

# “Indebtedness and profitability – A threshold model approach”

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# INDEBTEDNESS AND PROFITABILITY – A THRESHOLD MODEL APPROACH

**Abstract**

This study seeks to expand upon existing empirical results about the effect of debt on corporate profitability. Indicators Debt ratio (DR) and Return on Equity (ROE) were used to examine the relationship between debt and corporate profitability. The input data for the analysis represented the financial data of companies operating in the construction industry in Slovakia. The total sample included 7,529 companies. After excluding companies with extreme values, the sample consisted of 6,402 companies. Indicators ROE and DR were used in the given research. To determine the debt threshold, a threshold regression model was applied. Using this model, a nonlinear relationship between debt and profitability was found. An indebtedness threshold has also been identified. Once the threshold is exceeded, the positive relationship between indebtedness and ROE changes to negative. The results, in particular those which indicate a significant non-linear relationship between debt and profitability, are particularly useful for all stakeholders (internal and external) interacting with analyzed companies.

**Keywords**

indebtedness, debt, Kernel density, profitability,  
relationship, Threshold regression model

**JEL Classification**

M21, G32, C24

**INTRODUCTION**

One of the prerequisites for the successful operation of an enterprise is to determine its optimal indebtedness. Every enterprise faces two basic questions in this regard. The first question deals with how to obtain the resources necessary for its activities. The second question focuses on which assets the enterprise should invest in and how much. The two issues are interlinked and need considerable attention. In the search for an optimal indebtedness, it is necessary to take into account that the indebtedness is specific to each enterprise, while all components of capital are always associated with the costs of their acquisition and use. In this context, the enterprise should strive to create an indebtedness, which consumes as little costs as possible. When creating an optimal indebtedness, it is advisable to apply various tools available. It is primarily about the use of indicators of financial analysis and analysis of their interrelationships. In this analysis, it is necessary to focus primarily on indicators of indebtedness and profitability. It is very important to find out how the indebtedness affects the profitability of a company, because it is a prerequisite for performance, value creation and competitiveness of the company.

This research builds on a previous study (Horváthová et al., 2018) looking for the optimal indebtedness in relation to the cost of capital and business performance. The optimal capital structure was found in cases the costs of capital were minimal. Based on the analysis carried out in this research, it was possible to state with some generalization that “with rising proportion of debt in the capital structure of compa-

nies, the return on equity, cost of equity, weighted average capital cost, as well as economic value added calculated by EVA entity and EVA equity methods, also increase. In most of the analyzed companies, the return on equity exceeds the cost of equity resulting in a positive value of the Spread indicator (relative EVA). In terms of the research question and research objective, we also managed to find the optimal capital structure from the point of view of maximizing the performance and minimizing the cost of capital” (Horváthová et al., 2018, p. 302).

As there is still a continued interest in analyzing the relationship between debt and profitability, it was decided to continue in this research. This study focuses on the application of the Threshold Regression Model (TRM). Using this model, the study tried to find the debt threshold, below which the increase in the share of debt in the capital structure has a positive effect on a company’s profitability whereas, after exceeding this threshold, a further increase in the share of debt in the capital structure has a negative effect on profitability.

The paper addressed a causal research problem aimed at finding a link between indebtedness and profitability. This research problem was transformed into the following research questions: 1) Is there a relationship between the indebtedness and the profitability of a company? 2) Is the effect of debt growth positive or negative? 3) Is there a corporate debt threshold?

The paper researched a large sample of companies from one industry, in particular the construction industry in Slovakia. The sample represents 6,402 enterprises. Based on this sample of enterprises, it is possible to make a generalization for the given sector, taking into account the relationship between capital structure and profitability of enterprises. This relationship in the given sector has not yet been analyzed and the optimal indebtedness of construction enterprises in Slovakia has not been ascertained. The research addressed only one debt ratio and one profitability ratio in order to be able to confirm a clear relationship between indebtedness and profitability. Another benefit of the study is the application of the Threshold regression model, which can be used to determine the debt threshold for corporate profitability

## 1. LITERATURE REVIEW, THEORETICAL BASIS AND HYPOTHESES

Today, it is very important to monitor and analyze the financial health and performance of companies in order to ensure their competitiveness and sustainability. Business performance is generally affected by a number of factors. One of the factors that needs to be monitored is the capital structure. Therefore, the issue of capital structure in terms of its optimization has sparked an intense discussion among experts.

Modigliani and Miller pointed out the importance of examining the capital structure as early as 1958 (Horváthová et al., 2018). In their work, they have shown that in a perfectly functioning capital market, the indebtedness of an enterprise is irrelevant and financial leverage does not affect

the enterprise’s market value (Gill et al., 2011). In the absence of a perfect market, new views and models have emerged in this regard that have taken into account capital market imperfections. In 1963, Modigliani and Miller accepted the effect of taxes on the average cost of capital of an enterprise, and thus on an optimal indebtedness. According to their results, the value of the enterprise is simply equal to the sum of the value of the enterprise at zero debt and the current value of the interest tax shield (Kalusová & Fetisovová, 2015).

There are four basic theories that reflect the impact of debt on corporate profitability: “pecking order theory, the agency costs theory, tradeoff theory and signaling theory” (Habib et al., 2016, p. 71). In 1976, Jensen and Meckling pointed out that “the use of debt in capital structure of the firm leads to agency costs. Agency costs arise as the results of the relationships between shareholders and managers, and those between debt-holders and share-

holders” (Shubita & Alsawalhah, 2012, p. 104). Accordingly, there may be positive and negative effects of debt on profitability. In case of agency costs of equity between shareholders and managers, it has a positive effect (Habib et al., 2016). “Whereas; agency costs of debt between shareholders and creditors have negative effect on profitability” (Habib et al., 2016, p. 71). The Modigliani and Miller model was later modified by Myers (1984), who developed a static trade-off theory in which he emphasized the need to balance profits with the costs of debt financing. According to him, the indebtedness of enterprises is a certain choice between the benefits that the enterprise derives from the use of the interest tax shield and the costs associated with possible financial difficulties (Gill et al., 2011). “The static trade-off theory values the company as the value of the firm if unlevered plus the present value of the tax shield minus the present value of bankruptcy and agency costs” (Abor, 2005, p. 440; In Gill et al., 2016, p. 5). In 1984, Myers and Majluf developed a concept of optimal indebtedness based on the concept of asymmetric information. The existence of information asymmetries between the enterprise and the probable providers of finance causes relative costs between different sources of finance (Adam, 2015). They argue that enterprises would prefer internal resources to costly external resources. Pecking order theory suggests that enterprises initially rely on internally generated resources (e.g., retained earnings) where there is no information asymmetry (Nassar, 2016). “According to signaling theory, debt, in the presence of asymmetric information, should be correlated positively to profitability of the company” (Filipovic & Demirovic, 2016, p. 20). Kebewar (2013) examined the impact of debt levels on profitability of an enterprise. He analyzed a sample of 2,325 French enterprises for the period 1999 to 2006 (Kebewar, 2013). Applying the Generalized Methods of Moments (GMM), he pointed out that debt affects the enterprise’s profitability.

An indebtedness is considered to be optimal when the market value of the enterprise’s equity is maximized with an unchanged asset structure. Over time, it turned out that this goal can be identified in order to maximize the market value of the company, respectively to minimize capital costs (Sivák & Mikócziová, 2009). The optimal capital structure can therefore be determined from

the perspective of two basic approaches (Sivák & Mikócziová, 2009; Vlachynský et al., 2002; Valach, 2001; In Horváthová et al., 2018). Thus, a share of debt in which the marginal advantages and disadvantages of increasing debt are the same is considered to be optimal. “The advantages of rising debt are increased tax savings on interest and lower agency cost of equity, the disadvantages are the higher risk of financial difficulties and higher agency cost of debt” (Sivák & Mikócziová, 2009; In Horváthová et al., 2018).

## 2. DEBT VERSUS PROFITABILITY – THEORETICAL BACKGROUND

Examining the relationship between the indebtedness and the enterprise’s profitability has an important place in the enterprise’s financial management, as profitability is a prerequisite for the enterprise’s existence, competitiveness and growth (Kisefľáková et al., 2019). Therefore, increased attention needs to be paid to this relationship. The following section of the paper presents selected studies that have addressed this relationship. It should be pointed out that several indicators were applied in these studies to represent the enterprise’s debt. These were mostly indicators: long-term debt to total capital ratio (LTDR), short-term debt to total capital ratio (STDR), total debt to total capital ratio (DR), equity to total capital ratio (ER), equity to debt ratio (EDR), debt to equity ratio (DER). Return on Equity (ROE), Return on Assets (ROA), Return on Sales (ROS) or Return on Investments (ROI) indicators were used as profitability indicators. Only a few studies revealed a purely positive and purely negative relationship of all indebtedness indicators in relation to the stated profitability indicators.

### 2.1. Negative and mostly negative relationship between indebtedness and profitability

Pratheepkanth (2011) examined a relationship between indebtedness and financial performance. This research was conducted on a sample of businesses listed on the Colombo Stock Exchange in

Sri Lanka. The research yielded interesting results, in particular a negative relationship between the indebtedness represented by Debt/Equity (DER) and Debt/Total Funds (DR) and the financial performance represented by ROA and ROI was identified.

Salim and Yadav (2021) examined the relationship between indebtedness and performance on a sample of Malaysian companies listed on the Bursa Malaysia Stock. "The study used performance measures (ROE, ROA, Tobin's Q and Earning per Share) as a dependent variable and indebtedness measures (LTDR, STDR, DR and Growth) as an independent variable. Size was a control variable. The results of the study confirmed a negative relationship between the indicators STDR, LTDR and DR and firm performance measured by ROA and ROE" (Salim & Yadav 2021). The results of the study confirmed that there is a negative relationship between the profitability indicators STDR, LTDR, and DR.

Vătavu (2015) used a sample of 196 Romanian businesses to study the relationship between indebtedness and financial performance. Indebtedness in this study was represented by the ratio of long-term liabilities to total assets (LTDR), the ratio of short-term liabilities to total assets (STDR), Debt to equity ratio (DER), while financial performance was represented by ROA and ROE. The study resulted in Romanian companies performing better when their own funding sources predominated within their indebtedness. The result of this study was also the finding that the surveyed manufacturing companies do not have sufficient internal sources of financing and do not use their assets efficiently. In cases where they suffer from a lack of funding, they reach for external sources of funding (in line with Pecking order theory).

Nassar (2016) examined the relationship between indebtedness represented by Debt Ratio (DR), and performance represented by ROA and ROE. This research was carried out on a sample of 136 industrial enterprises in Turkey. The results of his study showed that there was a significant negative relationship between the indebtedness represented by DR and the performance indicators.

In her study, Strýčková (2017) investigated the relationship between leverage and corporate performance expressed by ROE. "The results of the re-

gression analysis confirmed a negative relationship between the company profitability and the use of debt in majority of business sectors (Agriculture, fishery and forestry, Construction, Wholesale and retail trade, repair of motor vehicles and motorcycles, Professional, scientific and technical activities, Administrative and support service activities). The opposite relationship was found in one business sector only (Mining and quarrying) where positive relationship between the company profitability and leverage was confirmed" (Strýčková, 2017, p. 98). This confirms the research results that the relationship between leverage and profitability also depends on the sector in which the research is carried out.

Alarussi and Alhaderi (2018) examined the relationship between the debt equity ratio (DER) and debt ratio (DR) and profitability. In their research, they applied the resource-based theory and the trade-off theory. The research also confirmed a negative relationship between these indicators.

Recent research in this area includes the study by Bindu (2021). The research was conducted on a sample of two and three-wheeler manufacturing companies in India. All companies listed on the BSE (Bombay Stock Exchange) over a period of 10 years (from 2007–2008 to 2016–2017) were included in the research. The research found that there is a negative relationship between indebtedness and performance (ROA)

The negative relationship between total debt (DR) and profitability was also confirmed in studies by Rao et al. (2007), Shubita and Alsawalhah (2012), Velnampy and Niresh (2012), Kebewar (2013), and Filipovic and Demirovic (2016). However, it should be noted that when applying several indicators of indebtedness, this relationship was not clearly negative for each indicator, e.g. in the case of a study by Velnampy and Niresh (2012), the relationship between DER and ROE was positive, which can be taken for granted in relation to the indicators used.

## 2.2. Positive and mostly positive relationship between indebtedness and profitability

The basis for the fact that the relationship between debt and profitability can be positive is Du Pont



chart analysis and Du Pont's equations (Kotulič & Rajčányiová, 2012).

According to Brigham and Ehrhardt (2005), using debt the enterprises may increase their profit.

Singapurwoko and El-Wahid (2011) also based their research on this assumption. However, these authors also pointed out that the increase in profitability may be due to a number of other factors (internal and external).

The positive relationship between indebtedness and profitability was revealed by Sarkar and Zapatero (2003) who found a positive relationship between leverage and profitability.

In their study, Sultan and Adam (2015) examined the relationship between indebtedness and profitability in Iraqi companies, listed on the Iraq stock exchange. They confirmed that there was a positive relationship between them. These findings are broadly consistent with the predictions of Pecking order theory and the signaling effects of decisions on the indebtedness of firms.

Gill et al. (2011) followed the results of Abor (2005) which they tried to elaborate. The results of their research confirmed a positive relationship between profitability (ROE) and indebtedness (short-term debt to total assets (STDR), long-term debt to total assets (LTDR), total debt to total assets (DR)).

The results of a study by Bistrova et al. (2011), which confirmed a positive relationship between stock performance and equity adequacy, are also consistent with this theory. However, an inverse relationship was confirmed between the level of debt and capital performance.

The authors also confirmed a positive relationship between indebtedness and profitability (Holz, 2002; Hadlock & James, 2002).

### 2.3. Mixed relationship between debt and profitability

The vast majority of the analyzed studies show an ambiguous relationship between indebtedness and profitability, especially in relation to the applied indicators. This relationship depends on

whether it is short-term or long-term debt, as well as on the amount of debt and the indicators used in the analysis. In addition, the industry in which the analyzed enterprise operates appears to be a significant factor. These results include the results of a study by Muhammad et al. (2014). They reveal a strong negative relationship between debt to assets ratio (DR) and a company's performance variables (Gross Profit Margin – GPM, Net Profit Margin – NPM, ROA and ROE). They further reveal a positive relationship between the debt-to-equity ratio (DER) and enterprise performance variables (GPM and NPM) and a negative relationship between the debt-to-equity ratio (DER) and variables ROA and ROE (Muhammad et al., 2014).

Abor (2005) examined a relationship between profitability and indebtedness of enterprises listed on the Ghana Stock Exchange (GSE). "The results reveal a significantly positive relation between the ratio of short-term debt to total assets and ROE. However, a negative relationship between the ratio of long-term debt to total assets and ROE was found" (Abor, 2005, p. 438).

Rahman et al. (2019), who state that there is no generally valid theory for determining the optimal capital distribution, contributed significantly to this research. The results of their regression analysis showed that the debt ratio (DR) had a positive effect on ROA, and this view was also supported by Modigliani and Miller. On the contrary, the growing DER has a negative impact on ROA and ROE. The authors confirmed that companies are increasing their indebtedness to reduce the cost of capital and thus take advantage of the tax benefits that result from this increase. However, increasing debt above the optimal indebtedness has a significant negative impact on ROA and ROE.

Margaritis and Psillaki achieved similar results in their study. Using a sample of 12,240 New Zealand firms they confirmed a theoretical basis of the Jensen and Meckling (1976) agency cost model (Margaritis & Psillaki, 2007). In addition, the authors used quantile regression analysis to point out that "the effect of efficiency on leverage is positive at low to mid-leverage levels and negative at high leverage ratios" (Margaritis & Psillaki, 2007, p. 1466). At the same time, they stated that the efficiency measured as a distance from the pro-

duction frontier of “best practice” in the analyzed sample of enterprises is positively related to the leverage effect in the whole range of observed data. The frontier in this study was constructed using a nonparametric DEA method.

In relation to the above, the empirical study by Javed et al. who analyzed the impact of indebtedness on the performance of 63 companies listed on the Karachi Stock Exchange should be mentioned (Javed et al., 2014). The fixed effects model was used as a combined regression model to establish the relationship between an enterprise’s performance represented by indicators ROA, ROE, and ROS and capital expenditures represented by indicators DR, ER, and LTDR. The results showed that there indeed was a relationship, but the direction of the relationship was mixed. The indebtedness had a positive effect on the enterprise’s performance when ROA was used as a dependent variable. When ROE was used as a dependent variable, then DR ratio showed the same positive effect, but ER and LTDR ratio revealed a negative effect on the dependent variable. In a re-analysis in relation to sales (ROS), which was used as a dependent variable, DR and ER showed a negative relationship with ROS, but LTDA revealed a positive impact on ROS. It has been proven that the indebtedness has an impact on the enterprise’s results (Javed et al., 2014).

Based on a study by Ngo et al. (2020), it can be stated that debt can affect profitability either linearly or nonlinearly. These authors state that in the given analysis it is necessary to take into account the time of debt commitment, some specific parameters such as the structure of capital owners or the environment in which the company operates and finally the methods that will be used in the given analysis. For example, if the relationship between debt and profitability is assumed to be nonlinear, these authors recommend the application of “econometric methods that can evaluate the effects of non-linearity as quantile regression and threshold models” (Ngo et al., 2020, p. 841).

Uluyol et al. (2014) confirmed that the relationship between debt and profitability is given by the industry in which the research is conducted. This result is seen as positive by the construction industry and as negative by the IT, food, mining and textile industries. Based on the above, it can be stated that

the relationship between indebtedness and profitability depends on whether these are long-term debt or short-term debt, but also on the sector in which an enterprise operates. In the case of short-term debt, there is mostly a positive relationship between indebtedness and profitability, and in the case of long-term debt, there is mostly a negative relationship between indebtedness and profitability. This was more or less confirmed by Baum et al. (2006), who pointed out that profitability increases with short-term debt faster than with long-term debt.

This brief analysis of selected studies addressing the issue in question showed that it is quite difficult to confirm the clear impact (net positive or net negative) of the indebtedness on the profitability of an enterprise. This impact depends on the indicators used, the time constraints of external sources, the industry in which the analysis is carried out, the agency costs incurred, as well as other factors.

Based on the theoretical background, it is clear that conclusions of the studies on this topic are different, some authors have confirmed a positive relationship, some of them have confirmed a negative one, but what is clear is the claim that this relationship exists.

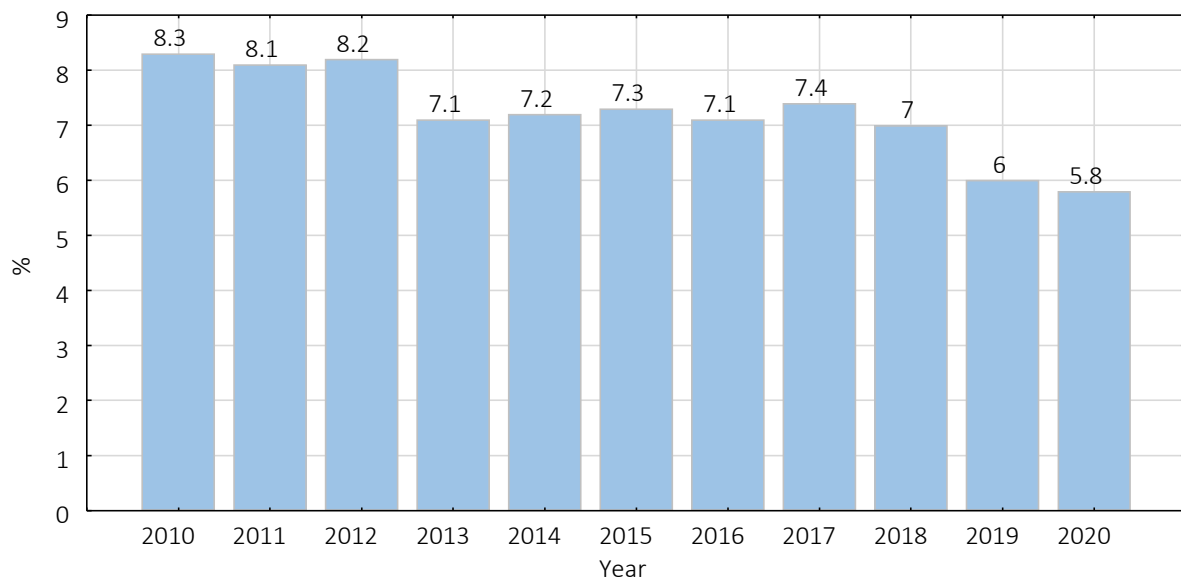
In line with the above-mentioned, the aim of the paper was to either confirm or refute the frequently discussed problem – whether the indebtedness of a company affects its profitability (positive or negative) (where the indebtedness is represented by the indicator Total Debt (TD) and profitability is represented by the indicator Return on Equity (ROE)). In this regard, the following hypotheses were put forward:

- H1: There is a relationship between corporate indebtedness and profitability.*
- H2: There is a linear relationship between indebtedness and profitability.*

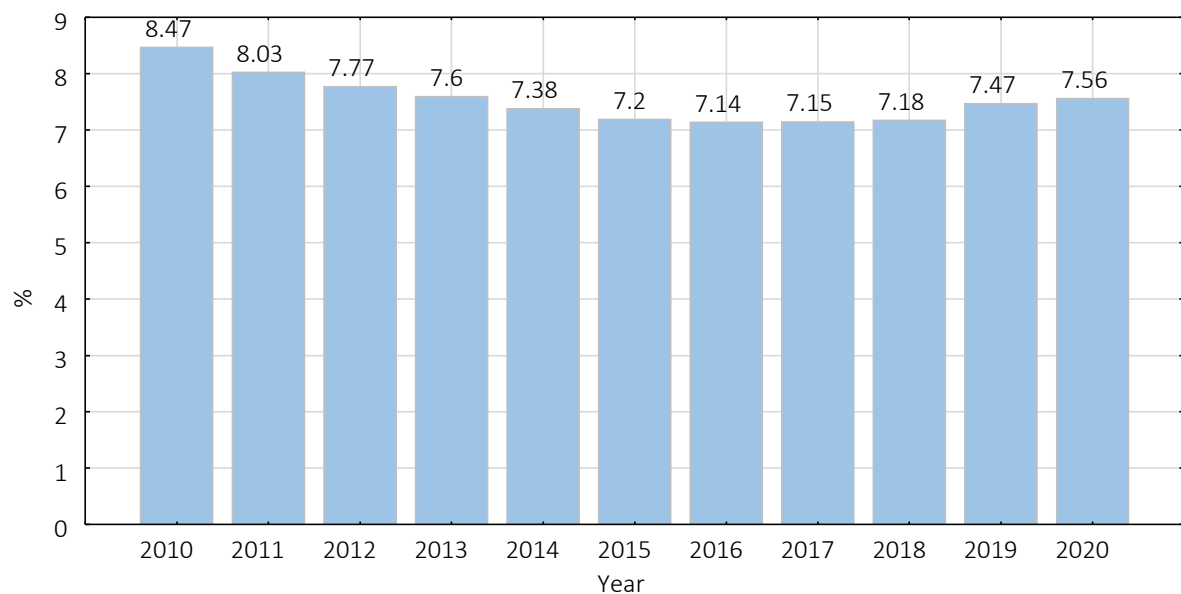
### 3. DATA AND METHODOLOGY

The database used in this study features 7,529 businesses active in the construction sector (SK NACE 41, 42, 43). Despite various economic impacts in

Source: Authors based on data of ŠÚSR (2015, 2019, 2020, 2021b).

**Figure 1.** The share of the construction industry in GDP (%)

Source: Authors based on data of ŠÚSR (2021a).

**Figure 2.** The share of the construction industry in total employment (%)

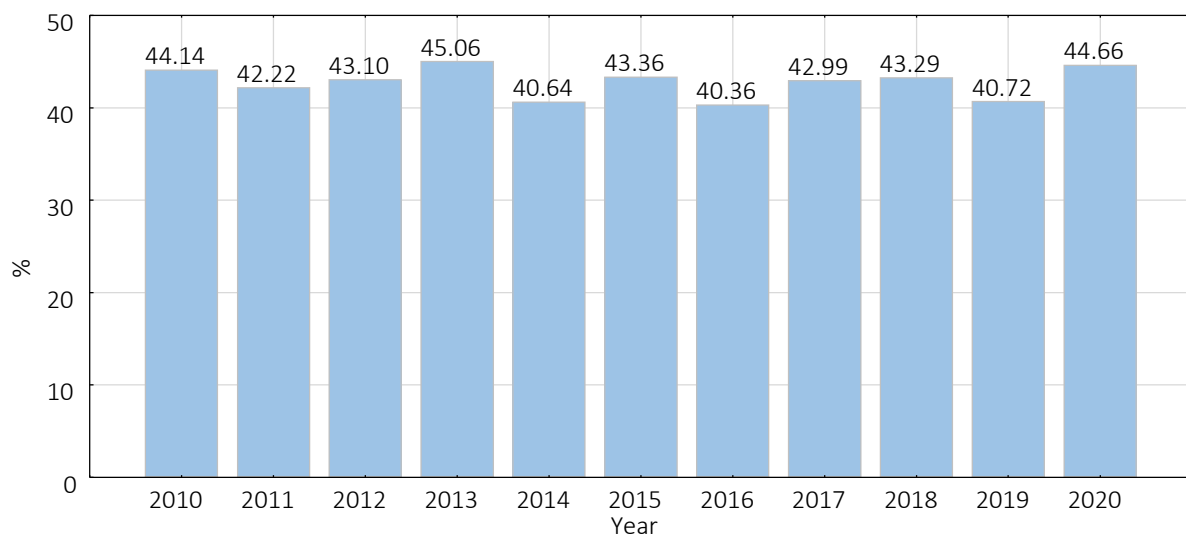
the area of private and public investments, the construction sector is still considered one of the key sectors of the Slovak economy. The position of the construction sector in the economy can be best assessed in terms of GDP and total employment (MDVSR 2019). The share of the construction sector in GDP in the period 2010-2018 accounted for 7-8%. It dropped sharply to 6% in 2019 (see Figure 1). In 2020, the share of construction in GDP was 5.8%.

The share of persons employed in the construction sector in the total number of persons employed in Slovakia decreased in the period 2010–2016 from 8.47% to 7.14%. This share has been increasing slightly since 2017, reaching 7.56% in 2020 (see Figure 2).

The construction sector builds buildings and structures that are an important part of investments and gross fixed capital in the Slovak econ-



Source: Authors based on data of ŠÚSR (2021a).



**Figure 3.** The share of constructions and buildings in gross fixed capital formation (%)

omy (MDVSR, 2019). The share of structures and buildings in gross fixed capital formation in the period 2010–2020 is shown in Figure 3. During this period, this share was above the level of 40%, in 2020 it reached 44.66%.

The construction sector is also an important representative of the economic development of the whole economy, as it is closely connected with cycles and changes in the economy. The construction sector responds immediately to changes in the economic cycle and has a multiplier effect on the development of other sectors. This means that investments in the construction sector trigger the entire chain of demand for goods and services in the related sectors of the country's economy, which has a positive effect on economic activities, employment and, most of all, the government budget (MDVSR, 2019).

Kernel density estimate, which is one of the most widely used non-parametric approaches to probability density estimation, was applied to identify the occurrence of outliers in the results of financial ratios. The relationship for the calculation of Kernel density estimate is as follows:

$$f_{(x)} = \frac{1}{nh} \sum_{i=1}^n K\left(\frac{x - X_i}{h}\right), \quad (1)$$

where  $K$  – Kernel function,  $x$  – the variable for which Kernel density estimate is determined,  $x_i$  – individual observations,  $n$  – number of observa-

tions,  $h$  – smoothing parameter also called bandwidth (Scott, 1992).

Kernel density estimate of the distribution depends mainly on the choice of the smoothing parameter  $h$ . Very high values of the smoothing parameter  $h$  cause the so-called over smoothing, very low values cause the so-called under smoothing.

It is also necessary to select the kernel function  $K$  to illustrate the kernel density estimate. Kernel functions of several types can be used: Uniform, Epanechnikov, Quartic, Triweight, Gaussian, Cosine and others. This study presents the definition of the Epanechnikov Kernel, which was used in this paper (2) (Gyamerli et al., 2019).

$$K|u| = \begin{cases} \frac{3}{4}(1-u^2) & \text{if } |u| < 1 \\ 0 & \text{otherwise} \end{cases}, \quad (2)$$

where  $u = (x - X_i)/h$ . This Kernel function has been used in studies by Produit et al. (2010), Moraes et al. (2021) and others. According to Wand and Jones (1994) and Gyamerli et al. (2019), it achieves the lowest (asymptotic) mean square error – MSE.

Nonlinear threshold models were used to determine the dependence between the DR and ROE indicators. These models allow the use of various coefficients for individual regimes, which

are determined depending on whether the values of the threshold variable are higher or lower than the threshold value. There can be more threshold values, the number of which depends on the results of AIC – Akaike information criterion, BIC – Bayesian information criterion or HQIC – Hannan-Quinn information criterion (Jenčová et al., 2021).

Threshold model with two regimes can be written as:

$$\begin{aligned} y_t &= x_t\beta + z_t\delta_1 + \varepsilon_t \text{ if } -\infty < q_t \leq \gamma, \\ y_t &= x_t\beta + z_t\delta_2 + \varepsilon_t \text{ if } -\gamma < q_t < \infty, \end{aligned} \quad (3)$$

where  $y$  – dependent variable,  $x_t$  –  $1 \cdot k$  vector of covariates that may include delayed values of  $y_t$ ,  $\beta$  –  $k \cdot 1$  vector of regime-invariant parameters,  $\varepsilon_t$  – IID error with mean 0 and variance  $\sigma^2$ ,  $z_t$  – vector of exogenous variables with regime-specific coefficient vectors  $\delta_1$  and  $\delta_2$ ,  $q_t$  – a threshold variable, which can be one of the variables  $x_t$  or  $z_t$ ,  $\gamma$  – threshold value.

The aim is to estimate unknown parameters  $\beta$ ,  $\delta_1$ ,  $\delta_2$ . Observations from the equations (3) are divided into two regimes depending on whether the threshold variable  $q_t$  is lower or higher than the threshold value  $\gamma$  (Jenčová et al., 2021).

## 4. RESULTS

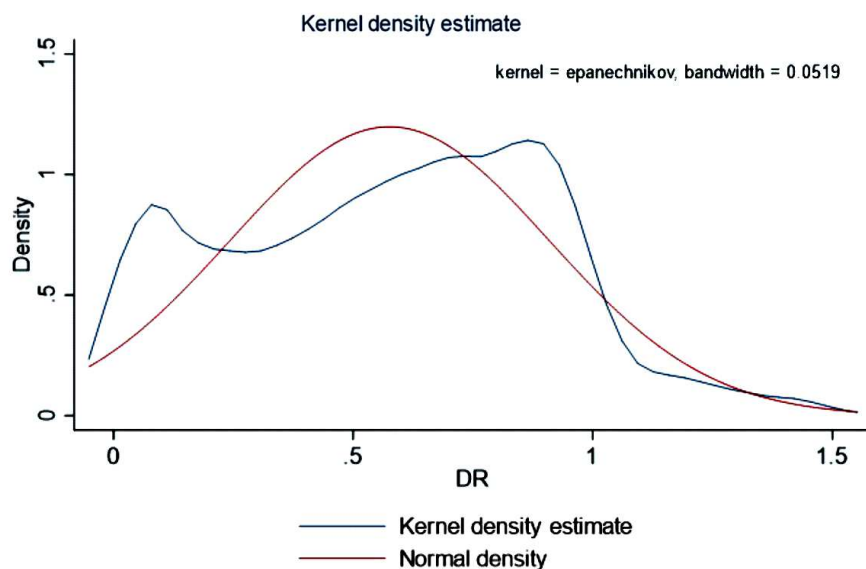
The kernel density estimate was used to determine the distribution of the investigated values and to identify outliers. In several stages, businesses with the values of financial ratios  $ROE$  ( $-1.5 ; 1.5$ ) and  $DR$  ( $1.5 ; 0$ ) were selected from the set of 7,529 businesses active in the construction sector, 6,402 businesses met this condition.

Figure 4 shows the kernel density estimate of the  $ROE$  indicator. The number of businesses with an  $ROE$  value higher than 0.5 was very low. Therefore, the upper edge of the considered interval was reduced from 2 to 0.5.

In the case of  $DR$ , it is a bimodal distribution, which points to two clusters of companies. The first cluster consists of businesses with  $DR$  values just above 0 (low-indebted businesses) and the second cluster consists of businesses with  $DR$  values just below 1 (debt predominate in the capital structure of businesses) (Figure 5).

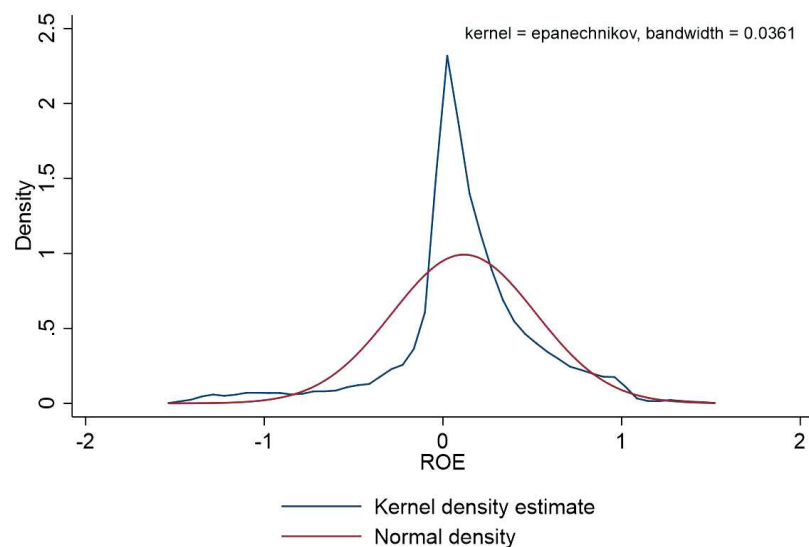
Descriptive statistics of  $ROE$  and  $DR$ , which is given in Table 1, corresponds with Figure 4 and Figure 5.

Source: Processed by authors in STATA.



**Figure 4.** Kernel density estimate of Return on Equity (ROE)

Source: Processed by authors in STATA.

**Figure 5.** Kernel density estimate of Debt ratio (DR)**Table 1.** Descriptive statistics of ROE and DR

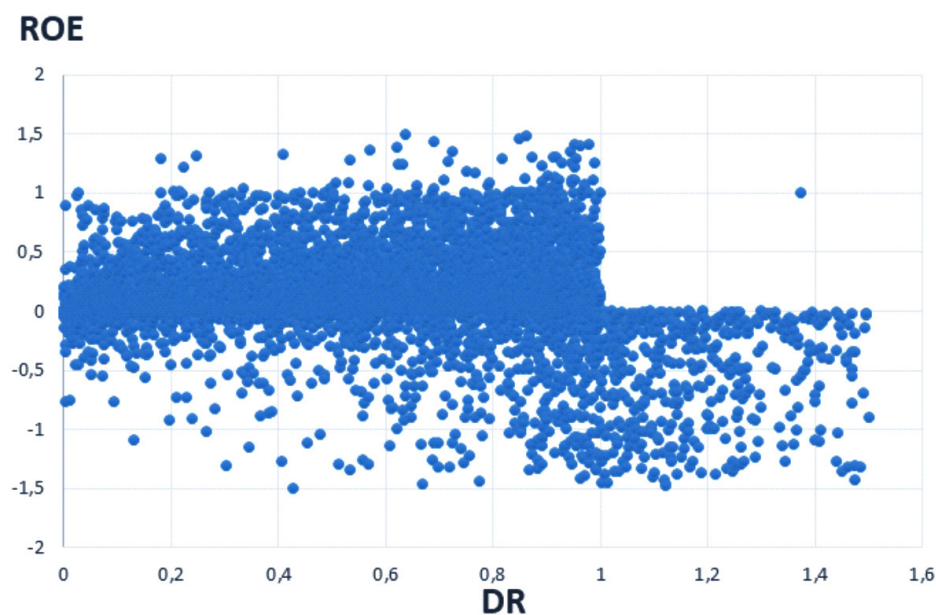
Source: Authors.

Variable	Obs.	Mean	Std. Dev.	Min	Max
ROE	6,402	.12	.40	-1.5	1.49
DR	6,402	.58	.33	.00	1.50

The Scatter Plot of ROE and DR can also be used for the initial analysis of the relationship between these indicators. Scatter Plot is shown in Figure 6.

Figure 6 clearly shows the threshold value of DR for the analyzed companies, which is at the value of 1. When the value of DR is lower than 1, the ROE increases, on the contrary, when the value of DR is higher than 1, the ROE decreases. This confirms the fact that the relationship between debt and profitability is not purely positive or purely negative, but it is mixed. An important point in this relationship is the debt threshold, at which

Source: Authors.

**Figure 6.** Scatter plot (ROE, DR)

this relationship changes from positive to negative, and thus the benefits of debt are lower than the costs of this debt.

To determine the dependence between ROE and DR, nonlinear threshold models were used. These were selected using the criteria listed in the Data and Methodology. Debt ratio was used as a threshold and mode variable. Models with one and two threshold values were compared. STATA 15.1 software was used to calculate the model parameters.

The results of the Threshold model with two thresholds (.2247, .9636) are shown in the following text. The following information criteria were calculated for this model:  $AIC = -1.275 \cdot 10^4$ ,  $BIC = -1.271 \cdot 10^4$ ,  $HQIC = -1.274 \cdot 10^4$ . The parameters of this model are given in Table 2.

**Table 2.** The threshold model with two thresholds

Source: Processed by authors in STATA.

ROE	Coef.	Std. Err.	z	$P> z $	[95% Conf. Interval]	
Regime 1						
DR	.93	.16	5.88	0.00	.62	1.24
_cons	.02	.02	1.31	0.19	−.01	.06
Regime 2						
DR	.00	.03	0.06	0.95	−.05	.05
_cons	.18	.02	10.35	0.00	.15	.22
Regime 3						
DR	−.87	.10	−8.86	0.00	−1.06	−.67
_cons	.63	.11	5.71	0.00	.42	.85

For the first and second regime, the correlation coefficients are positive, i.e., with the growth of DR in these areas, the ROE also grows. If the DR exceeds the threshold value 0.9636, the correlation coefficient changes to negative (-.87). In the third regime, therefore, with increasing debt, profitability decreases. The regression coefficient for the second regime is not significant and the confidence intervals for the regression coefficients have a non-zero intersection.

Table 3 shows the results of the Threshold model with one threshold value (.9636). The following information criteria were calculated for this model:  $AIC = -1.276 \cdot 10^4$ ,  $BIC = -1.273 \cdot 10^4$ ,  $HQIC = -1.275 \cdot 10^4$ . The parameters of this model are given in Table 3.

In the first regime (DR less than 0.9636), ROE increases slightly with increasing DR (0.0873). In the second regime, ROE decreases significantly with increasing DR (-0.87).

Due to the lower values of the information criteria (BIC, AIC, HQIC), the model with one threshold value (0.9636) is preferred. In addition, for the model with two threshold values (.2247, .9636), the coefficient for the second regime (0.00) is not significant.

**Table 3.** The threshold model with one threshold

Source: Processed by authors in STATA.

ROE	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
Regime 1						
DR	.09	.02	5.19	0.00	.05	.12
_cons	.12	.01	12.45	0.00	.10	.14
Regime 2						
DR	−.87	.10	−8.83	0.00	−1.06	−.67
cons	.63	.11	5.70	0.00	.41	.85

The model values differ from the initial estimate (see Figure 3), which was equal to 1, by less than 4 hundredths.

## 5. DISCUSSION

Decisions on the optimal indebtedness must be taken seriously as they are an underlying force behind a company's success. Equity and debt are the two main components of a company's indebtedness and at the same time the main sources of financing its activities. Choosing the right debt to equity ratio is a prerequisite for ensuring company's profitability. On the one hand, debt allows companies to implement strategies that would not be feasible without a sufficient amount of financial resources, but on the other hand, debt increases the company's financial risk. Experts on the topic are not united in their opinion on the role of debt in the company and its impact on profitability.

Available research reveals ambiguous and differing results in the analysis of the relationship (see theoretical background). These differences in views and results are due to the use of different indebtedness indicators (DR, STDR, LTDR, EDR, ER, DER) and different profitability indicators

(ROA, ROE, ROI, ROS, Growth). Some studies confirmed that this relationship is influenced by the length of the debt commitment (Abor, 2005). This relationship between debt and profitability also affects the industry in which the company operates (Vätavu, 2015; Uluyol et al., 2014). However, it should be stated that the indebtedness of the company affects its profitability. This is mainly due to the fact that interest on the debt is tax deductible. The results suggest that profitable companies depend on debt as their main financing option. Although interest on debt is tax deductible, a higher level of debt increases the risk of default, which in turn increases the likelihood of the company going bankrupt. Therefore, each company must consider setting the optimal indebtedness.

The optimal indebtedness represents a debt-to-equity ratio at which the cost of that capital is minimal. In examining this problem, a sample of 6,402 companies from the Slovak construction industry was analyzed. Using a threshold regression model, a nonlinear relationship between total indebtedness and ROE was confirmed. This result confirmed the findings of Ngo et al. (2020), who pointed out the possibility of a nonlinear relationship between indebtedness and profitability and

recommend applying quantile regression models or threshold regression models to examine the relationship. Jenčová et al. (2021) also confirmed a nonlinear relationship between ROA and indebtedness. Other authors who confirmed the nonlinear relationship between indebtedness and profitability included Vätavu (2016) and Kebewar (2012).

The result of this model is the debt threshold for construction companies in Slovakia (0.963). Up until reaching this level of indebtedness, ROE increases slightly, and once this threshold is exceeded, ROE decreases significantly. Based on these results it can be concluded that there is relationship between indebtedness and profitability, therefore hypothesis *H1* is accepted. However, the relationship between indebtedness and profitability is non-linear, therefore hypothesis *H2* is rejected.

In future research, it is necessary to focus on a dynamic solution to the problem, the length of debt binding period and its impact on the profitability of the company. It is also important to determine the dependence of the threshold value on the size of companies, ownership, but also to compare the impact of debt on profitability within the Slovak and EU industries.

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## CONCLUSION

The purpose of this contribution was to determine whether there is a link between a company's debt and profitability and, in connection with it, to find out whether the share of debt in the capital structure affects a company's profitability. The result was the finding that for the analyzed sample of companies, the share of debt in the capital structure is important for achieving the required value of profitability. Threshold value for indebtedness is 0.963. Up to this value, the profitability of companies increases, above this value the profitability decreases. This confirmed the non-linear relationship between debt and profitability.

These results could prove useful for internal and external users. Internal users (managers, shareholders and employees) may realize that the indebtedness is a determinant of increasing profitability. They can use the obtained results as benchmarking values in finding the optimal indebtedness for their company. However, once again, it is necessary to emphasize the individual approach to addressing the issue. External users (investors, creditors, the tax office) can also benefit from these results, as these users may be concerned about the profitability of the companies they do business with.

One of the greatest limitations of the study was the fact that it focused on only one year's worth of data (as the industry is known for its fluctuations). Finding data on the same company for previous years proved to be a challenge, too. It is planned to focus on creating the database spanning a longer period of time in the future, however. Another limitation is the large sample of companies, as the sample limited the ability to work with software products. In the future, the research will focus on analyzing data



spanning over longer period of time. It is necessary to focus on individual indicators of indebtedness and profitability and to draw conclusions in relation to selected indicators individually and to generalize the conclusions.

## AUTHOR CONTRIBUTIONS

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 Validation: Igor Petruška.  
 Visualization: Igor Petruška.  
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