

CAPITAL STRUCTURE FORMATION IN STOCK EXCHANGE LISTED COMPANIES OF THE VISEGRAD GROUP: A DYNAMIC APPROACH

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Purpose: The article aims to analyze the impact of selected factors on the level of financial leverage in stock exchanges listed companies of the Visegrad Group, and to determine whether the direction of this impact is consistent with the assumptions of the trade-off theory or the pecking order theory.

Design/methodology/approach: The analysis covered 259 non-financial companies listed in the years 1998-2020 on the stock exchanges in the Visegrad Group countries. The results of the dynamic panel econometric model estimates were verified via appropriate statistical tests. The calculations were carried out using the Gretl package. The subject of the analysis entailed the impact of profitability, liquidity, growth opportunities, company size and asset structure on the capital structure of the entities under examination.

Findings: Taking the country-specific effect into account, it has been demonstrated that the company capital structure decisions are consistent with the pecking order theory. Considering the companies surveyed as separate panels, in distribution by each individual country, a negative, a statistically significant correlation has been confirmed between debt and profitability only. Relative to other factors, divergent results were obtained for individual Visegrad Group countries, which does not negate the validity of the statement that the capital structure decisions of the companies analyzed are consistent with the pecking order theory. The dynamic nature of capital structure was confirmed for all Visegrad Group companies, considered collectively and individually, except for Poland.

Research limitations/implications: The research takes into account only quoted companies, so its results do not explain capital structure behavior of other companies. The research is a contribution to further analyses of the capital structure, which covers all types of enterprises.

Practical implications: Knowing the characteristics describing the activities of a given company and the country in which the company operates, analysts can determine on the basis of estimated models what capital structure is typical for a given company. In addition, the analyst is able to identify the effect of the country, i.e. compare companies in terms of capital structure.

Originality/value: The study takes into account the impact of 'country factor'. It made possible to identify main internal factors characterizing capital structure of the enterprises operating in different economic conditions. Moreover, dynamic nature of capital structure was taken into

account. The results can be generalized for all V4's companies listed on the stock exchange. The conducted research may be addressed to analysts, investors and managers of companies as well as researchers conducting research in this area.

Keywords: capital structure, pecking order theory, trade-off theory, panel modeling, Visegrad Group countries.

Category of the paper: Research paper.

1. Introduction

The issue of capital structure formation constitutes one of the key research streams in corporate finance. Despite the passage of more than half a century, it remains a relevant subject of scientific discussion. The research results on the financing source choices are inconclusive and often contradictory. Various concepts are known to explain the principles of capital structure formation, nevertheless, no universal solutions applicable in business practice have been developed. The set of the factors affecting capital structure decisions is expanding continually, which prompts the modification of the existing theories and the development of new ones, based on distinct assumptions (Agraval, 2013). What is more, by-country analysis of capital structure poses additional problems, one of which entails the so-called 'country factor'. The different economic conditions and the varying degree of capital market development in individual countries or groups of countries are indicated as one of the reasons underlying the diversity of the factors affecting capital structure (Kędzior, 2012), as exemplified by the Visegrad Group (V4). The idea of cooperation among Poland, the Czechia, historically known as Bohemia, and Hungary dates back to the 14th century, when during a congress held at the Visegrad Castle, the rulers of these countries agreed on close collaboration, both politically and economically. This event inspired the declaration signed in the early 1990s on the cooperation among Poland, Hungary and initially Czechoslovakia, later the Czechia and Slovakia, on the road to European integration. During the period of economic transition, these countries represented a similar level of socio-economic development. Despite all the similarities, the Visegrad Group countries did not develop at the same pace thereafter. The differences entailed the conditions determining and the level of financial market development in the V4 countries. Moreover, V4's countries participation in the EU can be called difficult. However, the countries managed to advance in further integration into the EU while maintaining the heterogeneity of economic results within the Visegrad Group itself (Chetverikova, 2020). The article aims to assess the impact of selected factors on the capital structures of the companies listed in the Visegrad Group countries, and to determine whether the direction of this impact is consistent with the assumptions of the trade-off theory or pecking order theory.

Two main research hypotheses were formulated:

Hypothesis 1: The capital structure of the stock exchange listed companies differs significantly for individual countries of the Visegrad Group.

Hypothesis 2. The capital structure of the entities under examination is dynamic in nature and is mainly determined by the internal factors characterizing these companies.

To verify the main hypotheses, several questions regarding the links between the various factors of capital structure needed to be answered. Accordingly, six auxiliary hypotheses were formulated:

1. A negative relation between growth opportunities and debt level can be observed.
2. Financial liquidity and debt level are negatively related.
3. The relation between investment tax shield and debt level is negative.
4. A negative relation exists between profitability and debt.
5. Company size and the debt level are positively related.
6. The relation between asset structure and debt level is positive.

The level of debt (D), acting as an endogenous variable, has been expressed by the ratio of total debt to total assets. As such, it describes the capital structure identified with the structure of financing. The remaining variables are exogenous in nature. Growth rate (GR) has been denoted as the percentage change in sales revenue with respect to previous year. Liquidity (LIQ) has been determined through the ratio of current assets to current liabilities. Investment tax shield (NDTS) was calculated as the depreciation to total assets ratio. Profitability (ROE) has been expressed as return on equity, i.e., the ratio of net income to total assets. The natural logarithm of total assets has been adopted to express company size (SIZE). The tangible assets to total assets ratio represents the asset structure (TANG).

The hypotheses formulated were verified using appropriate statistical tests. The calculations were carried out using the Gretl package. The analysis covered 259 companies listed between 1998 and 2020 on the stock exchange markets in the Visegrad Group countries.

The article consists of an introduction, four parts and a conclusion. The second part deals with capital structure formation, in the context of the trade-off or the pecking order theories. The third part entails an overview of the studies drawing on the two concepts. The next section explains the links between capital structure and the factors analyzed, providing justification for the research hypotheses formulated in this work. The fifth part presented research methodology. Results and discussion are presented in the sixth part, followed by a conclusion and final remarks.

2. The structure of capital in the light of the pecking order and the trade-off theories

Capital structure is an ambiguous concept, interpreted and measured variously. In the most general terms, it can be defined as the proportion of debt and own capital in business activity financing (Jerzemowska, 2013). In this context, the structure of capital is equated with the structure of balance-sheet liabilities, i.e., with the structure of financing. Understood as such, it refers to a company's sources of asset financing, taking long-term and short-term as well as interest-bearing and non-interest-bearing equity and debt capital into account.

Another approach views capital structure in terms of fixed (long-term) capital division into equity and long-term liabilities. Fixed capital is defined as the sum of equity and long-term liabilities. According to yet another view, capital structure expresses the combination of a company's issued debt and equity securities (Duliniec, 1998).

In the last approach, capital structure reflects equity and long-term as well as short-term liabilities, excluding liabilities to suppliers, tax liabilities, wages and salaries. This approach distinguishes capital structure from the structure of balance-sheet liabilities, as it only takes interest-bearing liabilities into account (Duliniec, 2011).

Decisions on capital structure formation - along with investment decisions - are among the most important and difficult corporate decisions. Despite nearly sixty years of research, the issue of how an optimal capital structure, i.e., one which allows maximum company value and minimum weighted average cost of capital, should be shaped has not yet been explicitly clarified. The numerous attempts to solve this problem have led to the formulation of many theories. A pioneering study by Durand (1952), aiming to organize and integrate the research on capital structure, mentions three different approaches, which today are referred to as the original theories of capital structure, i.e., the net profit theory, the net operating profit theory, and the traditional theory - as a compromise between the former two.

Contemporary theories of capital structure are based on the concept of Modigliani and Miller, who in 1958 formulated the theory of irrelevance, known as the MM theorem/model. The authors concluded that, assuming a perfect capital market and no taxation, company value does not depend on leverage, and the weighted average cost of capital is not dependent on capital structure. According to these authors, company value is only contingent on the expected rate of return on assets discounted at an asset class-specific rate (Modigliani, Miller, 1958). Developing their theory, they took the taxation of corporate income into account, concluding that the use of debt results in an increase in the value of the company (Modigliani, Miller, 1963).

In response to the concepts developed by Modigliani and Miller, the theories of capital structure were further developed, based on separate assumptions, taking the different factors affecting the choice of financing sources into account. The most important of these include the trade-off theory, the pecking order theory, the signaling theory, the agency theory,

and the market timing theory (Miglo, 2011; Chaklader, Chawla, 2016). The study objective adopted in work has limited Authors to analyses based on the trade-off and the pecking order theories.

The static trade-off theory represents a development of the Modigliani and Miller's work (1958, 1963), as an approach most commonly indicated in the literature on the subject (Lambrinouidakis, 2016). It was first presented by Kraus and Litzenberger (1973), modified several times in subsequent years by such authors as Jensen and Meckling (1976), Myers (1977, 1984) and Haugen and Senbet (1978).

The main assumption of the static trade-off theory posits that an optimal capital structure results from balancing the interest tax benefits with the so-called costs of financial distress (bankruptcy costs) and the agency costs associated with equity and debt capital. Such optimal capital structure maximizes the market value of an enterprise, as it simultaneously minimizes its weighted average cost of capital. This cost determines the level of the discount rate used in the company valuation. The trade-off theory assumes calculation of the optimal level of the interest-bearing liabilities to equity ratio, i.e., the leverage. In practice, however, there is no fixed optimal capital structure, as corporate financial standing and market environment change continually. The balance of the costs and benefits associated with the amount of debt therefore changes as well, forcing modification of the static trade-off theory (Leary, Roberts, 2005). Considering the dynamic model of the trade-off theory, one important factor affecting the choice of financing sources is the pursuit of a target capital structure, which due to the volatility of operating conditions, is subject to frequent modifications (Duliniec, 2015). Target capital structure differs significantly from company to company. Entities using low-risk tangible assets and generating significant sales revenues tend to have higher debt. Conversely, low-profit companies with high proportions of risky intangible assets should finance their operations with equity mainly.

In economic practice, it turns out that the trade-off theory offers an explanation for the capital structure variation across sectors, e.g., high-tech companies characterized by elevated percentage of risky, intangible assets. These companies mainly finance their operations with equity. The trade-off theory does not, however, explain why many of the highly profitable companies are characterized by low leverage (Borová, 2006).

The pecking order theory represents an opposite approach to capital structure formation. Donaldson (1961), whose approach was continued and described by Myers and Majluf (1984), Myers (1984), had been a precursor in this regard. The concept elucidates the order in which specific sources of financing are selected. Organizations are mainly oriented at the use of internal sources, which include retained earnings, surplus cash and short-term financial assets. Then, companies decide to use external sources secondarily, primarily credit and loans. When these options are exhausted, they issue debt securities, then hybrids and ultimately shares. The theory does not set a target capital structure. The key factor affecting the capital structure entails the choice of individual sources of financing (Duliniec, 2015).

The pecking order theory provides an answer to the question of why with highly profitable companies are characterized by low levels of debt, which is related to the preference for internal financing rather than the establishment of low leverage (Borová, 2006). Conversely, companies with low profitability choose debt, as they lack adequate internal financing resources. Correspondingly, debt financing comes next after internal financing.

One of the primary pecking order theory assumptions pertains to the existence of information asymmetry between the management and investors. Companies therefore avoid financing sources which generate the so-called information costs, as these costs have negative impact on the enterprise market value. The asymmetry theory links the pecking order theory with the signaling theory (Ross, 1977). The concept explains the negative or positive capital market reaction to corporate issuance of securities. As such, it constitutes an extension of the pecking order theory.

A variety of factors modify companies' preferences for particular sources of financing. Considering stock exchange listed companies, these factors mainly include market valuation and capital market conditions, which is why managers base their financing decisions on the market circumstances, rather than on the capital needs and the internal financing availability only. Such conduct is in line with the market timing theory. Baker and Wurgler (2002) proved that a company's decision to issue shares depends on its market value to book value ratio. The higher a given company's current market valuation, compared to its book value and previous listings, the more interest it shows in issuing new shares. Conversely, when the market value is low, companies opt for share buybacks. The literature on the subject, however, shows no consensus as to whether financial decisions based on the market timing theory assumptions yield short-term effects on capital structure (Alti, 2006), or whether these effects are long-term (Baker, Wurgler, 2002).

3. Overview of the trade-off theory-based and the pecking order theory-based research on the capital structure in the Visegrad Group countries

The rationales deriving from the trade-off theory and the pecking-order theory are commonly used to explain the impact of the factors shaping the structure of financing. The research to date has not led to clear conclusions on this matter, however. This section presents the results of the available trade-off theory-based and pecking order theory-based studies conducted in the Visegrad Group countries. Alas, most of these studies cover short periods and involve small research samples, which is why the results thereof can be considered contributive to further analyses.

During the economic transition, i.e., throughout the first half of the 1990s, profitability and indebtedness in Polish, Hungarian and Slovak enterprises were negatively related, which is consistent with the pecking order theory (Bostyn, Boytsun, 2002). This was mainly associated with the low availability of debt capital and its high cost. The credit markets in these countries were in crisis at the time. Banks were unable to provide business activity financing in the extent satisfying the needs of enterprises. What is more, on the one side, the outdated portfolios of the physical assets held by companies that had originated in the days of centrally controlled economy oftentimes did not provide proper credit collateral, and on the other, there were no secondary markets enabling productive tangible asset liquidation. Banks were therefore faced with difficulties in selling the assets seized as part of companies' defaulting on a loan agreement (Szemán, 2011). Similar conclusions were reached by Colombo and Revoltella (2003), who indicate that the companies listed in the Czech Republic and Hungary at the time of the economic transition were shaping their capital structure in compliance with the assumptions of the pecking order theory.

Mazur (2007), based on a survey of 238 Warsaw Stock Exchange listed public entities, proved that companies with high profitability and liquidity prefer internal sources of financing. This conclusion is consistent with the pecking order theory. Furthermore, the trade-off theory was not applied in the companies examined (Mazur, 2007). Similar results have been presented by Hamrol and Siczko (2006), who indicate that the pecking order theory serves as most accurate explanation of capital structure formation in Polish listed companies. Both these studies were carried out in a similar period. Jaworski and Czerwonka (2019) analyzed 335 service sector companies listed on the Warsaw Stock Exchange in 1998-2012. They also confirm the validity of the pecking order theory. Różański and Bogołębska (2022) studied Polish enterprises producing for the domestic and foreign markets in 2015-2019. They found that the primary source of financing with equity was retained earnings and with debt capital it was bank credit and leasing. It is consistent with the pecking order theory.

Koralun-Bereźnicka (2019) obtained less conclusive research results. The author underlines that the pecking order theory is primarily applicable to long-term debt level formation. The trade-off theory, on the contrary, poses as the rationale behind short-term debt decisions. Moreover, in the case of long-term debt, one important factor shaping the level thereof entails a given company's sectoral affiliation, whereas short-term debt levels show significant association with company size. The results of an analysis conducted by Białek-Jaworska and Nehrebecka (2016), in turn, indicate that the pecking order theory is primarily applied in large companies characterized by high profitability and self-financing capacity. Compared to small and medium-sized enterprises, these entities tend to finance their operations with credit to a lesser degree. By contrast, the relation between liquidity and leverage is negative, regardless of the company size, which is also in line with the pecking order theory. Unlike previous studies cited Hartwell and Malinowska (2018) argued that neither the trade-off nor the pecking order theories fully explain corporate capital structure in Poland. The authors indicate that the strength

of property rights and stock market capitalization are driving forces behind corporate financing decisions.

Research on Czech listed companies was conducted by Poulová (2017), who demonstrated that agricultural, industrial and construction companies shaped their capital structure in accordance with the assumptions of the two theories mentioned above. The level of leverage in these companies was affected by their sectoral affiliation and the type of ownership structure. Bauer (2004), in turn, analyzed Czech non-financial companies and proved that they were functioning in compliance with the pecking order theory, i.e., the level of debt was negatively related to the companies' profitability.

Režňáková, Svoboda, Polednáková (2010) analyzed the capital structure of Slovak non-financial companies. Based on their study, it can be concluded that positive relation occurs between the level of debt and the asset structure, profitability, and company size, while the relationship between the debt level and the growth opportunities, liquidity, and non-interest tax shield is negative. These results confirm the validity of the pecking order theory.

Hungarian public companies were shaping their capital structure in compliance with the pecking order theory, during the economic transition period (Nivorozhkin, 2002; Dević, Krstić, 2001). Another study carried out by De Jong, Kabir and Nguyen (2008) showed a negative relationship between debt and profitability, liquidity, and income tax rate. Debt and company size, in turn, were characterized a positive relation, which again confirms the companies' compliance with the pecking order theory.

Majerowska and Gostkowska-Drzewicka (2019) analyzed 328 non-financial companies listed in the Visegrad Group countries. The study confirms the earlier conclusions regarding the Polish and Czech companies' propensity to shape their capital structure in accordance with the assumptions of the pecking order theory. Research results on Hungarian and Slovak companies, by contrast, were less unambiguous. In Slovak companies, the level of debt was positively related with growth opportunities, whereas profitability and company size were characterized by a negative relationship, confirming compliance with the pecking order theory. The positive relation between liquidity and debt, in contrast, indicates compliance with the trade-off theory. Conversely, the negative relationship between the Hungarian companies' levels of debt and such factors as liquidity and profitability indicate compliance with the pecking order theory, while the negative relationship between growth opportunities and debt confirms the validity of the trade-off theory.

Kluzek and Schmidt-Jessa (2022) analyzed 8120 domestic and multinational enterprises operating in the Visegrad Group countries used data from 2012-2018. Among internal determinants of the capital structure which most often appeared as significant, in the case of all companies in all countries analyzed were sales profitability, tangibility and the age of the company. Moreover, a negative relation was observed between profitability and the level of debt what is in line with pecking order theory. In the contrary, asset structure and the level of debt were positively related. This conclusion is consistent with the trade-off theory.

Table 1 outlines the period covered by the study, indicating the subjects of the research and the capital structure-affecting factors analyzed by the authors of the works cited.

Table 1.

Selected studies by author, period covered and research subject as well as specification of the capital structure shaping factors analyzed in the works cited

Autor	Research period	Research subject	Factors
Mazur (2007)	2000-2004	238 Polish Warsaw Stock Exchange listed companies	Asset structure, profitability, liquidity, growth opportunities, size, product uniqueness, business risk, tax shield, dividend policy
Hamrol, Sieczko (2006)	2002-2004	134 Warsaw Stock Exchange listed companies	Asset structure, profitability, growth opportunities, size, product uniqueness, investment tax shield, cost of capital
Jaworski, Czerwonka (2019)	1998-2012	335 Warsaw Stock Exchange listed service sector companies	Asset structure, size, growth opportunities, profitability, liquidity, non-interest tax shield
Koralun-Bereźnicka (2019)	2005-2015	Polish small, medium and large private companies representing various sectors	Return on capital, size, sectoral affiliation, interaction between company size and profitability as well as between sectoral affiliation and profitability
Białek-Jaworska, Nehrebecka (2016)	1995-2012	Polish small, medium and large enterprises representing the non-financial sector	Profitability, liquidity, fixed assets, growth opportunities, tax shield, impact of monetary policy
Poulová, (2017)	2010-2014	624 Czech agricultural, industrial and construction companies	Asset structure, profitability, liquidity
Bauer, (2004)	2000-2001	74 non-financial sector companies listed on the Prague Stock Exchange	Size, profitability, asset structure, growth opportunities, income tax rate, non-interest tax shield, risk, sectoral affiliation
Režňáková, Svoboda, Polednáková, (2010)	2002-2007	1100 Slovak non-financial sector companies	Asset structure, profitability, growth opportunities, size, investment tax shield, liquidity
de Jong, Kabir, Nguyen (2008)	1997-2001	15 Hungarian companies	Asset structure, profitability, growth opportunities, size, income tax rate, liquidity, risk
Nivorozhkin, (2002)	1992-1995	25 non-financial sector companies listed on the Budapest Stock Exchange	Asset structure, profitability, growth opportunities, size, ownership structure, sectoral affiliation
Dević, Krstić (2001)	1996-1998	20 non-financial sector companies listed on the Budapest Stock Exchange	Profitability, size, asset structure, growth opportunities
Majerowska, Gostkowska-Drzewicka (2019)	1998-2016	328 non-financial companies listed in the Visegrad Group countries	Growth opportunities, liquidity, non-interest tax shield, profitability, company size, asset structure
Kluzek, Schmidt-Jessa (2022)	2012-2018	8120 domestic and multinational enterprises operating in the Visegrad Group countries	Taxation, tangibility, age, size, profitability, liquidity

Source: Own elaboration.

4. The links between capital structure and the factors analyzed

As discussed in the previous section, various capital structure factors are identified in the literature on the subject. These factors constitute the subject of the empirical studies, on the basis of which the direction and strength of the impact thereof on the level of financial leverage have been determined. These dependencies have also been linked with specific concepts of capital structure. Six such factors were selected for the study. The research hypotheses were formulated based on the available empirical studies, taking the direction of each factor's impact on the level of financial leverage into account.

Companies characterized by high development (growth) potential strive to maintain low leverage. This is in line with the trade-off theory, as realization of growth opportunities is associated with elevated risk and higher expected costs of financial difficulties, which results in reduction of debt. It should be underlined that high growth potential is often reflected in an increased market value to book value ratio, which, according to the theory of market timing, promotes the use of external sources of equity (issuance of shares) rather than debt capital (Duliniec, 2015). Accordingly, hypothesis one has been formulated as follows:

A negative relation between growth opportunities and the level of debt is observed.

Companies with high liquidity are able to finance their operational and growth activity by engaging the highly liquid assets held. This leads to a reduced demand for debt capital (Mazur, 2007), which is in line with the pecking order theory. Deriving on that, hypothesis two has been formulated as follows:

Financial liquidity and debt volume are negatively related.

The tax shield effect is one of the reasons leading to increased debt. Such conduct, however, is only attractive to companies which generate income that allows tax benefits, but do not show other costs acting similarly to the tax shield. Such costs primarily include depreciation, which, in relation to total assets, determines the level of the so-called investment tax shield. Unlike the tax shield, it leads to debt reduction (De Angelo, Masulis, 1980). Since this regularity is consistent with both the trade-off theory and the pecking order theory, hypothesis three assumes that:

The relation between investment tax shield and debt size is negative.

Companies with high profitability ratios tend to display lower levels of debt, which is consistent with the pecking order theory, for these entities are more capable of financing growth via internal sources (Myers, Majluf, 1984). As a result, they show lower demand for debt capital. Accordingly, hypothesis four has been formulated as follows:

A negative relation exists between profitability and the level of debt.

Large companies display higher levels of debt. These entities tend to diversify their operations, owing to which they are at low risk of losing liquidity, which reduces the cost of

financial distress and allows for higher leverage (Duliniec, 2015). This is in line with the trade-off theory, hence hypothesis five assumes that:

Company size and debt volume are positively related.

Companies holding significant stocks of physical assets show higher levels of leverage. This is because physical assets, by providing collateral for liabilities, allow for reduction of direct costs of bankruptcy, which promotes higher levels of debt (Duliniec, 2015; Chaklader, Chawla, 2016). This conclusion is consistent with the trade-off theory, and thus leads to the sixth hypothesis formulated on this basis:

The relation between asset structure and the level of debt is positive.

5. Methods

The subjects of the analysis entailed companies listed in 1998-2020 (as of November 19, 2021) on the main stock exchange markets in the Visegrad Group countries, i.e., Poland, the Czechia, Slovakia and Hungary. The Warsaw Stock Exchange sample encompassed 415 companies. Financial sector entities were excluded from the analysis, which is why 97 companies were eliminated from the sample. Entities which did not publish full financial statements during the period under examination, i.e., 24 companies, were also excluded from the sample. Furthermore, only the entities listed on the Warsaw Stock Exchange continuously for a period of at least 5 years were included in the analysis, which is why 92 companies were additionally eliminated from the sample. Ultimately, 212 companies, i.e., 51% of the entities selected initially, were qualified for the study.

Another stock market covered by the study was the Budapest Stock Exchange. Equities-listed companies, i.e., 34 entities, were selected for the study. Six financial sector companies and four entities listed for a period of less than five years were excluded from the sample. In total, 24 entities, i.e., 70% of the pre-selected sample, were included in the analysis.

Out of the 16 companies listed on the Prime Market and Standard Market of the Prague Stock Exchange, 9 companies, i.e., 56% of the entire sample, were qualified for the study. Companies listed for a period of less than 5 years (1 entity) as well as financial sector companies (6 entities) were excluded from the sample.

The Bratislava Stock Exchange is the smallest stock market in the Visegrad Group. In this case, 22 entities were included in the sample, 8 of which (financial sector companies) were excluded. Ultimately, the sample covered 14 entities, i.e., nearly 64% of the total number of Slovak listed companies.

Based on the above-mentioned literature, estimation of a linear panel data model has been propounded, in order to verify the hypotheses presented in the introduction:

$$Y_{it} = f(Y_{it-1}, X_{1it}, \dots, X_{6it}, Z_{1it}, \dots, Z_{4it}, \xi_{it}) \quad (1)$$

where the endogenous variable Y denotes the level of debt (D), while the ratio of total debt to total assets acts as an explanatory variable in current period (t) and as an explanatory variable in previous period ($t-1$). Selected exogenous variables used in the model include:

X_1 – growth rate (GR), the percentage change in sales revenue, with respect to previous year,

X_2 – liquidity (LIQ), the ratio of current assets to current liabilities,

X_3 – investment tax shield (NDTS), the ratio of depreciation to total assets,

X_4 – profitability (ROE), the ratio of net income to total equity,

X_5 – size (SIZE), the natural logarithm of total assets,

X_6 – asset structure (TANG), the ratio of physical assets to total assets.

Variables Z_1, \dots, Z_4 represent dummy variables, taking the value of 1 when a given company is associated with a given country and zero otherwise. The subscript i denotes the number of the company in question, t the period number, and ξ the random component.

6. Results and discussion

In the first stage of the study, the values of the correlation coefficients between each company's level of current debt and its previous-period debt and other factors were determined (Table 2). It can be noted that these coefficients differ significantly from country to country, both in terms of value and statistical significance.

Table 2.

Correlation coefficients between debt ratio and selected factors

	ALL COUNTRIES	CZECHIA	SLOVAKIA	HUNGARY	POLAND
D(-1)	0.4595*	0.9914*	0.9480*	0.0936	0.5595*
GR	-0.0022	0.1610*	0.0663	-0.0068	-0.0020
LIQ	-0.0081	-0.2248*	-0.3053	-0.0170	-0.0194
NDTS	-0.0016	-0.2296*	0.2489*	-0.0402	0.0066
ROE	0.0012	-0.3531*	0.1611*	0.0043	-0.0010
SIZE	-0.0686*	0.3091*	-0.0598	-0.1793*	-0.0692*
TANG	-0.0323*	0.3296*	0.2583*	-0.0739	-0.0305

*) statistically significant at 0.05 significance level.

In the second step, the dynamic model propounded (1) was estimated using pooled OLS, taking the Arellano–Bond estimator into account and incorporating all the capital structure factors selected. The estimation results are presented in Table 3.

Table 3.*Panel regression estimates for entire sample*

	Pooled OLS (1)	Fixed effects (2)	Pooled OLS (3)	Fixed effects (4)
const	1.7261*	11.2637***	0.3370***	10.3107***
D(-1)	0.4469***	0.3359***	0.4498***	0.3359***
GR	-0.0003	0.0007		
LIQ	-0.0007	-0.0004	-0.0006*	
NDTS	1.3826	1.5021		
ROE	0.0018	-0.0039		
SIZE	-0.1049***	-0.7746***		-0.7775***
TANG	-0.3718	-0.1738***		
Joint test stat.	1.7840#		1.5227#	
Breusch-Pagan test stat.	N/A		N/A	
Hausman test stat.	463.736#		391.714#	

*)***) statistically significant at 0.1; 0.05 and 0.01 significance levels.

#) at 0.05 significance level, the null hypothesis should be rejected.

Source: Own estimation.

The model (1) estimation results indicate occurrence of explanatory variables for which the statistical parameters proved statistically insignificant at 0.05 level of significance. The diagnostic tests for the panel data suggest the use of fixed effects models. Taking both these conditions into account, the result denoted in Table 3 as (4) was ultimately obtained. As such, it can be concluded that the estimation of the panel model accounting for company performance with respect to each country analyzed has led to factors shaping current debt, i.e., the level of previous year's debt and company size. The negative relationship between the level of debt and company size suggests that most accurate explanation of the capital structure formation in the stock exchange listed companies of the Visegrad Group involves the pecking order theory. According to this concept, large entities tend to display lower levels of debt, owing to their ample capacities to finance operations via internal sources. It should be underlined that the pecking order theory does not explicitly indicate the direction of the links between a company's size and its debt. This relation can be both positive and negative.

In the next stage of the study, dummy variables identifying the companies' country affiliation were added to the model. The results of the estimations are presented in Table 4.

Table 4.*Panel regression estimated for the entire sample*

	Pooled OLS (1)	Pooled OLS (2)	Pooled OLS (3)	Pooled OLS (4)
const	2.3487***	2.0788***		
D(-1)	0.4446***	0.4454***	0.4446***	0.4495***
GR	-0.0002		-0.0002	
LIQ	-0.0011		-0.0012	
NDTS	0.8663		0.8663	
ROE	0.0001		0.0001	
SIZE	-0.1576***	-0.1410***	-0.1576	
TANG	-0.3575		-0.3575	
CZECHIA	0.5276		2.8763	0.1954***
SLOVAKIA	-0.4519		1.8967*	0.2691***
HUNGARY	0.6498**	0.5860***	2.9985*	0.4703*
POLAND			2.3487	0.3273***

Cont. table 4.

Joint test stat.	1.7727#			
Breusch-Pagan test stat.	N/A			
Hausman test stat.	455.682#			

*)***) statistically significant at 0.1; 0.05 and 0.01 significance levels.

#) at 0.05 significance level, the null hypothesis should be rejected.

Source: Own estimation.

Table 4 shows statistically significant differences in the level of Hungarian listed entities' debt, compared to Polish companies (version 2 of the model). Inferring from the model with statistically significant structural parameters, it can be concluded that the level of debt in Hungarian listed entities differed notably from that of the companies listed in the other V4 countries. Relations identical to those indicated by the results presented in Table 3 have been observed as well. As such, it can be concluded that the level of debt in the companies under examination is shaped in accordance with the pecking order theory, with significant impact of previous year's debt.

Lastly, estimation of model (1) was proposed, by treating the sample companies in distribution by each country, due to the significant differences in the number of the companies listed in each V4 country. Estimates of the most accurate models are given in Table 5.

Table 5.

Panel regression estimated for the entire sample

	CZECHIA	SLOVAKIA	HUNGARY	POLAND
	Fixed effects	Fixed effects	Fixed effects	Fixed effects
const	-0.6753***	0.1060***	20.8459***	8.7347***
D(-1)	0.7140***	0.7916***	-0.0914*	0.4462***
GR		0.0075*		
LIQ		-0.0050***		
NDTS				
ROE	0.3498***	0.0132*		
SIZE	0.0465***		-1.2818***	-0.6776***
TANG				

*)***) statistically significant at 0.1; 0.05 and 0.01 significance levels.

Source: Own estimation.

The above estimates indicate that, taking the research sample entities in distribution by country, the use of the fixed effects models proved to be most appropriate in terms of company performance. In the case of the Czech listed companies, the level of debt is positively affected by previous year's debt, the level of ROE, and company size. It can thus be concluded that these companies shape their capital structure in accordance with the trade-off theory.

The factors shaping the level of debt in Slovak listed companies include the level of previous year's debt, growth rate, liquidity and ROE. The Slovak companies' functioning in compliance with the trade-off theory principles has been confirmed by the positive relation with respect to profitability. The positive relation with the growth rate and the negative with liquidity, in turn, indicate that the capital structure formation in these entities can be explained on the grounds of the pecking order theory assumptions.

The estimate results obtained for Hungarian companies are ambiguous, yet largely confirm compliance with the pecking order theory, as evidenced by a negative relationship between leverage and company size. It is worth noting that a negative relation between the level of debt in a given year and the year preceding can be observed with respect to Hungarian companies.

Poland, just as the other V4 countries, shows a significant dependence of debt on its previous year's level. Another factor negatively affecting debt at a significant level was company size. It is noteworthy that this impact was also negative, as in the case of Hungarian companies. This confirms the compatibility of the capital structure decisions made by Polish listed companies with the pecking order theory. The conclusions formulated on the basis of the research conducted are therefore in line with the results obtained by the authors of other works (March, 2010; Janus, 2006; Mazur, 2007; Hamrol, Sieczko 2006; Lisińska, 2012; Barbuski, 2014, Wrońska-Bukalska, 2014; Jaworski, Czerwonka 2019).

7. Summary

According to the research conducted, capital structure decisions of non-financial companies listed in the Visegrad Group countries are generally in line with the pecking order theory. Slovak companies, however, show dependencies consistent with the trade-off theory. With regard to the totality of the V4 companies examined, the preliminary analysis of the dependencies between the level of debt and selected debt shaping factors showed a statistically significant positive relationship between debt and previous year's debt, and a statistically significant negative relation between debt and company size as well as asset structure. These relationships differed for each country. The estimation of the panel model of debt indicated the need for fixed effects models. The results confirmed a statistically significant dependency between current debt and prior period debt. Taking the effect specific to each country into account, the above conclusions have again been confirmed, allowing a conclusion that the levels of company debt in each V4 country differ with statistical significance.

Profitability has a positive impact on debt in the Czech and Slovak companies only, which is consistent with the trade-off theory. Such relationships, as already mentioned, do not negate the validity of the statement that the capital structure decisions made by the companies analyzed are consistent with the pecking order theory, however. Divergent results were obtained in relation to the other factors under analysis, depending on the country. Company size positively affected the level of debt in the Czech Republic, and negatively in Hungary and Poland, whereas in Slovakia, it proved statistically insignificant. No statistically significant impact of non-interest tax shield and asset structure has been observed when analyzing the research sample companies in distribution by each V4 country.

Ultimately, it can be concluded that the first hypothesis posed in the introduction, assuming a significant difference in the capital structure of the companies listed in individual Visegrad Group countries has been confirmed. The second hypothesis assuming a dynamic nature of capital structure formation has been confirmed as well. What is more, despite the fact that the companies examined operate in a single geographic region (the European Union) and share common cultural roots, the impact of the individual factors shaping these entities' capital structures varies. Last of all, it is worth mentioning that the research results obtained fall within the scope of the conclusions formulated in the works mentioned in this article.

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