Company’s Capital Structure and Value: a Panel Threshold Regression Analysis

The study reviews capital structure theories and previous empirical studies on non-linear relationship between capital structure and value. In the empirical part of the paper the panel threshold regression analysis is employed on a sample of Baltic listed companies.

Keywords: capital structure, company value, market capitalization, panel threshold regression model.

JEL Classifications: C22/G32.

Introduction

Capital structure choice has been analyzed and discussed by both academics and managers for several decades, because an accurately estimated and selected equity and debt ratio can maximize the company value and minimize the cost of capital.

The starting point for the subject of capital structure is the irrelevance proposition of F. Modigliani and M. Miller (1958; 1963). The F. Modigliani and M. Miller approach supported the view that in perfect capital market the market value of any company is independent of its capital structure. Therefore it can be
concluded that, in imperfect capital markets, value of a company depends on capital structure.

Traditional viewpoint on capital structure emphasizes the benefits of debt capital; therefore the value of the company increases with the increase in leverage up to a certain point. After this point, the weighted-average cost of capital (WACC) once again starts to increase and the value of the company decreases.

However, if one analyses recent studies on capital structure and company value, it is common to use the return on equity (ROE) as a proxy for company value and,
in addition, linear relationship analysis is applied between both variables. The author of the paper disagrees with the aforementioned points. Return on equity cannot be used as a proxy for the company value, and it is incorrect to analyze only linear relationship, while the traditional viewpoint on capital structure clearly emphasizes a non-linear relationship between capital structure and company value.

The **aim of the study** is to apply the panel threshold regression model on a sample of Baltic listed companies, and, based on the empirical results, to put forward recommendations for improving the use of leverage.

The **tasks of the research** are as follows:

- To overview literature on capital structure theories;
- To review previous empirical studies where non-linear relationship between capital structure and value is analyzed;
- To apply the panel threshold regression model on a sample of Baltic listed companies;
- To make conclusions and work out recommendations for improvement of the use of financial leverage.

The analysis is conducted on sample of 58 listed companies (Baltic Stock Exchange) over the period from 2005 to 2013. The author has used generally accepted quantitative and qualitative methods of research in economic science, including analysis of the scientific theoretical literature, comparative analysis, graphical method and panel data regression analysis. The research is based on published papers on financial ratios and capital structure, as well as information provided by the Baltic Stock Exchange. Panel threshold regression analysis is done in STATA. Non-linear relationship between variables is examined by using the threshold autoregressive model (Hansen, 1999; 2000). Stock price and market capitalization are used as proxies for company value.

The paper is organized as follows: the following section provides the review on capital structure theories; in the next section, the author of this paper reviews recent empirical studies where the panel threshold regression model is applied; then the methodology and sample of the study is discussed; after the methodology section, empirical results are described; the final section concludes the paper.

**Capital Structure Theories: an Overview**

The traditional viewpoint on capital structure emphasizes the benefits of debt capital (it is relatively cheap compared to equity capital); therefore, the value of the company increases with the increase in leverage up to a certain point (particular leverage). After this point, the weighted-average cost of capital (WACC) once again starts to increase and the value of the company decreases.

It is widely considered that the modern theory of capital structure began with the paper by F. Modigliani and M. Miller (1958) on the conditions of capital structure irrelevance. The Modigliani and Miller (MM) approach supported the view that, in a perfect capital market, the market value of any company is independent of its capital structure. In 1963, both authors included the corporate tax in their theorem (Modigliani and Miller, 1963). Since interest payments on debt can be qualified as an expense, the use of debt reduces the amount of tax. The reduction in
the tax lowers the cost of capital. Overall, this approach is similar to the traditional viewpoint, however MM approach does not have an optimal point of leverage, where the WACC is minimized and the company value is maximized.

One must take into account that this does not imply that the company should rely completely on debt (since it is cheaper and gives tax shield). At a certain point the value of the company starts to decrease because of the costs of financial distress. Therefore, to sum up, the use of tax shield (tax benefits) increases the value of the company, however as leverage increases, the company faces the costs of financial distress and this in turn decreases the value of the company. Overall, it can be concluded that an optimal capital structure is reached if the marginal benefit of tax shield equals the marginal cost of financial distress (Fig.1). Modigliani and Miller theorem also influenced the development of the trade-off theory and the pecking order theory.

The trade-off theory states that the company chooses a debt and equity mix by balancing the benefits and costs of debt. If the company increases its leverage, the tax benefits of debt increase as well. At the same time, the costs of debt also rise. The original version of the trade-off theory grew out of the debate over the Modigliani and Miller theorem. A. Kraus and R. Litzenberger (1973) formally introduced the tax advantage of debt and bankruptcy penalties into a state of preference framework. The trade-off theory predicts that target debt ratios will vary from company to company. Companies with safe, tangible assets and plenty of taxable income ought to have high target ratios. Unprofitable companies with risky, intangible assets ought to rely primarily on equity financing. According to S. C. Myers (1984), a company that follows the trade-off theory sets a target debt-to-value ratio and then gradually moves towards it. The target is determined by balancing debt tax shields against costs of bankruptcy.

**Fig. 1. The MM approach after tax (but with bankruptcy costs)**

*Source: A. G. Puxty, J. C. Dodds (1992).*
Pecking order theory (Donaldson, 1961; modified by Myers and Majluf, 1984) states that companies prioritize their sources of financing. At first they prefer to use internal funds, then to borrow, and to issue equity as a last resort. There is no clear target debt-equity mix. The pecking order explains why the most profitable companies generally borrow less; it is not because they have low target debt ratios but because they don’t need outside money. Less profitable companies issue debt because they do not have sufficient internal funds for their capital investment projects and because debt is first in the pecking order for external finance. The pecking order theory does not deny that taxes and financial distress can be important factors in the choice of capital structure. However, the theory says that these factors are less important than managers’ preference for internal over external funds and for debt financing over new issues of common stock.

The theory of agency costs (Jensen, 1986) explains the benefits of debt in reducing agency costs of free cash flow and how debt can substitute for dividends. Managers with substantial free cash flow can increase dividends or repurchase stock and thereby pay out current cash that would otherwise be invested in low-return projects or wasted. Debt creation, without retention of the proceeds of the issue, enables managers to effectively bond their promise to pay out future cash flow. Thus, debt can be an effective substitute for dividends. By issuing debt in exchange for stock, managers are bonding their promise to pay out future cash flows in a way that cannot be accomplished by simple dividend increases. Thus debt reduces the agency costs of free cash flow by reducing the cash flow available for spending at the discretion of managers. These control effects of debt are a potential determinant of capital structure. Increased leverage also has costs. As leverage increases, the usual agency costs of debt rise, including bankruptcy costs. The optimal debt-equity ratio is the point at which company value is maximized, the point where the marginal costs of debt just offset the marginal benefits.

M. Baker and W. Jeffry (2002) developed a theory of capital structure based on market timing. Managers issue equity when they believe it is overvalued and repurchase equity or issue debt when they believe it is undervalued. Since there is no optimal capital structure, managers do not need to reverse their decision in later periods when they believe that the company is correctly valued. This means that temporary fluctuations in valuation have permanent effects on capital structure.

It can be concluded that most theories of capital structure emphasize the trade-off between the benefits and costs of leverage. Traditional viewpoint on capital structure, Modigliani and Miller approach with tax and bankruptcy costs, the trade-off theory and the theory of agency costs conclude that the company value increases up to a certain point in leverage; after this point the leverage becomes excessive and the company related risk increases, therefore, company value starts to decrease.

Nevertheless, only a few studies analyze the non-linear relationship between company value and leverage. The bulk of empirical studies on capital structure can be summarized in three sections:

- First, a lot of empirical studies of capital structure test the compliance to a particular theory of capital structure. The most common approach is to apply the testing procedure of the trade-off theory and the pecking order theory to a
sample of companies. In order to test the pecking order and the trade-off theory, the methodology by L. Shyam-Sunder and S. C. Myers (1999) is used. However, this methodology only shows the speed of adjustment (how quickly companies rebalance their current leverage to the target leverage). No threshold is calculated and determined in these studies. For example, L. Shyam-Sunder and S. C. Myers (1999) methodology is applied in studies by P. F. Amaral et al. (2012), M. Mazen (2012), C. Cotei and J. Farhat (2009).

• Second, bulk of papers is published on the factors which affect capital structure. One objective of these studies is to determine factors that are capable of explaining companies' leverage ratios. The other aim is to conclude which theory of capital structure – the trade-off theory or the pecking order theory – is applicable to the set of companies. The pecking order theory concludes that between leverage and tangibility, leverage and size, leverage and profitability negative correlations exist. The opposite is true for the trade-off theory (a positive correlation is expected with tangibility, size and profitability). Once again no threshold is calculated and no intervals / regimes for different ratios are determined. For example, the following papers review the determinants of capital structure: N. Delcoure (2007), K. Mazur (2007), W. Sbeiti (2010).

• Third, research is also concentrated on the linear relationship between company performance and leverage. Most common approach is to use return on equity, share price, Tobin's Q ratio, and other ratios as a measure of company performance. The main shortage of these studies is that they focus on linear relationship, while most theories of capital structure emphasize the non-linear approach. Since linear relationship is analyzed, then no thresholds are calculated in these studies. For example, A. Gill et al. (2011), J. Abor (2005) analyzes the linear correlation between leverage and profitability.

It can be summarized that most theories of capital structure conclude that a non-linear relationship between leverage and company value is present, however the bulk of empirical studies reviews linear relevance. Usually the authors of these studies apply correlation analysis and / or panel regression analysis. Therefore a discrepancy is obvious between mainstream theory and empirical studies.

Only few studies focus on non-linear connection. For example, one methodology was developed by E. Dudley (2007). This approach initially defines the highest and the lowest limits of the interval. Based on dynamic trade-off theory of capital structure it is stated that companies raise debt if the lowest value of debt ratio is achieved. On the contrary, if the debt ratio of company has reached the highest value of debt interval then companies decrease their debt amount in order to adjust the total debt ratio. These previously mentioned statements are included in the mathematical model and the limits (low and high) of interval are calculated. Several drawbacks of this approach can be mentioned. First, companies can make decisions on debt rising or repayment based not only on their optimal capital structure interval, but other factors might play a significant role in the decision making process. Second, this approach is not applicable to companies with no or very little debt, since dynamic trade-off theory of capital structure is not capable to explain this
phenomenon. In the end, it must be mentioned that this approach has been applied in study by M. Kokoreva and A. Stepanova (2012), and the sample included the companies from the Baltic countries, as well. If one analyses capital structure ratio ‘total debt to total capital’, then the optimal capital structure interval is between 43 % and 57 %. If one applies ratio ‘total debt to total assets’, then the optimal interval is between 20 % and 22 %.

Another approach / methodology is applied more often recently – panel threshold model which was developed by B. E. Hansen (1999; 2000). By applying this methodology, it is possible to determine one or more thresholds of capital structure, when company value changes significantly. In the next section, the author of the paper reviews the recent empirical studies where this methodology is employed.

Application of Panel Threshold Model in Empirical Studies

Y. Cheng et al. (2010) applied the panel threshold regression model to 650 Chinese companies over the period from 2001 to 2006. As a capital structure ratio ‘total debt / total assets’ was applied. Return on equity (ROE) was used as a proxy for company value. This study stated triple threshold effect and four regimes:

- Debt ratio is less than 53.97 %, the estimated coefficient is 0.0979;
- Debt ratio is between 53.97 % and 70.48 %, the estimated coefficient is 0.0507;
- Debt ratio is between 70.48 % and 75.26 %, the estimated coefficient is -0.0775;
- Debt ratio is higher than 75.26 %, the estimated coefficient is -0.2734.

Overall, these results are in accordance to the mainstream capital structure theory that additional debt increases company value up to a certain point and then value of the company starts to decrease.

The paper by F. Lin and T. Chang (2011) used a panel of 196 Taiwanese listed companies during a 13-year (1993–2005) period. Tobin’s Q was applied as a proxy for company value. Debt ratio is calculated as ‘total liabilities / total assets’. Two threshold effects between debt ratio and company value were found. When the debt ratio is less than 9.86 %, then Tobin’s Q increases by 0.00546 %, with an increase of 1 % in the debt ratio. When the debt ratio is between 9.86 % and 33.33 %, then Tobin’s Q increases by 0.0057 % (with an increase of 1 % in the debt ratio). When the debt ratio is greater than 33.33 %, there is no relationship between debt ratio and company value.

Two different capital structure ratios are applied in the study by F. Coricelli et al. (2011): total debt to total assets and total liabilities to total assets. In this paper, threshold analysis is used to analyze the non-linear relationship between leverage and total factor productivity. Sample included companies of Central and Eastern European countries (including 66 companies from Baltic countries). It was found that total factor productivity increases with leverage up to a certain point, beyond which leverage becomes too high and lowers productivity growth.

The study by N. T. Cuong and N. T. Canh (2012a) applied panel threshold regression model on a sample of 92 Vietnam’s seafood processing companies from 2005 to 2010. Return on equity was applied as a proxy for company value and
The debt ratio was calculated as ‘total debt / total assets’. The results of this paper show that there exists a double threshold effect between debt ratio and company value. If debt ratio is less than 59.27 %, then regression coefficient is positive, and if debt ratio is more than 59.27 % then a decreasing trend is present.

The next study by N. T. Cuong and N. T. Canh (2012b) assesses the factors affecting capital structure of Vietnam’s seafood processing enterprises in each debt ratio threshold; companies were divided into two samples based on their debt ratio. For companies which have debt ratio of less than 59.27 %, significant determinants of capital structure are size, tangibility, profitability and liquidity. For companies which have debt ratio of more than 59.27 %, only size, tangibility and interest expense are considered as significant determinants of capital structure.

A recent study by N. T. Cuong (2014) used an updated sample of 90 companies during the period from 2005 to 2011. In this study, two measurements of company value were used: return on equity and a sum of book value of equity and long-term debt. Once again, capital structure is calculated as total debt to total assets. For the sum of book value of equity and long-term debt, triple threshold effect exists at 57.39 %, 78.67 %, and 92.30 %. Therefore four regimes are applicable: 0.2963 (debt ratio of less than 57.39 %), -0.4109 (debt ratio between 57.39 % and 78.67 %), -0.9661 (debt ratio between 78.67 % and 92.30 %), and -1.6929 (debt ratio is higher than 92.30 %). For ROE, double threshold effect exists at 57.93 % and 89.98 %. In this case, three regimes can be found: 0.1488 (debt ratio of less than 57.93 %), -0.0043 (debt ratio between 57.93 % and 89.98 %), and -0.3128 (debt ratio is higher than 89.98 %).

J. Wang and W. Zhu (2014) used panel threshold model, as well, but variable ‘value added/total assets’ was applied as an indicator of corporate performance. Capital structure was measured by ratio ‘total liabilities / total assets’. Their sample included 1002 companies and 9018 observations. In this study, it was found that capital structure and corporate performance are negatively correlated for low growth companies, and positively related for high growth companies.

In summary, it can be concluded that there are no published papers where a panel threshold regression analysis is applied on a sample of Baltic countries. One exception is the afore analyzed study by F. Coricelli et al. (2011), which analyzed the interaction between capital structure and productivity. No research is done with company value in the Baltic countries.

Most empirical studies have found one or several thresholds, and their conclusions are in accordance with the main capital structure theories – that a) non-linear relationship is in place between capital structure and company value; b) company value increases up to a certain point of capital structure, after this point the value of the company starts to decrease.

Finally, the author of this paper accentuates that in empirical studies different proxies for company value are employed. Frequently return on equity is used, but other indicators – such as Tobin’s Q, Value added, etc. – are present as well. In addition, there is no consensus regarding capital structure ratios, either. Some studies analyze the ratio ‘total debt to total assets’, while in other papers ratio ‘total liabilities to total assets’ is included. In the next
section, variables and research methodology are reviewed in more detail.

**Sample and Research Methodology**

**Sample**

The study is based on the financial data collected from financial statements of 58 Baltic listed companies over the period from 2005 to 2013. The sample consists of 22 companies from the Baltic Main List and 33 companies from the Baltic Secondary List. Distribution by countries is as follows: 28 companies from Latvia, 7 from Estonia, and 23 from Lithuania.

All companies had all the necessary data for the whole period analyzed, therefore a balanced panel of data is achieved. The financial companies were excluded, because their characteristics are different due to the specific balance sheet structure. Data are obtained from the NASDAQ OMX Baltic. The total number of observations is 495.

**Variables**

In this study, the relationship between company capital structure and value is analyzed. Specifically, the author of the paper obtains one or more thresholds of capital structure, at which the relationship between capital structure and value significantly changes.

Company share price is used as a proxy for company value. In other empirical studies, it is common to use return on equity (ROE) as an indicator of both company profitability and value. However, the author of this paper argues that this ratio is not applicable as a proxy for company value. The main reason is that the decrease in profitability does not always correlate with the decrease of company value. In addition, it must be emphasized that the return on equity is calculated only based on net profit and equity. It is a common approach to consider that the share price reflects not only the short-term results and prospects (which is included in the return on equity), but also the future prospects, expected cash flows, investors’ viewpoint on company management and employees, and other factors (Berman et al., 2013). Therefore, it is incorrect that both return on equity and share price have the same determinants and dynamics.

As emphasized by A. Damodaran (2011), there are two main reasons for the focus on stock price maximization in traditional corporate finance:

- Stock prices are the most observable of all measures that can be used to judge the performance of publicly traded companies;
- If investors are rational and markets are efficient, stock prices will reflect the long-term effects of decisions made by the company.

Therefore, the author of this study chooses the share price as the best indicator of company value.

In empirical capital structure studies, a variety of debt ratios is used. In Latvia, it is common to use a debt ratio, where the sum of liabilities is divided by the total assets. It must be emphasized that the usage of all liabilities in debt ratio calculation can overestimate the financial leverage. Not only financial debt (borrowed resources from banks, other companies, individuals, etc.) and leasing liabilities (regular interest payments must be made) are included in total liabilities, but also such items as payables, prepayments, tax debt, and other (interest payments are not made). Therefore, if total
liabilities are used when capital structure indicator/debt ratio is calculated, then it is most likely that such indicator/ratio will overestimate the financial leverage and will not present the correct information on company performance and solvency. As a result, if such ratios are used in financial analysis without further and detailed analysis, then financial analysis can provide incorrect conclusions.

Therefore, two capital structure ratios are used in this study: TD/TA (total debt to total assets) and TD/TC (total debt to total capital). Only interest bearing debt is used for the numerator, and total capital is calculated as the sum of equity, long-term interest bearing debt, and short-term interest bearing debt.

Methodology

A panel threshold regression model proposed by B. E. Hansen (1999) and B. E. Hansen (2000) was applied. The following single threshold model can be stated as follows:

\[
y_{it} = \mu_i + \beta_1'x_{it}I(q_{it} \leq \gamma) + \beta_2'x_{it}I(q_{it} > \gamma) + \epsilon_{it}
\]

(1)

Equation (1) can be expressed as equation (2):

\[
y_{it} = \begin{cases} 
\mu_i + \beta_1'x_{it} + \epsilon_{it}, & q_{it} \leq \gamma \\
\mu_i + \beta_2'x_{it} + \epsilon_{it}, & q_{it} > \gamma
\end{cases}
\]

(2)

Double threshold model takes the form of equation (3):

\[
y_{it} = \mu_i + \beta_1'x_{it}I(q_{it} \leq \gamma_1) + \\
+ \beta_2'x_{it}I(\gamma_1 < q_{it} \leq \gamma_2) + \\
+ \beta_3'x_{it}I(\gamma_2 < q_{it}) + \epsilon_{it}
\]

(3)

All observations are divided into two or more groups, based on their threshold. For each group, a separate regression analysis is performed.

At first, the unit root test was performed in order to determine if the data are stationary. If the results of the unit root test show stationarity, then the threshold panel regression analysis is performed.

Empirical Analysis and Discussion of Results

The author of this paper first reviewed the graphical results for several companies.

![Graphical results for several companies.](image)
Figure 2 depicts the relationship between share price and ratio ‘total debt to total capital’ of joint-stock company (JSC) ‘Valmieras stikla šķiedra’ (listed company in Latvia).

A non-linear relationship can be found between capital structure and company value. The result of this company is in compliance with most capital structure theories. The following regression equation (4) can be calculated:

\[ y = -0.0017651x^2 + 0.117473x + 0.7439267 \]  

Based on this regression equation (4), it is possible to calculate specific leverage, when company value is maximized. Therefore it can be concluded that the company value is maximized if ratio ‘total debt to total capital’ is 33.33 % (\(= -0.117473 / (-2*0.0017651)\)).

At the same time, this conclusion cannot be applied to all companies. For example, in Figure 3 the most extreme cases is included when the relationship between capital structure and company value does not comply with the capital structure theories.

In the next step, all listed companies were divided into three groups, based on their market capitalization, and a threshold regression model was applied to each sub-sample of companies.

As shown in Table 1, the single threshold effect for ratio TD/TA is not significant (p-value = 0.17) for companies with small market capitalization. For ratio TD/TC, the single threshold and double threshold effect is very significant, but the triple threshold effect is not significant. Therefore, only the double threshold effect for TD/TC ratio is analyzed.

Three regimes can be defined: low debt (<24.64 %), medium debt (24.65-48.23 %), and high debt (>48.24 %). If the debt ratio (total debt to total capital) is less than 24.64 %, then market capitalization increases by 0.09 million Euros (if debt ratio increases by one percentage point). If debt ratio is higher than 24.64 %, then the effect of leverage on company value is smaller. Market capitalization increases by 60 000 Euros if debt ratio is between 24.65 % and 48.23 % and the leverage increases by one percentage point.

![Fig.3. Relationship between share price and capital structure of JSC ‘Ditton pievadķēžu rūpnica’, 2005–2013](image)

Source: prepared by the author.
Percentage point. If debt ratio is higher than 48.24%, then market capitalization will increase by 70,000 Euros (if debt ratio increases by one percentage point).

The results of companies, which have market capitalization between 3 and 30 million Euros, are included in Table 2. No threshold can be found if one analyses the TD/TA ratio (F-statistic 6.38 and p-value 0.2715). One threshold can be detected for the TD/TC ratio at 62.97% (5% confidence level).

Overall, if it can be concluded that for companies with small market capitalization the use of leverage increases the total company value, then the opposite is true for medium-sized companies. If total debt to total capital ratio is less than 62.97%, then an increase in leverage by one percentage point results in company value decrease by 0.23 million Euros. If debt ratio is higher than 62.97%, then the effect of leverage on company value is greater; value decreases by 0.46 million Euros.

**Table 1**

| Variable | Threshold | F-statistic | p-value | Threshold value | Regression coefficient | Standard Error | R-squared |
|----------|-----------|-------------|---------|-----------------|------------------------|----------------|-----------|
| TD/TA    | One threshold 11.60 | 7.15        | 0.17    |                  |                        |                |           |
|          | One threshold 24.64 | 11.99       | 0.009***|                  |                        |                |           |
| TD/TC    | Double threshold 24.64-48.23 | 10.96       | 0.0045***| <24.64           | 0.09                  | 0.03           | 0.22      |
|          | >24.64-48.23       |             |         | 24.65-48.23      | 0.06                  | 0.05           | 0.06      |
|          | >48.24            |             |         |                  | 0.07                  | 0.01           | 0.52      |
|          | Triple threshold 24.64-48.23 | 3.42        | 0.6155  |                  |                        |                |           |
|          | 24.64-75.51       |             |         |                  |                        |                |           |

Note: ***, ** and * indicate significance at the 1%, 5% and 10% confidence level, respectively.
Source: results calculated by the author of the paper, using Baltic Stock Exchange data.

**Table 2**

| Variable | Threshold | F-statistic | p-value | Threshold value | Regression coefficient | Standard Error | R-squared |
|----------|-----------|-------------|---------|-----------------|------------------------|----------------|-----------|
| TD/TA    | One threshold 44.28 | 6.38        | 0.2715  |                  |                        |                |           |
|          | One threshold 62.97 | 10.84       | 0.0245**| <62.97          | -0.23                  | 0.08           | 0.10      |
|          | >62.97        |             |         | -0.46           |                        | 0.32           | 0.06      |
| TD/TC    | Double threshold 62.97-73.86 | 4.77        | 0.3695  |                  |                        |                |           |
|          | 62.97-73.86   |             |         |                  |                        |                |           |

Note: ***, ** and * indicate significance at the 1%, 5% and 10% confidence level, respectively.
Source: results calculated by the author of the paper, using Baltic Stock Exchange data.
In Table 3, the results of companies with market capitalization of above 30 million Euros are included. The single threshold effect for ratio TD/TA is significant (F-statistic 9.41 and p-value 0.059) at 10 % confidence level. The double threshold effect is not significant for companies with large market capitalization. The double threshold effect for ratio TD/TC is significant at 1 % confidence level and a triple threshold is significant at 10 % confidence level.

Three regimes can be defined for ratio TD/TA: low debt (<1.99 %), medium debt (1.99 %–2.94 %), and high debt (>2.94 %). When debt ratio (total debt to total assets) is less than 1.99 %, then market capitalization increases by 169 million Euros if debt ratio increases by 1 percentage point. If debt ratio is higher than 1.99 %, then an increase in leverage results in a decrease of company value.

Double threshold effect for ratio TD/TC can be divided into three regimes: low debt (<9.60 %), medium debt (9.60–61.19 %), and high debt (>61.19 %). Company value increases if debt ratio is less

### Table 3

| Variable | Threshold | F-statistic | p-value | Threshold value | Regression coefficient | Standard Error | R - squared |
|----------|-----------|-------------|---------|-----------------|------------------------|----------------|------------|
| TD/TA    | One threshold **1.99** | 24.05 | 0.000*** | 1.99 | 169.93 | 28.34 | 0.30 |
|          | Double threshold 1.99 | 9.41 | 0.059* | 1.99-2.94 | -495.64 | 54.17 | 0.75 |
|          | 2.94 | 28.34 | 54.17 | 0.51 | | 0.51 | 0.01 |
|          | Triple threshold 1.99 | 6.95 | 0.1695 | 2.94 | | | |
|          | 24.62 | 28.34 | 54.17 | 0.51 | | | |
| TD/TC    | One threshold **9.60** | 32.71 | 0.000*** | | | | |
|          | Double threshold 9.60 | 13.73 | 0.001*** | 9.60-61.19 | 7.09 | 8.43 | 0.03 |
|          | 61.19 | 61.19 | 1.85 | | | | |
|          | Triple threshold 9.60 | 7.15 | 0.089* | 61.19-64.02 | 7.09 | 8.43 | 0.02 |
|          | 61.19 | 64.02 | 30.05 | 1.58 | | | |
|          | 64.02 | 86.64 | 4.39 | | | | |
|          | Quadruple threshold 9.60 | 6.41 | 0.126 | | | | |
|          | 61.19 | | | | | | |
|          | 64.02 | | | | | | |
|          | 80.66 | | | | | | |

*Note:***, ** and * indicate significance at the 1 %, 5 % and 10 % confidence level, respectively.

*Source:* results calculated by the author of the paper, using Baltic Stock Exchange data.
than 9.60% and higher than 61.19%. Market capitalization of company decreases if debt ratio is between 9.60% and 61.19%. However, one must note the high standard errors and the low R-squared values for first and third regimes, which means that these regression coefficients can be negative. The only robust conclusion can be made regarding the medium debt level; if a company has a debt ratio of between 9.60% and 61.19%, then the value of the company decreases.

A triple threshold effect for ratio TD/TC is significant at 10% confidence level. The results are similar to the double threshold effect but an additional threshold is defined at 64.02%. If debt ratio is between 61.19% and 64.02%, then the company value increases by 86.64 million Euros; if company's debt ratio is higher than 64.02%, then the increase in company value is not so high and the value is enhanced only by 4.39 million Euros.

In summary, the empirical findings confirm the non-linear relationship for companies with high market capitalization (TD/TA ratio). If company uses a small debt ratio of less than 2%, then the value of the company increases. If debt ratio is increased and is higher than 2%, then the company value decreases. In other empirical studies, where panel threshold regression analysis is used, threshold values are significantly higher (regardless of the applied debt ratio). Regarding large companies and debt ratio TD/TC, three / four regimes can be defined. Company value increases up to a certain debt ratio point (~9.60%), and then starts to decrease, if leverage is between 9.60% and 61.19%. Finally, the value of the company starts once again increasing if debt ratio is higher than 61.19%. This finding is contrary to capital structure theories.

This result (U-shape relationship) could be explained as follows. When company has very little debt, then insolvency risk is very small, therefore company value is high at low debt levels. Then at some point the company value starts to decrease, and at a high level of debt value once again is increasing. This could be related to two factors: information asymmetry and company size.

First, it must be noted that the sample of companies is small, and only the largest companies are included. Company size is usually positively correlated with leverage, because large companies have less volatile cash flows and more diversification opportunities.

Second, the U-shape relationship can be explained by applying information asymmetry. These companies usually have debt which amounts to several millions of Euros. Therefore it is only logical that creditors will perform detailed analysis of the company, its performance and future prospects. It means that an increase in this leverage interval can give a positive signal to the market that company has good investment projects; therefore, an increase in company value can be expected.

To sum up, while most capital structure theories argue that downward U-shape relationship is in place between capital structure and company value, then this cannot be found empirically for all companies and all sub-samples. Based on the graphical analysis, different conclusions can be made. Some companies have downward U-shape relationship between leverage and value, while other companies have the contrary relation (an upward U-shape). In addition, for some companies, no statistically significant relationship is in place between capital structure and company value.
For Baltic listed companies with small market capitalization, it can be concluded that an increase in leverage means that company value is enhanced, as well. The highest effect is achieved if the debt ratio is less than 24.64%; then the market capitalization of the company increases by 90,000 Euros, if the debt ratio rises by 1 percentage point. The contrary statement is true for medium-sized Baltic listed companies (based on their market capitalization). If the debt ratio increases for this sub-sample of companies, then the value of the company decreases. However, a threshold at 62.97% can be noted. If company’s debt ratio is less than 62.97%, then the company value decreases by 0.23 million Euros, and if this threshold is achieved and exceeded, then the value of the company decreases by 0.46 million Euros. Therefore, it can be advised to small companies to use the debt ratio of less than 24.64%, and for medium sized-companies to apply debt ratio smaller than 62.97%. This conclusion is also in line with the notion of the relationship between leverage and size. Namely, larger companies can afford to have a higher debt ratio due to their more stable cash flows and superior diversification possibilities.

Distinctive results have been achieved in the case of large companies (based on their market capitalization). Both debt ratios (TD/TA and TD/TC) show statistically significant results and different number of thresholds. If the TD/TA ratio is less than 2%, then the value of the company is increasing but value starts to decrease when this threshold is exceeded. A triple threshold can be found for ratio TD/TC, which states that an upward U-shaped relationship between leverage and value is in place. More specifically, company value is decreasing if debt ratio is between 9.60% and 61.19% but a value increase can be observed if the threshold of 61.19% is exceeded. This is not in compliance with capital structure theories.

However, to end, it must be noted that the sample of companies is not large. Similar empirical studies use samples where the number of companies exceeds one hundred. In addition, the selected time period (from 2005 to 2013) includes significant changes in economic activity (economic boom, recession, and recovery). It is highly likely that the management of companies had to significantly change their financing policies during this period. Therefore, for future research, it is advisable to use a larger sample of companies and divide the observations into different time periods (e.g., boom, recession, and recovery). Taking into consideration the small number of Baltic listed companies, the research approach mentioned above cannot be applicable to listed companies. This means that it would be advisable to use panel threshold regression analysis in a sample of non-listed companies. This in turn means that company market capitalization and share price cannot be used as proxies for company value and, in their place, other company ratio must be applied.

Conclusions and Recommendations

This paper investigates the non-linear relationship between capital structure and company value. A panel threshold regression analysis is employed on a set of 58 listed companies.

Most capital structure theories emphasize the trade-off between the benefits and costs of leverage. Traditional viewpoint on capital structure, Modigliani and Miller
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approach with tax and bankruptcy costs, the trade-off theory, and the theory of agency costs conclude that company value increases up to a certain point in leverage; after this point, the leverage becomes excessive and the company related risk increases, therefore, company value starts to decrease.

Nevertheless, only a few studies analyze the non-linear relationship between company value and leverage. The bulk of empirical studies on capital structure can be summarized in three sections: compliance tests to a particular theory of capital structure, determinants of capital structure, and linear relationship between company performance (usually, return on equity) and leverage.

Even though capital structure theories conclude that a non-linear relationship between leverage and company value is present, however, the bulk of empirical studies reviews linear relevance. Therefore a discrepancy is obvious between mainstream theory and empirical studies.

The panel threshold model is recently applied more often in empirical capital structure studies. By applying this methodology, it is possible to determine one or more thresholds of capital structure, when company value changes significantly. Most empirical studies found one or several thresholds and their conclusions are in accordance to the main capital structure theories – that a) non-linear relationship is in place between capital structure and company value; b) company value increases up to a certain point of capital structure, after this point the value of the company starts to decrease.

Important implications emerge from the empirical results of this paper. First, while most capital structure theories argue that downward U-shape relationship is in place between capital structure and leverage, this could not be found empirically for all companies and all sub-samples. Second, different threshold results are achieved if companies are divided into three sub-samples (based on their market capitalization):

- For Baltic listed companies with small market capitalization, an increase in leverage means that company value is enhanced, as well. The highest effect is achieved if the debt ratio is less than 24.64%; then market capitalization of the company increases by 90,000 Euros if debt ratio is increased by 1 percentage point.

- The contrary statement is true for medium-sized Baltic listed companies. If debt ratio is increased for this sub-sample of companies, then the value of the company decreases. However, a threshold of 62.97% can be noted. If debt ratio is less than 62.97%, then the company value decreases by 0.23 million Euros, and if this threshold is achieved and exceeded, then the value of the company decreases by 0.46 million Euros.

- It can be advised to small companies to use debt ratio of less than 24.64% and for medium-sized companies to apply a debt ratio below 62.97%. This conclusion is also in line with the notion of the relationship between leverage and size. Namely, larger companies can afford to have a higher debt ratio due to their more stable cash flows and superior diversification possibilities.

- Distinctive results have been achieved in the case of large companies. If the TD/TA ratio is less than 2%, then the value of the company is increasing and value starts to decrease when this threshold is exceeded. A triple threshold can be found for ratio
TD/TC, which indicates an upward U-shaped relationship between leverage and value. More specifically, company value is decreasing if debt ratio is between 9.60% and 61.19%, and a value increase can be observed if the threshold of 61.19% is exceeded. This is not in compliance with capital structure theories.

For future research, it is advisable to use a larger sample of companies and divide the observations into different time periods (e.g., boom, recession, and recovery). Taking into consideration the small number of Baltic listed companies, the aforementioned research approach cannot be applicable to listed companies. It means that it would be advisable to use panel threshold regression analysis on a sample of non-listed companies. This in turn implies that company market capitalization and share price cannot be used as proxies for company value, and, in their place, other company ratio must be applied.

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nesutinka su šia nuomone. Nuosavo kapitalo pelningumas negali būti panaudotas kaip netiesioginis rodiklis nustatant kompanijos vertę ir yra nekorektiška analizuoti tik tiesinį ryšį, kai tradicinis požiūris į kapitalo struktūrą aiškiai pabrėžia netiesinį kapitalo struktūros ir kompanijos vertės ryšį.

Tyrimo tikslas – Baltijos valstybių įtrauktų į biržos prekybos sąrašą kompanijų imčiai pritaikyti sekinių lūžio tašką įvertinintį regresijos modelį ir empirinių duomenų pagrindu pasiūlyti rekomendacijas sverto naudojimui gerinti.

Analizė atlikta 58-ųjų Baltijos vertybių popierių biržoje įtrauktų į prekybos sąrašą kompanijų imčiai 2005–2013 m. laikotarpiu. Autorė pritaikė bendrai priimtus ekonomikos mokslo kiekybinius ir kokybinius metodus, įskaitant mokslinės teorinės literatūros analizę, lyginamąją analizę, grafinį metodą ir sekinių regresinę analizę.

Nors kapitalo struktūros teorijose daroma išvada, kad tarp sverto ir kompanijos vertės pasireiškia netiesinis ryšys, daugumoje empirinių tyrimų apžvelgiama keista siekiant suprasti tarp kapitalo struktūros ir kompanijos vertės ryšio esmę. Remiantis straipsnio empiriniais rezultatais daromos šios išvados: pirma, nors dauguma kapitalo teorijų rodo, kad žemėjantis U formos ryšys tarp kapitalo struktūros ir sverto yra tinkamas, to nebuvo galima empiriškai nustatyti visoms kompanijoms ir visoms antrinėms imtims; antra, skirtinkę lūžiai yra gaunami, jei kompanijos padalijamos į tris antrines imtis (remiantis rinkos kapitalizacijos pagrindu).