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Valuing the Interest Tax Shield in the Central European Economies: Panel Data Approach

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Abstract

Capital structure is one of the most frequently discussed issues within Corporate Finance Theory. Optimizing the capital structure and value of the tax shield through the evaluation of its interests can lead to the increasing value of the enterprise, followed by the rising competitiveness and flexibility. The aim of this study is to provide a novel look at the value of the interest tax shield and its determinants in the emerging economies of the Visegrad Four. The model was created on a net sample of nearly 7,000 profitable enterprises between 2015 and 2019 using a one-way fixed effects model of panel data. Regional model results show five main determinants of the debt tax shield (Tangibility, Current Ratio, Gearing, Cost of debt and Size). Others, such as non-debt tax shield, business growth or profitability, are regional, and their impact varies depending on the economic conditions of the countries. The direction of influence of the main determinants indicates that, contrary to the assumed trade-off theory, profitable companies manage the capital structure and the value of tax shield according to the pecking order or modified pecking order theory. The tax shield is made up mostly of interest on short-term loans, which increases the risk of financial distress. There is a hierarchy of funding sources, from trade credit, through short-term loans, to long-term loans, which are used in the analysed firms to the smallest extent. The structure of liabilities may be considered another determinant of the debt tax shield.

Keywords: leverage, tax shield, competitiveness, Visegrad countries, panel data
JEL Classification: G31, G32

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1. INTRODUCTION

Following the shock of the 2008 financial crisis, corporate debt is growing globally. This growth is supported by easing debt conditions, economic growth and falling interest rates, especially in the euro area countries, a quantitative easing policy. According to a study by the International Monetary Fund (2019), corporate debt relative to GDP continued to grow in the world' s largest economies, particularly in the United States, Germany and Japan. In Central Europe, in the Visegrad countries, the debt ratio varies between 44% to 66% in the second quarter of 2019. On

the other hand, the gap between debt growth and GDP growth is widening as economies slow down. The International Monetary Fund (2019) states that debt-at-risk (debt of corporations with interest coverage below 1) and speculative-grade debt account for a significant proportion of total corporate debt.

An increase in corporate debt may have a significant negative impact on credit risk growth, high cost of debt and, ultimately, competitiveness and possible business failure (Hyers, 2020; Sawyer et al., 2020). The growth of global corporate debt may be justified by several facts, one of the most common being tax planning and tax optimization (Kotaskova & Rozsa, 2018; Privara et al., 2020; Grofcikova, 2020). So, choosing an appropriate capital structure is one of the main parts of corporate finance (Hitka et al., 2021). Its optimization and avoiding a high level of debt may lead to the increasing value of the enterprise, followed by the increasing competitiveness and flexibility (Ivanova & Masarova, 2018; White et al., 2020). Durana et al. (2021) studied the effect of the life cycle on earnings management and bankruptcy. They revealed that 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.

The tax-deductibility of interest paid (tax shield) plays an important role in deciding an enterprise between two situations: higher pre-tax profit with lower financial distress risk and higher corporate tax or lower pre-tax profit, higher risk and lower corporate tax. A tax shield is a legal way of reducing corporate tax liability and earnings management technique; it is illegal if it is achieved by illegal means. The legal way of tax optimization is tax avoidance, while illegal tax reduction is called tax evasion. Between the two concepts can be a vague boundary, it uses the term "tax evasion" (Williams et al., 2020; Hlawiczka et al., 2021; Cabinova et al., 2021).

According to corporate finance theory, the existence of a tax shield should have a positive impact on profitability and corporate value. Evidence of a positive relationship between debt (interest-rate shield) and profitability is unclear, depending on the prevailing theory of capital structure. Trade-off theory assumes a positive relationship between quantities, as confirmed by studies by Koralun-Bereznicka (2018). Korteweg (2010) found higher net tax benefits; 5.5% of the business value; Ko & Yoon (2011) estimated a similar value in gross tax benefit on a sample of Korean businesses; the net tax advantage was only 2%. Canadian businesses were surveyed by Doidge & Dyck (2015), with an estimated gross tax advantage of 4.6%. The latest study by Clemente-Almendros & Sogorb-Mira (2017) focused on Spanish-listed companies. It estimated a tax advantage slightly higher than Dodge & Dyck (2015) at 6.4%, with a net tax advantage of only 2.1%. Based on US-listed companies, Menichini (2017) pointed out a random walk. Menichini's estimation, based on the mean-reverting process, quantified only a 2.73% share of the value of the tax shield in the business value. The core of previous tax shield research is aimed at estimating the present value of the tax shield in the context of the market value of debt, as was investigated by Bence (2011) or in the context of stochastic valuation (Velez-Pareja 2017). Central European enterprises are only quoted to a small extent, and SMEs dominate (Dvorsky et al., 2019; Belas et al., 2020). There are only a few models from emerging market environments (Velez-Pareja, 2013; Velez-Pareja, 2017; Castillo et al., 2017; Belas et al.,

2018) or developed markets that take account of the book value of debt (Savova, 2021). Only a few authors have investigated the interest tax shield in the economies of the Visegrad Four (Buus, 2015; Valaskova & Bakes, 2017; Navickas et al., 2021).

Moreover, the above studies have failed to provide the determinants of the tax advantage of debt which should be crucial for maximizing corporate value. The high market value indicates an advantageous market position among companies and thus higher competitiveness. This paper sheds new light on the interest tax shield in the Central European (Visegrad Four) economies and discusses the main factors that have influenced it. Investigating the determinants of the interest tax shield fills a research gap in the theory of tax shield valuation within corporate finance. It can be a way to create more complex models of the value of a tax shield. A tax shield is investigated by a longitudinal data regression model of data from more than 7,000 enterprises (net sample) in 2015-2019. We did not take into account the following year 2020, because of the situation in the world, when global pandemic COVID-19 hit the whole world and stopped all activities and companies in their businesses. Therefore, the year 2020 was strongly affected by this situation, and for the correct evaluation of this effect, there is a need to study at least two or three following years. The applied method allows to include factors examined in previous studies in minimum extant, such as tangibility, liquidity, risk, profitability, investigate the impact of these factors on the interest tax shield, and comprehensively evaluate the position of the tax shield in the investigated economies.

The study is divided as follows: the Literature review contains a cross-section of the theory of the value of tax shield and the determinants of the interest tax shield. The second chapter focuses on a brief description of the panel data regression method and a description of investigated variables and the data sample. Results and discussion present the obtained results and findings concerning capital structure theory. Conclusions summarize the obtained findings, together with the limitations of this research and the implications for future research.

2. LITERATURE REVIEW

What is known about the tax shield is primarily based on the theoretical framework of an optimal capital structure. In a ground-breaking paper, Modigliani & Miller (1963), in a short MM model, found that the tax shield should be perpetual and risk-free. Its value depends only on the market value of the debt and marginal tax rate. Myers (1984) reworked the MM model, turning the WACC approach into an APV method; both the debt and the interest tax shield have the same risk characteristics. The present value of the tax shield is quantified as the product of the market value of the debt, the cost of debt, and the corporate tax rate discounted by the market cost of the debt. Furthermore, he found out that the Beta of tax shield is equal to the Beta of debt, i.e. both have the same systematic risk. Bence (2011) recommends applying this approach to stable and profitable enterprises operating in the low-growth industries. Debt policy based on stable debt value is rare in the real world (Ansay, 2010). A stable debt ratio policy is more realistic; Bence (2011), according to Miles and Ezzell, argued that the value of the tax shield might be known one year in advance, so it is as risky as debt; in other periods, the tax shield is uncertain as much as the value of an unleveraged business. The tax shield is as risky as operating cash flow. The tax

advantage is a function of the tax rate and should be discounted at a rate reflecting the riskiness of the debt. Fernandez (2007) deduced two formulae in which the tax shield is discounted by the cost of unleveraged capital: the Damodaran method and the Practioner's method used by investment banks. Oded et al. (2011) claimed that a tax shield is as risky as assets assuming debt rebalancing. Ansay (2010) states that, as well as fixed debt, constant market leverage in real businesses is very rare. Barbi (2012) adopted a risk-neutral approach to derive the general formula for the present value of the tax shield. Ansay (2010) also proposed an adjustment that applies to any debt policy and any cash flow pattern. His discount rate should include operational risk, market debt levels and debt cost. Liu (2009) states that the Modigliani and Miller model should represent the upper limit of the value of the tax shield, i.e. capacity of the tax shield. It is divided into earned and non-earned; the higher the ratio between risk-free interest rate and return on investment, the higher the earned tax shield. Fernandez (2007) also argues that it should be equalled to the difference between the present value of taxes paid by an unleveraged and leveraged company. In addition, four different types of debt policies and the corresponding tax shield formulas, two new models were introduced: non-constant leverage and tax operational cash flow risk shield (extended Miles and Ezzell); and non-constant leverage with the condition of a tax shield risk equal to the debt risk (extended Modigliani and Miller).

The tax shield is lower by default; its value depends on the present value of the debt in the deficit. Couch et al. (2012) model was based on the traditional models of Modigliani and Miller, Miles and Ezzell, and Fernandez. An estimate of the discount rate is not possible. Instead, a barrier option is used, the barrier being the value of the interest coverage specified in the option contract. Molnar & Nyborg (2011), on the other hand, assume only partial defaults (borrowers will be able to partially meet their obligations). They conclude that, with the assumption of constant leverage, the effect of positive recovery rates is minimal. Velez-Pareja (2013) also used the option approach because there is a likelihood that the tax shield will not be applied in full and that financial distress will be achieved, and the debt will not be fully or partially repaid.

Nonetheless, in emerging economies, most businesses are not traded on the capital market. Only the book values of equity and debt are known. Fernandez (2007) changed its 2005 model, assuming target book leverage. Velez-Pareja (2013) reviewed the basic formula of tax shield; tax advantage depends on the value of operating profit. An important element of the tax shield is also the loss carried forward (Velez-Pareja, 2016). The disadvantage of the model is, however, the condition of carrying the loss in advance only in full, which is not allowed by the laws in some countries (including Slovakia and the Czech Republic). Similarly, Valaskova et al. (2021) investigated the earnings management phenomenon in the Central European countries to identify the factors and incentives that can influence earnings management behaviour. They revealed that the economic sector is one of the most important earnings management determinants, as its statistical significance was confirmed in each analysed country. Menichini (2017) used a dynamic production function model to determine the value of the tax shield as well as the factors that influence this value. The value of the tax shield is negatively correlated with the business life cycle. In contrast, the classical life cycle theory assumes that the interest tax shield should reach its maximum value in the maturity phase (also according to the trade-off theory). The most important impact on the tax shield should be the curvature of the production function (ability to

generate operating profit); other important factors are the market cost of capital and the tax rate and non-debt tax deductions. The tax shield in Central Europe is primarily valued based on the best-known models (Modigliani and Miller, Miles and Ezzell). Buus (2015) in the Czech Republic focused on including financial distress in the dynamic model of free cash flow and the model of the tax shield. Simulating four different types of businesses (low-growth-low-risk, high-growth-high-risk, low-risk-high-growth and high-risk-low-growth) found that the cost of tax shield is not constant. Their value is somewhere between the cost of debt and the cost of capital. High-growth companies, contrary to the trade-off theory, have low leverage due to the high cost of financial distress and businesses prefer the pecking order theory. Conversely, low-growth companies have high leverage, as a tax shield increases the return on equity. Bin (2022) investigated goods tariffs and digital tax in the US and EU; changes in both had a significant effect on the value of stock indices. Ionescu (2019) favours a carbon tax over emissions trading. Ionescu (2020) adds that the carbon tax has an impact on competitiveness and green financial behaviour.

In summary, the tax shield does not depend solely on the value of debt, interest rate and tax rate. The interest tax shield is also affected by operating profit, risk of default (credit risk), but also the size of the business or its profitability. Secondly, developed markets and listed companies have been comprehensively examined, which cannot be said of emerging economies, especially in the Visegrad countries. The identified factors also affect the competitiveness of the company similar to Akben-Selcuk (2016). However, the turbulent development of these economies since the financial crisis, together with previous findings, provides a suitable basis for further research.

3. AIM, RESEARCH METHODOLOGY, AND DATA

The aim of this study is to propose a comprehensive model of the interest tax shield and to identify the factors that determine the tax shield. In terms of the subject of this paper, the interest tax shield is used as an explained (dependent) variable. There are several definitions and formulas for the tax shield quantification offered by the authors mentioned in the previous section (Modigliani & Miller, 1963; Myers, 1984; Velez-Pareja, 2013; Velez-Pareja, 2016). The formula for quantifying the dependent variable is as follows:

$$ITS = ln(I \times T) \tag{1}$$

Where:

ITS – interest tax shield, *I* – interest paid, *T* – corporate tax rate.

An overview of the interest tax shield models indicates that this value is affected by the tax rate, debt value and debt cost. On the other hand, the tax benefit of debt is one of the key elements of the capital structure, as has been shown in several studies (Overesch & Voeller, 2010; Lee & Swenson, 2012). Linking knowledge from these two areas, according to Kliestik et al. (2018), the set of 16 explanatory variables, including tangibility, liquidity, debt ratios, profitability, growth, operational risk, the size of the business and non-interest tax shield was composed. Cost of debt is an integral part of the debt tax shield, using the Damodaran methodology with synthetic rating. Table 1 contains a complete description of the variables along with their formulas to quantify.

Tab. 1 – Formulae of independent variables. Source: Kliestik et al. (2018)

Variable	Label	Algorithm
Tangibility ratios		
Fixed assets to total assets ratio	FATA	Fixed assets/total assets
Liquidity ratios		
Current ratio	CURR	Current assets/current liabilities
Networking capital ratio	NWCA	Networking capital/total assets
Debt ratios		
Equity multiplier	EQM	Total assets/Total equity
Debt ratio	DEBT	Total liabilities/Total assets
Gearing	GEAR	(Non-current liabilities + loans)/equity
Interest coverage	INCOV	EBIT/interest paid
Debt to EBITDA ratio	DEBTA	Debt/EBITDA
Profitability ratios		
Return on assets (gross)	ROA	EBITDA/total assets
Return on equity (net)	ROE	EAT/equity
Other ratios and variables		
Growth	GROW	(Total assets t-1+ Total assets t)/Total assets t-1
Operational risk	RISK	Total sales/EBIT
Non-debt tax shield	NDTS	Depreciation and amortization/Total assets
Cost of debt (tax-adjusted)	RD	(Riskless rate + default spread of company + rating based default spread of country)(1-tax rate)
Effective tax rate	ETR	Taxation/EBT
Company size	SIZE	ln(turnover)

Since the impact of these factors on the value of the tax shield is not known, a regression analysis is a suitable method. Given that the tax shield has a long-term impact on the value of the company, panel data models were selected. Hsiao (2014) claimed that these models make it possible to increase degrees of freedom, cover dynamic and more complex relationships, or control the impact of omitted variables. The panel data model analysed in this study is given in Eq. (2).

$$ITS_{it}=z_i'\alpha+FATA_{it}\beta_1+CURR_{it}\beta^2+NWCA_{it}\beta_3+EQM_{it}\beta^4+DEBT_{it}\beta^5+GEAR_{it}\beta^6+INCOV_{it}\beta_7 +DEBTA_{it}\beta_8+ROA_{it}\beta_9+ROE_{it}\beta_{10}+GROW_{it}\ \beta_{11}+RISK_{it}\beta_{12}+NDTS_{it}\ \beta_{13}+RD_{it}\beta_{14}+ETR_{it}\beta_{15} +SIZE_{it}\beta_{16}+\varepsilon_{it} \quad (2)$$

Where:

i =1, 2…n – cross-sectional effects, t = 1, 2…, T – time effects, $\beta_{1, \ldots, 16}$ – regression coefficients, $z_i'\alpha$ – individual effects containing the constant term and set of individual or group-specific unobserved variables; ε_{it} – error term.

The panel data model is divided into three groups: pooled OLS, fixed effect model and random

effect model. The suitability of pooled OLS is tested by the F test for no fixed effects. If the null hypothesis is accepted, pooled OLS is appropriate. Otherwise, the model can be estimated using a fixed or random-effect model. The fixed-effect model given as the least square dummy variable (LSDV) estimates different intercepts for each subject in the sample. Conversely, the random effect is estimated by FGLS (feasible generalized least squares model). The key assumption of random effects is the zero correlation between the intercept and the explanatory variables. The Hausman specification test is used to determine a suitable model. The null hypothesis says that the LSDV estimate is consistent but inefficient; a random effect is appropriate. The alternative hypothesis argues that the FGLS estimate is inconsistent, i.e. a fixed model is suitable.

SAS Enterprise Guide was used to provide a model of panel data. The significance of the whole model was examined by the F - test and the significance of the regression coefficients by the t-test. The significance level was set at 0.05, variables whose p - values were lower than this value are considered significant. Since a large set of independent variables has been selected, it is necessary to examine multicollinearity and determine the optimal set of variables. Multicollinearity is examined by the correlation matrix and associated Farrar-Glauber test and the auxiliary linear regression method investigating multicollinearity by Variance inflation factors (VIF). Backward elimination is also used to determine the optimum set of interest tax shield determinants concerning the multicollinearity.

Data for this study were obtained from the Amadeus database; four selection criteria were created; registered office in one of the Central European countries (Visegrad countries), number of employees over 10, non-zero profit before tax in the reference period and non-zero interest paid in the reference period. The data cover the years 2015 - 2019. These criteria ensure that the interest tax shield in the business and the period is obtained; it also excludes the impact of micro-enterprises that could distort the model's results. Overall, the sample contains balanced data on 5,922 Slovak, 1,362 Czech,12,202 Polish and 2,808 Hungarian enterprises. The Mahalanobis distance was used to remove extreme values.

4. RESULTS AND DISCUSSION

Firstly, it is necessary to analyse a sample of companies selected to create a tax shield model. However, some businesses offer incomplete financial data, so they have been removed. In addition, the sample also contained extreme values that could distort the model results. Extreme values were detected by the Mahalanobis distance; the net sample included 2,256 Slovak enterprises (11,280 data points), 551 Czech enterprises (2,755 data points), 2,017 Polish enterprises (10,085 data points) and 1,371 Hungarian enterprises (6,855 data points). The data cover the years 2015-2019, however, based on the algorithms of the variables listed in Table 1, variables can only be calculated in 4 years. Table 2 reports summary statistics of variables used in regression models.

Tab. 2 – Descriptive statistics variables in V4 companies. Source: own research

	Slovakia				Czech Republic			
Variable	Mean	Std Dev	Skew	Kurt	Mean	Std Dev	Skew	Kurt
FATA	0.4230	0.2391	0.1294	-0.8843	0.4244	0.2223	0.0325	-0.7227

CURR	1.4798	1.1857	4.8577	4.6882	2.7280	2.8960	1.0033	2.2214
NWCA	0.2040	0.2054	0.3105	0.2433	0.2290	0.1762	0.4856	0.3489
EQM	3.3546	6.1399	7.6512	7.1990	2.0728	1.0888	4.8743	5.1231
DEBT	0.5928	0.1891	-0.4015	-0.5910	0.4400	0.1849	0.0855	-0.8272
GEAR	0.7500	0.8810	2.8112	13.6793	0.4430	0.5707	4.5849	41.1818
INCOV	128.2625	3 625.08	5.7918	35.1950	305.6247	8 006.65	3.9706	16.4079
DEBTA	5.2891	15.6089	8.3997	14.6647	3.6487	3.0741	3.1976	20.7492
ROA	0.1684	0.0975	1.3030	2.2441	0.1640	0.0887	1.3617	3.1583
ROE	0.1949	0.2959	3.5673	23.9928	0.1657	0.1439	1.8592	5.0918
GROW	0.1329	1.0794	8.8707	88.1892	0.1101	0.2633	10.4507	24.3969
RISK	30.7676	35.0366	0.6689	1.4968	21.4890	85.4368	-2.9869	13.1943
NDTS	0.0676	0.0488	1.6473	5.4062	0.0525	0.0336	1.3965	3.1838
RD	0.0270	0.0146	2.2976	5.2845	0.0235	0.0131	5.0379	38.6530
ETR	0.3200	1.2307	6.2358	50.4505	0.2326	1.4784	5.0050	25.7551
SIZE	7.9669	1.3015	0.3652	0.0785	8.7050	1.4720	0.5607	0.2018
ITS	0.7755	1.4833	-0.1594	0.8982	1.0504	1.6550	0.0319	0.1856
	Poland				Hungary			
Variable	Mean	Std Dev	Skew	Kurt	Mean	Std Dev	Skew	Kurt
FATA	0.4624	0.2706	-1.6244	44.9248	0.4164	0.2326	0.1092	-0.8852
CURR	1.6418	1.3279	1.1761	4.1359	2.0343	2.4475	1.5272	3.9437
NWCA	0.2734	0.2138	0.4062	-0.3711	0.2312	0.1920	0.5296	0.0950
EQM	2.3481	1.0954	2.7487	1.9435	2.2218	1.3507	1.2488	4.0987
DEBT	0.5033	0.1765	-0.2154	-0.6972	0.4708	0.1801	-0.0231	-0.6400
GEAR	0.5667	0.5499	2.0348	7.0301	0.4209	0.5050	3.5269	28.3576
INCOV	51.6365	427.5288	2.4958	75.8650	205.9514	2 188.91	2.9987	10.4932
DEBTA	5.3652	4.2279	2.9362	22.4410	4.4097	21.6093	-7.8062	63.4387
ROA	0.1304	0.0827	1.3655	6.4840	0.1408	0.0781	1.3343	3.2626
ROE	0.1383	0.1285	7.8933	23.9351	0.1915	0.2591	2.3901	10.8168
GROW	0.1036	0.2466	7.5082	17.2680	0.0961	0.2435	9.7048	25.5295
RISK	32.0813	84.1828	-1.8445	9.2422	26.3540	62.8295	-7.6096	6.7680
NDTS	0.0419	0.0510	5.4125	43.9065	0.0422	0.0300	1.7212	5.9729
RD	0.0471	0.0172	2.5432	8.7475	0.0606	0.0160	4.9209	33.3634
ETR	0.2297	0.2913	5.7019	44.4435	0.8776	0.2232	3.7604	19.9259
SIZE	8.9893	1.2229	0.2112	-0.1072	9.1480	1.1604	0.3251	0.3463
ITS	1.8284	1.4791	-0.1782	0.2883	1.0340	1.6352	-0.3174	0.5036

The first variable, FATA, expresses the proportion of fixed assets in the total assets of the enterprise, also called collateral. In the period under review, it had a similar value (about 40%) in all analysed countries. Average liquidity indicators in all countries are within the recommended range (1.5-2). The standard deviation in the Czech and Hungarian enterprises indicates a higher incidence of extreme liquidity values, especially high liquidity.

The average indebtedness (DEBT indicator) of the companies in the sample complies with the golden risk-settlement rule. Slovak enterprises are significantly more leveraged than the companies in other countries. Said golden rule of risk-settlement can be changed into 2: 1, i.e. two-thirds debt indicator. This modification is applicable in riskier sectors. Given that a significant part of the sample companies belongs to the automotive industry, it should be noted that Slovak companies were not at particular risk in terms of the financial distress during the period. The interest coverage is characterized by significant variability across countries. The highest average value is achieved in the Czech Republic, while the lowest average value is achieved in Poland. High values of the indicator imply a higher ability to pay interest costs and the possibility of debt growth without increasing the risk of financial distress.

Profitability indicators were highest in Slovakia and Hungary. Return on equity is significantly higher in both countries. In the Slovak companies, the higher return on equity is given by the growth of the economy in the given period. In Hungary, the higher demands of equity holders are determined by the riskiness of the economy given by the rating, too. The growth of the companies is in line with the economic boom in the period under review; in Slovakia, significant economic growth was due to GDP growth, which was reflected in the 13% - growth of assets in the sample.

The stability of Czech companies is given by the value of operational risk. By contrast, the significant growth of Slovak companies is offset by higher operational risk. The highest value of the non-debt tax shield is achieved by the Slovak companies, while the lower tax advantage is achieved by the Polish and Hungarian companies. The risk of the company is also indicated by the cost of debt. In Slovakia and the Czech Republic, this cost is relatively low, with an average of 2%. Riskier enterprises in Poland and Hungary have an average cost of debt of 4% and 6%, respectively. The effectiveness of achieving a tax savings rate is given by the effective tax rate. In Poland, the average company does not make sufficient use of tax advantages. The maximum tax rate in the sample of enterprises differs from the nominal rate by only about 5%, compared to companies in the Czech Republic with a significantly higher maximum effective tax rate. Hungarian companies, on average, pay much lower taxes than nominal tax rates, despite a significant change in the tax rate in the years under review. The enterprise size given through turnover indicates that the average size of enterprises in the sample is similar in all countries except for Slovakia. Polish companies reach the highest value of the interest tax shield. The high effective interest rate is associated with a low rate of interest tax relief in Slovak companies. Czech companies have, on average, the same value of tax relief as Hungarian companies. However, Hungarian companies make more effective use of this tax advantage, which is reflected in the value of the effective tax rate.

To build an optimal tax shield model, it was first necessary to check the existence of multicollinearity. Correlation matrices were created for each of the four countries and all explanatory variables, and the cut-off value for the presence of multicollinearity was set at 0.75. Examination of the correlation coefficients did not show the existence of multicollinearity, but according to the Farrar Glauber test, there is multicollinearity between the variables. Moreover, the auxiliary linear regression method was used to detect collinear variables by VIF. Using both methods of detecting multicollinearity, we revealed two distinctly multicollinear variables, the debt ratio

and the net working capital ratio. There were other multicollinear variables in each country model; in the sample of Czech, Polish and Hungarian companies, it is an equity multiplier. For Slovak and Czech companies, return on equity is also multicollinear. Polish enterprises have a unique position, where a variable non-debt tax shield appears to be multicollinear. The strong dependence between the non-debt tax shield and the return on assets indicates that the non-debt (depreciation tax shield) significantly affects the profitability of Polish enterprises.

Subsequently, econometric models were developed for the countries in which the significance of regression coefficients was evaluated. The Backward elimination method was used to create a set of optimal determinants of the value of interest tax shield in V4 countries.

Tab. 3 – Results of the final one-way fixed effects models of V4 countries. Source: own research

Slovakia			Czech Republic		
Variable	Estimate	Pr > |t|	Variable	Estimate	Pr > |t|
FATA	1.174689	<.0001	FATA	1.828173	<.0001
CURR	-0.0668	<.0001	CURR	-0.02345	0.0007
EQM	-0.00454	<.0001	GEAR	0.298596	<.0001
GEAR	0.159527	<.0001	DEBTA	0.02062	0.0109
DEBTA	0.003388	<.0001	ROA	0.750055	0.0085
ROA	-0.52412	<.0001	GROW	-0.17762	0.0004
RISK	-0.00371	<.0001	RD	3.234374	0.0079
NDTS	1.538787	<.0001	SIZE	0.562566	<.0001
RD	12.75897	<.0001			
SIZE	0.481747	<.0001			
F test	8.63		F test	10.88	
Pr > F	<.0001		Pr > F	<.0001	
Hausman M test	349.19		Hausman M test	42.91	
Pr > M	<.0001		Pr > M	0.0003	
R-Square	0.8797		R-Square	0.9045	
Adj. R-Square	0.8495		Adj. R-Square	0.8803	
Poland			Hungary		
Variable	Estimate	Pr > |t|	Variable	Estimate	Pr > |t|
FATA	0.412613	<.0001	FATA	0.781374	<.0001
CURR	-0.07473	<.0001	CURR	-0.09902	<.0001
GEAR	0.468348	<.0001	GEAR	0.646495	<.0001
INCOV	-0.00058	<.0001	INCOV	-0.00012	<.0001
DEBTA	-0.01858	<.0001	ROA	2.944645	<.0001
GROW	-0.2426	<.0001	ROE	-0.23721	0.0002
RISK	-0.00022	0.0024	RD	9.654594	<.0001

RD	9.350352	<.0001	SIZE	-0.705	<.0001
ETR	-0.05876	0.0038			
SIZE	0.612947	<.0001			
F test	10.81		F test	5.67	
Pr > F	<.0001		Pr > F	<.0001	
Hausman M test	369.61		Hausman M test	819.38	
Pr > M	<.0001		Pr > M	<.0001	
R-Square	0.9055		R-Square	0.7877	
Adj. R-Square	0.8818		Adj. R-Square	0.7343	

Table 3 lists the results of panel data models. The results show that all models are statistically significant at the level of 0.05 and the fixed effect model is a suitable econometric model according to the Hausman specification test. The suitability of the models is also confirmed by an adjusted coefficient of determination higher than 80%, except for the Hungarian model. Compared to the original 16 variables selected as determinants of the interest tax shield, at most 11 variables proved to be suitable. However, in the Hungarian enterprises, only seven variables are relevant, which is reflected in the lower R - square value.

There are only five variables that are significant in all V4 countries; Tangibility (fixed assets to assets ratio), Current ratio, Leverage (Gearing), Cost of debt and Size. These variables can be considered as determinants of the value of the interest tax shield. Their rigorous planning should have a significant impact on achieving a higher tax advantage in the medium to long term. Other variables are not significant in all the economies analysed, so they should be considered specific to the country, and their impact on the tax shield is determined by macroeconomic conditions.

Tangibility (collateral) positively affects the value of the tax shield because with the growth of fixed assets, the enterprise can secure its debt by these assets. This result is in line with the trade-off theory of capital structure, as confirmed by Hartwell & Malinowska (2018). The growth of the long-term assets also indicates the maturity of the company and the stability of its profit. It makes it possible to obtain a higher amount of capital from debt holders at a lower cost of debt. Buus (2015) states that companies with valuable assets have higher indebtedness (higher tax shield). Rahman et al. (2017) also confirm our conclusions that in V4 countries, the need for collateral is higher for debt with higher interest paid. On the other hand, Menichini (2017) does not regard collateral as a significant factor in the value of the tax shield.

On the other hand, the company's liquidity negatively affects the value of the tax shield, which is in line with the pecking order theory. The growth of liquidity indicates the growth of internal resources in the company. Debt is cheaper in terms of tax relief but is subject to a higher risk. Similar results were also reported by Hernadi & Ormos (2012), according to which the negative relationship between debt and liquidity reflects past profitability and dividend policy. Low debt directly affects the value of the interest tax shield. Sufficient retained profits disincentives managers from seeking new external sources of funding regardless of the existence of a debt tax advantage. Buus (2015) partially confirms this view in the case of both high-growth and high-risk businesses. On the other hand, the company's liquidity is one of the indicators of the

company's financial health; very low liquidity, however, reduces the ability of the company to obtain additional debt resources.

Tax shield that the company leverage (GEAR) is positively correlated with the value of the tax shield as it follows the definition of a tax shield. The tax shield is a stochastic variable, a subject to the current debt value. In terms of a capital structure optimization, a positive relationship between debt and tax ratios has been demonstrated in several cases, e.g. Overesch & Voeller (2010), Hartwell & Malinowska (2018) or Koralun-Bereznicka (2018). Among the investigated economies, the lowest impact of debt on the tax shield was found in the Slovak enterprises, while the highest impact was found in the Hungarian ones. The positive effect found is inconsistent with the findings of other studies from the environment of the Visegrad Four countries than those of Kirch et al. (2012) or Hernadi & Ormos (2012). The latter explains the negative impact of leverage on the tax shield since the tax shield is not the main object of interest in choosing the optimal capital structure or deciding on further external financing. This discrepancy in the results is mainly in the sample of enterprises used. The existence of an interest tax advantage is subject to a positive pre-tax profit. In the long term, this condition is primarily met by large enterprises but also by some small and medium-sized enterprises. The cost of debt has a positive effect on the growth of the value of the tax shield. The relative impact of this indicator was the highest among all explanatory variables. This result is in line with the classical trade-off theory. Assuming a constant tax rate and debt level, the rising cost of debt has a positive impact on the tax advantage of interest only if there is no unbearable increase in the cost of financial distress. As for profitability, Clemente-Almendros & Sogorb-Mira (2018) argue that profitable companies have a lower expected cost of financial distress and interest tax shields are more relevant to the value of the business. Their results show that the value of the tax shield increases as debt increases. However, they argued that the monitored enterprises prefer a conservative debt policy; the tax shield should be offset by increasing the cost of debt (particularly the cost of financial distress). A certain degree of conservatism is also evident in the behaviour of businesses in V4 countries. Corporate debt is predominantly composed of short-term debt with a higher cost of debt resulting from a higher immediate probability of financial distress. Csiszarik-Kocsir (2017) notes that the Hungarian companies, after the 2008 financial crisis, had insufficient internal resources and only slowly achieved sufficient operating profits to obtain bank loans. In connection with the results of this study, it should be noted that despite initial support for the trade-off theory, the rise in the cost of debt increases the debt tax shield due to the existence of an order of sources of funding and higher cost of financial distress. Those facts refer to the position of the pecking order theory in those companies.

The size given as the logarithm of turnover positively affects the value of the interest tax shield. Larger companies with a higher turnover have higher creditworthiness and can secure long-term external resources by collateral. The secured debt has a lower default risk and lowers debt cost. The positive relationship between the tax shield and the size of a company is consistent with the conclusions of the Velez-Pareja theory (Velez-Pareja, 2013); similar results came from the work of Menichini (2017), too. He claimed that the curvature of the production function is the main determinant of the interest tax shield. In the sample of Hungarian enterprises, there was found a negative relationship between the size of the enterprise and the value of the interest tax shield.

A more in-depth analysis of the structure of debt sources shows that Hungarian companies have a higher share of short-term external sources than long-term ones. Short-term external resources are more expensive than long-term, i.e. financing by short-term liabilities gives rise to a higher tax advantage. The financing of business activities mainly by short-term external sources increases the value of the tax shield but also its riskiness. The value of the interest tax advantage is more sensitive to the sudden decline in the economy than in companies that have a higher share of long-term debt.

Other factors have only partial representation in regional models, which can be explained by different macroeconomic conditions. In this study, a depreciation tax shield was used as a proxy for a non-debt tax shield. NDTS is proportional to the value of the interest tax shield. An effective tax rate involves various forms of tax benefits, including R&D tax deduction, loss carried forward or investment incentives. It could be considered as another proxy for a non-debt tax shield. In this respect, the debt tax shield is offset by a non-debt (not only depreciation) tax shield in Polish companies. The Polish government provides businesses with a large number of tax incentives, delimitation of 14 economic zones with preferential tax conditions. These conditions are reflected in higher competitiveness than in Slovakia and Hungary; Poland reached second place in V4 countries in 2019 (Schwab, 2019). Profitability has an ambiguous impact on the value of the interest tax shield in the case of Slovak companies. On the contrary, Czech and Hungarian companies report a positive relationship between return on assets and tax advantage. The growth of the company (GROW) is inversely proportional to the tax advantage in the Czech Republic and Poland, which corresponds to the long-term growth of the countries' economies.

In conclusion, the regional models of all V4 countries show that, contrary to the general assumption of a tax shield, businesses in those countries follow the conclusions of the pecking order theory. The results of these models are in many ways similar to the capital structure models of emerging countries such as Hartwell & Malinowska (2018) or Hernadi & Ormos (2012). On the contrary, it only partially coincides with models that support trade-off theories, such as Koralun-Bereznicka (2018). The interest tax shield should motivate managers to increase debt. This premise of the trade-off theory is maintained, but there is a differentiation of liabilities. Enterprises are financed to a large extent by short-term debt, to a minimum extent by long-term debt. Trade credit has a vital role in short-term debt. Most of the tax-deductible interest comes from short-term debt, which increases its riskiness (cost of financial distress). Financing a business through short-term debt is more expensive and brings a higher tax advantage due to the higher risk of this capital. This strategy may be ineffective in the long term because the volatility of the value of the tax shield and the growth of the company's credit risk ultimately reduces the present value of the tax shield. The contribution of the tax advantage to the corporate value is lower than that arising from long-term funding. The order of funding sources is visible, from trade credit and short-term loans to long-term debt, which corresponds to the pecking order theory. The structure of liabilities is an important determinant of the value of the interest tax shield. Our results may also be explained by Buus' theory (Buus, 2015). He claimed that capital structure and optimal leverage could be explained as a combination of trade-off, pecking orders, and free cash flow theory called dynamic free cash flow theory. The tax shield depends on risk (financial distress) and profitability. Its value is not constant, as predicted by Modigliani & Miller (1963), but changes (increases) due to the growth of leverage.

In conclusion, it may be noted that this paper brings to the best of our knowledge this is one of the first a more comprehensive view of the debt tax shield and its determinants in the Central European environment; at the same time, we associate the tax shield with the capital structure issue. The results of this study may be useful for CFOs, developing long-term business strategies. Our findings can be a crucial factor in the long-term survival of the company and its competitiveness in the current turbulent economic conditions.

5. CONCLUSIONS

In recent years, growth in sovereign debt has been reflected in rising corporate debt. This increase in debt is not an end in itself; it also brings a tax advantage that can have a positive impact on the profitability, cash flow and business value. On the other hand, the indebtedness and hence the value of the interest tax shield should be regulated to avoid excessive financial distress and bankruptcy. For this purpose, it is appropriate to know the determinants of the value of the debt (interest) tax shield. The aim of this study was to investigate the value of the interest tax shield in the Visegrad countries and to discuss the influence of selected factors on the tax shield. The panel data model was developed based on a net sample containing information on nearly 7,000 businesses that received the interest tax benefit in the reporting period. From the sixteen factors examined, we selected 5 relevant factors (Tangibility, Current Ratio, Gearing, Cost of Debt and Size), which significantly affect the value of the interest tax shield in all Central European countries. To our best knowledge, this model is one of the few that focuses on the value of a debt tax shield in terms of its determinants. The results of regional models demonstrate that, despite the assumption of a trade-off theory, businesses in these countries primarily follow the pecking order theory and only partially trade-off. An important factor of the tax shield is the structure of liabilities. There was observed the prevailing level of trade credit and short-term loans, regardless of the higher level of financial distress risk. These findings could be helpful to further analyse the capital structure in the Central European countries and investigate the position of tax shield in earnings management techniques.

We are aware that our research may have several shortcomings and limitations that could be removed in future research. First, the impact of the debt structure on the value of the interest tax shield should be examined in more detail. The model used a depreciation tax shield as a proxy for a non-debt tax shield which proved to be a minor determinant. Second, the study results are limited by the period studied, which does not include the turbulent COVID-19 period. Future research may focus on a different definition of a non-debt tax shield or a change in debt and non-debt tax shields in the COVID-19 period. Moreover, this model could be extended to other European countries due to the widespread use of earnings management techniques and the tax shield mechanism for profit-shifting.

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