DETERMINANTS OF THE CAPITAL STRUCTURE OF THE COMPANIES LISTED ON THE WARSAW STOCK EXCHANGE

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Abstract - The aim of this article is to analyze the determinants of capital structure for companies listed on Warsaw Stock Exchange. On the basis of capital structure theories and previous empirical research, factors affecting capital structure of the companies were identified. Firstly, the correlation coefficients between the determinants and debt ratios were analyzed. Afterwards their joint impact on debt ratios was assessed with regression model estimated with generalized method of moments estimator. The study shows that total debt ratio is positively influenced by lagged debt ratio, while negatively by profitability, non-debt tax shield and liquidity. As far as long-term debt ratio is concerned, it is positively related to its lagged values, while negative impact was observed for liquidity, dividends and business risk. It should be therefore concluded that although the set of measures of capital structure determinants is similar for both total and long-term debt ratio, the magnitude and statistical significance of influence of these factors varies widely depending on the analyzed measure of capital structure.

Keywords - Capital structure, debt ratio, pecking order theory, trade-off theory, dynamic panel data.

I. INTRODUCTION

The aim of this article is to assess the impact of selected factors on capital structure of companies listed on Warsaw Stock Exchange. After a thorough empirical research review, the capital structure determinants are identified, and the significance of their impact on debt ratios is assessed on the basis of dynamic panel data model. All the decisions made by the company sum up to the state of the assets, for which the company had to choose financing, which is described by the structure of equity and liabilities [14]. Therefore it can be said that the decisions concerning the capital structure of the companies are the second most important decisions after the operating activities. Taking into consideration previous empirical research, their results differ significantly depending on three aspects of the studies. Firstly, the set of factors included in the regression models vary between the studies, and the research concerning multiple factors identified in previous research is not frequent [19]. Secondly, the measures used to describe the capital structure determinants may greatly influence the magnitude of their impact. Thirdly, the results of the studies differ depending on the estimation method for the regression model. This article focuses on the first of these issues, i.e. the choice of factors significantly influencing companies' capital structure.Further research concerning determinants of capital structure of polish companies can enhance the understanding of the mechanisms important for emerging markets. Moreover, existing studies focus on limited number of factors, and use relatively simple statistical tools. Therefore the review of determinants of debt ratios, together with the assessment of their importance, is highly desirable. The rest of the paper is organized as follows. Firstly, capital structure theories are described, with special attention paid to factors affecting debt ratios according to pecking order theory and trade-off theory. Secondly, the existing empirical research is reviewed in order to identify debt ratios' determinants. The next section focuses on the data and methodology used for the study. Then the results of the study are presented, starting with the correlation analysis, and moving on to the regression analysis. The last section concludes.

II. THEORIES OF CAPITAL STRUCTURE

The pivotal theories of capital structure are pecking order theory and trade-off theory. These theories differ not only in the mechanisms affecting capital structure, but also in the predicted direction of impact of selected factors on debt ratios. The pecking order theory was developed by Myers and Majluf [34, 36]. It focuses on the preferences of managers concerning the sources of financing. The first sources used to finance the company's operations are internal sources, i.e. retained earnings and cash and its equivalents. After these funds are used, the managers turn to external financing. Firstly, the company increases its debt, as it is safer source of financing than an increase in equity. The latter is considered only as a last resort. The described order can be explained on the basis of theory of information asymmetry: more preferred are these financing sources, the value of which will change less if the managers reveal important information concerning the company [25].

The trade-off theory claims that the management of the company seeks to reach the optimal capital structure [37]. Such an optimal capital structure balances the advantages and disadvantages of debt. However, as it is impossible to calculate the optimal capital structure, the efforts of the managers focus on the target capital structure. On one hand, the increase in debt has a positive impact on the value of the company as it increases the tax shield available for the company [14]. On the other hand, the

management has to take into consideration both direct and indirect costs of financial distress, decrease in elasticity and the consequences of eventual cut in dividends [19]. The direct costs of financial distress are mainly legal and administrative costs of bankruptcy and reorganization, while indirect costs include such actions as the sales of assets for an understated price, the drop in orders from the partners, or lower perceived value of after-sales services [35].

III. CAPITAL STRUCTURE DETERMINANTS

Although previous empirical research identified a broad set of factors which may influence capital structure, most of the studies focus on the analysis of profitability, growth opportunities, size and tangibility of assets. These determinants were identified as significantly influencing capital structure in companies from G-7 countries [41]. According to the study of Frank and Goyal [19], for American companies the most reliable factors influencing debt ratios are: median industry debt ratio, growth opportunities, tangibility of assets, profitability, dividends, size and expected inflation.

In Table 1 there are presented capital structure determinants identified on the basis of an empirical research review, together with the direction of their influence by pecking order theory and trade-off theory.

Table 1: The influence of selected factors on capital structure predicted by pecking order theory and trade-off theory

factor	pecking order theory	trade-off theory
profitability	–	+
growth opportunities	+	–
size	+	+
tangibility of assets	–	+
R&D expenditures		–
non-debt tax shield		–
business risk	–	–
liquidity	–	+
probability of bankruptcy		–
financial deficit	+	
dividends	+	
capital expenditures	+	–
uniqueness of product		–
asset turnover	–	+
tax rate		+

Higher profitability of the company results in higher value of internal sources of financing, therefore it should have negative impact on debt ratios according to the pecking order theory. The trade-off theory suggests that profitability increases the need for tax shield. The negative impact was identified in the previous empirical research [7, 11, 13, 15, 20, 22, 23, 24, 42, 49].

According to the pecking order theory, companies with more growth opportunities face higher asymmetry problems, and therefore should have higher debt ratios. The trade-off theory predicts the negative impact of growth opportunities due to higher bankruptcy costs faced by growing companies. The negative impact of this factor is reported by most of the empirical studies [7, 20, 32, 38, 42, 46, 49].

As far as size is concerned, bigger companies face higher information asymmetry and ar use more debt financing, as predicted by the pecking order theory. According to the trade-off theory, positive impact of size on debt ratio is explained by lower bankruptcy costs in comparison with the value of the company. This direction is mostly confirmed by empirical research [7, 18, 22, 23, 28, 32, 42, 44, 49].

Companies with higher tangible assets are less sensitive to the asymmetry of information, and therefore the pecking order theory predicts that they should have lower debt ratios. Considering the trade-off theory, higher tangibility of assets results in lower costs of financial distress, as such assets are less underpriced in case of bankruptcy. The mostly positive impact of tangibility of assets, reported by previous empirical research, supports the the trade-off theory's predictions [7, 13, 18, 19, 22, 23, 31, 33, 42].

As predicted by the trade-off theory, the expenditures for research and development increase the bankruptcy costs of the company, as they cannot be recovered if the company faces financial distress. The impact of R&D expenditures on debt ratios in previous empirical studies was found to be negative [1, 18, 21, 28].

Non-debt tax shield lowers the need for tax shield resulting from higher debt, having therefore negative impact on debt ratio according to the trade-off theory. This variable was included in some of the previous studies [20, 32], but its impact on debt was reported as mixed. Higher business risk aggravates the problem of information asymmetry, which supports its negative influence on capital structure predicted

by the pecking order theory. According to the trade-off theory, business risk increases the risk of financial distress, and thus negatively influences the debt ratios. Previous studies suggest rather negative impact of business risk on debt ratios [11, 12, 20, 27, 30, 42].

As predicted by the pecking order theory, the negative impact of liquidity on debt ratio results from higher financing needs. From the trade-off theory point of view, companies with lower liquidity face higher probability of bankruptcy. According to the previous studies, the variable in question has rather negative impact on capital structure [20, 31, 39, 45].

For the assessment of probability of bankruptcy, Altman Z-score is used [25, 42]. This measure is a concise assessment of the financial standing of the company. The trade-off theory predicts that higher probability of bankruptcy should have negative impact on debt ratio, and the negative relation is confirmed by previous studies.

Financial deficit, i.e. the ratio of (net investment - cash flow from operations + dividend expenditure - change in cash + change in working capital) to market value of assets [9, 42], is a measure of financing needs of the company. As a consequence, it should have positive impact on debt ratio according to pecking order theory, and this direction of impact is confirmed by empirical studies.

Companies paying dividends also have higher financing needs, which explain the positive impact of dividends predicted by the pecking order theory. Previous research supports this direction of influence [1, 8, 19].

The pecking order theory implies that companies with higher capital expenditure have higher financing needs, which increases their debt ratios. For the trade-off theory, capital expenditures are related negatively to debt ratios due to an expected rise in financial distress costs. On the basis of empirical research it can be said that this factor has a positive impact on debt ratios [22].

In light of the trade-off theory, the higher is the product's uniqueness, the higher are the costs of bankruptcy, which results in lower debt ratios. The negative impact of this factor is confirmed by previous studies [21]. According to the pecking order theory, asset turnover should have negative impact on debt ratio, while the trade-off theory predicts the influence to be positive. Previous studies suggest that this determinant has a positive impact on debt ratios [45]. Taking into consideration tax, trade-off theory predicts that higher tax liability should increase the importance of debt tax shield, resulting in higher debt ratio. Previous empirical studies do not agree on the direction of influence for this factor [1, 6, 13, 40].

IV. DATA AND METHODOLOGY

The aim of this study is to analyze the determinants of capital structure of companies listed on the Warsaw Stock Exchange. The sample consists in companies listed in the continuous trading system in 2002-2015. The main interest of the study is the capital structure, therefore the sample excludes the companies with industry-specific financing sources, i.e. the companies operating in the following industries (according to the classification of Warsaw Stock Exchange): banking, insurance, other financial, capital market and conglomerates. The companies trading in the currency other than PLN were also excluded. As a consequence, there are 479 companies in the final sample, accounting for 3 079 observations.

The study focuses on two measures of capital structure: total debt ratio and long-term debt ratio. For both of the ratios, the liabilities are measured with book value, as it is not possible to obtain their market value. When it comes to equity, its market value is used. Market value of equity is a forward-looking measure and is closer to its internal value [44]. However it has to be noted that managers do not react to the changes in share price, and book value is less volatile than its market value [47].

As far as factors affecting capital structure are concerned, the study includes a broad set of determinants. The list of factors and their measures is presented in Table 2.

Table 2: Capital structure determinants included in the study with operationalization and variable names

factor (variable name)	operationalization
profitability (prof)	earnings before interest, taxes, depreciation and amortization / total assets
growth opportunities (growth)	market value of equity / book value of equity
size (size)	natural logarithm of total assets
tangibility of assets (tang)	(property, plant and equipment + inventories) / total assets
non-debt tax shield (ndts)	depreciation / total assets
liquidity (liq)	cash and equivalents / total assets
financial deficit (findef)	(net investment - cash flow from operations + dividend expenditure - change in cash + change in working capital) / market value of assets
dividends (div)	dividends / total assets

factor (variable name)	operationalization
investments (inv)	(capital expenditure + depreciation) / total assets
uniqueness (uniq)	cost of sales / sales
asset turnover (assturn)	sales / total assets
tax (tax)	tax / earnings before interest and tax
business risk (risk)	standard deviation of (cash flow from operations / total assets), calculated over a 3-year period
industry classification (indtotal)	median total debt ratio for the industry, as classified by Warsaw Stock Exchange
industry classification (indlongterm)	median long-term debt ratio for the industry, as classified by Warsaw Stock Exchange

The impact of selected determinants on the capital structure is assessed on the basis of two methods: correlation analysis and regression model. Firstly, the Pearson correlation coefficients are used in order to assess the persistence of debt ratios, as well as the magnitude and the direction of relation between the analyzed determinants and debt ratios. It should be noted that current values of determinants, such as profitability or tangibility of assets, are likely to be interconnected with the current values of debt ratios. Therefore the study focuses on the impact of determinants lagged one period on the debt ratios of current period.

It has to be underlined that the correlation coefficient takes into account only the relation between two variables, and therefore it cannot be used in order to assess the magnitude of impact of multiple factors on companies' debt ratios. As a consequence, the next step in the analysis is to estimate the regression models. Firstly, the model with all the factors is estimated. Secondly, the variables which have insignificant impact on dependent variable are excluded from the model. The data concerning capital structure and its determinants have several properties, which decide on the choice of estimation method. Firstly, as proved by the results of the correlation analysis, the debt ratios are highly persistent. Therefore lagged dependent variable has to be included in the model as one of the explanatory variables [4]. Secondly, the factors affecting capital structure are likely to be endogenous, i.e. correlated with the residuals from previous years [48]. Thirdly, the use of panel data implies two-dimensional residuals, i.e. varying between companies and between observations [43]. Taking into consideration all of the above, the regression model is a dynamic panel data model. According to empirical studies based on both real and simulated data [2, 17], the best estimation method to use in such case is generalized method of moments – Blundell-Bond estimator [5]. The detailed description of the estimator in question can be found in Roodman [43] and Baltagi [4].
The generalized method of moments estimators are sensitive to the validity of instruments and the number of instruments' lags used for estimation. Moreover, the complexity of the estimation method may easily result in invalid estimates [43]. In order to verify the instruments, two tests are used: Arellano-Bond test for autocorrelation of residuals of second order and higher and Sargan test of joint validity of overidentyfying moment conditions [4]. When the robust standard errors are used, Hansen test instead of Sargan test should be performed. Both of the tests enable the researcher to choose the lowest number of instruments for which the estimation results are valid.

RESULTS AND DISCUSSION

In Table 3. there are presented correlation coefficients between current and lagged values of debt ratios. It can be seen that the persistence of total debt ratio is larger than of long-term debt ratio. The correlation for total debt ratio is high up to third lag, moderate for fourth lag, while for lags of five to eight it is low. For long-term debt ratio, the high correlation is observed only for the first lag, while up to fourth lag it is moderate. There is a low correlation between current value of long-term debt ratio and its values lagged by five to eight periods.

Table 3: Correlation coefficients between debt ratios and their lagged values

variable	TDratio	LTDratio
period	t	t
t-1	0.8334	0.6640
t-2	0.6841	0.5179
t-3	0.6145	0.5119
t-4	0.4823	0.4648
t-5	0.3667	0.3581
t-6	0.3450	0.3610
t-7	0.3150	0.3300
t-8	0.2153	0.2007

The next step of the analysis is to assess the magnitude and direction of influence of selected variables on both long-term and total debt ratios. The results are presented in Table 4.

Table 4: Correlation coefficients between debt ratios and lagged capital structure determinants included in the study

variable	TDratio	LTDratio
TDratio	1.0000	
LTDratio	0.6732	1.0000
prof	-0.3007	-0.0936
growth	-0.0846	-0.055
size	0.1869	0.2619
tang	0.0493	0.18
ndts	-0.1941	-0.0913
liq	-0.2493	-0.2232
findef	0.0979	0.034
div	-0.2299	-0.1493
inv	-0.2459	-0.0748
uniq	-0.0425	-0.024
assturn	0.0503	-0.186
tax	-0.0434	-0.0563
risk	-0.0769	-0.1302
indtotal	0.3328	0.2046
indlongterm	0.2173	0.2954

To begin with, the correlation between total debt ratio and long-term debt ratio can be considered high. At the same time, the magnitude of the impact of selected determinants on total and long-term debt ratio differs for all the factors.

In case of both measures of capital structure, industry median debt ratio and size are two the most important factors. For total debt ratio, the correlation with financial deficit, asset turnover and tangibility of assets is also positive, but lower than 0.1. When it comes to long-term debt ratio, it is positively related to tangibility of assets and financial deficit. It should be noted that the importance of tangibility of assets is almost 4 times higher for long-term debt ratio than for total debt ratio.

Moreover, the negative impact on total debt ratio was most pronounced for profitability, liquidity, investments, dividends and non-debt tax shields. Growth opportunities, business risk, tax and uniqueness are also negatively related to total debt ratio, though the magnitude of this relation is small.

For long-term debt ratio, the highest negative impact was observed for liquidity, asset turnover, dividends and business risk. Although the variable in question was also negatively related to profitability, non-debt tax shield, investments, growth and uniqueness, the value of correlation coefficient for these factors was visibly lower.

In order to assess the impact of multiple determinants on capital structure, the regression analysis is used. The regression models are estimated with Blundel-Bond [5] estimator, with forward orthogonal deviations transformation [43] and with robust standard errors. There were four models estimated: A and B with total debt ratio as a dependent variable and C and D with long-term debt ratio as dependent variable. All the models include years' fixed effects (not reported). The instruments used in estimation of all models are of second to fourth order. Models A and C include all the variables taken into consideration in this study. Model B, explaining total debt ratio, includes only those independent variables, for which the magnitude of correlation coefficient (reported in Table 4.) exceeds 0.1, i.e. profitability, size, non-debt tax shield, liquidity, dividends, investments and industry. Model D, explaining long-term debt ratio, includes only those independent variables, for which the magnitude of correlation coefficient (reported in Table 4.) exceeds 0.1, i.e. size, tangibility of assets, liquidity, dividends, asset turnover, business risk and industry. Estimates of the parameters (upper lines) with their standard errors (lower lines), together with the results of Arrelano-Bond test, Sargan test and Hansen test (with significance levels in brackets) are presented in Table 5.

Table 5: Regression models estimates for total debt ratio (model A, model B) and long-term debt ratio (model C, model D)

Variable	Model A	Model B	Model C	Model D
TDratio	0.7772***	0.7831***		
	0.0460	0.0366		
LTDratio			0.6549***	0.6761***
			0.0449	0.0487

Variable	Model A	Model B	Model C	Model D
prof	-0.1458***	-0.1502***	-0.0665*	
	0.0361	0.0538	0.0376	
growth	-0.0004		-0.0003	
	0.0016		0.0013	
size	0.0048	-0.0023	0.0070*	0.0013
	0.0052	0.0041	0.0041	0.0048
tang	-0.0196		0.0172	0.0229
	0.0282		0.0277	0.0266
ndts	-0.3501*	-0.2673*	-0.0455	
	0.1962	0.1602	0.1279	
liq	-0.1065	-0.1144**	-0.0859**	-0.1014*
	0.0689	0.0495	0.0435	0.0556
findef	0.0006		-0.0005	
	0.0018		0.0023	
div	-0.0632	0.0817	-0.1826	-0.2821**
	0.1603	0.1516	0.1367	0.1322
inv	0.1584	0.0489	-0.0214	
	0.1121	0.1095	0.1072	
uniq	-0.0314		-0.0058	
	0.0264		0.0234	
assturn	0.0159		-0.0008	-0.0110
	0.0073**		0.0073	0.0111
tax	-0.0015		0.0013	
	0.0020		0.0024	
risk	-0.0211		-0.0379	-0.0585
	0.0347		0.0379	0.0344
indtotal	-0.0221	-0.0524		
	0.0612	0.0559		
indlongterm			0.0412	0.0152
			0.0680	0.0719
constant		0.0480		-0.0147
		0.0614		0.0731
N	3072	3094	3072	3079
number of instruments	624	337	624	337
Arellano-Bond test for AR(1)	-8.72 (0.000)	-9.09 (0.000)	-7.50 (0.000)	-7.43 (0.000)
Arellano-Bond test for AR(2)	0.77 (0.440)	0.65 (0.513)	0.76 (0.449)	0.87 (0.384)
Arellano-Bond test for AR(3)	1.27 (0.204)	1.32 (0.186)	0.75 (0.454)	0.55 (0.580)
Arellano-Bond test for AR(4)	-0.78 (0.437)	-0.91 (0.364)	-0.10 (0.922)	0.04 (0.970)
Sargan test	800.28 (0.000)	456.12 (0.000)	862.52 (0.000)	487.84 (0.000)
Hansen test	0.00 (1.000)	321.89 (0.367)	358.65 (1.000)	328.70 (0.273)

significance of parameters: * - 0.01, ** - 0.05, * - 0.1.**

All models presented in the table above suffer from autocorrelation of first order, as the Arrelano-Bond test for AR(1) points out. For this reasons, as instruments in the study were used values of independent variables lagged by 2 and more periods. Moreover, Hansen test of overidentifying restrictions proves that neither model A, nor C, which include all variables chosen for this study, can be considered properly specified (suggesting that the number of instruments is too large). It should be noted that changes in the maximum lag of instruments did not change the conclusion of Hansen test. As a consequence, the parameter estimates for models A and C are presented in the Table 5. only for the purpose of comparison. Estimates obtained for models B and D, which included a smaller set of

independent variables, were properly specified according to the results of Hansen test.

The dependent variable in model B is total debt ratio, while the independent variables are: lagged dependent variable, profitability, size, non-debt tax shield, liquidity, dividends, investments and industry median debt ratio. Among these factors, profitability, non-debt tax shield and liquidity have a significantly negative impact on total debt ratio, while lagged total debt ratio has a positive influence on the dependent variable. The negative impact of profitability on total debt ratio is in line with the predictions of pecking order theory, but contrary to the predictions of trade-off theory. At the same time, the negative impact of non-debt tax shield and liquidity supports the trade-off theory. The negative impact of profitability and liquidity confirms the results of the previous studies.

The set of determinants proved to impact total debt ratio is similar in model B as it is for model A: the highest parameter estimate is reported for lagged dependent variable and non-debt tax shield, followed by profitability and liquidity. According to model A asset turnover had also positive, significant impact on dependent variable, though it was omitted in model B as the correlation coefficient for this variable was lower in magnitude than 0.1.

As far as long-term debt ratio is concerned, model D suggests that it is positively influenced by lagged dependent variable. There is also a significant negative impact of dividends, liquidity and business risk on long-term debt ratio. The negative influence of liquidity on long-term debt ratio supports the trade-off theory and is in line with the results of the empirical research. According to the pecking order theory, dividends should have positive impact on debt ratios, which is not confirmed by this study. The negative impact of business risk on long term debt ratio is in line with the predictions of both theories and with the previous research.

According to model C, which includes all the explanatory variables, profitability has significantly negative influence on long-term debt ratio, while size has a significantly positive impact on the dependent variable. However, profitability was omitted in model D, while size lost its statistical significance. Moreover, in model D, dividends and business risk were not statistically significant. For model D, the highest magnitude of impact is reported for lagged total debt ratio and dividends, followed by liquidity and business risk.

To summarize, total debt ratio is positively influenced by its lagged values, while negatively by profitability, non-debt tax shield and liquidity. For long-term debt ratio, the impact of lagged dependent variable is found to be positive, while the impact of dividends, liquidity and business risk – negative. It should be underlined that although preliminary analysis of correlation suggested similar hierarchy of capital structure determinants for both total debt ratio and long-term debt ratio, the regression analysis proves that there are significant differences between the sets of factors affecting these two measures of capital structure.

CONCLUSIONS

To conclude, it should be said that the determinants of total debt ratio for companies listed on Warsaw Stock Exchange are not the same as for the long-term debt ratio. The most important factor influencing the debt ratio is lagged value of dependent variable, which was confirmed by both correlation and regression analysis and for both measures of capital structure. The regression model estimated with generalized methods of moments estimator suggests that profitability, non-debt tax shield and liquidity have negative impact on total debt ratio, whereas long-term debt ratio is negatively influenced by liquidity and dividends. The negative impact of profitability and liquidity is in line with the predictions of the pecking-order theory, while the negative impact of non-debt tax shield supports the predictions of trade-off theory. The negative impact of dividends on long-term debt ratio is against the findings of previous research and not in line with the predictions of the pecking order theory. Therefore this determinant may require further attention.

The main limitation of this study is that it focuses only on companies listed in Poland. Moreover, not all the factors suggested in previous studies were included, as well as only one measure of each factor was chose. Therefore it would be advisable not only to compare the set of factors affecting capital structure for different countries and industries, but also to verify the sensitivity of results depending on the determinants' operationalization.

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