1994) claimed that each earnings number consists of cash flow and accruals. Joosten (2012) distinguishes between two types of profit manipulation: accrual based earnings management and real earnings management. Accrual based earnings management does not affect cash flow, it is based on flexibility in applying accounting principles (GAAP). Paolo and Gurgel Mota (2019) argue that there is a trade-off between accrual and real earnings management; during the decline in the economic cycle, discretionary accruals increase and decrease during the growth phase. Managers use real manipulation during a recession and downturn to reduce profits. Graham *et al.* (2005) found different results; 80% of respondents from their research said they use discretionary expenses to manage profits.

Research into accounting manipulations in emerging economies, especially in Central European countries, is less developed than in countries with developed capital markets. First of all, the authors focused on fraudulent financial behaviour. Papik and Papikova (2020; 2021) tested the well-known Beneish (2001) model, on the basis of which they developed two new models based on discriminant analysis and logit regression with a predictive power of more than 70% and 60%, respectively. Svabova *et al.* (2020) proceeded similarly, however, their model achieved up to 84% classification accuracy. Homola and Pasekova (2020), on the other hand, focused on accounting irregularities of Czech companies accounting under IFRS, while their frequency is not regular according to this analysis. Istrate *et al.* (2015) add that the financial accounting quality in Romanian companies has increased after these companies have passed IFRS standards and started to be audited by CRA-s from the Big Four.

The second significant direction in earnings management research is the detection of earnings management. Callao *et al.* (2017) tested thirteen models of accrual earnings management; their results in a sample of companies from the Visegrad Four indicate that although the modified Jones model is the most widely used model, there are other more reliable models such as Jones (1991) or Kasznik (1999). Nevertheless, a study by Kliestik *et al.* (2020a) and Valaskova and Durana (2020) lean towards the generally preferred modified Jones model.

Earnings management is often associated with the behaviour of listed companies towards their stakeholders. Nonetheless, most companies are unlisted in the Central European environment, which greatly narrows the scope of this research. Brzeszczynski *et al.* (2011) pointed to discontinuity in earn-

ings indicating the presence of earnings management practices, with a positive earnings threshold having significant implications for reported profits similar to those in US companies. Kliestik *et al.* (2020a) revealed a growing trend of accounting manipulations in all Central European companies, with earnings reaching a threshold in 2014, 2013 (the Czech Republic) respectively. Cherkasova and Radasi (2017) comparing samples from Central and Eastern Europe also did not reveal any difference in earnings management. Sosnowski (2017) examining Polish companies before the IPO, found no evidence of aggressive accounting manipulation before the IPO, but a weak form of earnings management was present. Significantly positive discretionary accruals of Polish companies in the IPO were found by Lizinska and Czapiewski (2018), which they attribute to the low quality of earnings.

Corporate life cycle, earnings management and bankruptcy

Life cycle theories have their roots in general of behavioural theories and, in the context of companies, are most often related to product life cycle theory. The basic principle of these theories is the fact that subjects located in one stage of the life cycle have similar characteristics and differ significantly from other subjects located in another stage of the life cycle. The variability of life cycle approaches is given by the diversity of economic disciplines; on the one hand there are organizational theories and, on the other hand, it is a financial approach.

Dickinson (2011) created a fully non-sequential model based on specific cash flow patterns typical for individual stages of the life cycle (Introduction, Growth, Maturity, Shake-out and Decline). This approach is one of the most common, because cash flow patterns absorb more financial characteristics and are more relevant in terms of market capitalization and dividends (Dickinson *et al.,* 2018).

During the Introduction stage, companies have low collateral value, high risk corporate risk and high capital costs. Negative working capital causes accrual growth and cash sales to grow significantly (Liu, 2007). Depreciation is at its lowest value, because fixed assets are only gradually accumulated. Hayn (1995) notes that small start-ups tend to report losses to a greater extent than large start-ups. These companies also face a higher risk of bankruptcy than during other stages (Akbar *et al.,* 2019). Growing businesses have better financing options, which is reflected in growing debt ratios in the short and long term. Gaver and Gaver (1993) oppose that growing companies have lower debt as well as lower dividends. Total accruals increase due to working capital growth. Compared to start-ups, growing companies are significantly

more profitable and have less risk of bankruptcy (Akbar *et al.,* 2019), risk-taking contributes positively to current profitability (Akbar *et al.,* 2020).

Mature businesses achieve maximum operating performance combined with minimum operating costs (Jovanovic, 1982; Grofcikova, 2020). Damodaran (2018) notes that investment cash flow is low because such companies are not very interested in new investments. The stable position of these companies increases the flexibility of debt acquisition; however, there is a tendency for internal financing due to positive cash flow and high liquidity (Seifert & Gonenc, 2012). Working capital accruals are low due to weak investment in current assets (Liu, 2006), which has a positive effect on profitability (Wang *et al.,* 2020). Bankruptcy risk is lowest along with overall corporate risk (Akbar *et al.,* 2019). Zadband and Omrani (2014) add that these companies are more focused on operational activities, their accounting is more transparent and their accounting reports are of better quality.

The shake-out stage spans Maturity and Decline; business growth is slowly declining, along with declining stock prices (Wernerfelt, 1985). Dickinson (2011) argues that the size of the business is increasing; the amount of products decreases causing product prices to fall (Miller & Friesen, 1984). Dickinson (2011) reveals that there is no clear evidence of how companies are behaving at this stage.

The last stage of the Decline is characterized by minimum values of profit, sales and cash flow. Debt ratios may also decline due to the repayment of debt from sold assets (Wernerfelt, 1985). However, the risk of default on debt covenants may encourage higher non-discretionary accruals (DeFond & Jiambalvo, 1994). The company reduces receivables to obtain liquidity, which is reflected in the highest value of cash sales (Liu, 2006). Bankruptcy risk is the highest of all phases (Akbar *et al.,* 2019), which causes a tendency to increase tax avoidance.

As can be seen from the previous paragraphs, the life cycle has a significant impact on the financial performance of companies, which provides room for accounting manipulations and also affects the financial fragility of these entities in relation to creative accounting. Hribar and Yehuda (2015) point out that cash flow and accruals are misinterpreted at various stages of the life cycle; in the growth phase, these quantities are not indirectly correlated as in the maturity and decline phases. This should indicate that information on earnings management in the earlier stages of the life cycle (growth) should manifest itself as information influencing the share price only in the later stages of the life cycle (graduation and decline). Chen *et al.* (2010) investigated financial ratios and accruals in Chinese listed companies. Their results show that accruals vary systematically throughout the life cycle. Gu *et al.* (2005) attribute this systematic change to the existence of heteroscedasticity.

Chen *et al.* (2010) adds that accruals are less homogeneous across the industry than for companies at the same stage of the life cycle. The addition of the life cycle variable to accrual models significantly increases the explanatory power of current accrual models.

Suberi *et al.* (2012) found that the life cycle is an important factor for the analysis of the relationship between earnings quality and future growth of the company. Quality of financial statements and business growth tends to grow over a period of maturity due to stable conditions in the company. Conversely, in the growth phase, companies have provided low-quality financial information to reduce the risk of losing competitive advantage. Leuz *et al.* (2003) argues that, according to signalling theory, companies in the growth phase want to have access to external financial resources, which forces them to increase the quality of financial statements and reduce information asymmetry. Low levels of profit manipulation may be required due to increased control by debt holders. Nonetheless, Dechow *et al.* (2010) consider the relationship between report quality and economic performance to be unprovable if some variables are omitted, which may indicate the existence of a spurious correlation.

Can (2020) focused on the quality of financial reporting analysed through discretionary accruals, audit aggressiveness and small profits on the Turkish stock exchange. Profit quality has a declining trend in the Introduction and Decline stages, on the contrary, audit aggressiveness grows as the company moves from one stage of the life cycle to another. Moreover, longer-listed companies are audited less aggressively. On the contrary, revenue minimization (downward earnings management) is characteristic of profitable companies at the stage of growth and maturity. Bushman *et al.* (2011) similarly state that accruals consist of two parts: a part independent of corporate growth and an investment part directly dependent on growth opportunities. Start-ups and growing companies should have a higher investment accrual than mature companies, which indicates a higher rate of accounting manipulation in these companies.

A high degree of accounting manipulation during sensitive stages of the life cycle (Indication, Decrease), as described above, may lead to an increase in the risk of default and bankruptcy. Beaver (1966) points out that bankrupt businesses tend to use creative accounting for more than a year before bankruptcy. Ronen and Yaari (2008) divide the life cycle into 5 stages; introduction, technical default, breach of debt service, bankruptcy to liquidation. The debt covenant hypothesis assumes that such accounting techniques are used in the enterprise to reduce the likelihood of technical default. The hypothesis of a time mismatch between earnings management and bankruptcy is also corroborated by Dechow *et al.* (1994) and DeFond and Jiambalvo (1994).

Leach and Newsom (2007) point out that four to five years before bankruptcy, companies increased their profits, and from the third year before bankruptcy, profits decreased. Similar results were found by Garcia Lara *et al.* (2009). Charitou *et al.* (2007) found downwards earning management a year before bankruptcy. Nevertheless, Smith *et al.* (2001), examining the behaviour of Austrian companies a year before bankruptcy, found that these companies increased income by earnings management. However, this accounting behaviour was also observed in a control sample of healthy companies. Dutzi and Rausch (2016) provided an extensive review of corporate pre-bankruptcy behaviour in the context of earnings management.

Research methodology

As stated in the introduction of this study, the aim is to examine the interrelationships between earnings management, bankruptcy risk and the business life cycle of Central European countries. A review of the literature shows that there is a relationship between these variables, however, its comprehensive evaluation is lacking on the international scale, as well as in the Central European concept.

Variables

Earnings management was chosen as a dependent variable, the concept of which can be diverse (Dechow *et al.*, 2010). We selected discretionary accruals calculated according to a modified Jones model proposed by Dechow *et al*. (1995). This model is one of the most used (Callao *et al*., 2017), on the other hand, its accuracy was also tested in a sample of Central European companies (Kliestik *et al.,* 2020a). In addition to the modified Jones model, Kothari *et al.* (2005) and Teoh *et al.* (1998) was used. As Strakova (2020) claimed, Kothari *et al.* (2005) model can achieve higher accuracy than when sales are modelled as a random walk. Unlike the modified Jones model, this model also controls corporate profitability (Kliestik *et al.,* 2020a). In addition, Liu (2006) tested its accuracy at various stages of the life cycle. Teoh *et al.* (1998) was also used in this study; it takes into account mainly short-term accruals. Earnings management in these models is detected as a discretionary component of the total accrual. The total accrual was estimated according to Hoglund (2012). The discretionary accrual is estimated as the residual of the regression model of the total accrual. Formulae for calculating total accrual and modified Jones model (Dechow *et al*., 1995), Kothari model (Kothari *et al*., 2005) and Teoh model (Teoh *et al*., 1998) is given in Eq. (1–4).

$$TA = \Delta CA - \Delta CL - \Delta Cash + \Delta STD - Dep \qquad (1)$$

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

$$\frac{TA_{it}}{A_{it-1}} = \alpha_0 \frac{1}{A_{it-1}} + \alpha_1 \frac{\Delta REV_{it} - \Delta REC_{it}}{A_{it-1}} + \alpha_2 \frac{PPE_{it}}{A_{it-1}} + \alpha_3 \frac{ROA_{it-1}}{A_{it-1}} + \varepsilon_{it} \qquad (3)$$

$$\frac{TA_{it}}{A_{it-1}} = \alpha_0 \frac{1}{A_{it-1}} + \alpha_1 \frac{\Delta SALE_{it} - \Delta REC_{it}}{A_{it-1}} + \varepsilon_{it} \qquad (4)$$

where:
ΔCA – change in current assets,
ΔCL – change in current liabilities,
$\Delta Cash$ – change in cash,
ΔSTD – change in short-term debt,
Dep – depreciation,
TA_{it} – total accruals in year t,
A_{it-1} – assets in year t-1,
ΔREV_{it} – change in revenues,
ΔREC_{it} – change in receivables;
PPE_{it} – property, plant and equipment in year t,
ROA_{it-1} – return on assets on previous year t-1,
$\Delta SALE_{it}$ – total sales in year t.

Dickinson (2011) model was selected as a suitable proxy for the life cycle stages. Cash flow patterns offer two significant benefits; first, they absorb better financial information than other variables used to determine the life cycle stage (revenue growth, dividends, cost of goods sold, or age) (Akbar *et al.,* 2019). Second, the non-sequence of the model makes it possible to classify a company at any stage, regardless of its age. Dickinson (2011) argues that the company, as a portfolio of products at different stages of the life cycle, does not move sequentially to individual stages. The model divides companies according to specific cash flow patterns given in Eq. (5-9).

$$Introduction: if\ CFO < 0; CFI < 0; CFF > 0 \qquad (5)$$

$$Growth: if\ CFO > 0; CFI < 0; CFF > 0 \qquad (6)$$

$$Mature: if\ CFO > 0; CFI < 0; CFF < 0 \qquad (7)$$

$$Shake-out: if \begin{array}{c} CFO < 0; CFI < 0; CFF < 0 \ or \\ CFO > 0; CFI > 0; CFF > 0 \ or \\ CFO < 0; CFI > 0; CFF < 0 \end{array} \qquad (8)$$

$$Decline: if \begin{array}{c} CFF < 0; CFI > 0; CFF > 0 \ or \\ CFO < 0; CFI > 0; CFF < 0 \end{array} \qquad (9)$$

In addition to the life cycle, the impact of bankruptcy risk on earnings management is under investigation in this study. There are various models for estimating a company's financial fragility and possible bankruptcy. Similar previous studies (Akbar *et al.,* 2019; Matonti *et al.,* 2020) have estimated Altman's Z-score (1968) as a proxy for bankruptcy risk. Nonetheless, we decided to use a modified Zmijewski model by Grice and Dugan (2003). It has an advantage over the Altman model in the statistical method used (MDA vs Probit model); moreover, the modified Zmijewski model was estimated on the basis of an unbalanced sample of healthy and financially stressed companies, which corresponds to the situation that not every company in financial distress goes bankrupt and vice versa (Grice & Dugan, 2003). The model estimates the probability of financial distress; a probability higher than 50% indicates a high degree of financial distress (bankruptcy risk).

In addition to the life cycle and the risk of bankruptcy (financial distress), we used other control variables that affect the value of corporate earnings management. Based on studies by Gulec and Karacaer (2017), Faff *et al.* (2016) Habib and Hasan (2017) and Hussain *et al.* (2020), we selected five corporate financial indicators (tangibility, profitability, corporate growth, corporate size, operational risk), which we assume have a significant impact on the level of earnings management in the company. Paulo and Gurgel Mota (2019), following Cohen and Zarowin (2007), argue that earnings manipulations are contaminated with GDP variability; the year-on-year percentage change in real GDP is used in the model to control this country level effect. The formulae of the examined variables together with their acronyms used in the study are given in Table 1.

Sample and data

The required company financial data were obtained from the Amadeus database covering the period 201–2019 and the countries of Central Europe (Slovakia, the Czech Republic, Hungary and Poland); real GDP growth data from Eurostat. The gross sample contained information on 5,555 Slovak, 4,302 Czech, 11 443 Hungarian and 22,392 Polish companies (a total

of 43,692 companies). These companies were selected on the basis of three criteria:
− registered office in Slovakia, the Czech Republic, Hungary or Poland;
− value of total assets in four consecutive years (2016–2019) at least EUR 2,000,000;
− value of Turnover in 2019 at least EUR 100,000.

The data are structured into several levels. Level 0 represents the firm-year observation, all annual observations of one firm are nested up to level 1. Level 3 and 4 express the industry level according to NACE rev. 2, life cycle stage (Introduction, Growth, etc.) respectively. The highest degree of breakdown are countries (level 5). Observations with missing values were removed from the sample, outliers were winsorized at 1% and 99%.

Methods and model design

The nested data structure conditions the control of both cross-sectional and time series dependencies. Nonetheless, classical OLS standard error approach provides inconsistent estimates of standard errors due to insufficient control of serial correlation (Petersen, 2009). For this reason, a hierarchical linear mixed model was used to control both dependencies. Unlike the often used fixed effect panel data model, a hierarchical linear mixed model allows variables to be modelled together from different levels (e.g. company, industry and country level variables) and better handled with unbalanced samples (Gelman, 2006). Oshchepkov and Shirokanova (2020) argue that they are more flexible and parsimonious than the statistical methods commonly used by economists. This approach is relatively new in econometrics and there are few studies in finance that use it (e.g. Kayo & Kimura, 2011; Marinsek, 2017; Akbar *et al.,* 2019 or Wang *et al.,* 2020). In the first step of creating this model, the effects in individual stages were divided into fixed and random factors. There are several rules for distinguishing between fixed and random effects (Snijders & Bosker, 2012); factors are modelled as fixed effects in the case of a small number of groups or if the data contain all variations of the factor. Otherwise, the factor is treated as a random factor.

In this model, as a pre-test phase, we tested all levels of factors (from firm-year observations to country level factors) in a random-intercept model for correct model design. Only two factors (firm-year observation and industry level factor) were determined as significant random factors according to the *p-value* of the *Wald Z test* and Snijders and Bosker (2012) criteria, the other factors are treated as fixed factors. A comprehensive empirical model examining the effect of life cycle and financial distress risk (bank-

ruptcy) on earnings management using the acronyms from Table 1 are given in Eq. (10).

$$
\begin{aligned}
EM_{tijkl} = {} & \beta_0 + \beta_1.DISTRESS_{tijkl} \\
& + \sum_{k=1}^{4} \vartheta_k.LIFE\ CYCLE_k DISTRESS_{tijkl} \\
& + \beta_3.TANG_{tijkl} + \beta_4.PROF_{tijkl} + \beta_5.GROW_{tijkl} \\
& + \beta_6.SIZE_{tijkl} + \beta_7.OPRISK_{tijkl} + \beta_8.GDP\ GROW_{tl} \\
& + \sum_{l=1}^{3} \theta_l.COUNTRY_l + u_{0j} + \varepsilon_{tijkl} \\
& u_{0j} \sim N\big(0, \sigma_{industry}^2\big) \quad \varepsilon_{tijkl} \sim N(0, \sigma^2)
\end{aligned}
\tag{10}
$$

where:
EM_{tijkl} – earnings management proxy (discretionary accruals),
β_0 – grand mean of earnings management proxy;
$\beta_1, \beta_2 \ldots, \beta_8$ – regression coefficients of fixed effect covariates,
ϑ_k – regression coefficients of interaction of life cycle stage dummy and risk of financial distress (bankruptcy),
θ_l – regression coefficient of COUNTRY dummy variable,
u_{0j} – random effect of intercept between industries,
ε_{tijkl} – residual.

The independent variables business life cycle and financial distress risk are treated as an interaction to clarify the impact of financial distress risk at different stages of the life cycle on earnings management. The life cycle is treated as the Dickinson (2011) approach, however, to compare this non-sequential model with the sequential approach, we used AGE variable (see Table 1 for the formula) to analyse the effect of age on earnings management levels. To compare the effect of bankruptcy risk and control variables on earnings management, we designed a model according to Eq. (11).

$$
\begin{aligned}
EM_{tijkl} = {} & \beta_0 + \beta_1.DISTRESS_{tijkl} + \beta_3.TANG_{tijkl} + \beta_4.PROF_{tijkl} \\
& + \beta_5.GROW_{tijkl} + \beta_6.SIZE_{tijkl} + \beta_7.OPRISK_{tijkl} \\
& + \beta_8.GDP\ GROW_{tl} + \beta_9.AGE_{tijkl} \\
& + \sum_{l=1}^{3} \theta_l.COUNTRY_l + u_{0j} + \varepsilon_{tijkl} \\
& u_{0j} \sim N\big(0, \sigma_{industry}^2\big) \quad \varepsilon_{tijkl} \sim N(0, \sigma^2)
\end{aligned}
\tag{11}
$$

In total, this study contains 6 models for estimating the relationship between earnings management and the risk of financial distress (bankruptcy) at different stages of the life cycle. Fixed effects and random effects in Eq. (10–11) are estimated based on Maximum likelihood; significance of fixed

effects according to *t-test* and random effects according to *Wald Z-test* at a significance level of 0.05. The proportion of variability captured by random factors was quantified based on interclass correlations (*ICC*). Snijders and Bosker (2012) consider an ICC threshold of 5%; *ICC* lower than the threshold means low intergroup differences between clusters of the dependent variable (levels of earnings management).

Mixed models are sensitive to the existence of multicolinearity (Oshchepkov & Shirokanova, 2020); we used a correlation matrix of independent variables and *VIF* factor to check multicolinearity. Pairwise correlations greater than 0.5 and VIF greater than 10 are problematic and indicate the existence of collinearity between variables (Gujarati & Porter, 2008). The model was created sequentially (from "empty model" only with intercepts to full model according to Eq. (10–11)) based on comparison of models according to metrics *AIC, BIC* and — *2 ML log-likelihood and Likelihood test* with significance level 0.05.

Based on Literature Review and the design of the model, we formulate the following hypothesis:

Hypothesis 1: *Bankruptcy risk is positively associated with earnings management in the Introduction, Growth and Decline stages of the life cycle.*

Results

The gross sample contains financial data on 43,692 enterprises for 6 years (2014–2019), from which the variables were calculated according to Table 1. Due to the nature of these indicators (e.g. year to year change), only five years of observations could be used. First, we analysed the sample and detect missing values and incomplete data points. These observations were removed from the sample. In the second step, we dealt with outliers that may inaccurate the results of the statistical methods used. We winsorized the sample to 1% and 99% percentiles after removing the missing values. This procedure is parsimonious, as observations with extreme values have not been removed and thus these observations have not been lost.

The overall net sample is unbalanced and contains 144,419 observations from 33,432 companies. According to Figure 1, the majority of the sample contains financial indicators of Polish companies (almost 18,000 companies), while the share of other countries is relatively the same. Secondly, on the basis of Figure 2, it is possible to examine the share of companies at individual stages of the life cycle. Most of the surveyed companies belong to the penultimate stage of shake-out, which is characterized by uncertainty

between the peak of the life cycle and the decline. Growing enterprises have the second highest share in the sample. The other stages are evenly represented in the sample.

Univariate analysis

Table 2 summarizes the results of the univariate analysis of the examined variables. First of all, the development of discretionary accruals is in line with the assumptions of the Literature Review. Start-ups and declining companies evidence strong upward earnings manipulation (mean value of discretionary accruals deflated by previous total assets are approx. 0.025) as these companies achieve only negative cash flow, which is in accordance with Can (2020). Regarding this, Park and Chen (2006) notes that failing companies apply a less conservative accounting policy, which increases value for investors.

However, the variability of accruals indicates that these companies can increase accounting profits to a similar extent by applying creative accounting as well as decrease them. Gross profitability is developing to a similar extent, which is the lowest in the early and ending stages of the life cycle. After reaching the top financial performance (at the stage of maturity) with maximum profitability, companies reduce the reported profit mainly for the purpose of tax avoidance in conflict with the results of Mangoting and Onggara (2018). Nevertheless, Drake (2015) argued in connection with this that mature companies have less persistent earnings and a higher difference between book and taxable income, which is reflected in downward earnings management. On the other hand, companies in the shake-out stage minimize accounting manipulations on average, discretionary accruals have the lowest variability among all phases of the life cycle. On the contrary, growing ones show positive discretionary accruals, but close to zero with lower variability, similar to shake-out enterprises.

Operational risk is highest during the growth phase, indicating high year-on-year volatility of operating profit, which affects working capital accruals (Liu, 2006), but according to the analysed data, it does not have a significant effect on total accruals. The profitability of growing companies copies the high operational risk. The volatility of operating mature firms is developing in the opposite direction, indicating a year-on-year decline in the value of turnover over time; which indicates that while overall corporate risk is declining, returns are much more volatile toward decline compared to growing businesses.

Surprisingly, the average size of a company is similar at all stages of the life cycle, including the variability of average values. This indicates that the

cash flow patterns of these companies are not significantly affected by turnover, despite the fact that the gross profitability of assets varies throughout the life cycle. AGE variable has a similarly insignificant development; all the enterprises analysed are on average 20 years old, in contrast to sequential life cycle models such as Anthony and Ramesh (1992).

Similar to earnings management, the risk of financial distress is the highest during the extreme stages of the life cycle (Introduction and Decline), the values indicate a higher probability of financial distress (bankruptcy). The risk of growing and shake-out companies is similar, on average these companies do not face the risk of financial distress. Last but not least, tangibility is expected to be associated with an increase in bankruptcy risk and to minimize the negative impact on future profitability. However, despite the growing risk of bankruptcy in various phases of the life cycle, the collateral in the analysed companies is stable.

All in all, three of the life cycle stages (Introduction, Growth and Decline) behave as expected (see Liu, 2006 or Dickinson, 2011). Moreover, mature companies show different patterns than assumed by life cycle theories in the area of financial distress risk, operational risk (gross profit volatility) or gross profitability.

The next step in the analysis is to check for the existence of multicolinearity between the explanatory variables. Table 3 reports the pairwise correlation between these variables. None of the cases listed in the correlation matrix exceeds the 0.5 correlation set by Gujarati and Porter (2008). A higher degree of mutual association is evident only between the probability of financial distress and gross profitability. This indicates that, regardless of the life cycle stage, declining operational return on assets significantly increases the risk of bankruptcy. Secondly, the size of the enterprise and the collateral (tangibility) according to the descriptive measures in Table 2 do not vary at different stages of the life cycle, but their mutual between subject covariance and thus the correlation is significantly indirect. Enterprises with lower turnovers (smaller) are thus more hedged by collateralised assets.

The second measure we used to assess multicolinearity is *VIF* (variance inflation factor). Consistent with the results of the correlation matrix, none of the variables showed a higher degree of collinearity because *VIF* was lower in all cases 2; Gujarati and Porter (2008) give a threshold of 5.

Multivariate analysis

Subsequently, next step is to create a model of the impact of life cycle and bankruptcy risk on the level of earnings management. The first step of

the procedure is to create an empty model containing only the intercept. As stated in the Methodology, this step, together with the division of factors into fixed and random, was part of the pre-test phase of the design of a hierarchical mixed linear model. In the second step, we included in the model zero-level variables (firm-year observations), which are time-varying. Finally, we included the country-specific *GDP growth* variable in the model. Detailed results of the complete model are given in Table 4, which contains an estimate of fixed and random effects together with their p-values.

Table 4 Panel A reports estimates of the fixed effects of the examined variables. The values of the regression coefficients for the interaction between life cycle and financial distress risk show a U — shape relationship in all investigated discretionary accrual models. This means that a start-up company facing the risk of financial distress will tend to manage its profits upwards in order to provide stakeholders with a better view of the company. On the contrary, the growth of financial distress risk and potential bankruptcy in Maturity and Shake-off stages (given as the DISTRESS reference category) encourages managers to dampen manipulative accounting practices with respect to financial performance control variables. Given the signs and p-values, we can accept hypothesis H1 set out in this study. These results are also consistent with the studies of Akbar *et al.* (2020), Akbar *et al.* (2019) and Hussain *et al.* (2020) or Bender and Ward (2002).

The intercept in these models expresses the grand mean, i.e. the average value of discretionary accruals deflated by the previous value of assets. These show the variability of estimates of the level of earnings management in companies. While the modified Jones model estimates that Central European companies are reducing their accounting profits on average; Kothari model assumes that companies do not manipulate profits on average, and vice versa. Teoh *et al.* (1998) estimate a high rate of positive discretionary accruals in companies. However, as described by Kliestik *et al.* (2020a), this model focuses on short-term accruals. Therefore, we can confirm that Central European companies, on average, opportunistically manage profits by manipulating the reporting of current assets and liabilities. Dickinson (2011) revealed that the value of fixed assets and the associated depreciation are maximum, while the change in cash sales is minimal at this stage of the life cycle (Liu, 2006). In this context, the relationship between accounting manipulations and the risk of financial distress in growing companies is not statistically significant, indicating that short-term discretionary accruals do not play a significant role in growing companies as long-term accruals (e.g. depreciation).

The hierarchical structure of the data made it possible to examine the nested effects on the value of earnings management. The country effect (Level 5) was treated as a fixed effect. The results show that there are significant differences in accounting manipulation between companies in different countries, which may be due to macroeconomic, as well as cultural, differences (Kliestik *et al.,* 2020b). On average, Polish and Hungarian companies increase their accounting profits. The influence of the Czech macro environment is insignificant, which purports that Slovak and Czech companies manipulate profits to a similar extent in accordance with the value of the grand mean in line with Michalkova (2021).

Panel B of Table 4 contains estimates of random effects. In the first place, firm-year observations were treated as random effects and their covariance was estimated based on the AR1 model. This makes it possible to estimate the correlation between two consecutive observations. A negative value of the AR1 rho parameter indicates that a smaller than average discretion accrual in one year is associated with a higher than average discretion accrual in the following year. This is confirmed by Pachariyanon (2014), who argues that profit manipulation will reverse in the coming years (current downward earnings management is linked to upward management in the future).

The second random effect is identified with the variability of earnings management in the examined countries between sectors. The influence of the sectoral structure can be analysed using interclass correlation (ICC), or the proportion of variability. In the investigated models, the ICC has a value of about one percent (1.05% for the modified Jones model (Dechow *et al.*, 1995), 0.88% for the Kothari model (Kothari *et al*., 2005) and 1.14% for the Teoh *et al.* model (Teoh *et al*., 1998). This is much lower than the 5% recommended by Snijders and Bosker (2012); the low intergroup correlation demonstrates small differences in earnings management between industries. Hastuti *et al.* (2017) and Chen (2016) therefore recommend that discretionary accruals be estimated based on corporate life cycle stages, as these estimates have higher reliability than estimates based on industry samples.

Table 5 reports the results of the earnings management model and the risks of financial distress controlling the age of the company. Corporate age has a slight negative impact on the level of financial reporting quality, taking into account intercept (grand mean of discretionary accruals), companies with increasing age abandon the practices of upward accounting manipulations and tend to reduce reported profit. The negative regression coefficient of financial distress risk, including the effect of age, suggests that older financially stressed companies are opportunistic towards low profits.

The linear concept of the life cycle does not capture as complex changes in earnings management during the life of the company as the Dickinson (2011) model, which indicates a U-shape change in accounting manipulations. Nevertheless, the signs of the control variables are the same when including life cycle and corporate age. Also, the random effects reported in Table 5 Panel B are similar to the life cycle model. The low *ICC* (in the range of 0.93% — 1.19%) in this case also indicates the level of earnings management varies very slightly between industries.

Discussions

The risk of financial distress during the life cycle (with increasing age) varies and to varying degrees affects the quality of financial reports as proved by the created models. Notwithstanding, discretionary accruals are complex variable that is also affected by other influences captured by embedded control variables.

Growth opportunities are indirectly linked to the level of earnings management. This is in contrast to the results by Matsumoto (2002), whose evidence shows that high growth opportunities are linked to opportunities to increase reported profits. In contrast, AlNajjar and Riahi-Belkaoui (2001) claimed that the growth of a company is linked to the growth of net profit and therefore produce political costs.

Business profitability is one of the main determinants of the level of earnings management; in all models, a strong positive association with upward earnings management is evident. Also, the change in operating profit (operational risk) shows a similar tendency, but the volatility of operating profit has a minimal effect on the quality of earnings. These findings contradict the assumptions of Iatridis and Kadorinis (2009), which assume the need to increase accounting profit consistent with declining profitability. On the contrary, GDP GROWTH is negatively associated with earnings management, i.e. improving economic conditions stabilizes the position of companies in the sample and allows downward earning practices and tax avoidance as is corroborated by Chen *et al.* (2020). Moreover, Czajor *et al.* (2013) evidenced in sample of Polish listed companies that high growth rate is associated with higher reporting quality.

The second point discussed is the selection of discretionary accrual models. The model based on current discretionary accruals differs significantly from the modelled Jones model and the Kothari model. The impact of corporate bankruptcy risk in the Growth stage is positive, but insignificant. Dickinson (2011) confirmed that the value of fixed assets and the

associated depreciation are maximum, while the change in cash sales is minimal at this stage of the life cycle (Liu, 2006). This indicates that the influence of the Growth stage in terms of cash flow patterns has a weak effect on the manipulation of current accruals.

Jaggi and Lee (2002) revealed that a higher risk of bankruptcy motivates companies to reduce reported profits in order to optimize creditors' satisfaction in the event of bankruptcy. This corresponds only with the results for mature businesses and contrasts with the conclusions of this study for other life cycle stages.

The last point discussed is the risk of financial distress, which is significantly affected by corporate leverage. Tian *et al.* (2015) argue that the life cycle of a company significantly affects the need and source of capital in the company; businesses in the Introduction and Shake-out stages have higher (lower) leverage than in the Decline, and mature businesses are better able to generate resources internally in accordance with pecking order theory. Our results share many similarities with this study, such as the difference in leverage (risk of financial distress) over the corporate life cycle. Their results also imply mixed effects of trade-off and pecking order theory, which is consistent with the Delcoure (2007) modified pecking order approach. Gregova *et al.* (2021) notes in a sample of V4 countries that these companies are largely financed by trade credit (trade payables) Businesses differentiate capital according to its cost, and trade credit, together with retained earnings, are one of the earliest sources of capital in the countries studied.

Amin *et al.* (2020) note that debt costs vary over the life cycle of an enterprise; compared to start-ups (declining) companies and mature companies, there is a difference of up to 6% (12%) in the cost of debt. The evolution of debt costs copies the U-shape in accordance with the risk-life cycle relationship similarly, as it demonstrated in this study. Garcia-Teruel *et al.* (2014) argue that Spanish companies reduce their payable accounts as soon as they have other internal resources at their disposal, such as retained earnings. Earnings smoothing facilitates access to greater trade credibility from suppliers, which is consistent with the conclusions of the U-shape relationship between bankruptcy risk and earnings management presented in this paper.

We assume that deteriorating economic conditions and the growth of the risk of financial distress will condition companies in the Introduction, Growth and Decline phases to reduce the quality of accounting reports and upward earnings of management. The persistently low quality of reported profits during the crisis has two negative consequences; first, a financially sound company in terms of accrual accounting may have a shortage of cash

for internal financing. Second, firms with significant upward earnings management may not qualify for state aid and may go bankrupt. Gourinchas *et al.* (2020) adds that state aid policies do not allocate resources correctly, the vast majority of supported companies do not need state aid. On the other hand, they revealed that it is estimated that a subsidy of 15% of corporate income in the current year would suffice to reduce the bankruptcy rate by 5.6%.

Conclusions

Current macroeconomic conditions worsen the competitive position of companies and increase the pressure on financial managers. In an environment of high risk of bankruptcies, stakeholders examine financial statements in more detail and apply a conservative policy towards risky companies. However, these practices cannot be applied uniformly, because the financial health and reliability of their reported profits varies significantly depending on the life cycle.

This study aimed to reveal the impact of bankruptcy risk on the level of earnings management in the life cycle stages. This was examined on a sample of more than 30,000 companies in 2014–2019 from the emerging economies of Central European countries. The hierarchical linear mixed model contained 5 levels of data —firm — year observation, firm level, industry level, life cycle and country level. Three types of accrual earnings management models (modified Jones model (Dechow *et al*., 1995), Kothari model (Kothari *et al*., 2005) and Teoh *et al.* model (Teoh *et al*., 1998)) were used to control the effect of total and current discretionary accrual. Using the non — sequential Dickinson (2011) life cycle model, it was found that financially distressed companies manipulate profits in line with the U — curve regardless of the proxy earnings management used; start — ups and declining businesses manipulate profits downward on average; mature and shake — out businesses tend to reduce accounting profits.

The industry effect had a minimal effect on the differences in the application of accounting manipulation techniques; indicating that industry cross-sectional estimates of discretionary accruals may be of low significance. Slovak and Czech companies manipulate profits downwards to a similar extent, while Polish and Hungarian companies increase accounting profits. In terms of time, the direction of accounting manipulations is not clear; Downward earnings management in the past is linked to current upward management. Taken together, these results suggest that estimating the level of accounting manipulations is a complex issue that should take

into account varying degrees of information from business performance to country level factors, and the direction and degree of earnings management depends on the risk of financial distress and cash flow patterns of life cycle stages. Stakeholders (government, auditors, creditors and accounting agencies) should assess the riskiness of companies with caution. The likelihood of a business going bankrupt and insufficient liquidity based on accounting data at one stage of its life cycle may not be as serious as that of a comparable company at another stage because of false financial statements.

Finally, several shortcomings need to be considered. The model estimates the risk of financial distress, regardless of a more detailed analysis of leverage, sources of debt and its riskiness. The study only takes into account companies from Central European countries whose economies are similar. Moreover, accrual earnings management has been studied, but some authors argue that during the corporate life cycle, managers apply accrual and real earnings management techniques to varying degrees. Therefore, we suggest that a sample of several European countries be in future research, which would allow the use of a random effect in a mixed linear model and refine its results. Second, the real earnings management in relation to the risk of bankruptcy could be quantified to comprehensively assess the impact of earnings management over the corporate life cycle.

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Annex

Table 1. Dependent and independent variables of investigated models and their formulae

	Dependent variable(s)	
Acronym	**Name**	**Formula**
MJM EM	Earnings management	Discretionary accruals of modified Jones model (1995)
KM EM	Earnings management	Discretionary accruals of Kothari *et al.* (2005) model
TM EM	Earnings management	Discretionary accruals of Teoh *et al.* (1998) model
	Independent variables	
Firm-level variables		
TANG	Tangibility	$Tangibility = \dfrac{Tangible\ fixed\ assets}{Total\ assets}$
PROFI	Profitability	$Profitability = \dfrac{EBITDA}{Total\ assets}$
GROW	Growth	$Growth = \dfrac{Total\ assets_t - Total\ assets_{t-1}}{Total\ assets_{t-1}}$
SIZE	Size	$Size = \ln(Turnover)$
OPRISK	Operational risk	$Operational\ risk = \dfrac{EBITDA_t - EBITDA_{t-1}}{EBITDA_{t-1}}$
DISTRESS	Financial distress	Probability of default (financial distress) by modified Zmjewski model (2003)
CYCLE	Life cycle stage	Life cycle stages according to Dickinson (2010) model
AGE	Age of company	$\ln(1 + company's\ age^*)$
Industry-level variables		
NACE	NACE group dummy	Industry classification according to NACE rev. 2
Country-level variables		
COUNTRY	Country dummy	Country affiliation (Slovakia, the Czech Republic, Hungary, Poland)
GDP GROW	Real GDP growth	Annual Real GDP growth rate (percentage of previous year)

Note: *. Difference between date of incorporation and date of firm year observation

Table 2. Descriptive statistics of the dependent, independent and control variables

	Life cycle stages subsamples									
	introduction		growth		mature		shake-out		decline	
	Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev
DISTRESS	0.7062	0.3469	0.4823	0.3780	0.5998	0,3774	0,5126	0,3893	0,6658	0,3764
TANG	0.3112	0.2952	0.4225	0.2790	0.3782	0,2860	0,4367	0,3055	0,3360	0,3123
PROFI	0.0624	0.0777	0.1389	0.1014	0.0955	0,1086	0,1194	0,1053	0,0553	0,0882
GROW	0.2538	0.3305	0.1663	0.2385	-0.0154	0,1801	0,0125	0,1662	0,0720	0,2470
SIZE	8.9585	1.6341	9.1294	1.4134	9.0286	1,5352	8,7896	1,4625	8,5646	1,6190
OPRISK	0.0837	2.1143	0.2358	1.3836	-0.1525	1,6135	0,0671	1,4926	-0,0877	2,1666
AGE	2.7514	0.5925	2.9128	0.5406	2.9289	0,5264	2,9378	0,5376	2,8413	0,5774
GDP GROWTH	0.0410	0.0103	0.0407	0.0103	0.0394	0,0105	0,0392	0,0103	0,0394	0,0105
EM_MIM	0.0274	0.1737	0.0055	0.1239	-0.0221	0,1443	-0,0055	0,1174	0,0212	0,1689
EM_KM	0.0269	0.1723	0.0050	0.1228	-0.0223	0,1441	-0,0063	0,1162	0,0207	0,1646
EM_TM	0.0307	0.1735	-0.0141	0.1329	-0.0418	0,1508	-0,0154	0,1194	0,0233	0,1688
N	9 311		46 128		17 071		56 047		15 861	

Table 3. Correlation matrix of independent and control variables

	DISTRESS	TANG	PROFI	GROW	SIZE	OPRISK	AGE	GDP GROWTH
DISTRESS	1							
TANG	.009**	1						
PROFI	-.315**	-.099**	1					
GROW	.085**	-.113**	.091**	1				
SIZE	.053**	-.324**	.227**	.083**	1			
OPRISK	-.034**	-.006*	.173**	.115**	.037**	1		
AGE	-.185**	.061**	-.067**	-.098**	.112**	-.015**	1	
GDP GROWTH	-.042**	-.025**	0.0002	.033**	.069**	.007**	.060**	1

Note:
**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Table 4. Results of fixed and random effects of mixed model (IV–LIFE CYCLE.DISTRESS)

Dependent variable	EM (modified Jones model)		EM (Kothari model)		EM (Teoh *et al.* model)	
Panel A: Fixed effects estimate						
Parameter	Estimate	Sig.	Estimate	Sig.	Estimate	Sig.
Intercept	-0.0100	0.021	0.0047	0.248	0.0830	0.000
DISTRESS	-0.0512	0.000	-0.0442	0.000	-0.0457	0.000
decline* DISTRESS	0.0609	0.000	0.0581	0.000	0.0660	0.000
growth* DISTRESS	0.0128	0.000	0.0172	0.000	0.0023	0.095
introduction* DISTRESS	0.0745	0.000	0.0709	0.000	0.0839	0.000
mature * DISTRESS	-0.0124	0.000	-0.0177	0.000	-0.0279	0.000
TANG	0.0129	0.000	0.0115	0.000	-0.0744	0.000
PROFI	0.1228	0.000	0.0361	0.000	0.1570	0.000
GROW	-0.0258	0.000	-0.0348	0.000	-0.0400	0.000
SIZE	0.0009	0.000	0.0002	0.567	-0.0077	0.000
OPRISK	0.0026	0.000	0.0029	0.000	0.0025	0.000
Czech Republic	0.0015	0.214	0.0011	0.347	0.0016	0.195
Hungary	0.0066	0.000	0.0046	0.000	0.0059	0.000
Poland	0.0054	0.000	0.0038	0.000	0.0062	0.000
GDP GROWTH	-0.1656	0.000	-0.1600	0.000	-0.1308	0.000
Panel B: Random effects estimate						
Parameter	Estimate	Std. Error	Estimate	Std. Error	Estimate	Std. Error
Repeated measures residual (AR1 diagonal)	0.0170	6.4E-05	0.0168	6.31E-05	0.0175	6.51E-05
AR1 rho	-0.0617	3.1E-05	-0.0753	3.08E-05	-0.0469	3.09E-05
Random intercept INDUSTRY	0.0002	6.1E-05	0.0002	5.08E-05	0.0002	6.78E-05

Table 5. Results of fixed effects of mixed model (IV–age)

dependent variable	EM (modified Jones model)		EM (Kothari model)		EM (Teoh *et al.* model)	
Panel A: Fixed effects estimate						
Parameter	Estimate	Sig.	Estimate	Sig.	Estimate	Sig.
Intercept	0.0119	0.011	0.0245	0.000	0.1084	0.000
DISTRESS	-0.0368	0.000	-0.0301	0.000	-0.0345	0.000
TANG	0.0064	0.000	0.0060	0.000	-0.0826	0.000
PROFI	0.0919	0.000	0.0080	0.026	0.1224	0.000
GROW	-0.0118	0.000	-0.0192	0.000	-0.0261	0.000
SIZE	0.0009	0.001	0.0002	0.524	-0.0080	0.000
OPRISK	0.0025	0.000	0.0029	0.000	0.0025	0.000
AGE	-0.0058	0.000	-0.0056	0.000	-0.0057	0.000
Czech Republic	0.0024	0.047	0.0021	0.075	0.0025	0.049
Hungary	0.0070	0.000	0.0051	0.000	0.0060	0.000
Poland	0.0064	0.000	0.0049	0.000	0.0074	0.000
GDP GROWTH	-0.1517	0.000	-0.1447	0.000	-0.1245	0.001
Panel B: Random effects estimate						
Parameter	Estimate	Std. Error	Estimate	Std. Error	Estimate	Std. Error
Repeated measures residual (AR1 diagonal)	0.0174	6.49E-05	0.0172	6.44E-05	0.0180	6.70E-05
AR1 rho	-0.0727	3.07E-05	-0.0856	3.07E-05	-0.0588	3.08E-05
Random intercept INDUSTRY	0.0002	6.54E-05	0.0002	5.46E-05	0.0002	7.33E-05

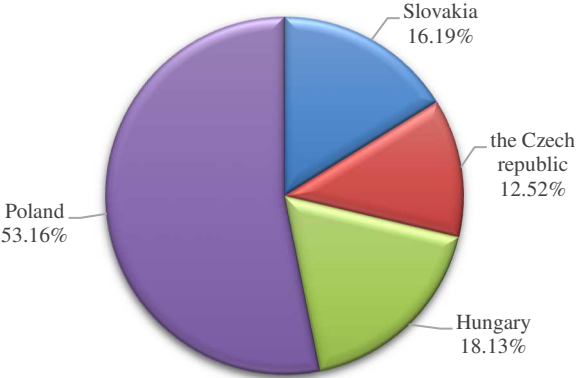**Figure 1.** Distribution of the sample according to country affiliation

Figure 2. Distribution of the sample according to corporate life cycle stages