

# **The role of financial factors interactions in the capital structure determination**

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Our research is aimed to explore the statistical relationship between the firm's capital structure and various indicators characterizing the financial state of the firm, to summarize good or bad practice of financial management.

The main idea is that might it is interaction between financial characteristics of any company that plays significant role in the capital structure choice. That is various combinations of their values might determine the set of statistically significant determinants of capital structure choice and the direction of their impact.

Results of research of such kind may depend on the branch and the period of time. The comparison of practice of financial management in different branches is the theme of our future research. In this one we planned to check our idea only. We used statistics from the database Ruslana (Bureau Van Dijk) for 2013 — 2011 years about companies from automobile retail according to the NACE revision 2.0 codes: the cars sale (code 4511), the cars maintenance and reconditioning (code 4520), the sale of spare car parts (code 4531), the sale of motorcycles and motorcycle spare parts (code 4540). In summary, there were 1620 financial statements extracted from database. Further, cleaning of data was performed. There were removed organizations with non-positive values of — revenue, retained earnings, profit before tax, net profit and book value of assets in current and preceding years. Also organizations were removed with negative long-run and short-run obligations in current and preceding years. The reason was that such data is a mistake or, if it is correct, in our opinion, such companies can't control capital structure because don't have internal sources of financing. Finely, 971 organizations were presented on the analysis.

The main instrument of research here is statistical modeling, in which some measure of capital structure is considered as response or dependent variable and some group of financial indicators are considered as independent variables or predictors. The model which may be built will represents the statistical relationship between the response variable and predictors and thus accumulate current practice of corporate finance management.

Linear regression and related techniques are traditional instruments of modeling in researches of capital structure determination. In most cases researchers use some kind of regression (linear, panel, dynamic and so on) of the capital structure measure on the set of financial indicators to test theoretical hypothesis. One of the hard problems here is the choice of regression model functional form. We avoided it

by the usage of regression trees — the instrument of statistical modelling which has a lot in common with linear regression, but doesn't require preliminary definition of functional form. Also we used the regression model with structural change to explore the difference between sets of determinants of capital structure choice in various segments of selected branch.

Traditionally properties of the above mentioned models may be interpreted as arguments in favor of one of two main hypotheses in the corporate finance — pecking order and trade-off theories. Without going into details the question is what theory is true. Researches of such kind have already been presented in the lot of publications but scientists haven't got the unique answer yet. There is a feeling that it cannot be obtained. We think that it'll be more effective to analyze the broader issue — if the strength and the direction of statistical relationship between capital structure measures and above mentioned financial indicators depend on the values of these indicators. That is, if different combinations of these indicators values lead to the different principals of capital structure determination. If we solve this problem the test of above mentioned hypothesis will might be done as byproduct of such research. The expected result is obvious much broader. The roadmap is following. We choose several traditional metrics as measures of capital structure and several financial indicators that are traditionally used in the corporate finance as possible determinants of capital structure. Within a chosen industry we attempted to allocate sets of companies (segments of industry) that possess three important properties:

- they are similar in some sense, i.e. some financial indicators from the selected set takes close values
- they have close capital structure
- each of the above mentioned set of companies has its own set of statistically significant capital structure determinants, that are different for different sets of companies, but may intersect.

In this research we define capital structure as the ratio of sources of financing that includes the long-term debt (e.g. long-term credits), the short-term debt (e.g. short-term credits) and equity. There may be various measures of the capital structure, which will reflect various features of it. Meaningful results for our statistics about the selected branch have been got for the TDRA measure of capital structure — the ratio of the total liabilities to the carrying amount of assets. The list of factors that might has significant impact on the capital structure and there measures are well defined in the rich literature about the capital structure choice.

Table 1 contains the list of potential determinants of capital structure choice and corresponding hypothesis. We use values of these factors for two consecutive years (2012 and 2013). It might seem strange, that we include in the model financial indicators for the current year — the year when dependent variable is measured. Financial manager of course doesn't know values of these factors when he makes decisions, which affect the capital structure of the company. But his decision is largely grounded on his expectations about future values of important financial indicators. So we include current values of them as

measures of expectations of financial manager.

Name	Way of settlement
Measures for collateral value of assets	
Intas	The ratio of the book value of intangible assets to the total value of assets
Tas	The ratio of the sum of the book values of tangible assets and the stocks to the total value of assets
Tasm	The ratio of the book value of tangible assets to the total value of assets
Measures for growth	
Capex	The ratio of the change for the year the book value of tangible assets to the book value of total assets in the former year
Dtas	The ratio of the change for the year the book value of total assets to the book value of total assets in the former year
Quit	The ratio of the change for the year the number of employees to the number of employees in the former year
Rev	The ratio of the change for the year the book value of revenue to the book value of revenue in the former year
Measures for uniqueness	
Selexp	The ratio of the book value of business expenses to the book value of revenue
Measures for size	
Size	Logarithm of book value of revenue
Sizea	Logarithm of book value of total assets
Eurosize	<ul style="list-style-type: none"> <li>• Very large companies (operating revenue <math>\geq</math> 100 million EUR, total assets <math>\geq</math> 200 million EUR, employees <math>\geq</math> 1,000)</li> <li>• Large companies (operating revenue <math>\geq</math> 10 million EUR, total assets <math>\geq</math> 20 million EUR, employees <math>\geq</math> 150)</li> <li>• Medium sized companies (operating revenue <math>\geq</math> 1 million EUR, total assets <math>\geq</math> 2 million EUR, employees <math>\geq</math> 15)</li> <li>• Small companies – all others.</li> </ul>
Measures for profitability	
Profa	The ratio of the book value of profit on sales to the book value of revenue
Profb	The ratio of the book value of profit on sales to the book value of total assets
Profc	The ratio of the book value of net income to the book value of total assets
Profd	The ratio of pre-interest after-tax earnings to the book value of total assets.
Additional variables	
Tax	The ratio of the book value of tax on profits to the book value of profit before tax
Intp	The ratio of the book value of interest paid to the book value of gross debt.
Legfor	Legal form of firm.
Type	Joint-stock or private company.

Table 1. Factors potentially influencing the capital structure

Meaningful results have been got for TDRA measure of capital structure for all companies. Six independent variables were selected by the tree building algorithm and the subsequent pruning as significant: dtas (2013 year) , profb (2012 year), profb (2013 year), profc (2012 year), profc (2013 year), selexp (2013 year). Table 3 contains description of all regression tree leafs. Dependent variables are placed in order of splitting.

Level of splitting	1	2		3		4		Cardinality	Ave{TDRA}
	profc11	profb12	profc12	dtas12	selexp12	profb11	selexp12		
Leaf 1	$\geq 0.068$	$\geq 0.18$						108	0.38
Leaf 2	$\geq 0.068$	$< 0.18$		$< 0.34$			$< 0.0024$	22	0.31
Leaf 3	$\geq 0.068$	$< 0.18$		$< 0.34$			$> 0.0024$	191	0.54
Leaf 4	$\geq 0.068$	$< 0.18$		$> 0.34$				74	0.72
Leaf 5	$< 0.068$		$\geq 0.046$					93	0.66
Leaf 6	$< 0.068$		$< 0.046$		$< 0.0002$	$< 0.0036$		13	0.39
Leaf 7	$< 0.068$		$< 0.046$		$< 0.0002$	$\geq 0.0036$		39	0.75
Leaf 8	$< 0.068$		$< 0.046$		$\geq 0.0002$			431	0.84

Table 3. Leafs of the regression tree.

It can be mentioned that profitability in preceding year plays the most important role in capital structure definition for companies in the chosen branch. It's natural, because if financial manager makes decision which should optimize (in some sense) capital structure, he'll first of all take into account preceding financial result of his organization. At the same time he may only predict the result of current year.

On the first level of splitting the algorithm of tree building divide sample into two subsamples. The first group (leafs with numbers from one to four, Table 3) can be named "Previously More Profitable" (PMP). It contains 41% of common sample set. The second one (leafs with numbers from five to eight) can be named "Previously Less Profitable" (PLP). We cannot say, that former have necessarily smaller average proportion of liability in capital then latter or vice versa. Comparison of TDRA mean values from this two groups of firms on the basis of nonparametric Kruskal – Wallis criterion let us state that mean value in former group less than one in latter group at the significance level less than 1%. It's argument in favor of pecking-order theory, but only at an average.

First, it can be mentioned, that the largest leaf in PLP (leaf number eight) has the largest average proportion of debt in capital. It follows from Table 3 that firms from this group didn't expect high profitability in current year but expect relatively high level of business expenses. It might make such firms to borrow more. It's argument in favor of pecking-order theory.

Second, firms from PMP which expect less level of profitability (leafs with numbers from three to four) have larger average proportion of debt in the capital. One can mention that firms in the leaf number three expected relatively high level of business expenses in current year, so they might want to compensate

for that. In comparison with firms from leaf number two, which expect lower level of business expenses, these firms have larger proportion of debt in their capital. In turn firms which belong to the leaf number four have high velocity of growth and it could be reason to have larger proportion of debt in the capital. The expectation of low level of profitability and the need to finance growth resulted in searching external sources of financing. It can be suggested, that possible asymmetry of information in such conditions makes them unattractive for investors and leads to very high proportion of debt in their capital. One can compare this firms with firms from leafs two and three that have lower velocity of growth and lower proportion of debt. It supports pecking-order theory.

So it can be stated that there are a lot of facts in favor of pecking-order theory for that branch and period of time on the basis of regression tree model. As was mentioned above the significant advantage of regression tree is including the interaction of variables. It follows from Table 3, that growth rate impact the capital structure only for PMP firms. Business expenses have same importance for capital structure for PLP firms. It has a little less impact on capital structure for PMP firms.

Finally, we estimated the model  $y(x) = \sum_{k=1}^n a_k I_{S_k}(x_k) + \sum_{j=1}^n \sum_{k=1}^m b_k I_{S_j}(x_k) x_k + v(x)$ , where

$$I_A(x) = \begin{cases} 1, & x \in A \\ 0, & x \notin A \end{cases}. \text{ It takes into account the possibility that values of independent variables coefficients}$$

might be different in different tree leafs. The results in the Table 4.

	leaf_1	leaf_2	leaf_3	leaf_4	leaf_5	leaf_6	leaf_7	leaf_8
(Constant)	0,37 *** (,035)	0,25 *** (,097)	0,66 *** (,035)	0,91 *** (,056)	0,72 *** (,060)	0,05 ** (,083)	0,74 *** (,058)	0,90 *** (,016)
profc11	-0,01 (0,24)	-0,89 (0,55)	-0,24 (0,40)	-0,48 (0,32)	0,17 (1,17)	8,45 *** (3,93)	0,17 (2,63)	-2,00 *** (0,63)
profb12	0,52 * (0,30)	-0,0048 (1,87)	0,50 * (0,29)	-0,45 (0,50)	-0,15 (0,11)	4,24 (1,27)	0,34 (1,44)	0,18 (0,12)
profc12	-0,57 * (0,32)	1,94 (2,00)	-0,95 ** (0,38)	-1,28 ** (0,55)	-0,83 *** (0,27)	0,17 (6,66)	-3,54 (3,33)	-1,59 * (0,88)
dtas12	-0,03 (0,05)	0,14 (0,29)	0,04 (0,08)	0,000089 (0,00068)	0,10 ** (0,04)	0,27 * (0,15)	0,11 (0,07)	0,08 *** (0,02)
selexp12	-0,20 (0,14)	-78,62 (96,28)	-0,27 * (0,16)	0,09 (0,46)	0,23 (0,19)	NA	-3667,69 *** (1139,76)	-0,11 (0,07)
profb11	0,02 (0,19)	0,45 (0,40)	-0,10 (0,31)	0,17 (0,26)	-0,26 (0,22)	-4,18 *** (1,08)	1,07 (0,88)	-0,01 (0,06)
R <sup>2</sup> for the model with common constant term takes value 0,516								

Table 6. Estimation of regression model (5) without constant term. Note. \*, \*\*, \*\*\* — significance at 10, 5, 1% levels. There are standard errors in parenthesis. NA – can't be estimated.

It may be pointed out, that there are different sets of variables that impact the capital structure significantly for different leaves of tree. In almost all leaves there is significant negative influence of the expectation of the future net profitability (variable “profc12”) on the capital structure. Coefficients of the variable “profc12” seems to be different in different leafs, but Wald test can’t reject hypothesis about their equality (Chi-square statistics — 4.87, DF — 7, p-level 0.68). So, one don’t have reasons to state that the future net profit expectation has different impact on the capital structure in different leaves. Also, it must be mentioned, that expectations of operational profitability (variable “profb (2013 year)”) and net profitability (variable “profc (2013 year)”) have multidirectional significant influence on the capital structure in some leaves. In contrary with pecking order theory the impact of the operational profitability expectations on the capital structure is significant and positive. Authors explain it in such a way. With one hand, operational profit is much more predictable than net profit, because latter depends on the taxes and interests that will be paid at the end of the financial year. These payments depend on the lot of external and especially internal factors which may not be fully taken into account in the middle and much less at the beginning of the year by the lender. Thus, optimistic operational profit expectations might improve relationship between creditor and borrower and make it easier to get a loan. On the other hand, financial manager has much more information about internal factors than lender, moreover, in most cases he or she is able to impact on the financial policy of the firm and consequently on the net profit. Thus, his net profit expectations may be placed in the basis of capital structure decision. As a result, the proportion of obligations will rise if financial manager expects the increase of operational profit and decrease of net profit.

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