

INTER- AND INTRA-INDUSTRY VARIATIONS OF CAPITAL STRUCTURE IN THE CZECH MANUFACTURING INDUSTRY

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Abstract

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The objective of the paper is to investigate the existence of inter-industry variations in the capital structure of enterprises of the Czech manufacturing industry and to identify the intra-industry causes of these differences. Three measures of capital structure are employed to determine the inter-industry variations. These are total debt ratio, long-term debt and short-term debt ratios. The set of explanatory variables is included to clarify the intra-industry variations. These explanatory variables are size, asset structure, asset utilization, profitability, non-debt tax shield and growth. The paper reports the analysis of capital structure of five distinctive industrial branches, namely the manufacture of beverages, the manufacture of textiles, the manufacture of paper and paper products, the manufacture of chemicals and chemical products, and the manufacture of computer, electronic and optical products. The data come from the financial statements of selected companies and cover a period from 2008 to 2012. The analysis of variance, correlation and regression analyses are used to develop the statistical framework. The paper aims to study the impact of industry and firm characteristics on capital structure choice.

capital structure, leverage, determinants of capital structure, manufacturing industry, industry effect

An investigation of factors determining the corporate capital structure is one of the most crucial issues in the field of financial management. Many academic studies on capital structure determinants have been dedicated to the role of internal firm characteristics; however, the question of industry is usually neglected.

The two most relevant theories in this domain make opposite predictions regarding the industry effects on capital structure choice¹. The static trade-off theory states that there is an optimal debt ratio. The acceptance of the theory would imply that firms tend to achieve industry averages as target ratios. Consequently, the comparison of firms within the same industry could improve corporate financial

decision-making. On the contrary, the pecking order theory suggests that firms have a particular preference order to finance their activities. This would mean that industry averages are not so relevant in the process of capital decision making.

The necessity to understand a relationship between industry and capital structure appears to be more urgent if there exists an optimal capital structure, which maximizes the value of the firm. Hence, the paper seeks to investigate the existence of inter-industry variations in the capital structure of enterprises of the Czech manufacturing industry and attempts to identify the intra-industry causes of these differences.

¹ For more information about the capital structure theories see Modigliani and Miller (1958), Jensen and Meckling (1976) or Myers (1984).

As it has been already mentioned, the majority of studies are concerned with the role of industry only marginally. More specifically, this factor is usually included as a dummy variable for regression analysis.

Similarly to theoretical expectations, the empirical findings are ambiguous. Some scientific papers (e.g. Hatfield, Cheng and Davidson, 1994; Cassar and Holmes, 2003) support the perspective of Myers (1984), declaring that corporate capital structure does not follow industry standards and is dependent on the financing needs of the firm. Nevertheless, there are also studies that indicate that industry affects the capital structure choice (Harris and Raviv, 1991; Michaelas *et al.*, 1999; MacKay and Phillips, 2005; Váradi, 2011).

To authors' best knowledge, the number of studies examining the corporate capital structure in the Czech Republic is even more limited (e.g. Krauseová, 1995; Svoboda, 2012). With regard to the factor of industry, Landa and Martinovičová (2010) have observed a tendency to equity utilization within different branches of manufacturing industry; however, significant differences in internal structure of capital have been proved.

METHODS AND RESOURCES

The sample population is consisted of enterprises from five distinctive manufacturing industries. The sampling period is 2008 to 2012. All the data utilised in the study have been gathered from the Amadeus database.

The enterprises in the population are in the legal form of private limited or public limited company. Both of the required financial statements (i.e. the profit and loss statement and the balance sheet statement) have to be submitted in each year of the sampling period. All enterprises in the sample fulfil the criteria of medium-sized enterprises according to the European Commission Recommendation (2003/361/EC).

The industries have been defined according to the statistical classification of economic activities in the European Community – the NACE classification. Five distinctive industrial branches have been selected to be analysed. These are:

- NACE 11 – Manufacture of beverages;
- NACE 13 – Manufacture of textiles;
- NACE 17 – Manufacture of paper and paper products;
- NACE 20 – Manufacture of chemicals and chemical products;
- NACE 26 – Manufacture of computer, electronic and optical products.

In total, the data comprised 1 152 enterprises. The cases with incomplete entries were excluded from the study. The random sample of 250 enterprises has been taken (i.e. fifty enterprises for each of the industrial branches).

Three basic statistical tools are used for empirical analysis. These are the analysis of variance, correlation analysis and regression analysis. Analysis of variance has been used to verify the significant differences in capital structure across distinctive industry groups. The correlation analysis and regression analysis have been used to determine the significant variables influencing the capital structure. In some aspects, the study adapts the methodology by Michaelas *et al.* (1999).

Estimation of explanatory and dependent variables

Due to data limitations, all the variables used in the study are based on book values. The following variables are defined in order to explain the intra-industry variations in capital structure.

- **Asset structure** (abbr. TANG) – the ratio of fixed assets to total assets (following the studies by Hall *et al.*, 2004; Feidakis and Rovolis, 2007; Mazur, 2007).
 - **Size** – the logarithm of total assets (Bauer, 2004; Feidakis and Rovolis, 2007; Mazur, 2007).
 - **Profitability** – the ratio of earnings before interest and taxes to total assets (Bauer, 2004).
 - **Non-debt tax shield** (abr. NDTs) – the ratio of depreciation charges to total assets (Michaelas *et al.*, 1999; Bauer, 2004; Gurcharan, 2010).
 - **Asset utilization** (abbr. UTIL) – the ratio of sales to total assets (Feidakis and Rovolis, 2007).
 - **Growth** (abbr. GRW) – the ratio of long-term investments to total assets (Mazur, 2007).
- For the purposes of the study, the capital structure is defined as the ratio of the debt to total assets. The long term debt and short term debt are also considered separately. Hence, the following leverage measures are analysed:
- **Long-term debt ratio** (abbr. LTD) – the ratio of long-term debt to total assets.
 - **Short-term debt ratio** (abbr. STD) – the ratio of short-term debt total assets.
 - **Total debt ratio** (abbr. TD) – the ratio of total debt to total assets.

RESULTS AND DISCUSSION

The summary figures for three leverage measures are provided in Tab. I. The mean (median) long-term leverage of the whole sample is 11.7% (2.7%). The mean (median) short-term leverage is 36.4% (31.6%). It emphasizes the importance of short-term debt in the capital structure, since a number of enterprises do not use long-term debt at all. This fact highlights the necessity to distinguish between long-term and short-term debt ratios.

The analysis of variance has been applied to see the differences in capital structure of particular industrial branches using various measures of leverage. The null hypothesis to be verified is that the companies from different industrial branches have the same leverage structure. The test was

I: Summary statistics of debt ratios

	Debt ratio (%)	Mean	Median	Min.	Max.	Std. Dev.
NACE 11	LTD	14.55	5.24	0.00	104.13	20.96
	STD	37.92	33.04	1.91	127.09	28.59
NACE 13	LTD	11.78	1.40	0.00	113.16	19.82
	STD	33.77	25.03	-19.82	164.09	31.41
NACE 17	LTD	14.98	10.78	0.00	102.40	16.96
	STD	42.20	37.28	-26.34	179.43	29.00
NACE 20	LTD	8.76	1.73	0.00	62.79	14.18
	STD	35.83	32.49	0.92	97.19	22.32
NACE 26	LTD	7.62	0.70	0.00	84.88	14.21
	STD	33.81	27.30	-79.45	122.93	32.55

Source: Authors' calculations

II: Analysis of variance results

	Debt ratio	NACE 13	NACE 17	NACE 20	NACE 26	Total
NACE 11	LTD	1.005 (0.317)	0.029 (0.865)	5.704 (0.018)	8.161 (0.005)	
	STD	1.038 (0.309)	1.203 (0.274)	0.361 (0.548)	0.980 (0.323)	
	TD	2.326 (0.129)	1.307 (0.254)	4.062 (0.045)	5.846 (0.016)	
NACE 13	LTD		1.649 (0.200)	1.673 (0.197)	3.170 (0.076)	
	STD		4.233 (0.041)	0.311 (0.578)	0.000 (0.993)	
	TD		7.498 (0.007)	0.057 (0.812)	0.777 (0.379)	
NACE 17	LTD			8.648 (0.004)	12.082 (0.000)	
	STD			3.300 (0.071)	4.034 (0.045)	
	TD			12.428 (0.001)	13.544 (0.000)	
NACE 20	LTD				0.351 (0.553)	
	STD				0.286 (0.594)	
	TD				0.603 (0.438)	
Total	LTD					3.945 (0.004)
	STD					1.601 (0.173)
	TD					4.640 (0.001)

Source: Authors' calculations

Notes: F ratio (*p*-value)

performed repetitively for each of analysed leverage measures. As far as short-term debt ratios are concerned, the null hypothesis cannot be rejected, which would mean that there do not exist significant differences in short term leverage of observed groups. However, in case of total leverage and long term leverage, the null hypothesis was rejected and the alternative accepted. This result signifies that there are differences in capital structure across the firms from different industrial branches. Similarly, the method has been repeated for each pair of industrial branches. The overall results of are given in Tab. II.

According to Hutchinson (2003), the differences in capital structure due to industry effects are more typical for small and medium sized enterprises, since majority of them tend to be undifferentiated. On the basis of our results, this statement cannot be confirmed. In five instances, the firms have similar capital structure (namely manufacture of beverages and manufacture of textiles, manufacture

of beverages and manufacture of paper *et al.*, manufacture of textiles and manufacture of chemicals *et al.*, manufacture of textiles and manufacture of computer *et al.*, manufacture of chemicals and manufacture of computer *et al.*). Only in one occurrence, there was difference in all three capital measures (i.e. manufacture of paper *et al.* and manufacture of computer *et al.*). In other four cases the differences emerged either in long-term debt ratios or in short-term debt ratios. More in detail, it was the long-term leverage differences in three out of four cases.

The correlation and regression analyses have been performed to specify the variables influencing the capital structure. These variables could potentially impact the dissimilarities in average capital structure of various industrial branches. The results of Pearson's correlation analysis are summarized in Tab. III. The values of correlation coefficient, together with the results of the significance test, are presented.

III: Results of Pearson's correlation analysis

	Debt ratio	TANG	SIZE	PROF	NDTS	UTIL	GRW
NACE 11	LTD	0.371 (S)	0.092 (I)	-0.220 (S)	0.144 (S)	-0.228 (S)	-0.141 (I)
	STD	-0.388 (S)	-0.292 (S)	-0.064 (I)	0.017 (I)	0.320 (S)	-0.004 (I)
	TD	-0.101 (I)	-0.197 (S)	-0.198 (S)	0.107 (I)	0.134 (I)	-0.094 (I)
NACE 13	LTD	0.325 (S)	0.113 (I)	0.168 (S)	-0.019 (I)	-0.111 (I)	-0.105 (I)
	STD	-0.100 (I)	-0.358 (S)	-0.331 (S)	-0.020 (I)	0.111 (S)	-0.180 (I)
	TD	0.096 (I)	-0.263 (S)	-0.207 (S)	-0.026 (I)	0.292 (S)	-0.225 (S)
NACE 17	LTD	0.458 (S)	0.264 (S)	-0.171 (I)	0.361 (S)	-0.361 (S)	0.004 (I)
	STD	-0.334 (S)	-0.292 (S)	-0.285 (S)	-0.088 (I)	0.353 (S)	-0.057 (I)
	TD	-0.068 (I)	-0.141 (I)	-0.398 (S)	0.127 (I)	0.145 (S)	-0.057 (I)
NACE 20	LTD	0.451 (S)	0.083 (I)	-0.191 (S)	0.168 (S)	-0.259 (S)	-0.130 (I)
	STD	-0.265 (S)	-0.387 (S)	-0.216 (S)	-0.010 (I)	0.428 (S)	0.123 (I)
	TD	0.020 (I)	-0.305 (S)	-0.308 (S)	0.088 (I)	0.240 (S)	0.037 (I)
NACE 26	LTD	0.460 (S)	0.183 (S)	-0.160 (S)	-0.025 (I)	-0.132 (I)	-0.115 (I)
	STD	-0.278 (S)	-0.118 (I)	-0.173 (S)	-0.105 (I)	0.244 (S)	-0.112 (I)
	TD	-0.072 (I)	-0.035 (I)	-0.227 (S)	-0.109 (I)	0.175 (S)	-0.152 (I)

Source: Authors' calculations

Notes: Significance test was performed at 5% level. Statistically significant values are marked by "S", statistically insignificant values are marked by "I".

Tab. IV presents the results of regression analysis testing the relationship between the explanatory variables and long-term debt ratios for all considered industry groups. The values of determination coefficients vary from 0.407 to 0.632, in dependence on the industry group. The lowest value has been achieved in the manufacture of beverages, the highest value in the manufacture of paper and paper products. The value of coefficient of determination 0.632 suggests that 63.2% of the variation in long-term debt can be explained by the variation in asset

structure, size, profitability, non-debt tax shield, asset utilization and growth.

Tab. V reports the regression analysis results relating to short-term debt ratios. Similarly to case of the long-term debt regression, the highest value of determination coefficient was recorded for the manufacture of paper and paper product; the lowest value occurred in the manufacture of beverages. The total values vary from 0.520 to 0.648.

With regard to these results, it can be concluded that the regression models for short-term debt ratios give better prediction ability. As Mazur (2007) points

IV: Regression analysis results for long-term debt

	(Constant)	TANG	SIZE	PROF	NDTS	UTIL	GRW
NACE 11	-0.132	0.279**	0.019	-0.197	0.495	0.004	0.002
NACE 13	-0.400	0.438*	0.061	0.319**	-1.063	0.027	-0.001
NACE 17	-0.021	0.251**	0.007	-0.120	1.907*	-0.043**	0.004**
NACE 20	0.408	0.295**	-0.063	-0.061	-0.153	-0.013	0.001
NACE 26	-0.025	0.279*	0.011	-0.217**	-0.478*	-0.009	-0.000

Source: Authors' calculations

Notes: * Statistically significant at 1% level, ** statistically significant at 5% level.

V: Regression analysis results for short-term debt

	(Constant)	TANG	SIZE	PROF	NDTS	UTIL	GRW
NACE 11	1.082**	-0.390*	-0.086	-0.494**	-0.578	0.107	-0.013*
NACE 13	1.908*	0.127	-0.264**	-0.904*	-2.525*	0.141**	-0.003*
NACE 17	1.032	-0.122	-0.098	-1.191*	-1.330	0.132*	-0.006*
NACE 20	1.448**	-0.055	-0.179**	-0.512	-0.509	0.110**	0.001
NACE 26	0.153	-0.538*	0.072	-1.133*	-1.171*	0.046*	-0.003**

Source: Authors' calculations

Notes: * Statistically significant at 1% level, ** statistically significant at 5% level.

out, the obtained values of determination coefficient do not seem satisfactory from statistical viewpoint. Nevertheless, they are fully comparable with the results of previous studies (see Hall, Hutchinson and Michaelas, 2004; Mazur, 2007).

Asset structure (Tangibility)

Tangibility is positively related to long-term debt and negatively related to short-term debt in all of selected branches. This is in accordance with the maturity matching principle, as suggested by Bevan and Danbolt (2002). Long-term debt is mainly utilized for funding of long-term assets; short-term debt is used for financing of short-term assets. The same finding has been observed in numerous other studies, for example, Michaelas *et al.* (1999), Hall *et al.* (2004), Feidakis and Rovolis (2007). Moreover, the results for long-term leverage confirm the expectations raised by the trade-off theory. Fixed assets are used as collateral in external borrowing that moderate agency and information asymmetry costs (see Jensen and Meckling, 1976; Myers and Majluf, 1984). Hence, fixed assets can support a higher level of long-term debt in a firm's financial structure.

Size

Size exerts a positive effect on long-term leverage and a negative effect on short-term and total leverage. The outcomes are analogous for all observed branches. The negative relationship between size and total debt demonstrates that larger enterprises favour equity funding over debt. The positive effect on long-term leverage indicates that large enterprises, compared to small businesses, have more opportunities to acquire long-term debt. It can be explained mainly by two reasons. Firstly, outside lenders are better informed about large firm's activities. This is known as the information asymmetry theory (see Myers and Majluf, 1984). Secondly, more diversified activities of large companies reduce the relative costs of bankruptcy and the probability of bankruptcy. Since size is positively correlated with long-term debt and negatively correlated with short-term debt, it can be inferred that debt maturity influences the character of relationship. Larger enterprises prefer long-term debt financing to short-term debt financing.

Profitability

With the exception of one outcome, all other show a negative correlation between profitability and considered measures of capital structure. This is consistent with the suggestions of the pecking order theory, which presumes that profitable enterprises prefer internal to external sources of financing (Myers and Majluf, 1984). The findings have been also supported by most empirical studies (e.g. Michaelas *et al.*, 1999; Bevan and Danbolt, 2002; Mazur, 2007).

Non debt tax shield

Regarding the relationship between capital structure and non-debt tax shield, the results show rather ambiguous effects across industries. Moreover, the obtained relationships are mostly statistically insignificant. This collaborates with the findings of Michaelas *et al.* (1999).

Asset utilization

Asset utilization is positively associated with short-term debt as well as total debt. Nevertheless, the relationship between asset utilization and long-term debt is negative. It can be concluded that the more effectively the company utilizes the assets, the less long-term debt is employed. If needed, the more efficient companies prefer short-term debt to long-term debt. This finding is in line with Feidakis and Rovolis (2007).

Growth

As far as growth is concerned, the results generally indicate a negative impact of growth on all capital structure measures. Nevertheless, these outcomes are statistically insignificant, which is consistent with other studies (e.g. Mazur, 2007). Even the change in measurement does not impact the results.

The overall outcomes of the study have proved that effects of potential determinants on leverage ratios do not vary across industrial branches. This finding is in disagreement with the research of Hall *et al.* (2000) or Michaelas *et al.* (1999). The heterogeneity between industries may be driven by other aspects, such as the industry competition or the degree of agency conflicts (Degryse, 2012). These industry characteristics seem to have bigger effects on capital structure variations than firm characteristics.

CONCLUSIONS

The present study aimed to explore two basic questions. Firstly, if there are any substantial differences in corporate capital structure across distinctive industrial branches. Secondly, what the causes of these differences are (i.e. firm and/or industry characteristics).

Three different leverage measures have been applied, namely total debt ratio, long-term debt ratio and short term debt ratio. The empirical results are rather ambiguous. They have not unequivocally confirmed if significant differences in capital structure across different industrial branches exist. Thus, the study does not verify the assumption that medium-sized enterprises are more prone to industry variations.

Four significant determinants of capital structure have been identified, namely size, profitability, asset structure and asset utilization. Non debt tax shield and growth are not significantly related to capital structure measures. Asset structure is negatively associated to long-term debt and positively to short term debt. This result indicates that companies tend to combine the maturity of assets with the maturity of sources used to finance them. Size is positively associated with long-term debt and negatively with short-term and total debt. It suggests that bigger companies give preference to equity financing, then to long-term debt financing and last to short-term debt financing. The negative association between

profitability and leverage implies that profitable firms prefer internal to external funding.

A highly interesting finding in the study is that the direction of relationship between variables is the same across the analysed industrial branches. Moreover, the results have highlighted the importance of distinguishing between long-term and short-term debt ratios, since the nature of relationship between determinants of capital structure and debt ratios is influenced by the choice of debt ratio. The use of total debt hides the contradictory effects of long-term and short-term debt capital.

Based on the regression analysis, it can be argued that the determinants of firm leverage do not differ in dependence on industrial branches, the effect on leverage remains stable. This seems to be the most relevant result of the paper, since it suggests that a significant part of capital structure variations is due to internal firm characteristics. Furthermore, this result is in agreement with the findings of pecking order theory.

There exist limitations to this study that might be considered in future research. The detailed analysis of long-term and short-term debt components, as well as the consideration of industry characteristics, should be performed for better understanding of determinants of capital structure and capital structure choice.

SUMMARY

The objective of the paper is to investigate the existence of inter-industry variations in the capital structure of enterprises of the Czech manufacturing industry and to identify the intra-industry causes of these differences. In other words, it aims to examine the extent to which the industry-specific factors influence the corporate capital structure and to examine how the relationship between the capital structure and capital structure determinants varies across the industries.

The sample consists of 250 companies within the period of 2008 to 2012. Five distinctive industrial branches have been analysed (the manufacture of beverages, the manufacture of textiles, the manufacture of paper and paper products, the manufacture of chemicals and chemical products, and the manufacture of computer, electronic and optical products). For the purposes of the paper, the analysis of variance, the correlation analysis and the regression analysis have been applied.

The empirical evidence suggests that asset structure, asset utilization, profitability and size are important influences in determining the capital structure choice. Non-debt tax shield and growth seem to be insignificant variables. Long-term debt is positively related to asset structure and size, and negatively related to profitability and asset utilization. Short-term debt is negatively associated with asset structure, size, and profitability; it is positively associated with asset utilization. The effect of capital structure determinants is identical across all analysed industrial branches and it is highly dependent on the choice of leverage measure. Neither the existence nor the non-existence of inter-industry differences in the capital structure has been proved.

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